Ministry of Electricity and Renewable Energy
The Arab Republic of Egypt

Arab Republic of Egypt

Future Cooperation Survey on Energy Efficiency & Conservation (EEC) in Egypt

Final Report

October 2022

Japan International Cooperation Agency (JICA)

Oriental Consultants Global Co., Ltd. (OCG)
Mitsubishi Research Institute, Inc. (MRI)

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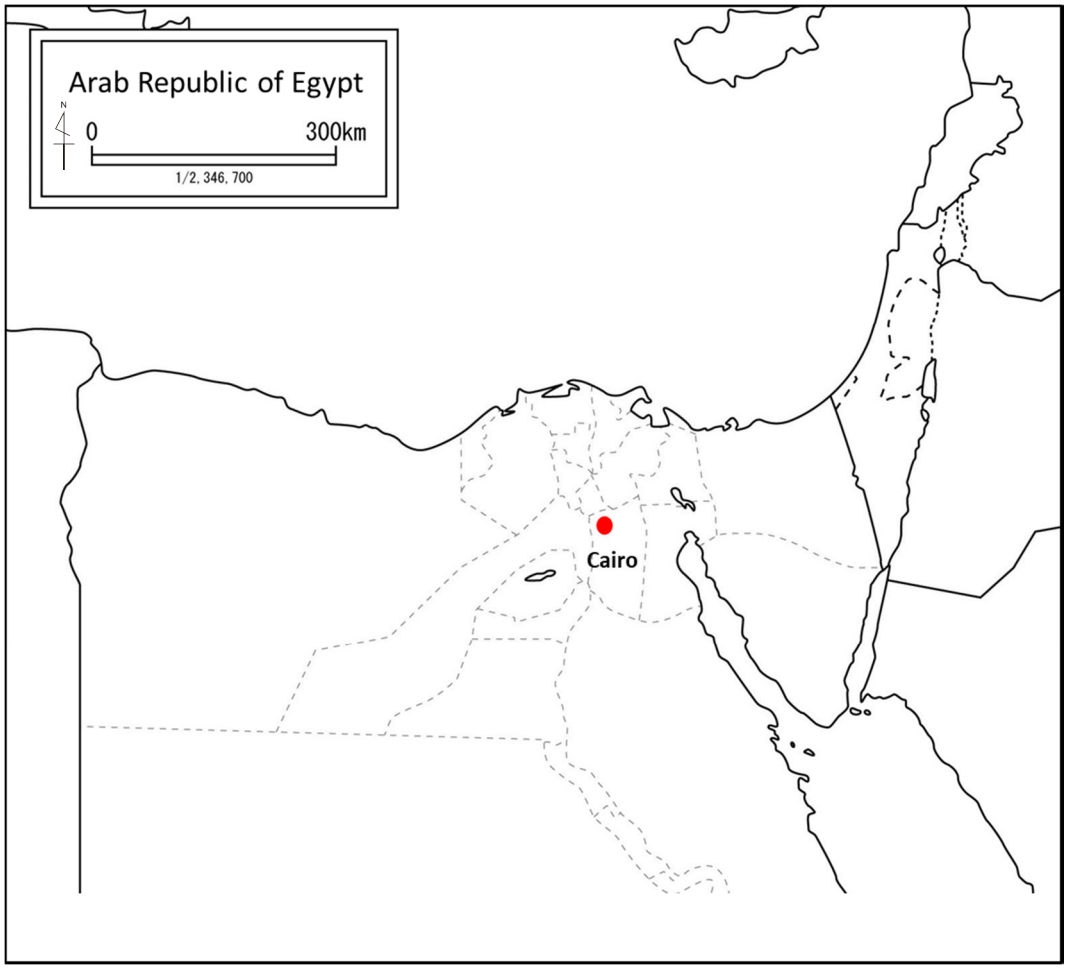

Study area: All of Egypt but mainly Cairo

LIST OF ABBREVIATIONS

AFD	Agence Française de Developpement
BAT	Best Available Technology
CBE	Central Bank of Egypt
COP	Conference of Parties
COP	Coefficient of Performance
CSP	Concentrating Solar Power
DC	Direct Current
E-JUST	Egypt-Japan University of Science and Technology
EEAA	Egyptian Environmental Affairs Agency
EEC	Energy efficiency and improvement
EER	Energy Efficiency Ratio
EECCD	Energy Efficiency and Climate Change Directorate
EEHC	Egyptian Electricity Holding Company
EIB	European Investment Bank
EM	Energy management
EMS	Energy Management System
EU-ETS	European Union Emissions Trading System
EUL	End User Loan
ENCPC	Egypt National Cleaner Production Centre
EV	Electric vehicle
IDA	Industrial Development Authority
IEA	International Energy Agency
ISO	International Organization for Standardization
LED	light-emitting diode
MEPS	Minimum Energy Performance Standard
MIIC	Ministry of Investment and International Cooperation
MOERE	Ministry of Electricity and Renewable Energy
MOP	Ministry of Petroleum and Mineral Resources
MSME	Micro, small & medium enterprise
NBE	National bank of Egypt
NEEAP-I	National Energy Efficiency Action Plan -I
NEEAP-II	National Energy Efficiency Action Plan -II
NIB	National Investment Bank

PM	Permanent Magnet
SCE	Supreme Energy Council
SME	Small & medium enterprise
TSL	Two-Step Loan
T&D	Transmission and distribution
VRF	Variable Refrigerant Flow

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Chapter. 1 Project Outline

1.1 Background of the project

As Egypt's GDP grew at a consistent annual rate of 4% on average from 2005 to 2015, maximum power demand increased by 5% per year on average over the same period. Generating capacity increased to keep pace, reaching 45GW in 2016, 15% higher than the previous year. Although capacity has so far managed to outpace demand, it is expected that demand will increase exponentially with population growth, rising incomes and multiple national infrastructure projects such as the new capital plan and the Suez Canal Economic Zone.

Due to subsidies, the price of electricity in Egypt is lower than the cost of generating power. Unfortunately, since the political upheavals in 2011 Egypt has suffered from economic stagnation and financial crises. So, in order to secure loans from the World Bank and IMF, austerity measures were implemented, including gradual cuts to electricity subsidies. Moving toward the ultimate goal to completely eliminate subsidies, power rates rose each year for five years after 2014. As these price increases dampened private-sector economic activity, promoting energy efficiency and conservation (EEC) became a high priority in the pursuit of sustainable growth.

Consequently, Egypt's government has prioritized EEC as a key goal in its 2030 Sustainable Development Strategy and 2035 National Energy Strategy. The government has also created a National Energy Efficiency Action Plan that sets out a framework for enhancing communication among relevant entities to promote EEC, plus a Sustainable Electric Energy Steering Committee under the Supreme Energy Council to monitor EEC promotion. Also, the Energy Efficiency and Climate Change Directorate (EECCD) of the Ministry of Electricity & Renewable Energy (MOERE) has been appointed to oversee technical aspects for the committee. EECCD roles are to implement EEC policy formulation, to develop relevant systems and to coordinate with stakeholders and concerned entities.

However, Egypt has not yet fully developed an EEC-relevant system, and public awareness of EEC is low due to the continuing low prices of electricity and gas. Therefore, in addition to enacting EEC-relevant laws and structures to promote EEC, incentives to install EEC equipment are required, along with specific measures such as financing.

JICA has been supporting EEC in Egypt's power grid via the yen loan "Electricity Distribution System Improvement Project." Plus, JICA has supported EEC policy and measures since 2017, via the "Energy Efficiency & Conservation" initiative and technical cooperation in EEC since 2019.

In this survey, relevant data collection and analysis in the energy sector including power, petroleum and gas will be performed from both supply- and demand-side perspectives. Based on the results, a future cooperation policy for the demand-side will be considered.

1.2 Purpose of the project

The purpose of this project is to clarify existing issues by analyzing EEC policies and relevant information for promotion of EEC assistance programs, which should be dealt with by the Egyptian government. Also, the details and status of assistance programs from other donors will be analyzed to clarify the issues. Solutions and assistance measures funded by Japan's ODA will then be proposed.

1.3 Project area

All of Egypt, but mainly Cairo

1.4 Project implementation structure

1.4.1 Survey team

Team members are shown below.

Table 1.1 Survey team

Name	Position
Hirotsugu KATO	Team Leader / EEC Policy 1
Mari IWATA	Deputy Team Leader / EEC Policy 2
Kimio YOSHIDA	Energy Management
Yoshihiko KATO	Business Scheme & Support Policy
Yasuhiro SAKAMOTO	EEC Technology
Ulysses COULMAS	Marketing Analysis & Demand Forecast
Takeshi KIKUKAWA	Organization Analysis 1
Eiko WATATSU (Predecessor)	Organization Analysis 2
Soichiro HAYASHI (Successor)	Organization Analysis 2
Tomoaki HIROSE (Predecessor)	Capacity Development & Promotion
Kazuhiro NAKAGAWA (Successor)	Capacity Development & Promotion
Kohei KUWAMORI	Environmental and Social Considerations

1.4.2 Egyptian counterpart and relevant entities

The Egyptian counterpart for this project is the Ministry of Electricity & Renewable Energy (MOERE). Other relevant entities include:

- Ministry of Trade and Industry
- Ministry of Petroleum and Mineral Wealth
- Ministry of Finance
- Central Bank of Egypt
- National Bank of Egypt
- Commercial International Bank

1.5 Schedule

1.5.1 Schedule

The project schedule is shown in Table 1.2, and scheduled work in Egypt is shown in Table 1.3.

Table 1.2 Project schedule

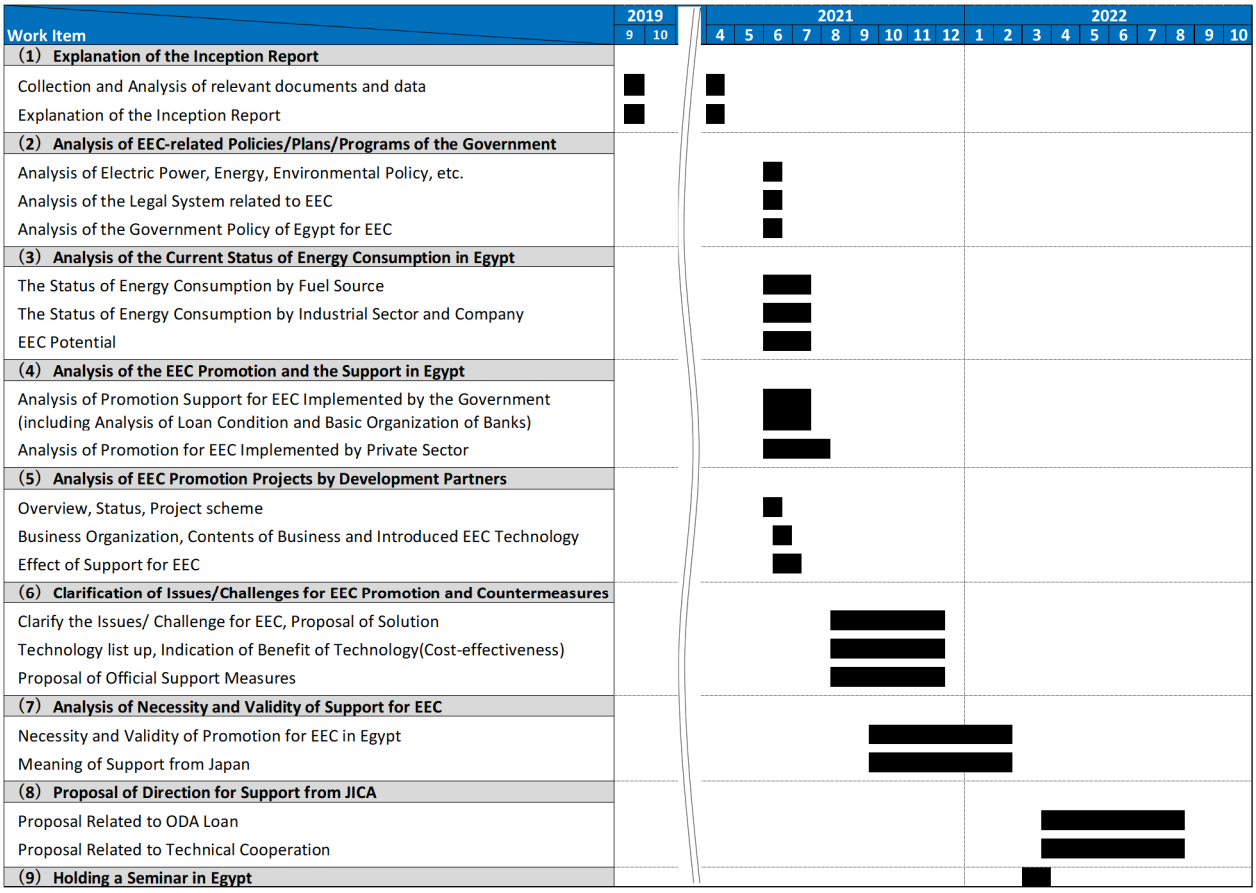


Table 1.3 Schedule of work in Egypt

Position	Name	Firm	Visit times	2019		2021												2022					
				Sep	Oct	April	May	June	July	August	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	August	Sep
Team Leader／EEC Policy 1	Hirotsugu KATO	OCG	9	5		15						8	13		14		9		9		9		9
Deputy Team Leader／EEC Policy 2	Mari IWATA	MRI	9	6				6		8			5	2	11		7			7		7	7
Energy Management	Kimio YOSHIDA	OCG	3	7														18	9				
Business Scheme・Support Policy	Yoshihiko KATO	OCG	9			15					8		16		10	20	3		9		9		9
EEC Technology	Yasuhiro SAKAMOTO	MRI	3							8		7											
Marketing Analysis・Demand forecast	Ulysses Coulmas	MRI	4			15											14			9			9
Organization Analysis 1（Finance／TSL)	Takeshi KIKUKAWA	OCG	4									15					15		9		9		
Organization Analysis 2（Direct Loan)	Eiko WATATSU・Soichiro HAYASHI	OCG	6							15			7					18		9		9	9
Capacity Development・Promotion	Hiroaki HIROSE・Kazuhiro NAKAGAWA	MRI	10					6		8	9	13	15		15	20		18	9		9		
Environmental and Social Considerations	Kohei KUWAMORI	OCG	7	7		15						8	12		13		7			7			

Chapter. 2 Preparing inception report, explanation and discussion

2.1 Inception Report

The inception report was made and submitted in September of 2019.

2.2 Explanation and discussion of the Inception Report

Project members visited the Ministry of Electricity & Renewable Energy (MOERE), Ministry of Investment & International Cooperation (MIIC), Industrial Development Authority (IDA), GIZ and Japanese manufacturers from September 28 to October 2, 2019.

During the visit, project members used the inception report to explain the project. Active discussions and exchange of opinions were conducted, including with the First Undersecretary of MOERE.

Table 2.1 Attendee list in first survey in Egypt

Organization	Name and Position	
Ministry of Electricity & Renewable Energy	Mohamed Mousa Omran	First Undersecretary
	Maha Mostafa Awad	Undersecretary
	Taghreed Saeed El Ayoti	General Manager
	Ramy Mousa El-Maghawry	Senior economist
	Mohammed Abdelmawla	
	Nora Saaol	
	Marwa Konsowa	
	Laila Ahmed	
Ministry of Investment & International Cooperation	Mona AHMAD	First Undersecretary
Industrial Development Authority	Amany Moemen	Chairman's Counselor
GIZ	Martin Neussel	Head of Project
	Torge Stehnken	Advisor
	Khaled Shehata	Advisor

Chapter. 3 Analysis of EEC-related development policies and plans

3.1 Documents

The following documents were collected and analyzed.

Table 3.1 Key documents collected and analyzed

Type	Contents	Publication date	Publisher
1 Energy Data			
1	Egypt Energy Balance	2017	IEA
2	Egyptian Electricity Holding Company Annual Report 2016/2017, 2017/2018	2016, 2017, 2018	EEHC
2 Energy Policies			
1	Renewable Energy Master Plan for Egypt (CREMP) 2011-12		
2	Energy Efficiency Plan in the Electricity Sector (NEEAP)	July 2012	
3	EEDC Addressing Egypt's Electricity Vision	March 2015	MOERE
4	Electricity Law	July 2015	
5	Medium Term Action Plan 2015–2019 – White Book Energy Strategy to 2035 Volume 2 Draft-Version 1.0	Dec. 2015	
6	Integrated Sustainable Energy Strategy to 2035 Volume 1	Nov. 2015	EU
7	Integrated Sustainable Energy Strategy to 2035 Volume 2 – Energy Efficiency	Nov. 2015	EU
8	Second National Energy Efficiency Action Plan 2018-2020 (NEEAP II) English Translation		
9	JICA Report - Egypt Energy Efficiency and Conservation Training Preliminary Survey Report	June 2017	JICA
10	(ERA) Action Plan (Current and Proposed Status)		
11	(MOERE) Action Plan for Electricity Sector Final		
12	(MOTI) Area of cooperation - Japan 2017	2017	Dr. Amany
13	Con Note Energy Efficiency & Climate Unit		Ministry of Petroleum
14	Egypt National Cleaner Production Centre		RECP
15	EOS - Japan 2017	2017	
16	Labelling UNDP June 2018 Presentation	June 2018	UNDP
17	MoP EE Action Plan		Ministry of Petroleum
18	Presentation NEEAP II 2018-2020		
19	SDS Egypt Vision 2030		
20	Updated QW - Objectives 25.07.17	July 2017	Ministry of Petroleum
21	Oil & Gas Modernization Project		
3 Finance			
1	Egypt: Enabling Private Investment and Commercial Financing in Infrastructure	Dec. 2018	World Bank
2	Egyptian Pollution Abatement Program (EPAP III)		MOERE

Type	Contents	Publication date	Publisher
3	FY18 TICAD Application Egypt Alternative Fuels for Cement	Nov. 2018	
4	Brochure-Eng-GEFF	2018	EBRD
5	NBE & Environmental Sustainability: Overview on Energy Efficiency		NBE
4 Industry			
1	Industrial Energy Efficiency Strategies and Policies	2015	UNIDO (Industrial Energy Efficiency Project)
2	Industry and Trade Development Strategy 2016 - 2020	2016	Min. of Trade & Industry
3	Integration of Energy Efficiency into Food Manufacturing Sector Strategy	August 2017	UNIDO (Industrial Energy Efficiency Project)
4	integration of Energy Efficiency into Building Materials Sector Strategy	August 2017	
5	integration of Energy Efficiency into Chemical Sector Strategy	August 2017	
6	integration of Energy Efficiency into Textile Sector Strategy	August 2018	
7	2017 - Steel industry	Dec. 2017	
8	Cement Industry in Egypt	March 2018	
9	EE Sectors - Synthesis Report	Sept. 2018	
10	ITC Presentation Destination Africa 2018 V3	2018	
11	ITMF-Schindler, Christian-Destination Africa 2018 - Cairo, Egypt - 2018.11.18	Nov. 2018	
12	Sustainable Conference Destination Africa Conference Agenda	Nov. 2018	
13	TEC Members Map		
14	Textile Industry - Dr. Amirah El-Haddad	April 2012	
15	Textile Industry - PB11 RMG Industry		
16	Textiles Development Strategy Vision 2025	Dec. 2015	Min. of Trade & Industry
5 Climate Change			
1	Egyptian Intended Nationally Determined Contributions	2015/2016	
2	Egypt - Second National Communication	May 2010	
3	Egypt - Third National Communication	March 2016	
4	Egypt – First Biennial Update Report	2018	MOERE
5	Electricity Specific Emission Factors For-Grid Electricity	Aug. 2011	
6 Motor			
1	Back to Office Report UNIDO Ministry of Industry Workshop	Dec. 2017	UNIDO
2	Dr Hani EL Ghazaly - UNIDO Consultant	Dec. 2017	UNIDO
3	UNIDO Introductory Presentation Motors - Rana Ghoneim	Dec. 2017	UNIDO
4	UNIDO Presentation - Egypt Validation Project	Dec. 2017	UNIDO

3.2 Analysis of electricity, energy and environment policies

3.2.1 Main plans

This section will cover the key policies and plans announced in Egypt since the inauguration of President Abdel Fattah el-Sisi, including the Sustainable Development Strategy / Egypt's Vision 2030 (SDS2030). The key policies and plans are presented in chronological order as much as possible, taking into account the relation between them. The New Electricity Law is described in details in Chapter 3.3.1.

Fig. 3.1 Key electricity, energy policies and plans

(1) Combined Renewable Energy Master Plan for Egypt (CREMP)

In February 2010, the Supreme Energy Council (SCE) approved a new energy strategy (Strategy of the Energy Sector until 2030 in Egypt), to strength the energy sector's ability to respond to risks. In the strategy, the government identified the diversification of energy sources as a top priority, specifically the need to develop nuclear and renewable energy as soon as possible.

In response, the EU supported the development of CREMP, which was led by KfW Bankengruppe (KfW) and coordinated with AFD and EIB through the Neighborhood Investment Facility (NIF) scheme. The following are the main objectives of CREMP:

- Develop renewable energy framework for wind and solar energies
- Conduct feasibility study for a large-scale CSP project in Kom Ombo
- Assess Egypt’s capacities for manufacturing and servicing of wind and solar power plant equipment

The Renewable Energy Framework (REF) was formulated taking into consideration the industrial capacity to increase the local component for optimal use of land, assessment of wind and solar energy resources, and improvements to the financial status of projects. REF is a development plan that aims to increase wind and solar energy generation capacity in Egypt, based on a scenario to achieve optimal technical and economic conditions. The scenario outlines the appropriate legal and financial instruments and initiatives to support the development of large-scale wind and solar energy generation projects. REF identifies involvement of local industry to the wind and solar energy generation business as a priority initiative. REF includes an action plan to achieve the objectives.

CREMP is divided into the following eight tasks:

- Task 1: Economic potential and key challenges for wind and solar energies in Egypt
- Task 2: Integration of wind and solar energies in the electricity power supply
- Task 3: Technology policy and promotion of national manufacturing
- Task 4: Institutional support structure for wind and solar energies
- Task 5: Financing a framework for wind and solar energy in Egypt
- Task 6: Wind and solar (CSP & PV) sector framework and road map for implementation
- Task 7: Terms of reference for other renewable energies
- Task 8: Feasibility study for a large-scale CSP project in Kom Ombo, Egypt

Task 4 indicates that the Egypt ERA will play an important role in the development of necessary legislation. Task 5 outlines the financing strategy for renewable energy projects. The standard project financing ratio in Egypt is 20-30% equity and 70-80% debt. A minimum IRR of 10% to 13% is needed. The report also outlines lending conditions of potential funding sources (international development banks, public banks, and private-sector banks).

(2) National Energy Efficiency Action Plan -I (2012-2015)

To promote energy efficiency and conservation in the region, the Arab Electricity Ministerial Council adopted the "Arab Energy Efficiency Indicative Framework" in November 2010, calling on countries to consider effective involvement of the public sector, establish governance in the energy efficiency and conservation sector, establish methods to calculate energy savings, implement capacity building and provide incentives for energy efficiency/conservation. Taking those initiatives into account, the Council asked participating countries to develop a National Energy Efficiency Action Plan (NEEAP). The Executive Office mandated the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) to monitor the progress of national plans in Arab countries, prepare annual reports on results achieved and prepare a template to help Arab countries in preparing their first national energy efficiency plans. RCREEE was established with support of the EU and the Egyptian New and Renewable Energy Authority (NREA), with 17 Arab League countries participating. The secretariat is in Cairo. Based on the RCREEE guidelines, Jordan, Lebanon, Palestine, Sudan, etc. formulated NEEAP. Egypt developed NEEAP-I covering the period 2012-2015. The Cabinet approved NEEAP-I in July 2012.

NEEAP-I aims to reduce electricity consumption (equivalent to cutting 5,565.69 GWh/Year) compared to the average of the previous five years (2008 to 2012) by 5%. The four measures to achieve this are: (1) promote energy efficiency and conservation in households, public utilities and tourism sectors; (2) energy supply-side initiatives; (3) cross-sector initiatives; and (4) evaluate formulation and implementation of energy efficiency and conservation policies. Of the four, the measure set out to reduce electricity consumption in real terms was high-efficiency lighting in the household sector. Specifically, the government distributed 12 million energy-saving bulbs, provided that bulbs should be sold at half-price in cash or installments, and promoted the usage of high-efficiency household appliances (second phase of program of energy efficiency standards and labeling for household appliances). Up to 2015, these two key programs realized savings of 3,320GWh and 1,663GWh respectively.

When NEEAP-I was evaluated as NEEAP-II was developed, seven points were identified as challenges. First, there was a lack of collaboration, particularly with actors outside the power sector, plus a lack of an organizational framework to share data/information and coordinate in implementing NEEAP. Second, there was no mechanism to measure, verify and summarize the results of NEEAP. So, there was no way to monitor progress. Third, although the Cabinet Office Decree in 2009 required the establishment of an Energy Efficiency Institutional Framework (EEIF), only three sectors (industry, tourism and households) actually implemented Sectoral Units for Energy Efficiency, out of the nine sectors required to do so. Fourth, the initiatives set out in NEEAP-I were formulated using a bottom-up approach, and considered measures where funding was already available. Initiatives were also limited to the power sector, and there was a disconnect between long-term national strategies such as the Integrated Sustainable Energy Strategy to 2035 (ISES2035). Fifth, although the distribution of high-efficiency lighting in the household sector was a key program, it did not include households with high cost-effectiveness, nor mandate elimination of incandescent lighting. Sixth, capacity building programs were not implemented as planned, particularly lacking cooperation with research institutions and decommissioning of inefficient facilities. Seventh, there was a lack of awareness-raising programs targeting universities and schools. On the other hand, important additional plans and policies on energy efficiency and conservation (e.g., Integrated Sustainable Energy Strategy to 2035, ISES 2035) were formulated during the implementation of NEEAP-I, although it was beyond the organizational scope of NEEAP-I. There was a certain amount of progress in planning during the formulation period.

(3) Sustainable Development Strategy/ Egypt's Vision 2030 (SDS2030)

SDS2030, Egypt’s long-term development vision to 2030, was presented at the Egyptian Economic Development Conference (EEDC) in March 2015. It comprises three dimensions – social, environmental and economic – supported by 10 pillars. Each pillar has a set of Key Performance Indicators (KPIs) to deliver the long-term development goals and programs. Energy is a pillar of the economic dimension. The following table summarizes the KPIs.

Table 3.2 Key Performance Indicators for economic development up to 2030

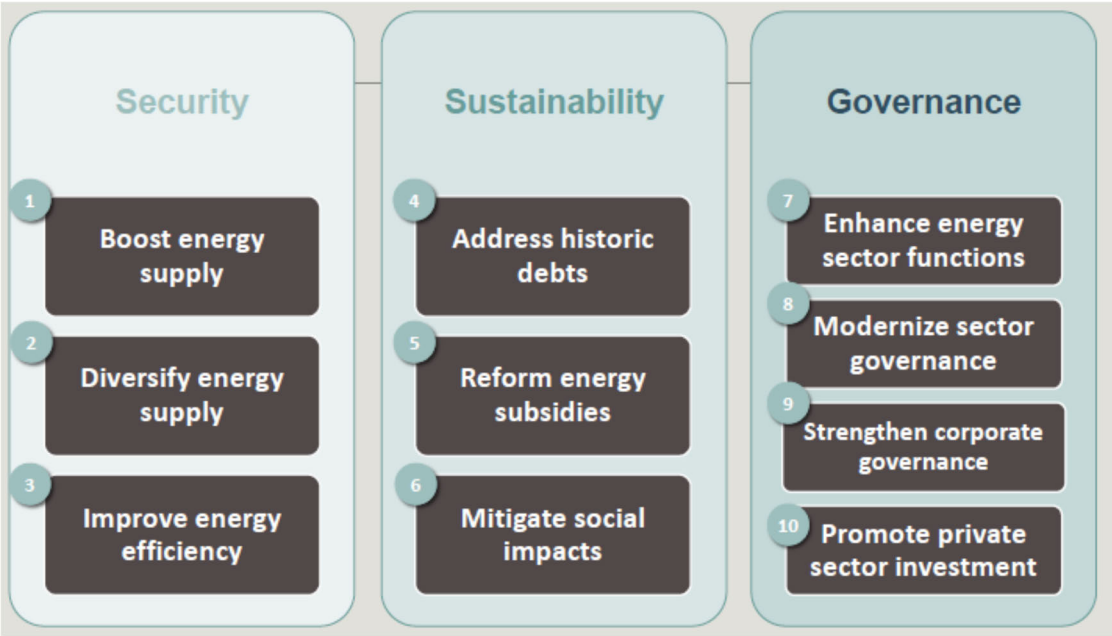
S.N	Indicator	Current value	2020 target	2030 target
Strategic results				
1	Ratio of primary energy supply to the total planned energy consumption	*	100%	100%
2	Average duration of outages	*	0	0
3	Percentage change in energy intensity	0.65	-1.3%	-14%
4	Share of energy sector to GDP	13.1%	20%	25%
Outcomes				
5	Percentage decline in greenhouse gas emissions from the energy sector	*	5%	10%
6	Crude oil reserves (years)	15 years	15 years	15 years
7	Natural gas reserves (years)	33 years	33 years	33 years
8	Efficiency of electricity production	41.3%	*	*
9	Efficiency of electricity transmission and distribution	15%	12%	8%
10	Percentage of residential, commercial and industrial buildings connected to electricity	99%	100%	100%
11	Percentage of primary fuel mix	Gas: 53% Oil: 41% Renewable: 1% Coal: 2% Hydroelectric: 3%	*	*
12	Percentage of fuel mix for electricity production	Oil and Gas: 91% Hydroelectricity: 8% Solar and Wind: 1%	*	Oil and Gas: 27% Hydroelectricity: 5% Solar: 16% Wind: 14% Coal: 29% Nuclear: 9%
13	Value of fuel subsidy	126.2 Billion EGP	0	0

SOURCE: SDS2030

(4) Addressing Egypt's Electricity Vision

In the EEDC, the Minister of Electricity & Renewable Energy presented the government's vision for the electricity sector, titled "Addressing Egypt's Electricity Vision."

The vision lists key challenges in the electricity sector as "Ensuring power generation security," "Financial sustainability" and "Improve institutional framework to unleash the sector's potential." The government's action plan is based on three main pillars (security, sustainability and governance), and 10 areas of action.



SOURCE: ADDRESSING EGYPT'S ELECTRICITY VISION

Fig. 3.2 Government's Vision & Actions in the Egypt's Electricity Vision

Each action area includes multiple policy measures and key elements, with timeframes and lead institutions specified for each element.

"Improve Energy Efficiency" is the action area three identified in the Key Action Areas – Security. The following table summarizes the energy efficiency policy measures.

Table 3.3 Energy efficiency policy measures

Policy measures	Key elements	Lead institutions
Improve supply-side efficiency	Convert open-cycle gas plants to combined cycle	EEHC
	Measures to cut T&D losses from 12% to 8%	EETC & DISCOS
Improve demand-side efficiency	Publish 5-year energy efficiency plan with targets	CAB, SEC
	Efficiency programs for energy intensive industry	SEC (MoI, MoP, MOERE)
	Enforce appliance efficiency standards/building codes	MoI, MoH
	Introduce incentives for energy efficiency finance	CAB
	Conduct awareness-raising campaign	CAB, EEHC, EGPC
	Phase out incandescent bulbs and roll out 10+50 million LED lamps	DISCOS
	Approve plan to roll out smart meters w/in 5 years	DISCOS

SOURCE: ADDRESSING EGYPT'S ELECTRICITY VISION

"Reform Energy Subsidies" is number 5 in Key Action Areas – Sustainability, where implementation of an annual electricity price increase is a Key Element. "Enhance Energy Sector" is number 7, where transformation of the Energy Efficiency unit into a fully-fledged entity is a Key Element. The plan cited investment requirements of over USD 70 billion from 2015 to 2022.

(5) Medium Term Action Plan 2015–2019: White Book-Energy Strategy to 2035

In 2015, an Integrated Sustainable Energy Strategy to 2035 was prepared with EU support, in addition of a Medium-Term Action Plan (White Book) to address the main actions or measures that need to be either further evaluated or implemented within the first five years (from 2015 to 2019) of the Energy Strategy to 2035. The following are the five actions identified:

- Action Plan for Upstream Oil and Gas Sector
- Action Plan for Downstream Oil and Gas Sector
- Action Plan for the Conventional Power Sector
- Action Plan for Renewable Energy Sector
- Action Plan for Energy Efficiency

In Chapter 8 – Action Plan for Energy Efficiency – 25 Actions are outlined. Each action has a specific policy goal/objective, description, status, steps, implementing entities, beneficiary entities, deliverables, prerequisite, type of activity and time horizon outlined.

(6) Energy strategy for integrated and sustainable development to 2035

The Energy Strategy for Integrated and Sustainable Development to 2035 (ISES2035) was formulated with EU support. The strategy refers to the improvement of Energy Efficiency in specific sectors, with specific energy targets and energy savings calculated for each sector.

The TIMES-Egypt Model was used to try to obtain the energy efficiency potential of industries, buildings, tourism and transport sectors. To obtain this potential, a specific scenario was created where all energy efficiency is eliminated from the market. It was modeled by keeping available technologies at 2015 levels, and all the remaining as the least cost scenario where subsidies are fully removed by 2020. This strangulated scenario was then compared with the least cost scenario.

Energy-efficient technologies in the industrial sectors assumed in the model were estimated for energy-intensive industries by referring to global data on energy-efficient technologies specific to each industrial process. For non-energy intensive sectors, it was assumed that there were technologies that could achieve energy savings of 10% or 15%. For residential and commercial sectors, it was assumed there were technologies that could achieve energy savings of 5% or 10%. In transport, it was assumed that fuel consumption of existing vehicles would improve by 1% per year. The table below shows energy efficiency and conservation targets for 2035, based on potential energy efficiency amounts and savings calculated using the model.

Table 3.4 Energy savings targets by 2035

Sector	Policy Package (PP)	Energy targets by sector (%)	Energy savings (Mtoe)
Institution	1. Institutional development for EE	NA	NA
Industry	2. Programs in most energy-intensive industrial sectors 3. Programs in cross-cutting technologies 4. Transforming EE market for industry	-18%	6.8
Buildings	5. Replacing existing electric appliances with EE ones 6. Interventions on new building envelope & systems 7. Energy refit of existing building envelope & systems	-16%	8.0
Tourism	8. Move towards green tourism		0.4
Street lighting	9. Efficient street-lighting		0.3
Transport	10. EE road vehicle stock 11. EE practices for public and commercial 12. Fostering use of EE modes for passenger transport 13. Fostering EE in freight transport and logistics	-23%	4.6
Total		-18%	20.0

SOURCE: ISES2035

ISES2035 also provides supplementary information on past energy efficiency and saving initiatives in each sector, plus challenges in promoting energy efficiency and conservation in future. Details are as follows:

1) Industrial Secto

(i) Current status of the industrial sector

Energy consumption of Egypt's industrial sectors cited in ISES2035 are summarized in the table below.

Table 3.5 Final energy consumption in industry

(ktoe)	Coal	LPG	Diesel	HFO	N. Gas	Electricity	Total	Percent
Iron and Steel Production	412				1,420	575	2,406	13%
Aluminium Production					10	400	410	2%
Copper Production						1	1	0%
Other Non Ferrous Metals Production						34	34	0%
Fertilizers Production					753	33	786	4%
Other Chemicals Production		1	79	239	717	365	1,401	8%
Cement Production			1	1,423	3,068	403	4,895	27%
Glass Flat Production			0	24		27	50	0%
Other Non Metallic Minerals Production			14	296	1,337	146	1,793	10%
Paper Production			20	337	113	66	536	3%
Food, drink and tobacco		29	1,912	502	464	188	3,095	17%
Textile, leather		1	53	679	378	210	1,321	7%
Other Industries		1	35	307	7	907	1,257	7%
Total	412	32	2,114	3,807	8,267	3,355	17,985	100%
Weight of energy sources	2%	0%	12%	21%	46%	19%	100%	
Non-energy consumption					4,709			

SOURCE: ISES2035

(ii) Initiatives and issues in the industrial sector

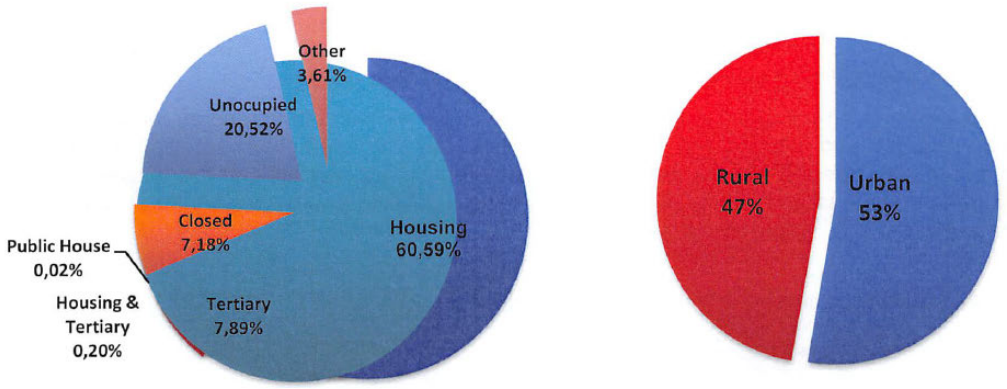
Various donor agencies have developed energy efficiency and savings programs in the industrial sector, but these were created independently of each other. Programs therefore lacked overall uniformity and have not been maintained. Programs have not led to formulation of a national energy efficiency and conservation strategy for Egypt. In this context, special attention was paid to a benchmarking study conducted by UNIDO in 2015. Although the study was limited to the cement, fertilizer and steel sub-sectors, it concluded that Egypt's energy intensive industrial sector had an energy saving potential of 25 to 35% when compared international BAT (Best Available Technology), based on estimated their energy saving potential in 2030 and 2050.

Challenges in promoting energy efficiency/savings are also identified. These include lack of energy efficiency and conservation policies, lack of actors to promote energy efficiency and conservation, low energy prices, lack of financial support, lack of energy management systems in industry, lack of awareness raising, and underdevelopment of service markets such as energy audits.

2) Buildings Sector

(i) Current status of the buildings sector

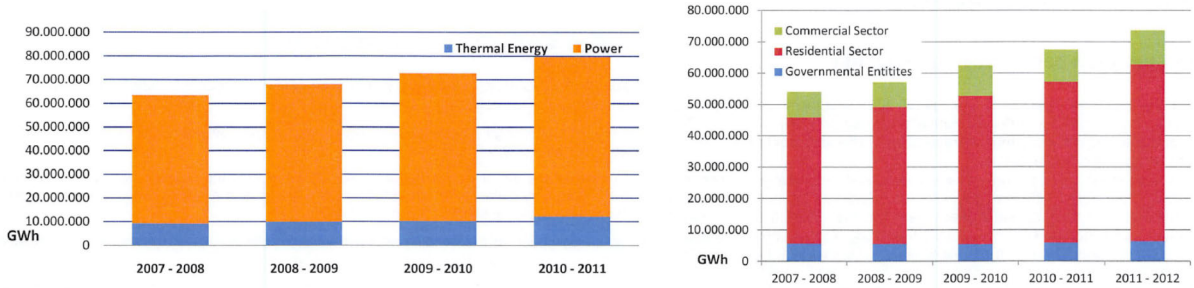
Energy consumption in the buildings sector (residential & tertiary/service sector) accounts for one-third of final energy consumption in Egypt (55% of total electricity). Residential activity accounted for 75.8% of energy demand in the buildings sector; commercial buildings 16.4%; and government buildings 7.8%. Residences account for more than half of all buildings in Egypt, with 99.1% of households connected to the grid. The number of connected units increased by 36% while the population increased by 18% over the period from 1996 to 2006. This is the main reason for increasing in energy consumption in the buildings sector. (However, energy consumption per household is lower than in neighboring countries).



SOURCE: ISES2035

Fig. 3.3 Building stock by usage (2006)

Energy consumption in the buildings sector is increasing at an average rate of 7 to 9.5%. The following chart shows total electricity consumption and natural gas consumption in the buildings sector.



SOURCE: ISES2035

Fig. 3.4 Buildings sector consumption of electricity (left) & natural gas (GWh) (right)

(ii) Initiatives and issues in the buildings sector

The following table summarizes Egypt's energy efficiency policies for the buildings sector.

Table 3.6 Energy efficiency policies for the buildings sector

Regulatory Instruments	Building EE Codes for residential, commercial and public buildings Energy efficiency standards and labels for equipment Draft electricity law
Financial Instruments	Subsidized Compact Fluorescent Lamps (CFLs) program
Policy Processes	National Sustainable Development framework Strategy National Energy Efficiency Action Plan
Voluntary Agreements	Green Pyramid Rating System Green Star Hotel Initiatives

(iii) Potential for energy efficiency in the buildings sector

The majority of energy consumption in the commercial and residential sector is for cooling, heating, hot water, cooking, lighting and home electric appliances. In 2010, the commercial and residential sector's energy consumption was more than 20 Mtoe, accounting for 37% of total final energy consumption. Electricity consumption in the sector accounted for more than 50% of total electricity consumption. Over the last decade, energy consumption by the commercial and residential sector grew at an average annual rate of 7%, 2% higher than total energy consumption. With further economic development and improving living standards, residential and commercial energy consumption will continue to increase rapidly. Energy efficiency measures in the residential sector mainly focus on efficient white goods, efficient lighting and air conditioning, solar water heaters and building insulation. Estimated savings from these measures range from 10 to 100%.

Table 3.7 Potential energy savings in the residential sector

End user Sector	Energy Saving Potential (%)
Lighting	60
Refrigerators	20
Washing Machines	20
Air Conditioning	10
Insulation – Double glazing	90
Use of Solar Water Heaters	100

SOURCE: ISES2035

There is great potential for energy savings in public buildings, streetlights and public water systems. A recent estimate indicates that savings of more than 30% can be achieved in public buildings and streetlights, and 80% in the water sector. The table below summarizes potential savings in government buildings.

Table 3.8 Energy efficiency potential in government buildings

Area	Energy efficiency measure	Complexity	Investment	Energy savings*	Payback period
Lamps and lights	Replacement of incandescent light bulbs with energy savers (CFLs)	simple	low-medium	75%	1-2 Years
	Metal halide lamps instead of high pressure mercury lamps	simple	low-high**	up to 80%	
	Electrical ballasts instead of magnetic ballasts in fluorescent tubes	simple	low-high**	20-30%	
	Utilization of grid luminaries as reflectors	simple	low-high**	20%	
	Replacement of T12-fluorescent tubes by T8-or better by T5-tubes	simple	low-high**	3-7%	
Control	Using motion detectors, daylight sensors and time switches (dimmable)	simple	low	30-40%	1-3 Years
Design	Using daylight where possible – transparent roof sheets etc	medium	low-medium	up to 100%	variable
Energy source	Replacement of central or individual electrical water heaters with solar water heaters	simple - medium	medium	up to 100%	3-7 Years
	Replacement of electrical water heaters with gas fired boilers where possible	simple - medium	medium	ca. 70%	
Walls	Insulation of walls to reduce cooling losses	medium-high	high	40%	5-10 Years
Windows	Replacement of single-glazed windows with double-glazed windows	low-medium	medium	20%	
Heat recovery	Using waste heat of air conditioning systems compressors to (pre-) heat warm water	variable	medium	up to 60%	variable
Overall system	Higher-level control to ensure the needs are adjusted to supply	complex	medium	15%	2-7 Years
	Speed control in ventilators	simple	medium	up to 30%	1-5 Years
Overall system	Higher-level control to manage peak loads in the cooling demand	simple	low-medium	30%	2-5 Years
Heat recovery	Using waste heat of compressors of cooling devices to (pre-) heat warm water	simple	low-medium	40-60%	3-7 Years

* The installation of several efficient technologies at a time can influence the savings potential due to interaction
** Depends on quantity
*** Electricity tariff residential sector monthly consumption 350 – 650 kWh: 24 Pt/kWh

SOURCE: ISES2035

The scenario for 2015-2025 categorizes energy consumption in residential buildings. The Energy Efficiency Strategy 2026-2035 indicates the development and qualification of targets and results of the Energy Efficiency Strategy in the residential sector. The energy efficiency of new and refurbished buildings has been calculated for each category of residential building stock.

Table 3.9 Annual growth & energy efficiency of new/refurbished buildings (2015-2025)

Annual growth of residential building stock	New building units	Energy Efficiency improvement of new Buildings	Energy Efficiency improvement of refurbished Buildings
Low-income classes	327,000	15%	10%
Middle classes	237,500	20%	15%
Upper middle and high classes	120,000	25%	20%
Total	**684,500**		

SOURCE: ISES2035

Table 3.10 Annual Growth & energy efficiency of new/refurbished buildings (2026-2035)

Annual growth of residential building stock	Building Units	Energy Efficiency of new Buildings	Energy Efficiency of refurbished Buildings
Low-income classes	338,000	15%	10%
Middle classes	243,000	20%	15%
Upper middle and high classes	122,000	25%	20%
Total	**703,000**		

SOURCE: ISES2035

(iv) Barriers to energy efficiency in the buildings sector

The market uptake of more energy-efficient buildings faces four sets of barriers. First, it is difficult to visualize the problem and convince people of the need for energy efficiency due to low visibility and low energy costs. Second, due to split incentives and the "principal agent problem," as the decision-maker (i.e., the investor, a landlord) often does not use the building or pay the energy bill, there is no incentive to invest in expensive solutions. Third, there is lack of information and knowledge. Lastly, delivering more energy efficient buildings is a complex problem, given multiple stakeholders, each with their own incentives and interests. Stakeholders and mediators include developers, engineers, capital providers and local authorities.

3) Tourism Sector

(i) Current status of the tourism sector

The following table summarizes energy use in hotels. Water heating represents 75% of the primary energy consumption in hotels. Total consumption for the tourism sector is 0.84 Mtoe/year, representing 11% of tertiary sector consumption, 4.3% of building consumption, and 1.6% of total final uses consumption.

Table 3.11 Energy use in Egyptian hotels

Primary energy consumption in Hotels in Mtoe/year	Year 2010	Percentage of use
Space Cooling	0.08	11%
Water heating	0.62	75%
Lighting	0.07	9%
Cooking	0.05	3%
Refrigeration	0.01	1%
Other Electric	0.01	1%
Total	0.84	100%

SOURCE: ISES2035

Natural gas consumption in hotels is approximately 3% of the total in the tourism sector.

Table 3.12 Natural gas consumption in the tourism sector

Fiscal Year	Tourism (GWh)	Total (GWh)	Tourism Sector (%)
2007 - 2008	261.541	9.238.090	2.83%
2008 - 2009	294.014	9.968.121	2.95%
2009 - 2010	349.178	10.169.889	3.43%
2010 - 2011	353.089	12.056.932	2.93%

SOURCE: ISES2035

(ii) Past and current initiatives in the tourism sector

Specific initiatives/programs have already been implemented to boost energy efficiency and sustainability in the tourism sector. These include:

- Cooperation Protocol (MOU) Green Energy in Tourism: aim is to attract interest and investment to Green Energy systems without financially burdening the investors.
- Green Star Hotel Initiative (GSHI): aim is to encourage more sustainable operations and improve environmental performance of Egyptian hotels & resorts, via a national voluntary eco-certification and capacity building program. To achieve the eco-certification, hotels must conform to more than 100 internationally recognized criteria.
- Energy Saving Program (ESP) for the Tourism Sector: Launched by UNEP to promote energy saving water heaters and other technologies in hotels and resorts in the Red Sea and South Sinai. It provides a finance mechanism to encourage local financial institutions to participate in renewable energy by covering part of the financial cost of installing the technology.
- Diesel to Solar (D2S) Initiative: aims to enable a transition to sustainable energy and helps address climate-change issues in the Arab region. It aims to reduce diesel use by encouraging integrating solar PV technology into the existing diesel-based power systems.

The EGYSOL Project was implemented in cooperation between the governments of Egypt and Italy and UNEP. The project aims to implement a mechanism to finance the distribution of solar water heaters in hotels and resorts in the Red Sea and Sinai Peninsula. The project budget was USD 500,000. The following table summarizes the energy savings targets.

Table 3.13 Energy saved in the EGYSOL Project

Realized savings (GWH) in EE Programs	2012	2013	2014	2015
Total savings achieved per year	757	2142	3964	5565

SOURCE: ISES2035

(iii) Technical and economic potential in the tourism sector

Potential in the tourism sector is calculated based on the breakdown of energy consumption per final use, potential market penetration of the interventions and the potential saving per technology. The overall result is approximately 20% of total tourism-sector consumption.

Table 3.14 Energy efficiency potential in the tourism sector

Technology	Quota of energy consumption	Potential market penetration (from market inquiry)	Potential energy saving of the technology	Overall potential respect to tourism sector consumption
Behavioural change	100%	50%	10%	5.0%
Cooling	50%	20%	70-80%	7.5%
Hot water	10%	80-90%	90%	7.7%
Lighting	5%	80%	30%	1.2%
Total saving				21.4%

SOURCE: ISES2035

The expected short, medium, and long-term expected results from the implementation of the proposed policy package have been calculated. The expected energy saving in the short-term is 5.8%. These calculations can be updated with further details, with more accurate implementation through the implementation of an Energy Information System.

Table 3.15 Energy efficiency potential in the tourism sector

Phases of implementation	EE goals, according to the proposed policy package for each phase	Expected Energy Saving
Short term (2015-2020)	- Energy saving target: 13% per guest-night - Penetration target: 100,000 hotel rooms	**5.8%** of the total annual energy consumption by hotels
Medium term (2015-2025)	- AC consumption: 11% of total consumption - Energy saving target: 34% of AC consumption - Penetration target: 50% of existing hotels	**7.3%** of the total annual energy consumption by hotels
Long term (2015-2035)	Continuation of the renovation and replacement plan for air cooling systems in the other 50% of hotels	**8.3%** of the total annual energy consumption by hotels

SOURCE: ISES2035

(iv) Barriers to energy efficiency in the tourism sector

The EBRD study cited six barriers to more sustainable and energy efficient hotels in the tourism sector:

- Lack of legislative and regulatory framework
- Financial constraints
- Low energy costs that reduce the profitability of EE measures for end users
- High up-front investment cost
- End user low interest/awareness of EE/RES solutions and their benefits
- Lack of conditions that stimulate growth of energy services companies (ESCOs)

Survey findings indicated that 74% of respondents considered lack of finance to be the main market barrier to energy efficiency. The second barrier, lack of information, was a distant second with only 10% of the responses. Only 3% considered lack of profitability to be a market barrier. The simple payback period for investment can be assumed to not be a key decision factor for most of the respondents.

An essential prior step to reaching energy efficiency goals in the tourism sector is to create a database dedicated to sector-specific information. This requires identifying the tourism sector separately from the other commercial activities at the national level.

4) Street lighting sector

(i) Current status of the street lighting sector

Analysis of the sector used databases developed for Heliopolis (Cairo) and Alexandria. Egypt has about four million streetlights that consumed 6,200 GWh in 2010, about 4% of Egypt's total electricity supply.

The energy price for streetlights was set at 47.5 piasters per kWh in January 2014, then increased to 56.6 in July 2014. Since then, the price has increased several times as shown in the table below.

Table 3.16 Increases in electricity tariff for street lighting

Year	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
Price in EG Piasters per kWh	56.6	58.0	58.0	58.6	66.5

SOURCE: ISES2035

(ii) Past and current initiatives in the street lighting sector

According to the Electricity Sector Energy Efficiency Plan, published by the Energy Department of the League of Arab States, the objective was to cut energy use in public lighting by 450 GWh between 2012 and 2015. This represented approximately 7% of electricity consumption in 2010.

Recent reinforcement of the CEEU and the expected establishment of Energy Efficiency Units in the Ministry of Industry and elsewhere will contribute to energy efficiency becoming an energy policy priority.

Lamp replacement programs and UNDP-supported projects have also been implemented. The aim of the UNDP project was to update guidelines/regulations on energy efficient streetlighting, implement capacity building measures and raise awareness among responsible municipal authorities.

(iii) Technical and economic potential in the street lighting sector

Energy efficiency potential was estimated via two approaches. First was a top-down approach using global energy consumption data. Second was a bottom-up approach using local field data.

Efficiency potential estimated via the top-down approach was 3,200 GWh (53% of gross energy consumption). For the bottom-up approach, a case study was developed using the streetlight infrastructure in Alexandria. The study calculated that average power consumption per streetlight was about 920 kWh. Assuming use of a range of the latest available technologies, a potential energy saving of at least 50% can be achieved. If implemented nationwide, an overall energy efficiency gain of 1,840 GW is possible.

(iv) Barriers to energy efficiency in the street lighting sector

The following are seen as barriers to energy efficiency in the street lighting sector:

- Low energy prices
- Lack of awareness and information among streetlight operators
- Lack of financing capacity for energy efficiency projects

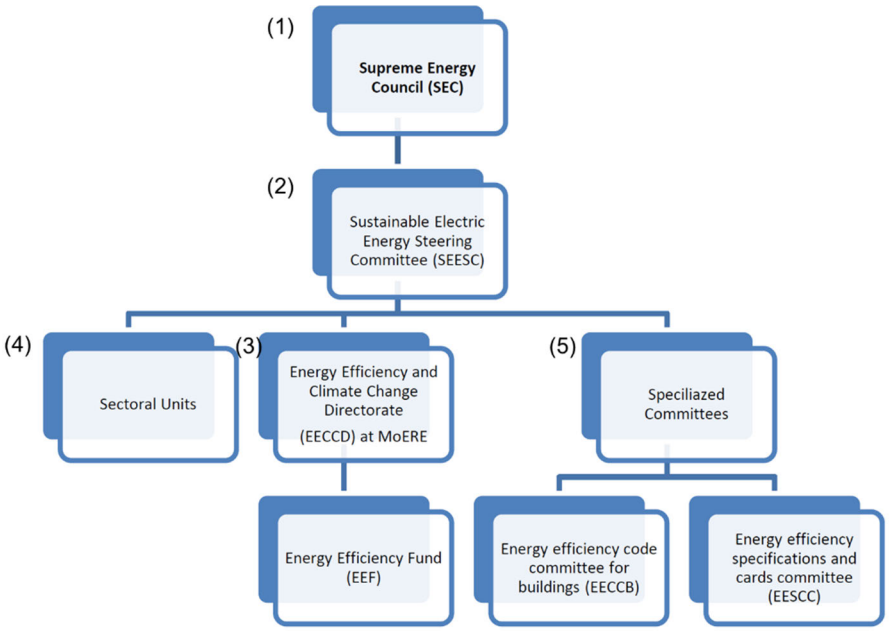
(7) National Energy Efficiency Action Plan II (2019-2022)

The Second Egyptian National Energy Efficiency Action Plan (NEEAP-II) covers the period between 2019 and 2022. It takes into consideration challenges faced with the preceding plan to ensure achievement of the aspired outcomes. NEEAP-I complies with Egypt's Integrated Sustainable Energy Strategy to 2013 (ISES2035) and Egypt Vision 2030 and sets out to enforce the provisions of the Electricity Law No. 87 of 2015 and its Executive Regulations. The ISES2035's goal is for rationalization to reach 18% of expected energy consumption by 2035 for the industrial sector, 16% for the buildings sector, 23% for the transportation sector, for a total energy rationalization of 18%.

This report will cover (a) Energy Efficiency institutional framework, (b) Financing tools for energy efficiency activities, and (c) Energy efficiency on the supply side.

1) Energy efficiency institutional framework

The need for an institutional framework was a key challenge identified in NEEAP-I. In NEEAP-II, the following institutional framework was developed.



SOURCE: SECOND NATIONAL ENERGY EFFICIENCY ACTION PLAN (NEEAP)

Fig. 3.5 Energy efficiency institutional framework (EEIF)

The following table summarizes the composition of EEIF.

Table 3.17 Composition of the Energy Efficiency Institutional Framework (EEIF)

(1) Supreme Energy Council (SEC)	The Supreme Energy Council (SEC) was established in 1979 by Decree No. 1093 and restructured pursuant to Decree No. 1395 0f 2006 issued by the Prime Minister. Chaired by the Prime Minister, it includes the ministers of Electricity & Renewable Energy, Petroleum & Mineral Wealth, Environment, Industry and Trade, Housing & Utilities, Transport, Finance, Planning & Administrative Development, Investment, Foreign Affairs, and Defence General Intelligence. Its mandate is to oversee development of ISES in support of the socio-economic development plan; to meet efficiency standards in the use of resources; and to guide the restructuring of energy markets and address development taking place in this regard.
(2) Sustainable Electric Energy Steering Committee (SEESC)	The Sustainable Electric Energy Steering Committee (SEESC) was established a decree issued by the Prime Minister. SEESC is chaired by the First Undersecretary for Research, Planning and Authorities' Follow up. SEESC will include first under-secretaries in charge of energy efficiency units at their ministries which are engaged in the implementation of NEEAP, including the ministries of Industry & Trade, Public Business Sector, Housing & Utilities, Tourism & Local Development, Education, Transport, Youth & Sports in addition to the managing directors of Egypt ERA, EEAA, EEHC and other relevant experts. SEESC's mandate is to supervise implementation of NEEAP, supervise EEF and ratify support provided thereby for implementation of measures outlined in NEEAP and to facilitate related works, supervise and follow up the implementation of plans for eliminating non-energy efficient appliances, approve capacity building programs and secure necessary funds for them, prepare semi-annual reports on the implementation progress of NEEAP, coordinate with MIIC to determine sources of financial and technical support provided by international partners, make available and disseminate information and data to assist all entities and consumers to improve energy efficiency, and supervise preparation of NEEAP 2022-2024.

(3) Energy Efficiency and Climate Change Directorate (EECCD)	EECCD's mandates: 1) Coordinate with stakeholders and concerned entities – including Egypt ERA and licensed electricity generation and distribution companies, Egyptian Electricity Transmission Company (EETC), and monitoring and evaluation of EEAC. 2) Databases – Set up databases on energy efficiency managers at establishments, an energy efficiency register, a register of energy service companies, a register of measurement and verification companies, a database of certified organizations and centers providing training on energy efficiency, grant accreditation certificates, and conduct performance evaluation and KPIs. 3) Secure funds for energy efficiency activities – Coordinate with Central Bank of Egypt (CBE)'s SME initiatives, credit risks guarantee initiative for energy efficiency projects with a credit risk guarantee company CRCG, undertake promotions and coordination with donors, and direct and guide the Egyptian Energy Efficiency Cluster Initiative (EEECI) 4) Technical Secretariat of SEESC overseeing energy efficiency – Record minutes of SEESC's meetings, follow-up on the implementation of SEESC's decisions, prepare energy efficiency annual report, and prepare for annual energy efficiency conference
(4) Energy Efficiency Sectoral Units	10 Energy Efficiency Units have been established in the following ministries: Ministry of Electricity and Renewable Energy, Tourism Development Authority, Ministry of Education and Technical Education, Ministry of Trade and Industry, Ministry of Housing, Utilities, and Urban communities, Ministry of Higher Education, Housing & Building National Research Center, Ministry of Civil Aviation, Ministry of Environment, Ministry of Petroleum and Mineral Resources. The mandate is to develop capacity building programs, develop a map illustrating opportunities for improving energy efficiency, follow-up carrying out of cost-effective measures, propose appropriate energy efficiency indicators, recommend developing and enhancing policies and programs, evaluate results of energy efficiency programs and measures, and communicate with sector stakeholders
(5) Specialized Committees	1. Energy Efficiency Specifications and Labelling Committee (EESLC) – Mandate is to review proposals made by EECCD and other concerned entities to expand minimum energy efficiency specifications program for electrical equipment and appliances, as well as the energy efficiency labels system, guide programs for replacing non-energy efficient appliances, identify requirements to be met by pilot laboratories for conducting energy efficiency tests on electrical equipment and appliances, review requirements for awarding the licenses to laboratories and testing facilities that implement required tests, supervise awareness-raising programs on the importance, coordinate with merchants and stores selling electrical equipment, and lay mechanisms for market regulation for monitoring and verifying that energy efficiency labels are placed. 2. Energy Efficiency Code Activation Committee for Buildings (EECACB) – Mandate is to lay roadmap for activation of the energy efficiency code for buildings and a priorities plan, including new buildings, renovation of existing buildings, governmental and public buildings, commercial buildings and residential buildings

SOURCE: SECOND: NATIONAL ENERGY EFFICIENCY ACTION PLAN (NEEAP)

2) Financing tools for energy efficiency activities

Three financial tools are identified for energy efficiency activities:

Energy Efficiency Fund (EEF): EEF will be financed from fees paid in consideration of energy efficiency improvement services, to be added to the electricity tariff at the rate of EGP 1/1000 per kWh of electricity sold to consumers. Electricity companies will deposit the collected amounts in EEF's account which will be opened for this purpose at CBE. Expected revenue for fiscal year 2021/2022 is

calculated to be EGP 195.582 million. Fields financed by EEF are provision of necessary funds to set up, manage and develop the energy register, high efficiency lighting programs, EEIPs at schools, etc.

Credit Risk Guarantee Mechanism (CRGM): CRFM identified three fast return technologies (a simple recovery period of less than three years) and easy application, namely high efficiency lighting, enhancement of power factor and energy system management. CRGM's funds were completed with financial leverage provided by the CRCG for the project and for the company to provide the required guarantees for projects. So far, 86 projects have benefited from CRGM with total funds (investment costs) of EGP 48.4 million with guarantees worth EGP 31.5 million during the period from 2005 to 2015.

CBE initiative to support SMEs: CBE announced an initiative to be implemented via commercial banks to support SMEs by offering loans worth EGP 200 billion over three years. CRGM aims to benefit from loans provided through the initiative by identifying the best type/form of projects to benefit from CRGM and the initiative's conditions.

3) Energy efficiency on the supply side

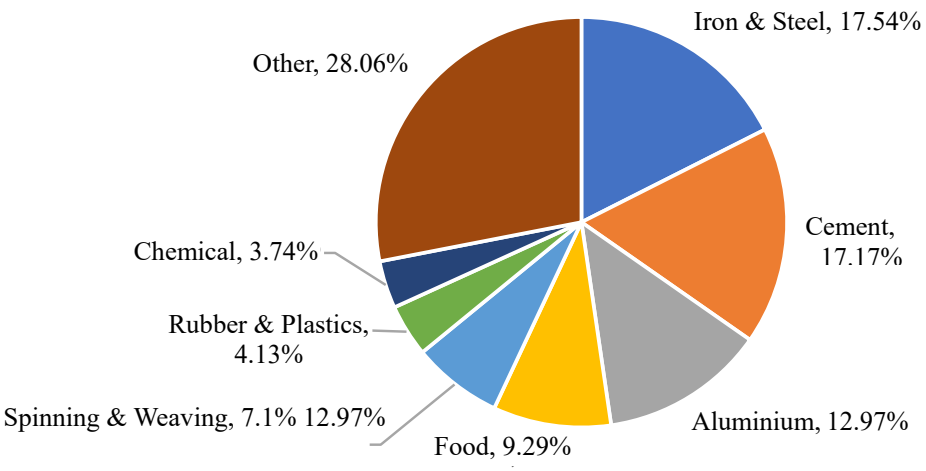
The following table summarizes energy efficiency projects under NEEAP-II.

Table 3.18 Energy efficiency projects in NEEAP-II

Supply-side energy efficiency projects	Power plant expansion plans Egyptian Saudi Interconnection Project Reduction of losses in electricity distribution networks Use of smart meters Activation of EDC role in achieving energy efficiency gains for subscribers
Energy efficiency procedures in the buildings sector	Energy Efficiency Specializations and Labeling Procedures (EESLP) Elimination of non-energy efficient equipment New mechanism for distribution of LED lightbulbs Deployment of solar water heaters in residential sector and governmental facilities Improving efficiency of lighting systems in public and private buildings Connected small-scale PV power plants
Energy efficiency in the tourism sector	Deploy solar water heaters in tourism facilities in the Red Sea/South Sinai (EGYSOL) Use of solar water energy and energy rationalization technology in hotel facilities
Energy efficiency in industrial sector & SMEs	Promote use of high-efficiency electric motors in industry Promote solar energy for heating processes in industry Pilot project on usage of low-carbon technologies in industrial applications
Energy savings in public lighting	Improve energy efficiency of public lighting Program for road lighting using PV Modules Improve energy efficiency of street advertisements and public places

SOURCE: SECOND: NATIONAL ENERGY EFFICIENCY ACTION PLAN (NEEAP)

The following is an analysis of energy efficiency procedures in the industrial sector. The chart shows the composition of energy consumption in the industrial sector. Energy-intensive industries, such as iron & steel, cement and aluminium, account for a large portion of consumption.



SOURCE: SECOND: NATIONAL ENERGY EFFICIENCY ACTION PLAN (NEEAP)

Fig. 3.6 Consumption by energy intensive-industries

The following table summarizes the four proposed energy efficiency measures in the industrial sector under NEEAP 2017-2020.

Table 3.19 Proposed energy efficiency measures in the industrial sector

Project	Promotion of high-efficiency electric motors in industry	Use solar energy for industrial heating processes	Environmentally sound technology transfer (MED-TEST II)	Use low-carbon technologies in industrial applications
Description	Prepare/adopt standard specifications for electric motors IE1, IE2, IE3 through EOS Audit energy consumption in electric motors at 100 factories Set regulatory policies for electric motors of 1-200 kW capacity Set technical specifications for electric motors Provide assistance to establish labs for measuring efficiency of electric motors Increase local production of electric motor components.	Implement several pilot projects to use solar energy in industrial heating processes. Use solar energy in industrial applications (food, chemicals, textiles etc.) at 100 plants. Design innovative financing parcels up to USD 2 million. Technical assistance. Accreditation of solar heater labs.	Calculate raw material & energy consumption to create database for optimization of energy and raw materials. Environmentally sound technology transfer and energy rationalization in 30 companies.	Financial support for improvements at 2 of 12 factories for which technical support was provided, particularly in food sector for frozen vegetables & fruits, and frozen meats.
Implement-ation period	From October 2017	From 2017	NA	NA
Implementing agency	Egypt National Cleaner Production Centre (ENCPC)	ENCPC	ENCPC	ENCPC
Total costs	USD 3.2 million	Around USD 5.4 million for technical assistance USD 2 million	USD 440k	USD 109k

Support	International Finance Corp. (financing) Lawrence Berkeley Lab (technology)	UNIDO (financing)	UNIDO (financing)	UNIDO Japan Ministry of Foreign Affairs
Estimated savings across sector	270GWh by June 2020 1,100 MW by 2030 11TWh by 2050	4.5GWh between 2017 and 2020	20 to 30% of energy and raw material used	30% of fuel usage

SOURCE: SECOND: NATIONAL ENERGY EFFICIENCY ACTION PLAN (NEEAP)

(8) EEC policies in the oil and gas sector

Modernization programs in the oil & gas sector are an essential part of the oil & gas strategy and its work plans, aligned with the framework of an integrated energy vision until 2035. It consists of six programs:

- Investment attraction
- Sector structure reform
- People agenda
- Downstream performance & energy efficiency
- Upstream performance
- Hub strategy

1) Program summaries

Program 1, Investment attraction: The objective is to attract more investors and partners into the sector. Although the production-sharing agreement model has proven successful, there is a need for flexibility to incorporate best practices. The ministry will be able to provide an upgraded version of the production-sharing agreements to have a better model in place, and to attract more investors into the energy sector.

Program 2, Sector structure reform: The modernization plans come with an unseen element of structural reform. Reorganization of sectoral entities is identified as a key aspect of success. Based on this understanding the Ministry of Petroleum would be the policy and strategy maker, while state corporations (EGPC, GANOPE, and EGASI) will focus on operating profitable businesses upstream, midstream and downstream. An independent regulator will set prices, fees, tariffs, subsidies and prevent monopolies. Based on these rationales behind structural reform, the main objective is to segregate roles and responsibilities, to reach an ideal organizational structure. The program targets the following: 1. Demarcating Sector roles between policymaking, operations and regulations, and 2. Enhance sector workflow to create an attractive investment environment.

Program 3, People agenda: As capacity building is indispensable to the success of the program, the people agenda is one of the six major initiatives. Specifically, the program will work on developing and raising the efficiency of employees and optimizing the available competencies and developing modern human resource management systems and efficiency-based promotions.

Program 4, Downstream performance & energy efficiency: The most important part of this program is to address inefficiencies in the oil & gas sector. To strengthen competition, the sector needs to identify the issues and set solutions. The main objective for Program 4 is to improve downstream performance and energy efficiency of all Egyptian oil and gas activities (upstream, midstream and downstream). The program was divided into 2 subprograms.

4-A: Optimize downstream through securing efficient mass balancing (sourcing and output) to maximize performance and revenues. To improve performance in oil, gas and petrochemicals, there is a need to boost production, remove bottlenecks, enhance added value through chain integration between refineries, gas plants and the petrochemicals industry, maximize refinery utilization rates, optimize crude oil & gas transmission and distribution and optimize yields of refineries。

4-B: Improve energy efficiency for Petroleum Sector activities to minimize energy consumption and cost.

Program 5, Upstream performance: To encourage investment in Egypt, the sector needs proper criteria, agreements, pricing, processes and cycles for permits and approvals. That will allow upstream players to secure permits to conduct seismic works, exploratory drilling or production wells in a shorter timeframe.

Program 6, Hub strategy: The modernization initiative sets a clear path for Egypt to become a regional oil & gas hub in the global market. To become a regional hub, petroleum products, LPG and electricity trading must be included, not just natural gas. With the addition of new power plants currently under construction, Egypt is in a position with extra capacity of generated electricity.

Objective-1, Develop energy efficiency departments in sector companies: Establish Energy Efficiency Departments to ensure sustainable commitment for implementing and follow-up of energy conservation & energy efficiency activities. The proposed departments would work to improve energy efficiency, record energy consumption data, propose and participate in the study and implementation of proposals for the improvement of energy efficiency, and coordinate between parties involved in implementation in addition to verify & evaluated periodically the results of execution.

Objective-2, Increase awareness of the importance of reducing energy consumption: The objective identifies three key topics that are the basis of the awareness program: 1. Responsibilities and tasks of EE Department staff; 2. Methodology of energy data collection and registration; 3. Identify and follow up implementation of no/low-cost energy efficiency measures.

Objective-3, Establish energy database & monitoring systems: Create a detailed energy consumption database to identify intensive energy users and take the necessary actions to reduce energy consumption. Three forms developed to collect energy consumption data are: 1. General energy consumption data to determine intensive energy consuming companies to focus on improving their energy efficiency activities during project's second phase; 2. Detailed consumption data including energy consumption for major units to be recorded in the company's energy registry; 3. Short form energy

consumption data to be sent periodically to EGPC and holding companies to evaluate & follow up on energy efficiency activities and support KPIs for different sector companies

Objective-4, Implement no/low cost and housekeeping energy efficiency measures: Submit a draft list of no/low-cost energy efficiency improvement measures implemented in different companies and found to be effective. Draft list will be submitted to petroleum sector companies to study its potential implementation. This will provide an incentive, and is a first step towards implementation of the long-term objectives.

The following are long-term objectives of Program 4-B.

Objective-5, Introduce EE new/oriented technologies to reduce cost and improve yield: 1. Implement waste heat recovery for turbines (4 projects); 2. Improve performance of oil heaters & boilers (6 projects); 3. Associated gas recovery, pilot project; 4. Improve motors optimization system.

Objective-6, System optimization to reduce energy consumption and operating cost

Objective-7, Develop energy efficiency legal/administrative framework: 1. Establish energy efficiency & climate unit (EECU) at Ministry of Petroleum; 2. Short-term energy efficiency legal & administrative framework; 3. Long-term energy efficiency legal & administrative framework.

(9) Key Environmental Policies

The following are current environmental policy priorities in Egypt.

1) Presidential decree assigning Minister for Environmental Affairs

In June 1997, Egypt's first full-time Minister for Environmental Affairs (EEAA) was in Presidential Decree no.275/1997. The Ministry is focused on setting environmental policies, priorities and initiatives within a context of sustainable development. The following are directives in the policy statement of the Ministry:

- Strengthening partnerships at the national level
- Supporting bilateral and international partnerships in environmental fields
- Enforcing Law 4 of 1994 for protection of the environment, and Law 102 of 1983 for Natural Protectorates and all other environmental legislation
- Supporting institutional strengthening and capacity building for the Egyptian Environmental Affairs Agency and Environmental Management Units (EMUs) of the governorates
- Supporting Integrated Environmental Management Systems
- Supporting the various international agreements signed by Egypt
- Integrate use of market-based instruments in the field of environmental protection
- Transfer and adaptation of environmentally friendly technologies
- Encouraging private-sector foreign investment
- Promotion of decentralization

2) National Environmental Action Plan 2002 - 2017 (NEAP)

This is the official document setting out Egypt's agenda for environmental actions for 2002 to 2017. NEAP includes components to integrate existing sectoral plans and social development. EEAA formulates the general policy and lays down the necessary plans for protecting the environment, with NEAP as the main environmental source document for line ministries as sectorial action plans are developed every five years.

An updated NEAP has not been published since 2018, but the Sustainable Development Strategy: Egypt Vision 2030 outlines two key pillars and performance indicators.

Table 3.20 Environmental Performance Indicators in the SDS2030

S.N	Indicator	Current value		2020 target	2030 target
Strategic results					
1	Ratio of total water consumption (%)	107%		100%	80%
2	Fresh water resources per capita (renewable)	650 m^3/year		750 m^3/year	950 m^3/year
3	Percentage of decreased pollution caused by fine airborne dust (%)	157 Microgram/m^3		-15%	-50%
4	Percentage of municipal solid waste regularly collected and managed in a suitable manner (%)	20% collection efficiency: 60%		40% collection efficiency: 80%	80% collaection efficiency: 90%
5	Percentage of hazardous wastes, safely disposed (treatment, recycling, final disposal) (%)	7%		30%	100%
6	Composite Biodiversity and environment indicator of 3 sub-indicators: (1) the area of nature reserves/ total area of land and watercourses, (2) area of marine and coastal natural reserves/marine and coastal total area, (3) ratio of protected sites classified as AZE to total sites classified.	(1)11.1% (2) 4.3% (3) NA		(1)17 (2)10	(1)17 (2)10
7	Rate of reduction of Ozone-depleting materials	HCFC-22 HCFC-141b HCFC-142b HCFC-123 HCFC-124	3,179,380 1,116,780 151,387 0 0.270	97.5%	100%
8	Rate of reduction of the expected increasing rates of greenhouse gas emissions	276 equivalent Tons of Carbon dioxide			
Outcomes					
9	Ratio of non-traditional water resources to total water resources usage	20%		30%	40%
10	Sanitation as percentage of the total sewage (%)	50%		60%	80%
11	Illegal industrial sewage into the Nile River as a percentage of the total industrial sewage (%)	21%		16%	0%
12	Sanitation percentage according to the national standards, disposed in the Nile River (%)	50%		70%	100%
13	Number of natural reserves, with an approved and activated management plan (reserves)	13		15-20	30
14	Percentage of progress in the commitment to ratified conventions (%)			100٪	100٪

Inputs				
15	Percentage of loss in water transfer networks (%)	15%	Less than 10%	Less than 5%
16	Percentage of loss in water treatment plants (%)	30%	Less than 20%	Less than 10%
17	Number of national monitoring air pollutants plants	87 plants	92 plants	120 plants
18	Number of monitoring sites at the national network of monitoring industrial emissions	164 sites 40 companies	250 sites	500 sites

SOURCE: SDS2030

3) Climate Change Policies

(i) The Nationally Determined Contribution (NDC)

Egypt, as a signatory of the United Nations Framework Convention on Climate Change, submitted its first National Communication in 1999. Egypt ratified the Kyoto Protocol in January 2005, submitted its second National Communication in 2010 and third National Communication in 2016. Egypt participated in the Paris Agreement in June 2017 and submitted its Nationally Determined Contribution (NDC) to UNFCCC.

Egypt has not specified performance indicators in the SDS2030 nor the NDCs. But the following initiatives are mentioned in the NDC regarding the roadmap to reducing greenhouse gas emissions:

- Widespread diffusion of locally appropriate low-carbon energy production technologies, with substantial reductions in energy intensity
- Comprehensive mitigation efforts covering all major sources of emissions
- Locally appropriate technology transfer and financial flows from industrialized countries (Annex I countries) to support carbon emission abatement according to UNFCCC principles that acknowledge that developed countries should provide required support to developing countries in this regard.
- Energy efficiency is among five policies mentioned regarding continuous development:
- More efficient use of energy, especially by end users
- Increased use of renewable energy as an alternative to non-renewable energy sources
- Use of advanced locally appropriate and more-efficient fossil fuel technologies, which are less-emitting, in addition to new generations of nuclear power
- Energy efficiency is the cornerstone to be targeted by policymakers to decouple demand on energy and economic growth
- Reform energy subsidies. This policy is implemented using four pillars: set different prices for petroleum products based on energy generation efficiency; increase efficiency of energy use; provide support to certain sectors to promote switching from conventional energy sources to clean energy sources; and apply the fuel subsidy smartcard system to ensure that subsidies are received by target beneficiaries.

(ii) Biennial Update Report (BUR)

Egypt submitted its Biennial Update Report (BUR) to UNFCCC in 2018. As of 2015, GHG emissions in Egypt were reported as 325,614 Gg CO_2e. This is an increase of 31% versus 2005. Energy industries account for 43% of GHG emissions, while manufacturing industries and construction account for 23%.

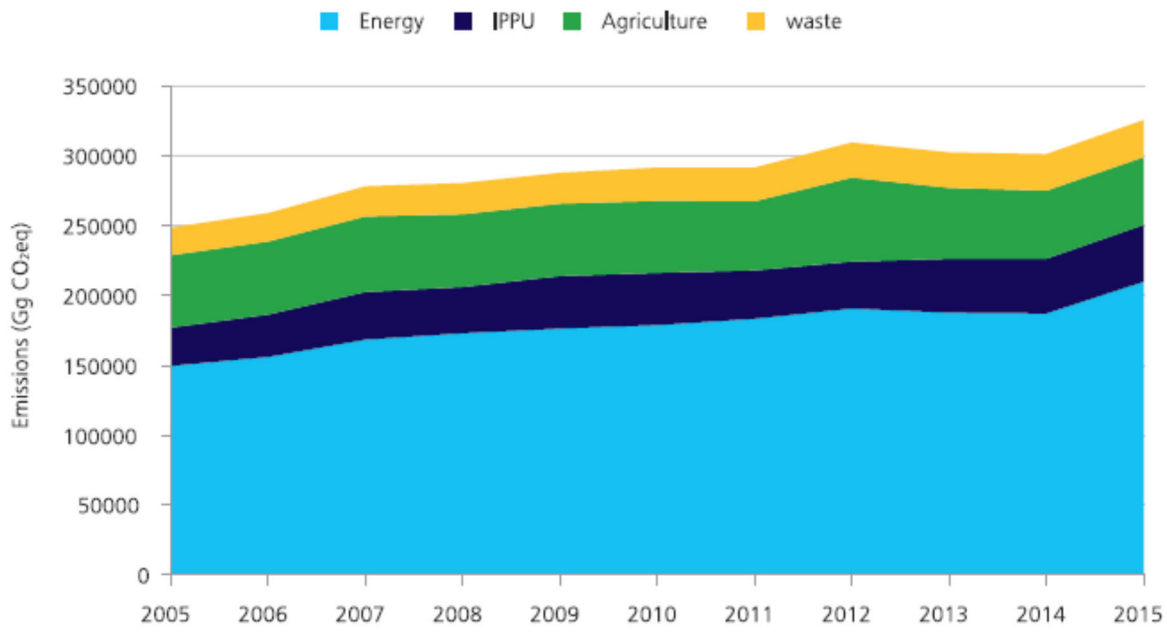


Figure 2.1: GHG emission trend in the period from 2005 to 2015 per sector

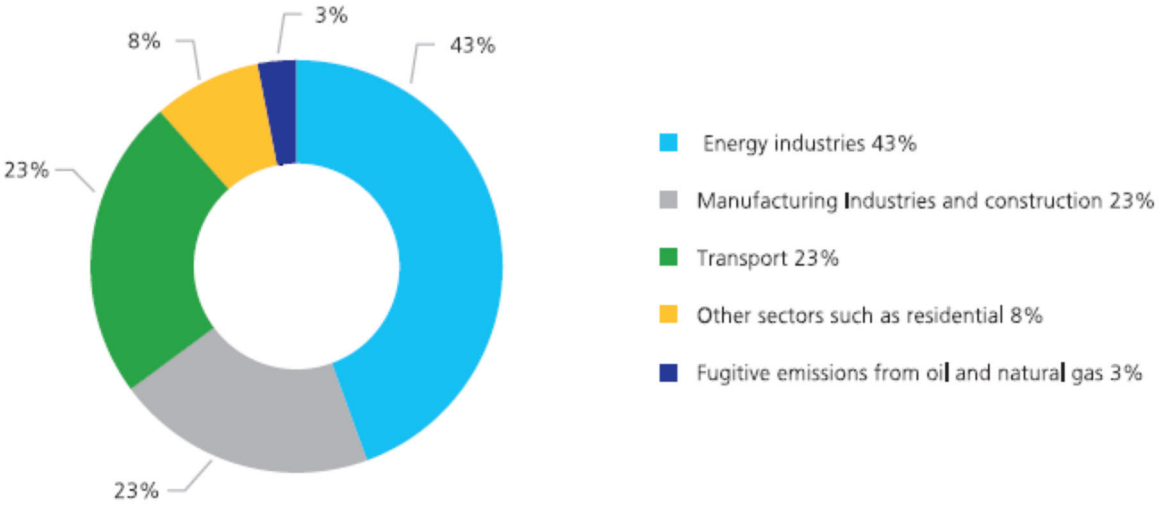


Figure B: Emissions per category for the energy sector, 2015

SOURCE: BUR EGYPT

Fig. 3.7 GHG emissions in Egypt

Several GHG mitigation policies and actions in the energy sector are mentioned in the Industrial Energy Efficiency Project (IEE) (2013-2015), including: electricity sector subsidy reform program

(2014-2015); increase of renewable energy contribution to national electricity generation (2013-2015); energy efficiency for electricity generation and end-users (2005-2015); sustainable transport and expansion of metro network (2009-2015).

The following chart summarizes planned mitigation policies and actions beyond 2015.

Table 3.21 List of planned mitigation policies and actions beyond 2015

No.	Mitigation action	Sector / subsector	Implementing entity	Duration
1	Removal of energy subsidies	Electricity, oil & gas	MOERE and MoP	2016-2019
2	Install additional renewable energy generation to reach 37% target by 2035	Energy, renewable energy	MOERE	2016-2035
3	Renewable energy and solar water heaters in housing sector*	Energy & housing	MoH	
4	Energy efficiency per Energy Strategy 2035 (all sectors) & National Energy Efficiency Action Plan 2018/2019-2020/2021 (NEEAP II) for electricity sector	Energy, energy efficiency	All ministries	2016-2035
5	Sustainable transport programs and national rail system expansion	Energy, transport	National Authority Tunnel (NAT) and Egyptian National Railway (ENR)	2016 on
6	Low-carbon roadmap for cement industry, including alternative fuels utilization	IPPU, cement	MoTI and EEAA	2016 on
7	Management program (NSWMP)	Waste	EEAA	2016 on
8	Feed-in tariff for power generation from waste	Waste	EEAA	
9	Reduce cultivated areas of rice	AFOLU	MALR	2017-2030
10	Reduce GHGs emissions from livestock	AFOLU	MALR	2017-2030
11	Recycling agricultural waste and manure	AFOLU & Energy	MALR	2016 on
12	Green Growth Fund (GGF)	Cross-cutting	Financial institutions	2016 on
13	Implementation of a national MRV system	Cross-cutting	All sectors	-

SOURCE: BUR EGYPT

THIS MITIGATION ACTION HAS BEEN IDENTIFIED UNDER THE NAMA MAPPING CONDUCTED UNDER LOW EMISSION CAPACITY BUILDING PROGRAM (LECB) SUPPORTED BY EEAA AND UNDP.

(iii) COP26

At the COP26 meeting in Glasgow the Minister of Environment launched Egypt's National Climate Change Strategy, 2050, that aims to enable Egypt to plan and manage climate change on different levels, in addition to supporting sustainable development goals and Egypt's vision 2030 targets. The strategy has five main objectives:

1. Achieving sustainable economic growth
2. Enhance adaptive capacity & resilience to climate change, and alleviating associated negative impacts

3. Enhancing climate change action governance
4. Improving infrastructure for financing climate activities
5. Enhancing scientific research, technology transfer, knowledge and awareness management for combating climate change, increasing awareness on climate change among different stakeholders

One action to achieve sustainable economic growth is maximizing energy efficiency by improving thermal energy terminals' efficiency, transmission and distribution networks, activities related to oil and gas, and improving energy efficiency of electrical appliances and equipment. Plus, use of cleaner energy sources such as electric/natural gas-powered transportation, public transit and cycling, as well as boosting energy efficiency in buildings and promoting energy efficiency in all industrial processes.

(iv) First updated NDC

Since Egypt announced it will host COP27 in Sharm El Sheikh in November 2022, climate change measures have accelerated and the NDC was updated in June 2022 for the first time. It includes these chapters:

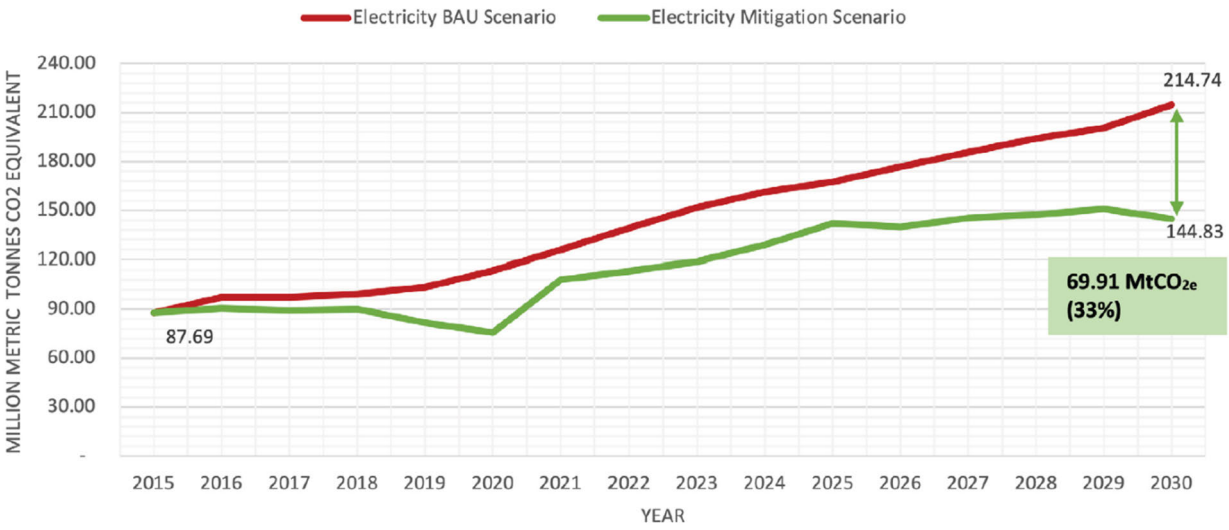
- Actions taken to implement the first NDC since 2015
- Pathway to 2030 mitigation targets/measures for electricity, oil & gas, transport, industry, buildings & cities, tourism, and waste management)
- Contribution to climate change adaptation
- Implementation measures (including key mitigation projects with estimated costs)
- MRV

In “actions taken to implement first NDC since 2015,” progress on energy efficiency is evaluated as:

Energy efficiency in electricity sector: As part of a national plan to improve energy efficiency, measures have been implemented on both supply and demand sides. Due to extensive power station maintenance, and upgrades on the supply side, a significant drop in fuel consumption was achieved in FY2019/20. Improvements in generation efficiency coupled with supply from renewable sources led to a substantial decline in fuel consumption for electricity generation in from 2017 thru 2020.

In progress on green finance, the first sovereign green bonds, valued at USD 750m were issued in 2020.

In “Pathway to Egypt’s 2030 mitigation targets,” target for the electricity is to reduce GHG emissions by 33% vs. the BAU scenario. To achieve this target, renewable energy as well as energy efficiency measures in both supply and demand sides are stipulated. Efficiency measures on the demand side include incenting electricity distribution companies to promote energy efficiency projects for their customers.



SOURCE: EGYPT'S FIRST UPDATED NDC (JUNE, 2022)

Fig. 3.8 2030 Mitigation targets in electricity sector

No quantitative targets were set for buildings & cities, but mandated measures include energy efficiency initiatives, such as LED lighting in the residential sector, expansion of standards and labeling system, elimination of energy-inefficient equipment, and enforcement of energy efficiency codes for new buildings.

In "Measures for Implementation," estimates for conditional finance as pegged at USD 196 billion for mitigation and USD 50 billion for adaptation.

4) Environmental Impact Assessment (EIA)

The following table summarizes Egypt's key environmental laws.

Table 3.22 Key environmental laws in Egypt

No.	Law No. / Year	Title	Contents
Environmental Impact Assessment (EIA)			
1	Law No. 4/1994 (amended by 9/2009, 105/2015)	The Environment Law	Main legal instrument for environmental protection. Established EEAA, Environmental Protection Fund, and EIA system
2	Decree 338/1995 (amended by 1741/2005, 1095/2011, 710/2012)	Executive Regulations of the Environment Law	Environmental standards, EIA classification and procedures etc.
3	EIA Guidelines (2nd Edition) 2009	Guidelines of Principles and Procedures for Environmental Impact Assessment	Detailed requirements for EIA process, including social assessment and consultation.
4	Law No. 48/1982 (amended by 92/2013)	Protection of the Nile River and Its Waterways from Pollution	Effluent standards for WWTPs discharging to drains

No.	Law No. / Year	Title	Contents
5	Law No. 93/1962 (amended by MHUUC Decree 44/2000)	Concerning Drainage of Liquid Wastes with Its Executive Regulation	Effluent discharges to public sewers, limits for reuse of treated wastewater in agricultural purposes, and limits for reuse of sludge in agricultural purposes.
6	Egyptian Code 501/2005, 501/2015	Wastewater Reuse	Classifying treated wastewater into four grades depending on level of treatment and setting limits for reuse of treated wastewater depending on grade.
Land Acquisition and Resettlement (This project will not require any land acquisition and resettlement.)			
7	Law No. 10/1990 amended by Law No. 1/2015	The law on Property Expropriation for Public Benefit	Regulation and procedures for expropriation of real estate in the public interest.

The list approach depends on screening projects into three categories based on different levels of EIA required according to severity of possible environmental impacts as follows:

- "A" list projects for projects with minor environmental impact
- "B" list for projects that may result in substantial environmental impact
- "C" list for projects that require complete EIA due to their potential impacts

EIA screening process:

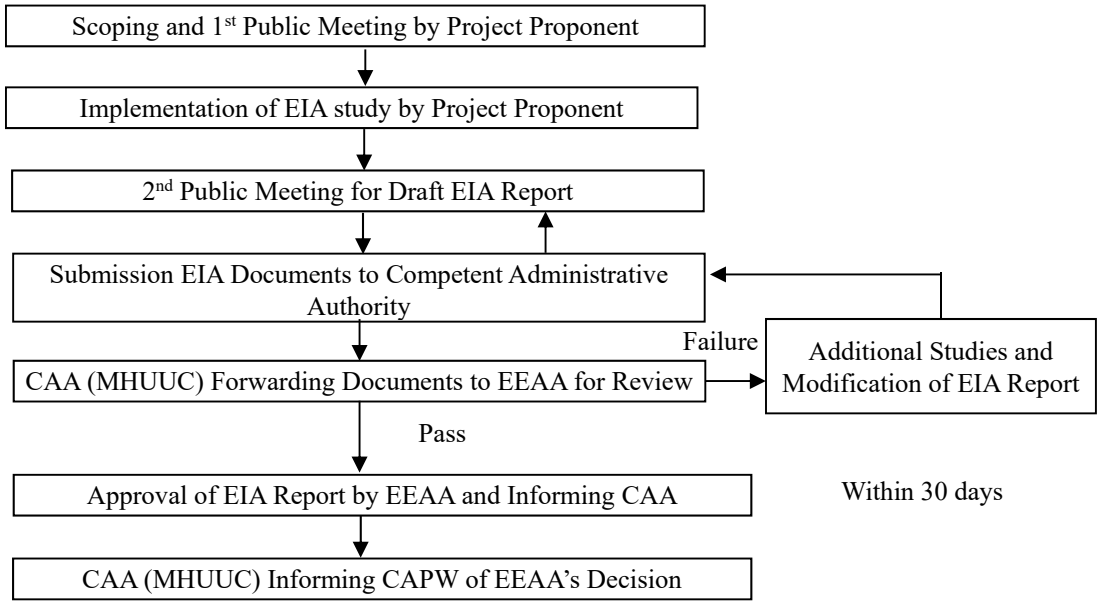


Fig. 3.9 EIA screening process in Egypt

3.3 Analysis of EEC Laws

3.3.1 New Electricity Law

(1) New Electricity Law (No. 87 of 2015)

The New Electricity Law 87/2015 was issued in July 2015. On April 28, 2016, the Minister of Electricity issued a resolution No. 230 (Ministerial Decree No.230/2016, Executive Regulations of the Electricity Law) that sets executive regulations of the Electricity Law, including stipulations on improving energy efficiency.

Chapter Four of the Executive Regulations includes Articles 64 and 65, stipulating appointment of an official to improve energy efficiency in facilities. Subscribers are divided into two groups: over 10MW, and over 500kW. A participant with a contractual capacity of more than 500 kW is required to appoint an official to improve energy efficiency in the facility. If the contractual capacity increases by 10 MW, participants are required to fulfill and update energy record data periodically and follow-up energy consumption in the facility and develop proposals to increase the efficiency of its use. All major subscribers are required to submit energy efficiency reports to the Egypt ERA.

Table 3.23 Articles of the Electricity Law

Article 45	The network operator or the electricity distribution licensee shall purchase or pay the value of the excess electricity of the common generation units and the units of producing electricity from the restored energy that the capacity of which is less than 50 megawatts in accordance with the conditions and prices determined by the Agency
Article 47	The network operator or the electricity distribution licensee may conclude contracts with the consumers or the authorized distributors for reducing or carrying the loads forward along with observing the non-differentiation. The executive regulations shall prescribe the controls to be observed on concluding these contracts
Article 48	The subscriber whose contractual capacity exceeds 500 KW shall appoint an official to improve the efficiency of energy use and it shall keep a record of the energy as set forth in the executive regulations
Article 49	The network operator or the electricity distribution licensee shall implement the annual plan suggested thereby and approved by the Agency for the implementation of projects or programs targeted to consumers in the following fields: 1. Managing the demand for electricity 2. Improving the efficiency of electricity use 3. Promoting the uses of renewable energy 4. Increase awareness of the efficiency of energy use
Article 50	In cooperation with the related entities, the entity determined by the Cabinet for improving the efficiency of energy use shall develop the policies which aim at the following: 1. Expand the application of the specifications and cards of energy efficiency for the devices and equipment which consume electricity 2. Replace the devices and equipment of low efficiency in accordance with the stipulations of the executive regulations 3. Improve the efficiency of electricity use in the industrial and commercial systems
Article 51	The producers and importers of the devices and equipment which consume electricity shall fix the energy efficiency cards on the electric appliances in accordance with the ministerial decrees issued in this respect and the stipulations of the executive regulations

The Electricity Law, Chapter 48, entitled “Improving Energy Efficiency,” includes Articles 61 to 72.

Table 3.24 Efficiency-related articles in executive regulations

Article 61	Reducing or relaying loads during peak time
Article 62	
Article 63	
Article 64	Subscriber with a contractual capacity of more than 500 kW shall appoint an official to improve energy efficiency in the facility. If the contractual capacity increases by 10 MW, this official shall carry out the following tasks: 1. Fulfill and update energy record data periodically 2. Follow-up energy consumption in the facility and develop proposals to increase the efficiency of its use 3. Conduct technical/economic feasibility studies on applications to improve efficiency 4. Follow-up procedures for contracting projects to improve the facility’s energy efficiency 5. Prepare annual calculations of energy performance indicators, 6. Educate and train facility workers on measures of improving energy efficiency 7. Measure and verify the seriousness of energy efficiency improvement projects
Article 65	The energy record shall contain all energy data and information of the facility, particularly the following data regarding electric power: 1. Measurements of electrical loads in the facility which are distributed between lighting and driving forces 2. Statement of the electrical equipment in the facility and their electrical capacity 3. Average daily operating hours during month for each device, equipment or lighting device 4. Statement of electricity amount consumed per month distributed between lighting and driving forces 5. Statement of amount of electricity that has been conserved monthly 6. Statement of all the equipment’ categories including lighting ones used by the facility according to the energy efficiency label 7. Statement of electricity sources and proportion of (conventional/renewable energy) 8. Statement of training programs conducted in the field of energy conservation monthly 9. Statement of the studies and researches conducted at the facility to support energy efficiency technology 10. Statement of the plan established for energy rationalization.
Article 66	The energy record shall be subject to control and monitoring by the entity determined by the Cabinet by means of the following procedures: 1. Create an electronic record in which each subscriber whose capacity exceeds (10 megawatts) shall record the data of the energy of the establishment 2. Keep a soft copy and a hard copy of the energy record approved by the energy director 3. Develop reports which include the measurement standards and performance indicators related to improving the energy use efficiency 4. Ensure the accuracy of the data of the energy record
Article 67	Control of the energy record in the establishments
Article 68	Entity determined by the Cabinet shall develop policies in cooperation of the related entities

Article 69	The devices lighting, tools of energy low efficiency in the establishments shall be replaced in accordance with the following procedures: 1. Count the devices, equipment and lighting tools of energy low efficiency and set a schedule for the replacement thereof 2. Observe inclusion of a condition on the determination of the energy efficiency category upon the development of the requirements and specifications related to the purchase of the devices, equipment and lighting tools which shall replace the low-efficiency ones 3. Develop the technical and economic feasibility studies for replacing the devices, equipment and lighting tools of energy low efficiency. 4. Develop the unified standard technical specifications for each device or piece of equipment conforming to energy high efficiency specifications.
Article 70	Energy Efficiency Card
Article 71	
Article 72	

(2) Energy record

Network operators and electricity distribution licensees must implement annual plans approved by Egypt ERA for the implementation of projects or programs targeted to consumers in the following fields:

- Management of electric power demand
- Improvement of electric power usage efficiency
- Promotion of renewable energy uses
- Raising awareness of power usage efficiency

According to MOERE, implementation of an Energy Record framework is progressing, but agencies such as Egypt ERA have yet to confirm it. MOERE said that details on the contents of the data being collected were unknown.

(3) Current situation of the energy management framework

Under the law, a subscriber with contractual capacity of more than 500 kW is required to appoint an official to improve energy efficiency in the facility. However, there is no national certification. Although the ministry is providing training opportunities to acquire ISO 50001 or European Energy Manager (EUREM) certification, it is not mandatory.

According to MOERE, numerous energy management certification training programs have been conducted with donor support. However, such programs are still limited, and MOERE is plans to implement such programs with support from Denmark in future.

3.3.2 Energy efficiency label

With UNDP support, Phase 1 (1998-2011) of the Energy Efficiency Improvement GHG was implemented. Phase 1 included introduction of minimum energy performance standards (MEPS) and Energy Efficiency Labels for five appliances. The table below summarizes 13 appliances requiring Energy Efficiency Labels.

Table 3.25 Energy efficiency standards for appliances and lamps

	Appliances	EES decree number/date
1	Refrigerators & freezers	3794/2002 and Max. energy consumption limits updated in 2008, 2013, 2018
2	RACs with fixed speed	3795-1/2002 and Min. EER limit is updated in 2013 & 2016
3	Clothes washers	4100/2006 and Max. energy consumption limit updated in 2018
4	Water heaters	5806/2007 and Max. heat loss limit updated 2019
5	CFLs	6313/2009
6	Dishwashers	7820/2014
7	Fans	7821/2014
8	LED lamps	7823/2014
9	TVs	7993/2016
10	Vacuum cleaners	8057/2017
11	Electric ovens	8058/2017
12	RACs with inverter	3795-2/2017
13	Instantaneous WH	8187/2018
Note: All Egyptian energy efficiency standards are developed according to international standards IEC and ISO. It is compulsory for manufacturers and importers to comply with standards and labeling requirements		

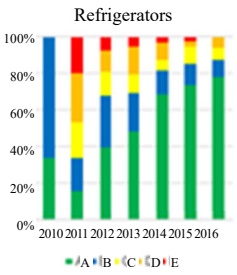
SOURCE: EOS

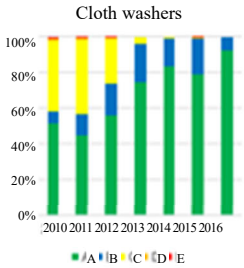
SOURCE: EOS

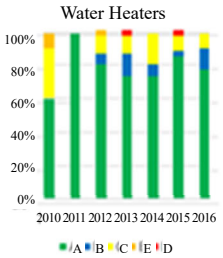
Fig. 3.10 Energy efficiency standards in Egypt

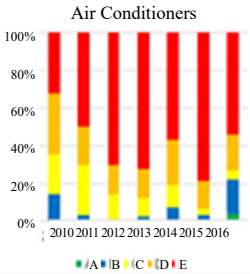
Under the Improving Energy Efficiency for Lighting & Building Appliances project, energy efficiency labeling and implementation of LEDs in Egypt has greatly advanced. This project was co-led by GEF and UNDP. Fig. 3.11 shows Energy Efficiency Label Levels Development under the project. Higher efficiency level products are A & B levels, and lower efficiency level appliances are E & D levels.

- The testing of applicances revealed a significant growth towards higher efficient levels (A & B Levels) products as well as decrease in the lower efficient levels (E & D Levels) appliances.









SOURCE: IMPROVING ENERGY EFFICIENCY FOR LIGHTING & BUILDING APPLIANCES, UNDP/GEF, 2018

Fig. 3.11 Energy efficiency labeling development

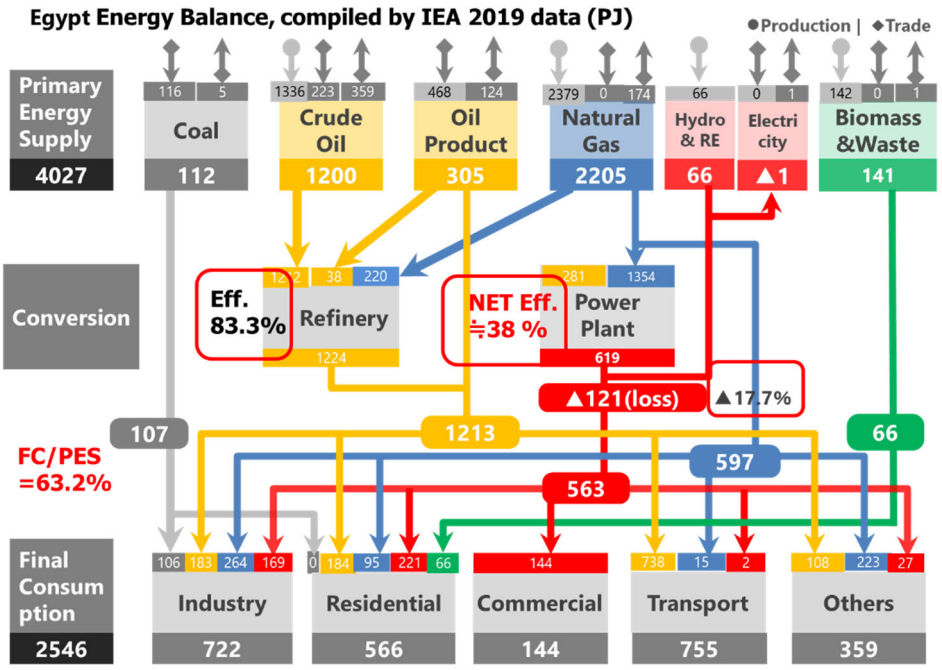
Chapter. 4 Analysis of present energy consumption in Egypt

4.1 Macro view of the energy balance

4.1.1 Energy balance

Fig. 4.1 shows the national energy balance for Egypt, compiled from 2019 IEA data. On the supply side, the upper part of figure shows that natural gas accounts for 50% of the national energy supply and that the thermal power generation ratio is relatively high at around 38% (Japan: 42%). Power transmission & distribution loss ratio is also high at 17.7% (world average: 8.6%). The efficiency ratio of oil refineries is likewise low at 83.3% (world average just below 90%). The transport, industrial and residential sectors account for the bulk of final energy consumption.

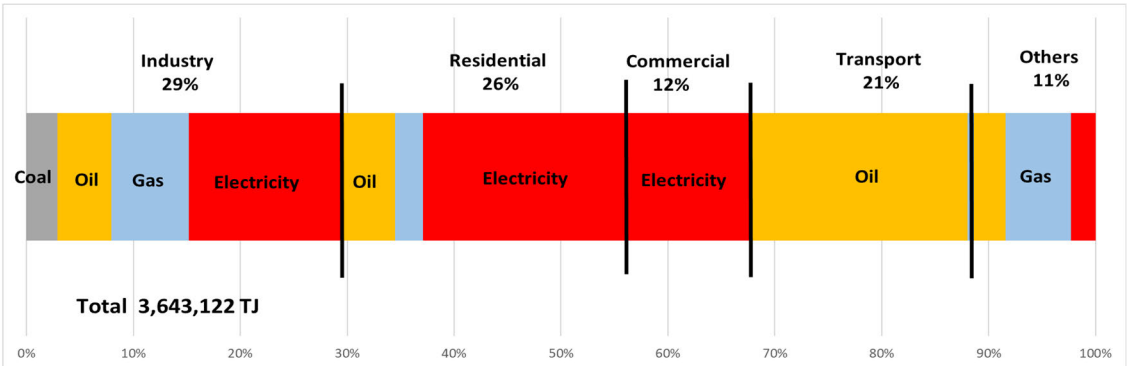
Looking at the total energy flow from supply through conversion to final use, efficiency improvement potential is evident in power transmission & distribution, refining, transport, industry and residential sectors.



SOURCE: COMPILED BY JST BASED ON IEA 2019 ENERGY BALANCE TABLE (PJ)

Fig. 4.1 Energy balance in Egypt (2019)

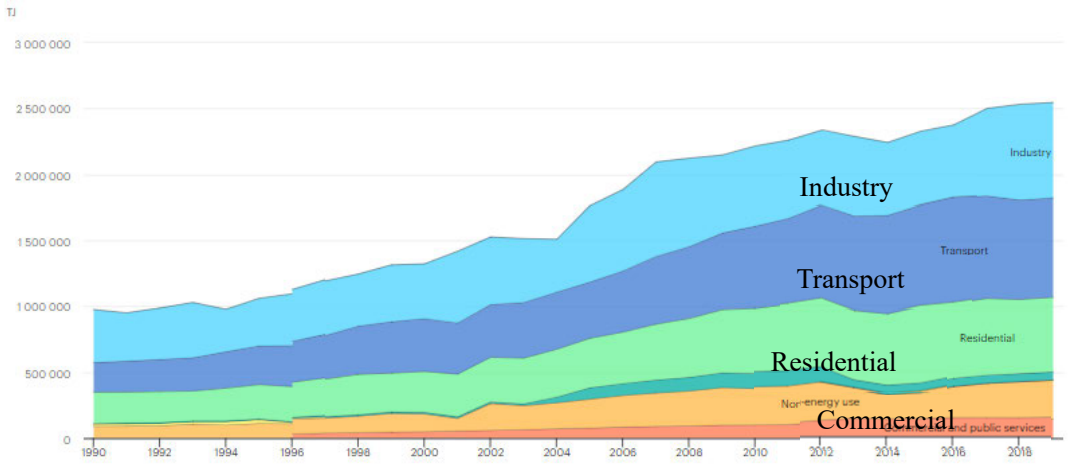
- As industries are the largest energy users (29%), followed by residential (26%), efficiency improvement measures for these two sectors are important.
- Electricity is the largest category of primary energy basis consumption (around 47% of total)
- Transport is the third-largest sector at 21%, of which 97% powered by oil
- Primary energy consumption in the building sector is 12%, almost 100% electricity
- The industrial and buildings sectors are priorities for improvement schemes as they account for 41% (29＋12) of national total primary energy consumption.



SOURCE: COMPILED BY JST BASED ON IEA 2019 ENERGY BALANCE TABLE (EXCLUDING BIOENERGY)

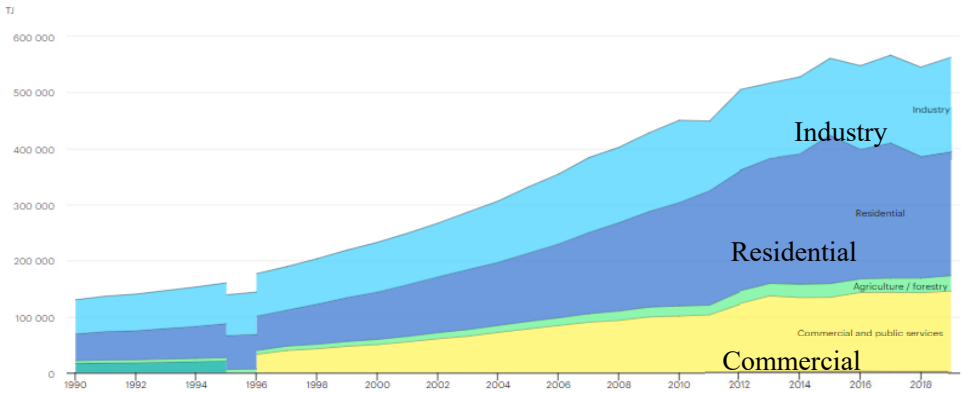
Fig. 4.2 Primary energy consumption by sector and energy type in Egypt

Fig. 4.3 shows the trend of final energy consumption by sector, and Fig. 4.4 shows the trend of electricity consumption. Since 1990, the total final energy consumption has been steadily increasing by around 4%/year and electricity consumption by around 5%/year (As for residential and commercial: around 4%). Note that electricity use is growing faster than other fuels.



SOURCE: IEA 2019 DATA

Fig. 4.3 Final energy consumption trend by sector (2018)



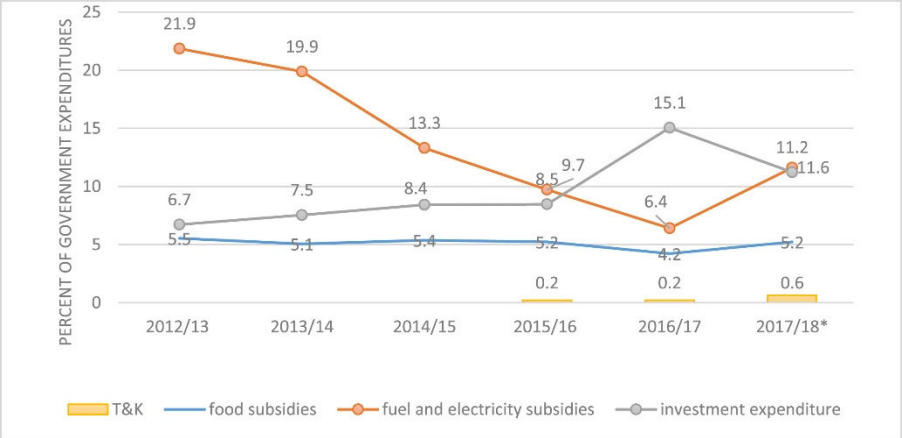
SOURCE：IEA2019 DATA

Fig. 4.4 Electricity consumption by sector trend (2019)

4.1.2 Revision of electricity tariffs

Electricity tariffs have been increased to resolve the negative cashflow of electricity companies due to the protracted maintenance of fixed electricity prices.

In 2014, the government launched a new pricing plan, increasing electricity tariffs to comply with IMF requirements. Increases started from July 2014 with the objective to phase out subsidies over five years. Subsidies decreased from 4 billion Egyptian Pounds (LE) to 2 billion, but were later increased to 6 billion LE due to currency devaluation. In June 2020 the phase-out of subsidies was extended for a further three years to the end of fiscal 2024/2025, due to repercussions of the Covid-19 pandemic.



SOURCE: MOF, 2017 A,B. NOTES: * = PROJECTED. T&K = TAKAFUL AND KARAMA. EGYPT HAS BEEN PROVIDING CASH TO POOR HOUSEHOLDS THROUGH ITS FIRST CONDITIONAL CASH TRANSFER PROGRAM, TAKAFUL AND KARAMA, A SOCIAL PROTECTION PROGRAM RUN BY THE MINISTRY OF SOCIAL SOLIDARITY (MOSS), SINCE MARCH 2015. TAKAFUL ("SOLIDARITY") SUPPORTS POOR FAMILIES WITH CHILDREN UNDER 18, WHILE KARAMA ("DIGNITY") SUPPORTS THE ELDERLY POOR AND PEOPLE LIVING WITH DISABILITIES. THE PROGRAM SUPPORTS 2.25 MILLION FAMILIES ACROSS EGYPT (BREISINGER ET AL., 2018).

Fig. 4.5 Breakdown of government subsidies

Low-consumption users and irrigation are subsidized according to Article 41 of the Electricity Law. Consumption from (700 -1000 kWh/month) is billed at actual cost of electricity without subsidy.

Electricity tariff revisions are promulgated by Ministerial Order. Proposals for revision of electricity tariffs are prepared by EEHC on the basis of profit and loss projections for the following fiscal year, reviewed by MOERE, agreed to by Egypt ERA), and finally approved by the President.[1]

In order to promote EEC, the reduction of energy subsidies is critical. Table 4.1 to Table 4.3 show the trend of electricity tariffs for residential, commercial and industrial sectors. It is observed that residential and industry tariffs have increased from 3 to 6 times in recent years.

[1] Egypt ERA website, http://EgyptERA.org/ar/Tarrif2019.aspx

Table 4.1 Trend of electricity tariffs for the residential sector

	Applied tariff							Planned tariff			
(kWh/month) Unit: Pt./kWh	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
From 0 to 50	7.5	7.5	11	13	22	30	38	48	58	68	71
From 51 to 100	14.5	14.5	19	22	30	40	48	58	68	68	71
From 101 to 200		16									
From 0 to 200	16		21.5	27	36	50	65	77	83	90	97
From 201 to 350	24	30.5	42	55	70	82	96	106	111	119	123
From 351 to 650	34	40.5	55	75	90	100	118	128	131	135	136
From 651 to 1,000 (*1)	60	71	95	125	135	140					
From 0 to less than 1,000 (*1)							118	128	136	136	136
From 0 to more than 1,000	74	84	95	135	145	145	145	145	145	145	145

SOURCE: EEHC ANNUAL REPORT (FOR APPLIED TARIFF) AND MOERE, PUBLIC ANNOUNCEMENT OF ELECTRICITY TARIFF FOR THE COMING FIVE YEARS (2020/2021 – 2024/2025)

Table 4.2 Trend of electricity tariffs for the commercial sector

(kWh/month) Unit: Pt./kWh	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
From 0 to 100	30	32	35	45	55	65	65	65	65	65	65
From 0 to 250	44	50	69	84	100	115	120	120	123	123	123
From 251 to 600	59	61									
From 0 to 600			69	96	115	140	140	140	140	140	140
From 601 to 1,000	78	81	96	135	145	155	155	155	155	155	155
From 0 to more than 1,000	83	86	96	140	150	160	160	160	160	160	160

SOURCE: EEHC ANNUAL REPORT (FOR APPLIED TARIFF) AND MOERE, PUBLIC ANNOUNCEMENT OF ELECTRICITY TARIFF FOR THE COMING FIVE YEARS (2020/2021 – 2024/2025)

Table 4.3 Trend of electricity tariffs for the industrial sector

(kWh/month) Unit: Pt./kWh	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Ultra-high voltage (132-220 kV)	22.6	26.9	41.9	67.6	96.4	105	105	105	105	105	105
High voltage (33-66 kV)	27.5	29.1	44.6	70.9	101.5	110	110	110	110	110	110
Med. voltage (11-22 kV)	36.5	43.5	52	76.7	105	115	115	115	115	115	115
Low voltage (380 V)	36.6	46	64.4	90	110	125	125	125	125	125	125

SOURCE: EEHC ANNUAL REPORT (FOR APPLIED TARIFF) AND MOERE, PUBLIC ANNOUNCEMENT OF ELECTRICITY TARIFF FOR THE COMING FIVE YEARS (2020/2021 – 2024/2025)

4.2 Consideration by sector

4.2.1 Industry

Energy-intensive sub-sectors of Egypt's industrial sector include cement, steelmaking, food processing and non-ferrous metals, as shown in Table 4.4. For energy consumption in by industry, although some data is described in the ISES2035 report and elsewhere, there are some inconsistencies. The accuracy and content of energy data will be confirmed in another JICA technical cooperation project. Aspects to be considered in this survey for the major industrial sectors are described below.

Table 4.4 Final energy consumption in the industrial sector (by energy type)

(ktoe)	Coal	LPG	Diesel	HFO	N. Gas	Electricity	Total	Percent
Iron and Steel Production	412				1,420	575	2,406	13%
Aluminium Production					10	400	410	2%
Copper Production						1	1	0%
Other Non Ferrous Metals Production						34	34	0%
Fertilizers Production					753	33	786	4%
Other Chemicals Production		1	79	239	717	365	1,401	8%
Cement Production			1	1,423	3,068	403	4,895	27%
Glass Flat Production			0	24		27	50	0%
Other Non Metallic Minerals Production			14	296	1,337	146	1,793	10%
Paper Production			20	337	113	66	536	3%
Food, drink and tobacco		29	1,912	502	464	188	3,095	17%
Textile, leather		1	53	679	378	210	1,321	7%
Other Industries		1	35	307	7	907	1,257	7%
Total	412	32	2,114	3,807	8,267	3,355	17,985	100%
Weight of energy sources	2%	0%	12%	21%	46%	19%	100%	
Non-energy consumption					4,709			

SOURCE: ISES2035VOLUME2 P52/113

(1) Cement industry

The cement industry accounts for 27% (max.) of Egypt's total final energy consumption. As shown in Table 4.5, about 95% is heat utilization during firing while electricity utilization is approximately 5%.

Table 4.5 Energy consumption in cement manufacturing process

Production Process		Portland Cement (GJ/t)
Raw Materials Preparation:	Electricity	0.07
Clinker Making	Fuel	2.79
	Electricity	0.08
Finish Grinding 325 Cement	Electricity	0.06
Total Thermal Energy Use (GJ/t Cement)		2.71
Total Electricity Energy Use (GJ/t Cement)		**0.21**
Total Energy Use (GJ/t Cement)		**2.92**

SOURCE: UNIDO IEE PROJECT: BENCHMARKING REPORT FOR THE CEMENT SECTOR (UNIDO, 2014)

Since energy-saving measures during firing require complex/large-scale investment and time, this survey will focus on improving the crushing process with electricity, which JICA has financed in Bangladesh.[2]

Plus, according to the previous cement sector benchmark analysis conducted by UNIDO, an energy management system has not been introduced. Since energy management is more important/indispensable than adopting energy-saving facilities, stronger commitment is expected.

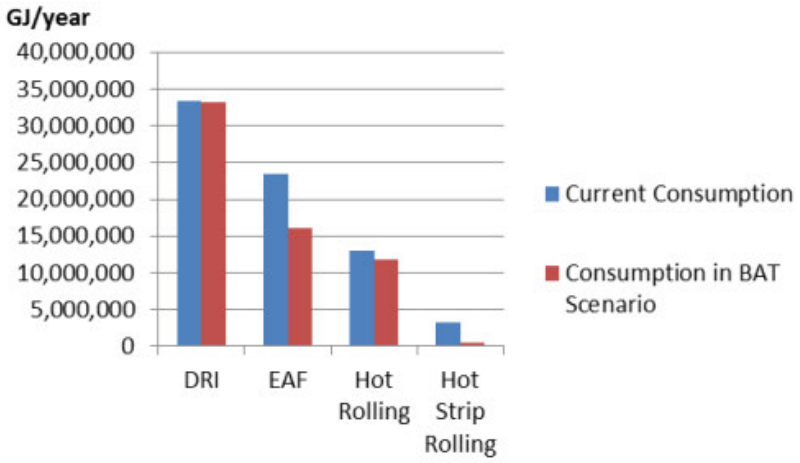
The UNIDO report states that cement production in 2050 will be 2.8 times higher than in 2012 with a potential reduction of approximately 28%.

(2) Steel industry

The steel industry accounts for 13% of Egypt's total final energy consumption. Crude steel production in Egypt in 2012 was 6,627,000 tons, with 92% produced in electric arc furnaces (EAF) and 8% in basic oxygen furnaces (BOF). Plus, when IDA registered steel company was disassembled, there were 8 plants with electric arc furnace and rolling equipment, 1 plant with blast furnace/converter and rolling equipment, and 26 plants with only rolling equipment which account for the majority.

According to a previous benchmark analysis conducted by UNIDO, 30% of energy savings for EAF is listed as a steelmaking process with a lot of opportunities (see Fig. 4.6). No Japanese companies have entered Egypt's steelmaking sector and none are considering entering the market.

[2] Although Japanese companies also manufacture and export mill, all equipment adopted in Bangladesh Energy Conservation Loan Project are made in EU.



(DRI STANDS FOR DIRECT REDUCED IRON MANUFACTURING) SOURCE: INDUSTRIAL ENERGY EFFICIENCY PROJECT – BENCHMARKING REPORT FOR IRON AND STEEL SECTOR, 2014, UNIDO

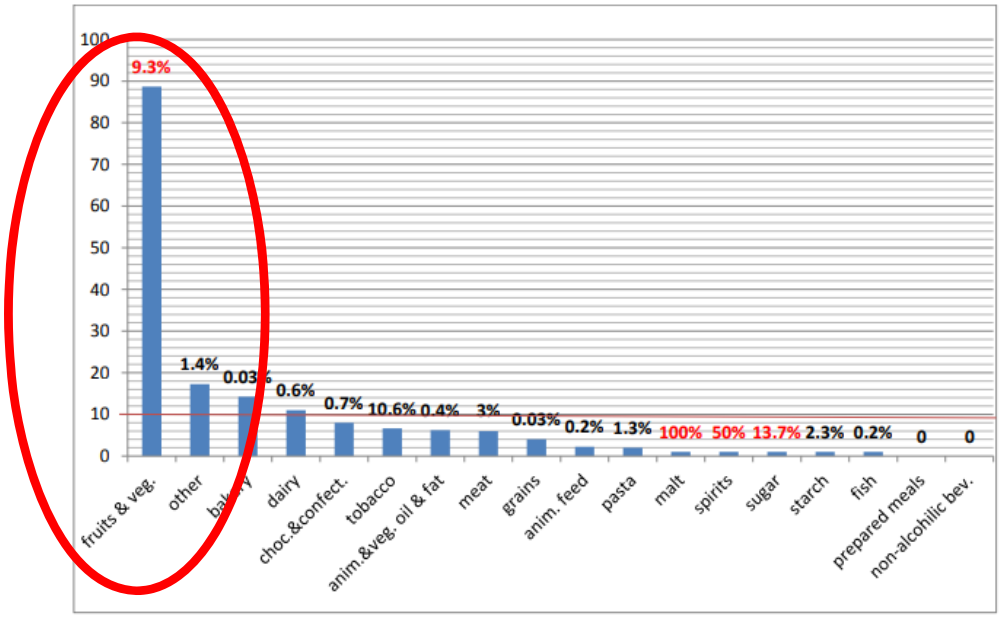
Fig. 4.6 Energy saving potential by production process in steel industry

UNIDO also mentions that energy management systems have not been introduced in any of the plants surveyed. In the cement industry, energy management is more effective and indispensable for energy-saving compared to the installations of energy-saving equipment to promote energy saving in plants, so stronger commitment is expected.

(3) Food processing industry

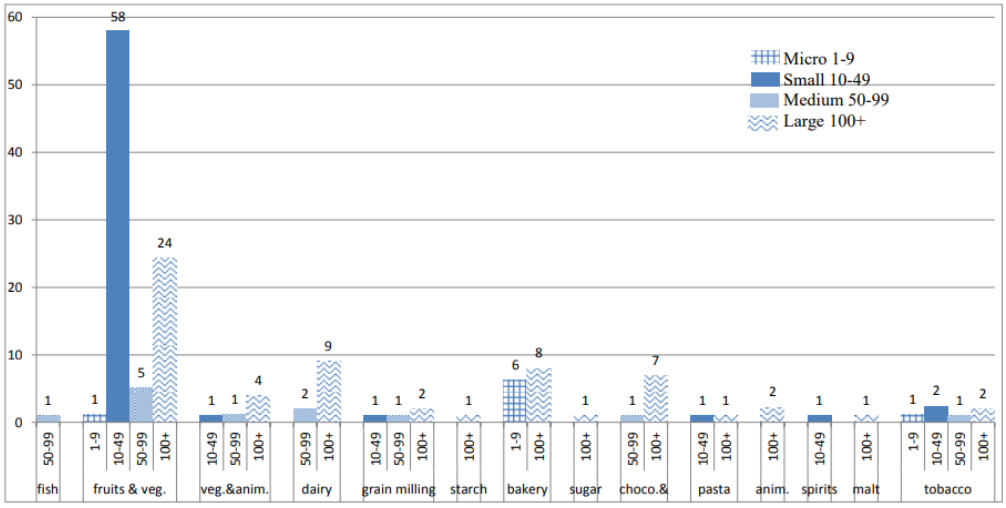
Food-processing generates 5% of Egypt's GDP and accounts for 17% of final energy consumption. According to a World Bank analysis, as much as 30% of Egypt's fruits and vegetables are lost to spoilage. To address this, increasing refrigerated/frozen storage is a high national priority. Note that:

- Fruit & vegetable producers make up an overwhelmingly high percentage of companies in food export industry, and employ large numbers of people (see Fig. 4.7)
- Most fruit & vegetable producers are SMEs with 10 to 49 employees (see Fig. 4.8)
- Many companies in the food export industry depend on refrigeration/freezing processes (see Fig. 4.9)



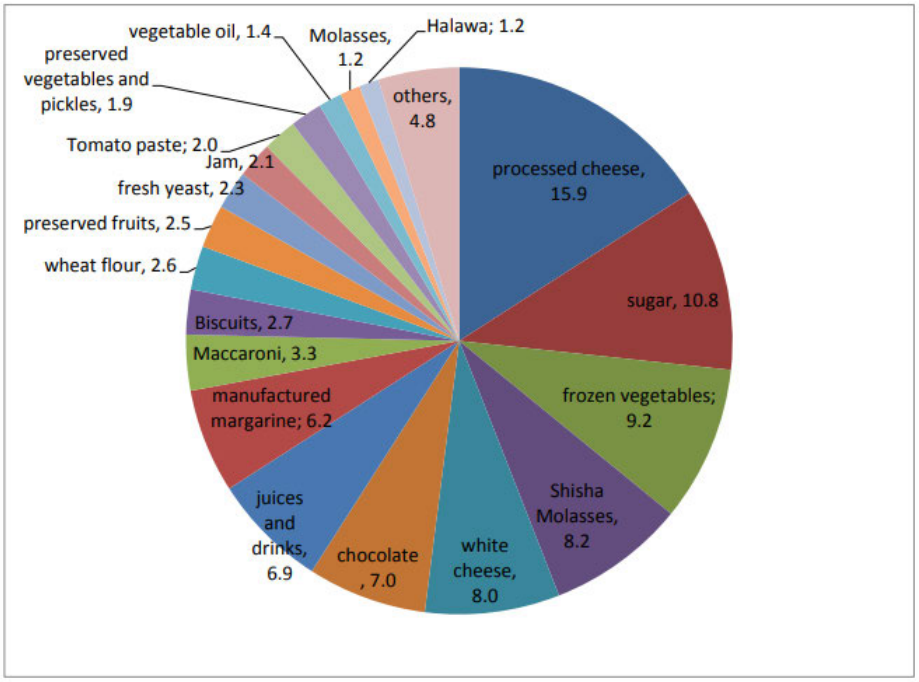
SOURCE: INDUSTRIAL ENERGY EFFICIENCY PROJECT –INTEGRATION OF ENERGY EFFICIENCY INTO THE FOOD MANUFACTURING INDUSTRY SECTOR STRATEGY (CAPMAS2014 DATA), 2017, UNIDO

Fig. 4.7 Number of companies engaged in export food processing & employee ratio



SOURCE: INDUSTRIAL ENERGY EFFICIENCY PROJECT –INTEGRATION OF ENERGY EFFICIENCY INTO THE FOOD MANUFACTURING INDUSTRY SECTOR STRATEGY (CAPMAS2014DATA), 2017, UNIDO

Fig. 4.8 Business size (number of employees) by sector of export food processing industry



SOURCE: INDUSTRIAL ENERGY EFFICIENCY PROJECT –INTEGRATION OF ENERGY EFFICIENCY INTO THE FOOD MANUFACTURING INDUSTRY SECTOR STRATEGY (CAPMAS2016 DATA), 2017, UNIDO

Fig. 4.9 Ratio of export food processing industry by product (revenue, 2013-14)

As food-processing includes energy-intensive processes such as refrigeration, freezing and heating, the ratio of energy cost to total production cost is quite high (see Table 4.6). However, due to the disincentive of subsidized energy prices the adoption of modern refrigeration equipment has lagged. But the rapid increase in price of industrial electricity rates (3-6 times in 5 years) has spurred modernization.[3]

Table 4.6 Energy cost ratio in export food processing industry in Egypt (2014)

Sector	Electricity cost as % of the total added value (approximately)	Fuel cost as % of the total added value (approximately)	Total energy cost as % of the total added value (approximately)
Food	2.31	5.34	7.65
Beverage	0.8	1	1.8
Tobacco	0.2	1	1.2

SOURCE: INDUSTRIAL ENERGY EFFICIENCY PROJECT –INTEGRATION OF ENERGY EFFICIENCY INTO THE FOOD MANUFACTURING INDUSTRY SECTOR STRATEGY (CAPMAS2014 DATA), 2017, UNIDO

(4) Textile industry

The textile industry generates 3% of Egypt's GDP, accounts for 7% of final energy consumption and is the nation's largest industrial employer (30% of total). It includes 32 large state-owned companies and 7,150 private companies (mainly SMEs).

[3] In 2014, the energy cost ratio was at estimated 7.65%, but today at around 20%.

Although state-owned textile companies are planning to introduce major structural reforms and high productivity equipment, implementation has caused many course corrections and confusion. So, JICA support will mainly be considered for private sector firms. Japanese companies that handle textile-related equipment, mainly Marubeni, have experience in introducing facilities to state-owned textile plants, but there few Japanese companies have introduced facilities into private companies.

In Egypt's textile industry, larger companies (many state-owned) are involved in upstream spinning and weaving (fabric manufacturing) while sewing processes are mainly handled by SMEs (see Fig. 4.10)

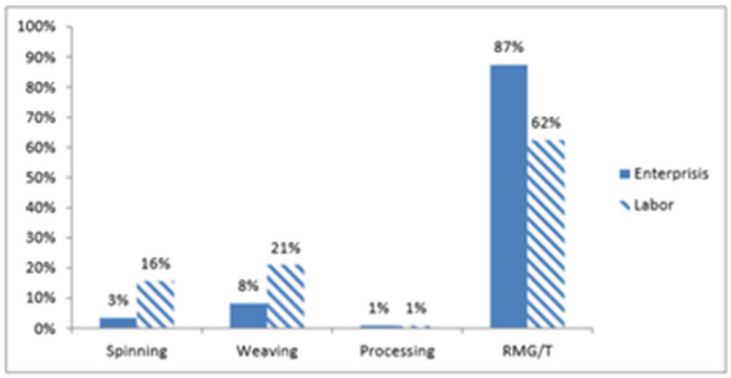


Figure (6): Percentages of Textile Subsectors as Enterprises and Labor

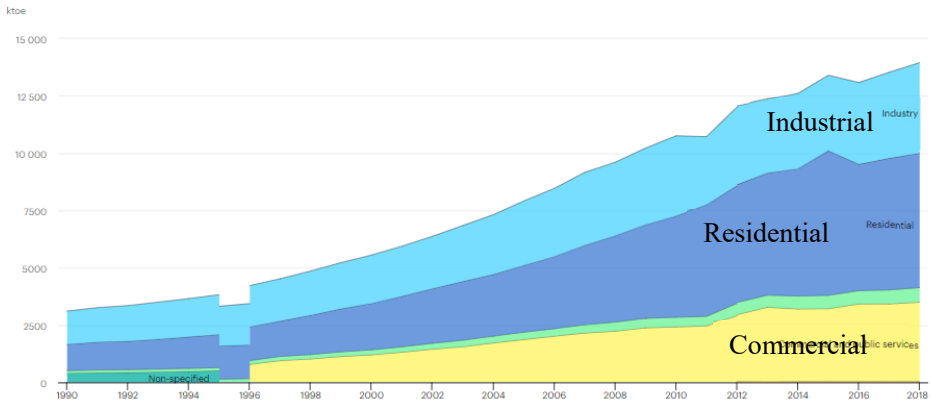
Source:CAPMAS, 2017

SOURCE: INTEGRATION OF ENERGY EFFICIENCY INTO THE TEXTILE SECTOR STRATEGY, AUGUST 2018, UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Fig. 4.10 Number of companies/employees by production process in textile industry

4.2.2 Buildings (business facilities)

As shown in Fig. 4.11, the primary energy consumption ratio of business buildings is about 12% of the national total. And mid- to long-term consumption growth exceeds the industrial sector (see Fig. 4.11).



SOURCE: IEA2019 DATA

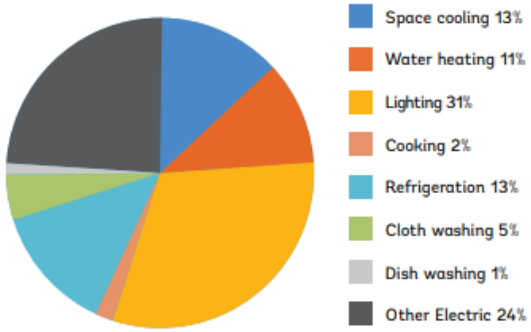
Fig. 4.11 (Repost) Trends in electricity consumption by sector in Egypt

The main features of buildings' energy consumption are: 50% for cooling and about 20% for lighting. By introducing energy-saving measures such as high-efficiency air conditioners and LEDs, it is thought that these demands can be cut in half. Offices are the largest consumers in the buildings sector, along with hotels, hospitals and shopping centers.

4.2.3 Housing

Housing accounts for about 28% of primary energy consumption as shown in Fig. 4.2. And the housing sector leads in consumption of electricity as shown in Fig. 4.4. Based on data from the World Bank report "Energy Efficiency and Rooftop Solar PV Opportunities in Cairo and Alexandria," it is estimated that 13% of residential energy consumption is for air conditioning, 31% for lighting and 13% for refrigerators (see Fig. 4.12). Potential to reduce energy consumption for cooling, lighting and refrigerators is estimated at about 50%. That achievement would cut total consumption by about 30%.

From the viewpoint of energy-saving loans, it is extremely difficult to devise a scheme for housing where installment systems are not commonly used. As such, this report will explore possibilities for on-bill finance and schemes such as loan formation for energy-saving equipment distributors – which is common in other countries. On-bill finance is a mechanism by which the power company sells energy-saving equipment and "on-bills" with monthly electricity charge collection.



SOURCE: ENERGY EFFICIENCY AND ROOFTOP SOLAR PV OPPORTUNITIES IN CAIRO AND ALEXANDRIA, WORLD BANK

Fig. 4.12 Breakdown of energy consumption in Egyptian houses

By analyzing energy consumption in each sector and eligible EEC technologies/policies, nationwide energy-saving potential has been estimated. Table 4.7 shows energy-saving potential, by multiplying primary energy consumption and expected energy-saving rate via introducing promising energy-saving technologies/policies (by ordering the largest primary energy consumption by sector and energy type, based on primary energy consumption data by sector and energy type shown in Fig. 4.3).

As a result, it can be seen that: (1) the energy-saving effect of improving air conditioning efficiency and lighting across sectors is large; (2) energy management systems are expected to be introduced in industry; (3) energy-saving measures are also expected to be introduced in transportation fields; (4) by introducing these measures in major sectors about 18.9% of nationwide primary energy supply can be reduced. This is equivalent to a reduction of 42.6Mt-CO_2.

Table 4.7 EEC potential by sector and energy type

Ranking	Sector and energy type	Consumed primary energy (TJ)	%	Eligible measuresfor saving	Expected saving % in sub-sector (JICA estimate)
1	Oil for transport	738,027	20.3%	RE+EV, regulation for vehicle efficiency, BRT,	▲30.0%
2	Electricity for residential	676,865	18.6%	Efficient cooling, lighting, refrigerator	▲25.0%
3	Electricity for industry	517,569	14.2%	Efficient cooling, lighting,EM	▲20.0%
4	Electricity for building	441,555	12.1%	Efficient cooling, lighting,heating	▲35.0%
5	Gas for industry	264,279	7.3%	Efficient heating,EM	▲15%
	Others	1,004,827	27.6%		
Total		3,643,122	100.0%		▲18.9%for total

Chapter. 5 Analysis of current energy-efficiency promotion

5.1 Analysis of government policies in energy-efficiency promotion

5.1.1 Energy-efficiency institutional framework

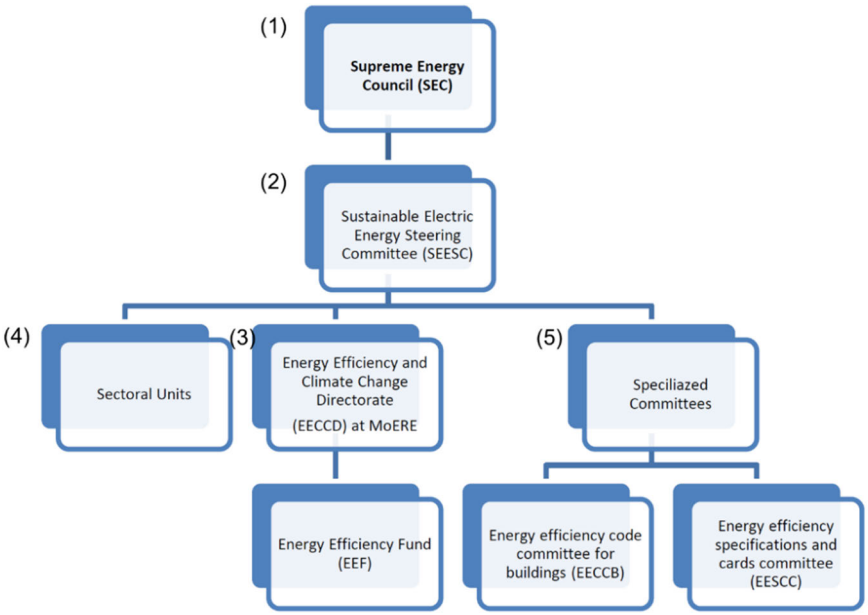
(1) Electricity sector

The Supreme Energy Council (SEC), Egypt's highest forum for energy policy, is in charge of developing and monitoring energy policy through a ministerial committee that guides and oversees the energy sector. Established in 1979 it is headed by the Prime Minister with representation from 11 ministries: Defense, Finance, Petroleum, Electricity Economic Development, Environment, Investment, Housing, Trade & Industry, Transport and Foreign Affairs.

The Ministry of Electricity and Renewable Energy (MOERE), supervises and guides the power sector. To fulfill its mandate to provide electricity to all consumers nationwide, the ministry must: set electricity prices for various voltage levels and usages; supervise the study and execution of essential electrical projects; Publish statistics and data relating to electric energy production & consumption; etc.

Egyptian Electric Utility and Consumer Protection Regulatory Agency (Egypt ERA), formed in 1997 and reformed in 2000, monitors the performance of utilities via a benchmarking scheme that covers both financial and technical performance. Its mandate is to regulate, supervise and control all matters related to electric power from generation to consumption to ensure continuity of supply and satisfy demand for various aspects of usage at equitable prices, taking into consideration environmental protection and the interests of consumers. The agency also aims to promote lawful competition in electricity generation, transmission and distribution and prevent monopolization.

The Energy Efficiency Institutional Framework was developed in NEEAP II:



SOURCE: SECOND: NATIONAL ENERGY EFFICIENCY ACTION PLAN (NEEAP)

Fig. 5.1 Energy Efficiency Institutional Framework (EEIF)

5.1.2 EEC policies and promotion activities by government

Key EEC policies reviewed in the previous chapter include ISES2035, the Electricity Law and NEEAP II. Significant progress was made during the of NEEAP II period including:

- Fuel saving in electricity supply improved remarkably due to expansion of renewable energy and the introduction of high-efficiency combined-cycle power plants.
- EEIF was activated by Decree No. 1479/2013 which mandates MOERE-EECCD to act as the central unit of energy efficiency in Egypt. Other ministries also established energy efficiency units. MOERE supported and collaborated with these efforts.
- Some renewable energy and energy efficiency measures stipulated in NEEAP II made good progress, including the introduction of PV and efficient transformers, plus distribution of LEDs in residential, streetlight and transport sectors.
- Several development partners are working to support energy-efficiency finance measures, although these are still in the development phase.
- Awareness-raising activities were conducted via TV, radio and internet.

5.1.3 Existing government financing schemes and implementation status

In Egypt and other national governments may use a financial facility to pursue specific public policy aims. Subsidies are the most common use of the financial facility. There is also a more sustainable form of financial facility where preferential lending terms may be offered to suit the government's policy aims. A good example are low-interest loan schemes offered to support vulnerable sectors such as agriculture or SMEs. Other financial schemes may aim to promote exports or tourism, support start-ups, environmental

protection, rural regeneration, etc. These preferential financial facilities (lending, credit and guarantees) are sometimes termed as "policy financing."

Policy financing may be arranged via a special fund pooled for low-interest loan lending, granting credit or guarantees. The fund may be governmental or managed by a specialized organization. As the fund is to be used for low-interest loans or guarantees it entails greater risks and the rate of return will inevitably be lower than conventional investments. Consequently, the fund owner offers the scheme at the expense of the opportunity cost (return the investor might gain from a conventional investment). The government effectively subsidizes this lost opportunity cost.

Egypt has several existing policy-financing instruments, including Central Bank of Egypt (CBE) initiatives that provide low-interest loans to SMEs and other sectors as a tool to promote government policies. Two major entities that offer policy financing are National Investment Bank (NIB), and CBE.

(1) Policy financing by the National Investment Bank (NIB)

NIB, established in 1980 to finance and monitor national development projects, participates in such projects either as an equity investor or a lender, and monitors project progress. NIB is the government's major investment institution for implementing economic & social development plans. Sector coverage includes housing & construction, education, sanitation & drinking water, transport & roads, health, culture, media and energy. In the energy sector, NIB activities include:

- Loan to Nuclear Power Plants Authority – EGP 1.1 billion between FY 2009/10 & FY 2016/17, with main objective to prepare for Egypt's first nuclear plant
- Loan for hydro power generation – EGP 241.3 million between FY 2009/10 & FY 2016/17, with the main objective to exploit hydro power potential.
- Loan for promotion of new/renewable energy (New & Renewable Energy Authority) – EGP 1.3 billion between FY 2009/10 & FY 2016/17, for projects including Zafarana 6, 7, 8, Jabal Al-Zayt and Siwa.

NIB's board of directors is headed by the Minister of Planning & Economic Development. Other board members are representatives of the ministries of Finance, Investment & International Cooperation and Social Solidarity, as well as the Financial Regulatory Authority, Central Bank of Egypt, Banque Misr and General Authority for Investment and Free Zones.

Another key funding source for NIB is domestic savings. NIB's major mandate is to effectively mobilize domestic savings to support national development activities. NIB offers high interest rates for domestic savings, but as its investment activities do not generally yield high returns, the government subsidizes the cost of finance in order to fund development priorities.

NIB's policy financing activities are mostly for infrastructure development projects. The borrowers are the end users of preferential loans and the lenders are governmental entities. NIB's activity is a classic finance and investment type policy financing commonly employed for infrastructure development projects.

(2) CBE initiatives

The few policy financing facilities in Egypt are mostly operated by CBE, which offers preferential rate financing in the following sectors: industry, SMEs, agriculture, tourism and housing loans. Called the "CBE Initiatives," these serve as the country's major policy financing instruments. CBE has allocated a total fund amount of EGP 600 billion for these initiatives, mostly from CBE's own funds.

(3) Industry loans

A joint industry initiative involving the government and CBE was launched in December 2019, with a dedicated fund of EGP 100 billion, allowing medium-sized manufacturers (annual sales between EGP 50 million and 1 billion) to access preferential interest rate loans at 10%. The fund is being channeled through state-affiliated banks. The number of eligible factories is said to be 96,000.[4] [5]

In response to the COVID-19 outbreak, in March 2020 CBE cut its prime lending rate to 8%. In June 2020, the scope of eligible borrowers was widened to include start-ups and new entrepreneurs.

(4) SME loans

SME loans were introduced in 2016 with a fund of EGP 200 billion. Businesses with annual sales from EGP 1m to 50m are eligible for this financial facility. So far, EGP 160 billion has been lent to 86,000 small factory owners at a 5% interest rate. Originally planned to end in January 2020, CBE has extended the initiative for another four years.

(5) Agricultural loans

As a part of the SME financing initiative (there is not designated fund reserved for the sector), the fund is being offered to small companies and enterprises operating in agriculture, agricultural manufacturing, dairy products, livestock feed, fish, poultry and animals, with annual sales ranging from EGP 0.25 – 50 million.

(6) Housing loans

A CBE and Mortgage Finance Fund (MFF) joint initiative for housing loans launched in July 2019, with a fund of EGP 50 billion, aimed at middle-income borrowers. Loans are channeled through state-affiliated banks including NBE, Banque Misr, Banque du Caire, CIB and Housing & Development Bank (HDB).[6] Preferential housing loans at 10% are offered through this initiative.[7] A similar program was offered from 2014 until 2019 with 5-7% long-term loans to individual homebuyers. It was replaced by the new fund.[8]

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4 Al-Ahram online 9 December 2019
5 Enterprise, 5 December 2019
6 HDB is a bank established in 1979 with the mandate to finance moderate housing units for the citizens. Its largest shareholder (29.81%) is the New Urban Communities Authority (NUCA), under the Ministry of Housing, Utilities and Urban Communities (MOHUUC), and three of the nine board members are representing NUCA.
7 Housing & Development Bank webpage on "Real Estate Financing Program".
8 Enterprise, 2 June 2019

(7) Tourism sector loans

A previous EGP 5 billion fund offering preferential loans to the tourism sector, introduced in 2019, was boosted to EGP 50 billion and interest rates were cut to 8%. Plus, there is an EGP 3 billion fund offered by the Ministry of Finance via the same channel at a lower interest rate of 5%.

(8) Start-ups and entrepreneurship (non-financial)

"NilePreneurs," an initiative by CBE and Nile University, mobilizes support the public and private sectors to offer non-financial services to support SMES entrepreneurs in various sectors. It aims to raise banking awareness and prepare start-ups to integrate into the formal sector and to benefit from the banking services through the Business Development Service (BDS) hubs.

Table 5.1 Financial intermediary lending facilities under CBE initiatives

Initiative	SMEs	Medium enterprises	Housing loans	Tourism
Fund amount	EGP 200 billion	EGP 100 billion	EGP 50 billion	EGP 50 billion
Introduced	Dec 2018	Dec 2019	July 2019	Dec 2019
Subject of loan	EGP 0.25-6 million Up to 80% of equipment or 100% of working capital	Up to EGP 40m for up to 10 years.	Maximum house price EGP 2.25m Up to 80% of house value for 20 years	Six months grace period; tenure of up to 15 years.
Interest rate	5% interest rate, no service charge	8% interest rate, no service charge	8% interest rate, no service charge	8% interest rate, no service charge
Note	Originally planned to be end by Jan 2020, but extended for 4 more years.	Originally for industry sector, but later including agriculture, construction, SMEs and start-ups participating in "NilePreneurs"	Previous initiative had EGP 20 billion offering 5-7% interest rate loan introduced in 2014. Interest rate was lowered from 10% to 8% in March 2020.	Previous initiative had EGP 5 billion offering 10% interest rate. A separate EGP 3 billion fund was provided in May 2020 by Min. of Finance.

SOURCE: COMPILED BY THE CONSULTANT TEAM BASED ON CBE, NBE, BANQUE MISR, AND HDB INFORMATION.

(9) Other policy financing instruments

NIB's policy financing measures are mainly aimed at developing social and economic infrastructure, while CBE activities encourage industrial and social development. As in other countries, there are also policy financing instruments focused on export promotion (export credit & trade finance), scholarships to send students abroad, etc., but as these do not relate to EEC promotion this report will provide no details.

Dedicated financial institutions are mandated to offer preferential loans as policy financing. Government entities offering low-interest loans are liable for the cost of realizing an attractively low-interest loan. From these examples, it is evident that policy financing is a well-established instrument to support government policies, and that an EEC promotion fund may add to the government's policy implementation capacity.

If funds are provided to the Government of Egypt at interest rates significantly lower than the market, the cost that the government must cover will be diminished, perhaps even negligible. There can be an option

for the Egyptian Government to utilize a fund provided from an international organization, banks and bilateral development cooperation organizations for pursuing its policy to promote EEC.

The aim of policy financing for EEC promotion would be to offer low-interest loans to those who purchase energy efficient equipment. Low-interest loans will help borrowers significantly reduce the total cost of equipment versus market rates. If potential borrowers see the advantage of using such low-interest loans, they can be expected to participate.

5.2 EEC promotion in business sector

5.2.1 Awareness-raising on industrial energy efficiency

(1) Global trends in decarbonization

In May 2021, the IEA released "Net Zero 2050, a Roadmap for the Global Energy Sector." These guidelines are key for future discussions and may be the basis of a macro-understanding of global decarbonization. Its main messages are:

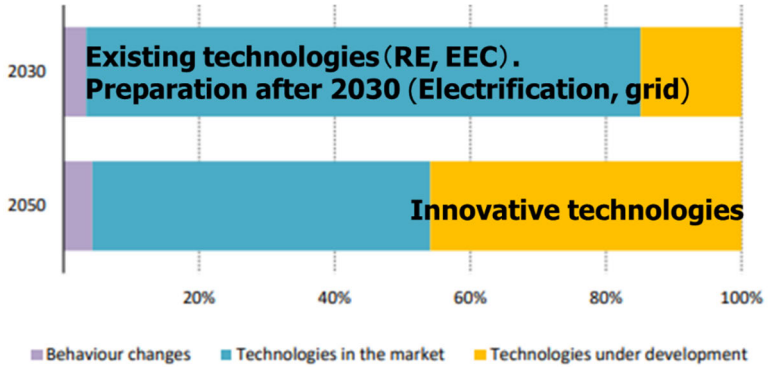
- Although many countries have announced their net zero commitments for the next 10 years, even if all these targets are achieved it will still be impossible to achieve net zero emissions by 2050 and keep world average temperature rise below dangerous limits. The path to realize net zero 2050 is narrow and challenging. Continuous action on a global level from this year onwards is essential.
- Priority actions proposed by IEA include:
- Stop new investment in fossil-fuel-related projects
- Stop new construction of coal-fired power plants without decarbonization technologies
- Stop sales of internal combustion engine passenger cars by 2035
- Stop sales of fossil fuel combustion boilers by 2035, and replace them by hydrogen, heat pump and solar water heater
- Electricity utility companies should achieve net zero emission by 2040

Currently available technologies can play a dominant role in global decarbonization by 2030. Around half of carbon emissions reductions by 2050 will be realized by today's demonstration and/or prototype-stage technologies. Each country has a responsibility to facilitate these innovative technologies.

- Seven proposed priorities

  Priority 1: Make 2020s a decade to surge existing clean energy technologies, such as solar & wind power generation and energy efficiency improvement.

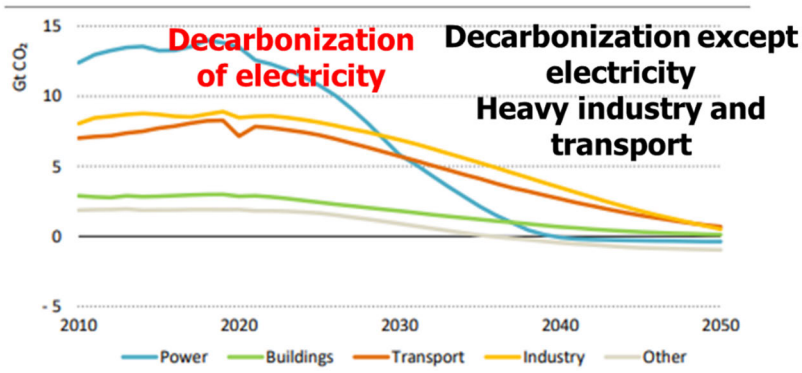
  Priority 2: Make 2020s a decade to prepare for the introduction of innovative technologies after 2030. To achieve net zero 2050, it is essential to apply innovative technologies after 2030. The 2020s should be a decade of preparation to adopt innovative technologies in the 2030s (see Fig. 5.2).



SOURCE: IEA NET ZERO 2050 ROADMAP

Fig. 5.2 Proposed timeline by technology towards Net Zero 2050 by IEA

IEA also proposes that the 2020s should be a decade to accelerate the decarbonization of electricity, such as introducing renewable energy and boosting energy efficiency (See Fig. 5.3).



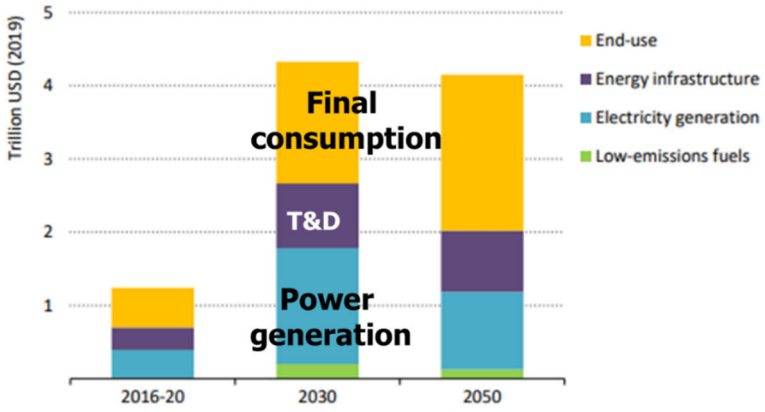
SOURCE: IEA NET ZERO 2050 ROADMAP

Fig. 5.3 Proposed timeline by technology towards Net Zero 2050 by IEA (2)

Priority 3: Strong promotion of clean energy job creation and shifting fossil fuel industry workers to clean energy jobs.

Priority 4: Adjust short-term targets and set long-term targets.

Priority 5: Massive push in clean energy investment. IEA proposes clean energy investment portfolio for net zero society in Fig. 5.4. The necessity of increasing clean energy investments, especially energy efficiency improvement in end-use and decarbonization of power generation is high.



SOURCE: IEA NET ZERO 2050 ROADMAP

Fig. 5.4 IEA proposed clean energy investment portfolio for Net Zero 2050

Priority 6: Strengthen countermeasures against expanding energy security risk.

Priority 7: New age of international cooperation

In this report, consistent with the IEA's priorities, the following points will be stressed:

1. Importance of energy efficiency improvement and decarbonization of electricity
2. Quantitative energy efficiency improvement by proven (existing) technologies

In 5.2 and after, analysis of potential for energy efficiency improvements in Egypt is described in detail.

(2) Corporate awareness and efforts on energy conservation

Through interviews with local companies, industry associations and companies supplying equipment to local factories, we gained an understanding of each company's awareness of energy conservation, the status of their efforts (including energy-saving technologies) and future plans.

With local companies, interviews were conducted with three manufacturers/vendors of air conditioning and refrigeration equipment, two food-related industries, four construction companies and two companies in the building and hotel industry. Visits were also made to industry associations, including the textile industry, the food processing industry and the hotel association.

With Japanese companies supplying equipment to local factories, interviews were conducted with three trading companies, three air conditioning and refrigeration equipment makers and one manufacturer/vendor of boiler equipment.

Following is a list of organizations interviewed.

Table 5.2 List of companies interviewed

	Company name	Field	Interview date
Local Companies and Organizations			
1-1	Textile & Home Textile Export Council	Textiles	2021/4/7
1-2	El Araby	Air-con & refrigeration	2021/6/9, 8/8
1-3	EGICAT	Air-con & refrigeration	2021/8/9
1-4	TIBA Manz Engineering	Air-con & refrigeration	2021/ 9/9
1-5	Egypt-Japan Business Council/Modern Farm	Food	2021/8/9
1-6	Chamber of Food Industries	Food	2021/8/11
1-7	Japan Food Solutions	Food	2021/8/23
1-8	Arab Contractors	Construction	2021/8/15
1-9	Elsewedy Electric	Construction	2021/8/15
1-10	Orascom	Construction	2021/8/17
1-11	Cleopatra Group (Hotel & Resort)	Architecture & Hotels	2021/8/16
1-12	Contrack Facilities Management	Architecture & Hotels	2021/9/28, 10/4
1-13	Cleopatra Group (Real Estate)	Architecture & Hotels	2021/10/19
1-14	Egyptian Hotel Association	Architecture & Hotels	
Japanese firms supplying equipment to local manufacturers			
2-1	Toyota-tsusho	Trading company	2021/4/8
2-2	Marubeni, Marubeni Protechs	Trading company	2021/4/13、5/19
2-3	Sojitz	Trading company	2021/6/6
2-4	Daikin (Daikin Air Conditioning Egypt S.A.E)	Air-con & refrigeration	2021/4/12, 8/9,9/26
2-5	Hitachi Johnson Controls	Air-con & refrigeration	2021/5/21
2-6	Mayekawa Egypt LLC	Air-con & refrigeration	2021/6/7
2-7	Yokogawa	Other (controls)	2021/6/8, 8/25

1) Results of interviews with local companies, industry associations, etc.

(i) Air conditioning and refrigeration-related companies (El Araby, EGICAT, TIBA)

Three companies handling Japanese products were interviewed about the status of the products they handle, efforts needed to disseminate energy-saving technologies in Egypt, and their expectations for this survey.

In addition to confirming the effectiveness and market share of Japanese products for air conditioning equipment, they commented on the need for incentives for purchasers (e.g., interest exemption on installment payments) and awareness campaigns to spread the effectiveness of the technology.

Company: El Araby	Interview date: 2021/6/9	Interviewees: Mr. Mohammed Magdy, Mr. Ezzeldin Ahmed, Mr. Osama Said Moustafa
Interview outline	1) Main business and products: • AC: El Araby manufactures inverter-controlled AC, using SHARP technologies; 38% are inverter controlled ACs. El Araby does not manufacture VRF. • In Egypt, LG, Carrier (USA & China), Gree (China) and some local manufacturers supply inverter-controlled ACs. LG imports ACs, while others manufacture in Egypt. • El Araby mainly serves residential, plus some government buildings & small factories. • In Egypt, two energy standards exist for normal ACs and inverter-controlled ACs. El Araby worked with government to develop standard for inverter-controlled ACs in 2015-17. They use weighted energy efficiency ratio (EER). Now government unofficially started to consider unifying two standards into one. • Refrigerators: El Araby manufactures inverter-controlled refrigerators, using SHARP and TOSHIBA technologies; 40% are inverter-controlled refrigerators (8 models). They also export refrigerators to Gulf and African countries. • LED: El Araby manufactures LED using their own local technologies. They supply LEDs to residential sector only LED sales, compared to ACs and refrigerators, is small. 2) Needs, interests and comments from El Araby: wishes to work with JICA to create awareness of inverter technologies among end-users; proposed JST to study feasibility of financing not only for end-users but also EEC equipment suppliers like El Araby.	
Company: El Araby	Interview date: 2021/8/8	Interviewee: Mr. Ezzeldin Ahmed
	1) Market share of inverter equipped AC is about 28%. For El Araby, three products (refrigerator, AC and LED) are proposed targets. El Araby is keen to get JST proposal 2) Promotion of EEC products and promising market: issue is how to promote three EEC products in the market. Need to demonstrate benefits to end-users (financial incentives such as installment paying, long-term payment (12-24 months) with no interest, etc.). • New Cairo city developments will generate huge business opportunity, as a large number of people move in and buy new home appliances.	
Company: EGICAT	Interview date: 2021/6/9	Interviewee: Eng. Ahmed Abdel Fattah
Interview outline	• Overview of EGICAT: company has worked with Japanese brands Daikin and Mitsubishi since 1966 and 2016 respectively. • Many projects use Japanese products, e.g., Al Fattah El Aliem Mosque, Al Massah Hotel, Maadi smart village, Egyptian Museum and Pfizer pharma plant • Customers include direct and B2B: works as supplier for construction contractors • Japanese VRF technology in Egypt since 1996, but very expensive and Egyptians didn't care about energy efficiency as electricity was cheap. • As Japanese products are more expensive than Chinese or European products, clients shun Japanese products. Market share has dropped to 20% since 2017 as Korean and Chinese products dominate the market. 3) Needs, interests and comments from EGCAT: • Financial support: there are no financial incentives such as instalments. • Political support: when JICA gives grants for largest projects in Egypt, contractors buy European or Korean not Japanese products. Japan should emphasize purchasing Japanese products when they give grants to Egypt.	

Company: TIBA	Interview date: 2021/9/28	Interviewee: Eng. Ahmed Abdel Hakim (General Manager), Eng. Mohamed Ragab (Business Development Manager)
Interview outline	• Overview of TIBA Manz Engineering: sole representative for Hitachi products, e.g., chiller (absorption chiller (ABR) and Room Air conditioner (RAC) including after-sale services. TIBA also represents other brands including GREE. Air-cooled chiller (e.g., scroll compressor type, 100-200RT) is best-seller in Egypt. • EEC technology: end users need EE technologies, but with AC electricity rates are still low. First priority is raising awareness among users; second priority: Egyptian government should monitor labelling situation. • Market trends in AC systems customers: 10 years ago, hotels; 5 years ago, offices; today, government project – new capital. Over next 4 years, complex projects (apartments + commercial + offices) • Many investors have bought land to build complex projects. • Consultants/design offices mainly set equipment specifications and select vendors. • Construction companies want to buy equipment with low initial cost, but consultants often do not accept. Needs, interests, comments from TIBA: • Awareness campaign about efficient ACs and JICA low-interest loan program needed for owners who purchase efficient ACs. • Set up research centers to test equipment because makers go to China, Europe, USA to test their equipment.	

(ii) Food-related companies (Food Processing Association, Modern Farm, Japan Food Solutions)

In the food-related industry, where products from Japanese companies such as refrigeration and freezing equipment could be used, interviews were conducted with three organizations: a food processing association, a company close to the production site, and a company focused on processing. We were able to confirm the situation surrounding the industry, including the large amount of food loss and compliance with standards related to safety.

Company: Food Processing Assn.	Interview date: 2021/8/11	Interviewee: Mahmoud El Bassiony
Interview outline	1) Membership: Association has 15,000 members, but only half are active. Members are divided into three categories: 85% are small firms (EGP 0-50M); 10% are mid-sized (EGP 50-200M); 5% are large firms (EGP>200M). 2) EEC needs in food sector: • Mr. Bassiony emphasized need for technical assessment to confirm energy savings before taking a loan. • Water supply system is important for fruit and vegetable production. • 80 companies got benefit from assessment of the Solar Heating for Industrial Process (SHIP) project but only six companies implemented the project. • Companies have many problems with safety and health standards so loan must be attractive. • Actual registered exporters are 800 companies (medium to large), limited by onerous requirements from each country and EU. • Available financing sources: GEFF and Green Value Chain developed by EBRD are utilized, but GVC eligibility is difficult for Egyptian food industry.	
Company: Modern Farm	Interview date: 2021/8/9	Interviewee: Mr. Fadl Abdel Hamid
Interview outline	1) Main business, needs, interests and comments: • Mr. Fadl works in agriculture and poultry firm. Largest EEC needs lie in water pumps that run on diesel. Solar power may work for 24h water sprinkling. • Like many other agri-businesses, it relies on self-finance, because to borrow money from banks, the lands (= collateral) need to be settled first, which takes a long time.	

Company: Japan Food Solutions	Interview date: 2021/8/23	Interviewee: Mr. Emad Shaker Said
Interview outline	1) Main business and products: Nile International was established in 1994 in Japan aiming to provide Egyptian vegetables and fruit to the Japanese market, adapting to the strict Japanese quality control system. Nile Delta Fujinomiya factory was established in 2004, and Japan Food Solutions (JFS) was established in Egypt in 2010. Capacity of the factory started at 3t/h, but is now 20t/h. • JFS's main market is in Japan. Their products are dried and frozen vegetables such as onion, frozen fruits such as strawberry, and tomato source, etc. Their services are fruit and vegetable processing, packing, storage and transport. • JFS's business affected by electricity tariff increase. It was reflected to sales prices and may result in drop of the competitiveness of Egyptian export. 2) EEC facilities in JFS • Cold system is main power consumer. Lighting is minimal to avoid insects. • Latest facility improvement (JPY 1.4 billion) included: concrete insulation to control heat; variable speed drives (VSD) for compressor and motor, AC system, full automation of packing lines. • JFS expects to install photo sensor system and air curtain in future to improve EEC. • In previous factory improvement, JFS first contacted Maekawa, but finally chose GEA as Maekawa did not provide turnkey solution. GEA could do it and dispatch technical team for installation, but Maekawa could not. Other compressor makers are Hitachi and Kobe Steel. • JFS wants to install Maekawa's air curtain to control factory temperature. There are local products but with lower quality than Maekawa. • JFS uses boiler (natural gas) to boil agriculture products (blanching) and for cleaning processing machines and factory. • JFS cares about product quality, so they think current pipe system should be upgraded to stainless; also have interest in heat pump as more clean energy use. • When food industry companies want to improve their facilities, they may check with other companies and consult facility vendors' directory.	

(iii) Construction companies (Construction Materials Association, Arab Contractors, Elsewedy Electric, Orascom, Contrack Facilities Management)

Interviews were conducted with construction companies and industry associations responsible for infrastructure projects regarding effective energy-saving technologies and their expectations for this study.

We confirmed that construction companies have limited opportunities to propose energy-saving equipment, that they proceed with projects according to specifications determined by clients and consultants, and that cost is a major factor in client decisions. In addition, the facilities department of the construction company confirmed the effectiveness and high need for air conditioning technology in building energy efficiency and conservation.

Company: Construction Materials Assn.	Interview date: 2021/8/15	Interviewee: Ms. Lobna Fathy,
Interview outline	1) Member of the association: CMBI covers 11 industries: bricks & refractories, cement, cement products, ceramics, contracting, glass & porcelain, insulation material, marble & granite, pipes, quarries and sanitary ware. • CMBI has more than 4000 registered members, 70 –75% are SMEs. • CMBI provides support to members in facilitating any problem they face, especially those related to government authorities. • Several quality standards must be followed. 2) Needs, interests and comments from CMBI: • CMBI appreciates the support of JICA project; members prefer financial support to include a grant part in addition to soft loan. Lending term is also important.	
Company: Elsewedy	Interview date: 2021/8/9	Interviewee: Dr. Yehia Shankir
Interview outline	1) Main business: Elsewedy works with different technology providers in promoting green hydrogen. Since Egypt has a huge potential in solar energy, green hydrogen production is promising. • In buildings, Dr. Yehia pointed out key role of insulation in reducing HVAC energy consumption. • With PV rooftop systems for commercial buildings, big area needed to meet demand of an office building. For residential, investment cost is still high for the consumers. Several problems in disseminating PV systems. Current regulations don't work for coordination between PV systems and grid, so benefits of PV system are not clear. • Incentive is the only driver to promote EE technologies, and incentive should be paid to end user not producer. • Elsewedy is focused on exports with over 70% of production going abroad. To reach the international market, company must meet target-market requirements. Therefore, company applied energy management system to be able to export their products. Certification system is important to promote energy management service in Egypt. 2) Needs, interests and comments from Elsewedy: • With EEC projects, Dr. Yehia pointed out that industries suffering from economic barriers, e.g., cement and other energy intensive industries, could benefit from financial support from the JICA project. • Elsewedy Co. prefers long-term loans even with higher interest to cover investment payback period. Local banks usually only offer short-term loans.	

Company: Arab Contractors	Interview date: 2021/8/16	Interviewee: Eng. Mostafa Saad, Eng. Karim Mostafa Hussein
Interview outline	1) Overview of Arab Contractors: A widely diversified contractor covering a wide spectrum of the construction industry and ancillary services including all types of infrastructure. Company is government-owned and governments are their main clients. 2) EEC technology in building sector: Based on their experience, almost half the clients select new technologies including EEC, but the other half select traditional technologies. • Company now has many projects in the new Administrative Capital including a variety of residential, commercial and government buildings – most considered as smart/efficient. • Company normally follows technical specs provided by client and consultants. • For building sector, RE is an effective technology already installed in office buildings. Plus, insulation improves energy efficiency. LED lighting is already common in more than 80% of new projects, but insulation is not yet common. Central air-cooling systems and Building Energy Management System (BEMS) are also effective. • They can propose EEC technologies to clients, but they don't provide ESCO services. 3) Needs, interests and comments: • Arab Contractors advised that financing should partially covered by the beneficiary (10-20%) to guarantee serious participation. Plus, technical support should be effective to ensure the loan is spent in the targeted EEC projects and to validate the impacts. • Finally, Mostafa Saad asked for support from the project to implement EEC measures in one of their buildings as a pilot project that could be replicated in other buildings after proving its technical & financial feasibility. • As a government-owned corporation, if they access JICA finance, some conditions from government may apply.	
Company: Orascom	Interview date: 2021/8/17	Interviewee: Eng. Khalil Zakher, Mr. Nader Ragheb
Interview outline	1) Company overview: Interviewees mainly work on constructing conventional power plants as they are hugely profitable, but they have an investment in Gabl Ezeit Wind Farm with Toyota. Diverse group includes aluminium company and steel mill. • They can provide EPC+F for power plant projects, but in normal building projects, consultants provide design and project owner selects facilities. They are just contractor. 2) Needs, interests and comments: recommend conducting technical assessment on different sector to identify exact needs. • As current power generation capacity exceeds demand, energy saving needs are limited on supply side, but increasing electricity prices affects attitudes on demand side.	

Company: Contrack Facilities Management	Interview date: 2021/9/28	Interviewees: Mr. Nagy Aboutar, Managing Director; Mr. Peter Ezzat, Mr. Angelos Wafik, Eng. Mohamed A. Raou
Interview outline	1) Company overview: CFM is a subsidiary of the ORASCOM construction group that works in partnership with clients to create tailored Facility Management Solutions, which can cover on-site and off-site management, maintenance, cleaning, essential services, security, renovations and fit-out services as well as a range of related services. • CFM provides a systematic approach to operate, maintain, improve and adapt the buildings and infrastructure (assets). • CFM serves clients in different sectors: industrial, commercial, retail, healthcare, etc. • CFM provides hard services: engineering, civil and architectural repair & maintenance services, as well as soft services such as housekeeping, deep clean hygiene services, with specialties in façade cleaning, landscaping, pest control, waste management & recycling services in addition to security services and industrial health & safety for large commercial properties. • CFM has more than 100 major clients and some clients have more than 700 buildings. CFM makes recommendations to these clients including facility replacements. 2) Overview of EE measures in the Nile City Tower (NCT): 34 floors with total floor area of 200,000 square meters, 24 elevators and 1,250 car parking slots. • In the past the EE measures were conducted including conversion of the lighting system to LED and use of control & management system for elevators, AC system, etc. Facade lighting remains conventional type, but CFM will soon replace with LED. 3) CFM renovation five-year plan and expectation: upgrading Building Management System (BMS) to cover all loads and equipment in the buildings. • Replacing the domestic & chiller' pumps with new efficient and VSD system with USD 2 million budget. • Replacing old chillers (total cooling capacity = 8000 RT (8 units) by Carrier with efficient chillers. Currently power consumption by chillers amounts to 40% of total. Total replacement budget will be USD 10 million. • Replacing exhaust and supply air fans with new efficient ones. • Total estimated cost of 5-year plan is about USD 20 million.	

(iv) Architectural and hotel-related (Cleopatra Group, Hotel Association)

Interviews were conducted with the hotel industry, which is considered to have high building energy conservation needs, and the real estate industry, which handles residential, commercial and business buildings.

Company: Cleopatra Group (Hotel/resort)	Interview date: 2021/8/16	Interviewee: Eng. Mohamed El Sayed
Interview outline	1) EEC technology needs: Hotels have several types of equipment that consume electricity: lighting, HVAC, water heating and pumping systems. Currently, VR air cooling and centralized control systems are installed in new hotels. • Difficult to retrofit new EEC facilities in existing hotels because of disruption to business. So, EEC facilities are mainly installed in new construction. • Two new construction projects are ongoing in north coast area (Mersa Matruh & Mersa Allam). To get international "Green Hotel" certification, EEC technologies such as VR cooling system, boilers for hot water supply, water pumping system will be installed. • Strongly need green investment not only for hotels but also shopping mall. • They have reached GEFF and started to prepare application. Currently they are in technical assessment stage and selecting facilities.	
Company: Cleopatra Group (real estate)	Interview date: 2021/10/16	Interviewee: Mr. Mohamed Abdel Hameed
Interview outline	1) Company overview: Developer of large residential, commercial and mixed-use projects, including two residential compounds with retail components in Cairo; two residential towers in Cairo and Alexandria and one mall in Cairo. They will launch soon three developments on the north coast, at Mersa Allam and Makadi. • Group includes several subsidiaries including industries, hotel & tourism, real estate, agriculture and media (TV). Cleopatra group has internal finance, but each sector also has separate finance. 2) Needs, interests and comments: • They don't develop office buildings, but other companies such as Sabbour group may have an interest as they develop and operate the buildings and rent spaces to tenants. • Major enterprises in Egypt are funded by state-owned enterprises. For example, Al Ahly Sabbour development is a joint-venture with NBE. These companies can finance from commercial banks, but the bank will evaluate the share of capital.	
Company: Hotel Association	Interview date: 2021/10/18	Interviewee: Ms. Tayssir, Executive Director
Interview outline	• The member of hotel association has three category, Hotels, Management Companies, and Owning Companies. It includes restaurants and shopping malls. The member more than 1, 000 companies and include SMEs and State-owned companies. • The association promotes the Green Star Hotel (GSH) which is a national green certification and capacity-building program managed by the EHA under the patronage of the Egyptian Ministry of Tourism.	

(v) TEC Egypt (Textile Association)

TEC expressed interest in this survey, but said that the possibility of Japanese products entering the market is low.

Company: TEC Egypt	Interview date: 2021/4/7	Interviewee: Ms. Rasha Fahim, Executive Director; Mr. Mohamed Tarek, Business Development
Interview outline	• Textile exporters market overview: Of around 3,000 companies in the sector, about 200-300 are export-oriented companies and members of TEC. The largest-scale manufacturers are all state-owned but 90% of export-oriented companies are privately-owned companies. • TEC Egypt is a privately-managed organization created by the government in 1997 to be responsible for development and promotion of textile exports. It is one of the think-tanks that help Egyptian policymakers prepare strategies to increase both the quality and quantity of textile exports. • TEC is recognized for its commitment to provide services for the export community to drive the growth of Egypt's exports in the textile sector. • TEC functions as a framework gathering representatives of textile manufacturers and exporters (spinners, weavers, knitters, dyers& others). They all work on increasing the competitiveness of an industry that has an acknowledged heritage in Egypt. • Most members are yarn and fabric exporters. 3) Needs, interests and comments from TEC: • The range of spinning machines presented (Trutzschler, Rieter, Saurer, Toyota, Savio) looked familiar to TEC. • USD may be preferable to EGP for export-oriented companies when borrowing money for EEC equipment purchases, because members are trading with foreign countries. • TEC expressed interest in cooperating with the JICA EEC project.	

2) Interviews with Japanese companies supplying equipment to local factories

(i) Trading company

No trading company currently handles energy-saving equipment, but we did ascertain their future expansion plans and intentions.

Company: Toyota-tsusho	Interview date: 2021/4/8	Interviewees: Mr. Hidaka, Mr. Ono
Interview outline	1) Status of development in Egypt: The company does not handle looms or cement-related equipment in Egypt. Currently, energy development projects (thermal power generation, wind power generation, gas development, etc.) are underway. 2) Plans for future expansion: May consider trading in boilers in future and are interested in the iron and steel sector.	
Company: Marubeni Protechs	Interview date: 2021/5/19	Interviewees: Mr. Mizutani, Mr. Hirayama
Interview outline	• Plans and interests in Egypt: In electric power, amorphous transformers and other power distribution equipment, BEMS, heat pumps, etc. are under consideration. The main targets are electric power utilities and power distribution companies. • Japanese companies with which they do business include Aichi Electric and Toko Kogaku for power distribution equipment. In heat pumps, Maekawa Manufacturing Co.	
Company: Sojitz	Interview date: 2021/6/6	Interviewee: Mr. Yuasa
Interview outline	1) Status of development in Egypt: Participated in an energy development project since 2006, but stopped in 2020. Currently, engaged in projects related to raw materials. • In the 2000s, Sojitz supported El Araby's AC manufacturing (related to Sharp) and has maintained good relations with the company. • Sojitz has business with the textile industry, but does not deal in manufacturing equipment. It has not entered the cement, electricity or steel industries. 2) Plans and interests in Egypt: interested in the food processing industry, but says competition is already fierce. Egypt's government is promoting a green economy, and Sojitz would like to enter the environmental, energy and recycling businesses.	

(ii) Air conditioning and refrigeration companies

Two companies currently deploying air conditioning and refrigeration equipment in Egypt were interviewed regarding their current status and future plans. Interviews revealed that although end-users have real needs for efficient air conditioning equipment, construction companies have not promoted the issue.

Company: Daikin	Interview date: 2021/4/8	Interviewees: Mr. Hidaka, Mr. Ono
Interview outline	• Status of expansion in Egypt: Established in 2016 and moved into current office in 2019. New showroom was about to open. Marketing strategy is to promote VRV to commercial and government building market plus luxury villas. Chillers are also supplied to various commercial and governmental buildings. • Market size in Egypt is assumed to be around USD 500 million/yr., with USD 400 million in residential AC market and USD 100 million commercial/government market. Daikin's share in commercial/governmental market is under 10%. • Competitors in chiller market: Hitachi-JCI, Carrier. • VRV/VRF market shares: Daikin 30-40%, LG 30-40%, 10% each for Mitsubishi, Hitachi, Samsung. • All products come from European plants, import duty exempt through free trade agreement. • Penetration of inverter-controlled AC in Egypt's household market is less than 5%. Locally available conventional products cost less than 1/3 or even 1/5 of Daikin's split ACs. • Daikin has 8 local dealers in residential market (which is not really their target market. • Plans, interests, etc. in Egypt: target products: Chiller, VRV, Split AC • Common transaction pattern for new building development = Daikin => facility contractor => building contractor => building owner. • Design consultants usually specify types and brands of ACs to be supplied. • Retrofitting business (e.g., 50-yr-old flats in Zamalek) may be a good opportunity for low-interest loan from proposed finance facility (as business transaction is simpler).	

<table>
<tr><td>Company: Daikin</td><td>Interview date: 2021/9/26</td><td>Interviewee: Eng. Sherif Soliman, Mr. Ali Saad, Mr. Mohamed Kamal</td></tr>
<tr><td>Interview outline</td><td colspan="2">
• Levels of need for efficient air-conditioning systems:
<table>
<tr><th></th><th>End user</th><th>Building owner/ developer</th><th>System designer</th><th>Construction company</th></tr>
<tr><td>RAC</td><td>A</td><td>C</td><td>B</td><td>E</td></tr>
<tr><td>VRV</td><td>A</td><td>B</td><td>A</td><td>E</td></tr>
<tr><td>Chiller</td><td>A</td><td>A</td><td>A</td><td>E</td></tr>
</table>
#Note: A: High B: Medium high C: Medium D: Medium low E: Low
#Owners/developers select products but contractors favor low initial cost equipment.
• Needs for air-conditioning systems according to Daikin
<table>
<tr><th></th><th>Reliability</th><th>Ease-of-use</th><th>Noise level</th><th>Profitability (machine cost + O&M cost)</th><th>Function -ality</th><th>After-sales service</th></tr>
<tr><td>RAC</td><td>A</td><td>D</td><td>C</td><td>C (A for residential customer in initial cost)</td><td>C</td><td>A</td></tr>
<tr><td>VRV</td><td>A</td><td>D</td><td>A</td><td>A</td><td>B</td><td>A</td></tr>
<tr><td>Chiller</td><td>A</td><td>D</td><td>B</td><td>B</td><td>B</td><td>A</td></tr>
</table>
#Note: A: High B: Medium high C: Medium D: Medium low E: Low
• Refrigerants strategy at Daikin
<table>
<tr><th></th><th>Past</th><th>Present</th><th>Future</th></tr>
<tr><td>RAC</td><td>R22</td><td>R32</td><td>R32</td></tr>
<tr><td>VRV</td><td>R22</td><td>R410a</td><td>R32</td></tr>
<tr><td>Chiller</td><td>R134a
+ various</td><td>R134a</td><td>?</td></tr>
</table>
#Note: Daikin’s approach to refrigerant replacements:
i. VRV: Vent existing refrigerant
ii. Chiller: Recovery of existing refrigerant
Daikin sales efforts focus on construction company/designer rather than owner/developer.
</td></tr>
<tr><td>Company: Maekawa</td><td>Interview date: 2021/6/7</td><td>Interviewee: Islam Fathy, Business Development Manager</td></tr>
<tr><td>Interview outline</td><td colspan="2">
• Status of expansion in Egypt: Mycom Egypt has sold compressors since 2018, around 10 sets/year. Compressors are installed in frozen foods export industries, dairy plants, cold storage and food processing. End-users are mostly SMEs (both Egyptian and foreign firms).
• Mycom sells some compressors directly to end-users, some to turnkey project developers (most developers are foreign firms with good cash flow). Mycom initially tried to work as project developer, but could not compete. So is now focused on supplying compressors.
• Mycom is developing business independently, not working with trading companies.
• End-user purchases 1-4 sets/project. Mycom prices are 10% lower than GEA/Johnson Controls (main competitors), but 30% higher than SRM (Chinese maker that recently entered Egyptian market).
• As Mycom Egypt does not hold importer license, Mycom Dubai issues invoice and makes contract with client.
• SME end-users normally borrow from banks in Egyptian Pounds and pay Mycom in Euro or USD. Qatar National Bank (QNB) is preferred by some Mycom clients.
</td></tr>
</table>

(iii) Other equipment

Interviews were conducted with Japanese companies that handle control systems for factories, etc.

Company: Yokogawa	Interview date: 2021/6/8	Interviewees: Osama A. Maguid, Country Manager, Ramy Mohamed Tayel, Sales Manager
Interview outline	• Status of expansion in Egypt: Main clients are in petrochemical sector (companies affiliated with Ministry of Petroleum), utility sector (power, water) and some industrial sectors (fertilizer, steel, pharmaceuticals); 70% of clients are government-affiliated, 30% are the private. • Yokogawa Egypt provides SCADA systems (for oil & gas networks), power-plant control systems, continuous emissions monitoring systems (for factories). • Yokogawa is interested in collaboration with JICA.	
Company: Yokogawa	Interview date: 2021/8/25	Interviewee: Mr. Matsui
Interview outline	• Business in Egypt and future plans: main customers are in petrochemicals, followed by electric power, industrial sector (steel, sugar, control systems for private power generation, etc. Number of customers in power and industrial sectors is small. • Existing products are sensors and control systems. In future, plan to sell advanced process control and optimization systems. Customers are also interested in DX. Scale of sales is from tens of millions of yen to less than 1 billion yen. Also interested in ammonia, hydrogen, renewable energy, and smart cities as new areas. • In grid control systems, they are one of the top 3 companies in Egypt. • Customers are often reluctant to replace existing systems.	

5.3 EE trends in Egyptian industry

5.3.1 Macro observation of EE improvement potential in Egypt

As described in Chapter 4, Egypt's primary energy electricity consumption in residential, industrial and building sectors is quite large, second only to transport use of oil and gas. Table 5.3 shows a more detailed picture, lining up energy consuming sectors and energy type in order. The top five energy consuming sectors consume over 70% of national primary energy consumption. Ideas to promote EEC in these areas are described in the right part of the table.

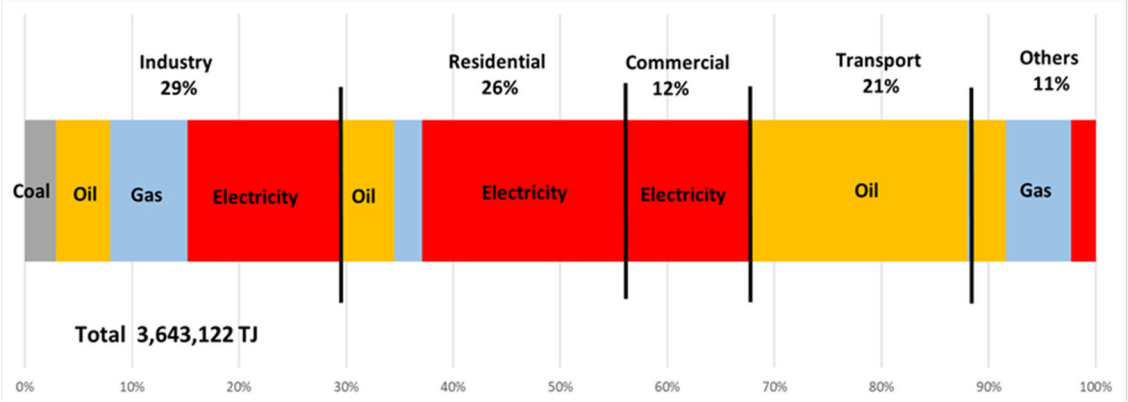


Fig. 5.5 (Re-post) Primary energy consumption by sector& energy type in Egypt (2019)

Efficient space cooling and lighting can make a large contribution to reducing electricity consumption across all sectors. In the following analysis, efficient space cooling and lighting are examined first, then other potential EEC technologies.

Table 5.3 (Re-post) Energy consuming sector × Energy type & main EEC measures/ potential

Ranking	Sector and energy type	Consumed primary energy (TJ)	%	Eligible measuresfor saving	Expected saving % in sub-sector (JICA estimate)
1	Oil for transport	738,027	20.3%	RE+EV, regulation for vehicle efficiency, BRT,	▲30.0%
2	Electricity for residential	676,865	18.6%	Efficient cooling, lighting, refrigerator	▲25.0%
3	Electricity for industry	517,569	14.2%	Efficient cooling, lighting,EM	▲20.0%
4	Electricity for building	441,555	12.1%	Efficient cooling, lighting,heating	▲35.0%
5	Gas for industry	264,279	7.3%	Efficient heating,EM	▲15%
	Others	1,004,827	27.6%		
Total		3,643,122	100.0%		▲18.9%for total

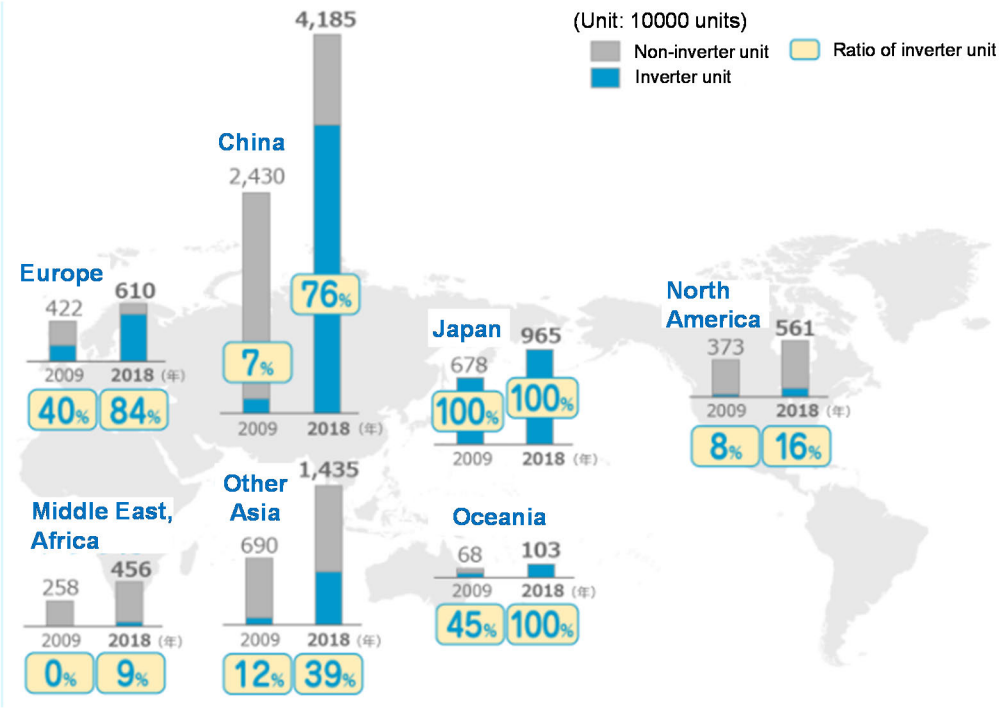
SOURCE: COMPILED BY JST, BASED ON IEA2019 DATA

5.3.2 Analysis of energy-saving potential with dominant technologies

(1) Room air conditioners

1) Global trends in room air conditioners

Introduction of inverter control is extremely important as an energy-saving technology for room air conditioners. The following figure shows the global room air conditioner market volume as well as the ratio of inverter units in 2018. It can be observed that (1) the adoption rate of inverters in the Middle East and Africa is low at about 9%, (2) the adoption rate of inverters in room air conditioners in Japan is 100%, and (3) the adoption of inverters is progressing globally, although there are differences among regions.



SOURCE: PREPARED BASED ON DATA FROM DAIKIN & JAPAN REFRIGERATION AND AIR CONDITIONING INDUSTRY ASSOCIATION.

Fig. 5.6 Global room air conditioner inverter adoption rate (2018)

2) Room air conditioner situation in Egypt

In 2019, more than 1 million room air conditioners were sold in Egypt, with total sales value of 64.6 billion yen (EGP 1=JPY 6.93). This was the result of a 78% increase in sales value between 2016 and 2019[9]. The following figures show the progress/trend of inverter adoption in room air conditioners (left figure: volume ratio, right figure: sales value ratio) over 2011-2019. Although the number of inverter units gradually increased, it remains at 11% of total units and 13% of total sales value in 2019[10]. Combined with increasing demand for air conditioners, promotion of inverter technology is becoming a major issue in promoting energy efficiency & conservation.

[9] Market Survey Information
[10] Market Survey Information

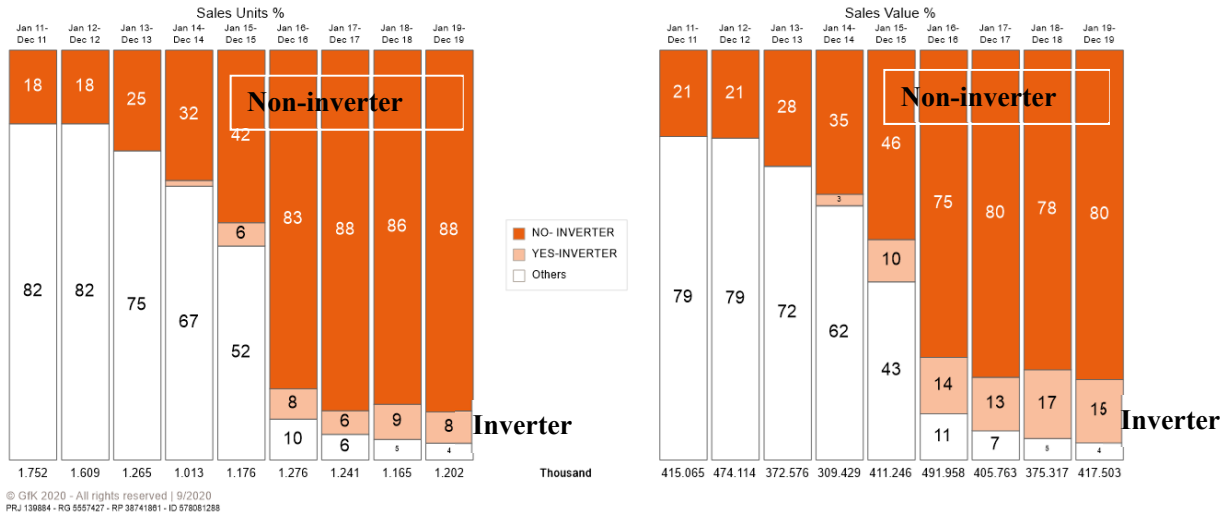


Fig. 5.7 Trends in inverter adoption rate in room air conditioners in Egypt

The following figures show market trends for non-inverter (low efficiency) room air conditioners from 2011 to 2019 (left figure: volume ratio, right figure: sales value ratio). (1) The largest market share, about 40%, is held by El-Arabi, which uses Sharp technology; (2) LG stopped selling low-efficiency non-inverter units several years ago; (3) other suppliers selling non-inverter units are mainly local manufacturers[11].

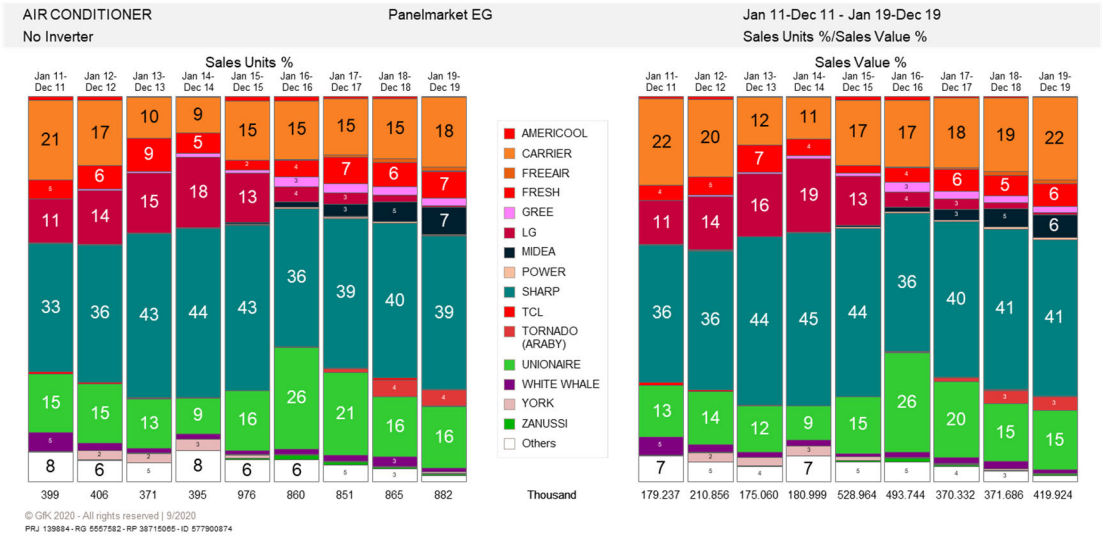


Fig. 5.8 Market-share trends of non-inverter room air conditioners in Egypt

The figures below show market trends of inverter room air conditioners (left figure: volume ratio, right figure: sales value ratio) over 2011-2019. (1) The largest share, about 54% is held by El-Araby, which uses Sharp technology; (2) second, with about 39%, is held by LG; (3) local makers do not sell inverter models (a near-oligopoly of two companies[12]). Sharp brand air conditioners are manufactured domestically by El-Araby. Sojitz (ex-Nissho Iwai) was commissioned by El-Araby to build a room air

[11] Market Survey Information
[12] Market Survey Information

conditioner plant in the past, and Sharp still supplies components to El-Araby today (can be counted as Japanese equipment).

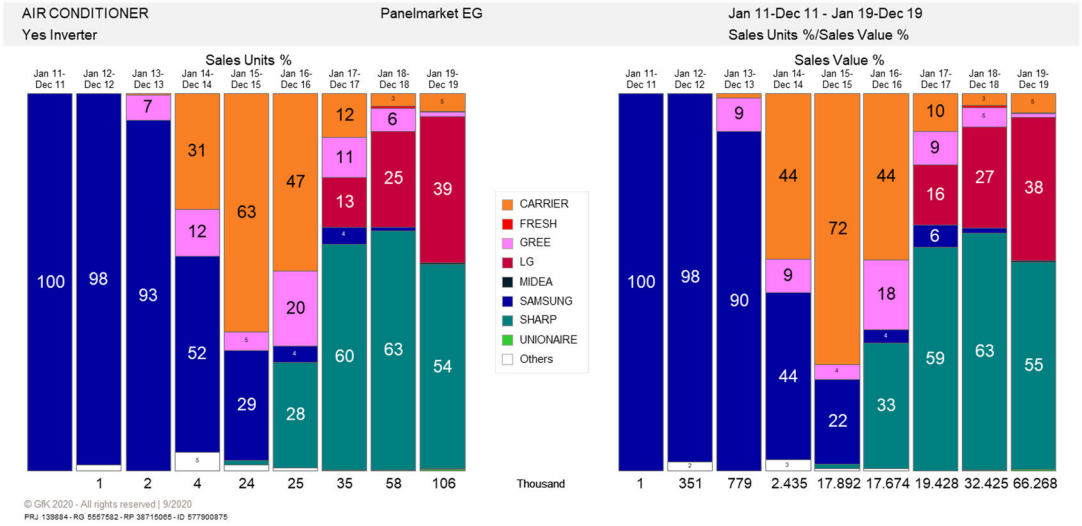


Fig. 5.9 Market share of inverter room air conditioners in Egypt

3) Energy-saving trend with room air conditioner and energy-saving potential

As mentioned, energy saving with room air conditioners can be achieved with inverter control. The amount of investment required to convert 10%[13] of the 64.6 billion yen/year of room air conditioners currently sold to inverter units every year would be about 8 billion yen/year[14]. The energy savings to be achieved by this would be 125 GWh/year[15]. In terms of cost-effectiveness, the additional investment (difference between inverter & non-inverter units) is estimated at 1.6 billion yen/year, and energy savings benefits are estimated at about 1.04 billion yen/year[16], with payback effect within about 1.5 years. (Mainly SME, residential target)

Inverters in air conditioners contribute greatly to energy efficiency, but as two companies, El-Araby and LG, hold over 90% of the inverter market share, when forming a program to promote inverter air conditioners it will be necessary to consider how to respond to local makers that do not offer inverters.

(Since 2019, Daikin has also entered the room air conditioner market and is gradually expanding its market share.)

4) Global standard collaboration on energy efficiency evaluation methods for air conditioners

To evaluate air conditioner energy efficiency/performance, Egypt currently measures energy efficiency (COP) at rated operation (100% load). But ISO advocates using the "Efficiency Evaluation

[13] On Market Survey data, market transformation from 7.4% to 83.2% (19%/year) over four years from 2015 to 2019
[14] 646 x 10% x 1.25 (Market price difference between inverter and non-inverter units: survey by this team)
[15] 5 kW (cooling capacity: average size of air conditioners: Market Survey Information) x 1 million units/year x 10% x 1,250 hours (full load equivalent operating hours) x 50% (expected energy saving rate) Survey team data: The average COP value of air conditioners in several government buildings is about 2.5. By switching to A++++ class (high efficiency) inverter ACs, the COP increased to about 5.0. (Energy saving rate: 50%)
[16] 125,000,000 kWh x 8.3 yen/kWh (rate for commercial customers)

Method by Seasonal Performance Factors (ISO-16358)" as a global standard (enacted in 2013, revised in 2019). The introduction of this periodic efficiency assessment is particularly significant in Egypt, where there is a large difference in temperature between seasons and between times of day. In JICA's "Project for Capacity Development on Energy Efficiency and Conservation", underway separately, energy efficiency and conservation demonstration tests of inverter air conditioners and non-inverter air conditioners are planned in E-JUST (Egypt-Japan University of Science and Technology) from 2021 to 2022. Promotion of inverter air conditioners is seen as a priority due to: (1) significant energy savings expected; (2) benefits to Japanese companies expected; (3) collaboration with the results of this project will be ensured.

5) Domestic manufacturer protection

Energy efficiency standards for non-inverter and inverter machines in Egypt as of 2020 (rated capacity: 100% load basis) are shown in Table 5.4 and Table 5.5. The fact that the energy efficiency standards are different for both units has caused confusion among end users and has delayed promotion of energy efficient equipment. This is mainly due to the fact that the energy efficiency standards in Egypt are double-standardized, one for inverter units (El-Araby and LG have over 90% share) and the other for non-inverter units, in order to protect domestic suppliers who do not sell inverters. The table below shows that energy consumption of inverter machines at rated capacity is 10-20% higher than that of non-inverter machines. (COP: coefficient of performance (%): cooling capacity (kW) by 1kW electricity input)

Double standardization of energy efficiency in order to protect domestic manufacturers, which goes against the promotion of energy efficiency and conservation, is also a factor in Indonesia and Thailand. But in both countries, adjustments are being made to unify standards (promoting the shift to inverters) by 2025. This will be a major issue in Egypt as well.

Table 5.4 Energy conservation standards for non-inverter room AC (2020 version)[17]

	Window Type		Split Type	
	COP (W/W)	**EER (Btu/Wh)**	**COP (W/W)**	**EER (Btu/Wh)**
A^{++++}	COP 4≥.69	EER 16≥	COP 4≥.69	EER 16≥
A^{+++}	4.4 ≤COP < 4.69	15 ≤EER < 16	4.4 ≤COP < 4.69	15 ≤EER < 16
A^{++}	4.1 ≤COP < 4.4	14 ≤EER < 15	4.1 ≤COP < 4.4	14 ≤EER < 15
A^{+}	3.81 ≤COP < 4.1	13 ≤EER < 14	3.81 ≤COP < 4.1	13 ≤EER < 14
A	3.51 ≤COP < 3.81	12 ≤EER < 13	3.51 ≤COP < 3.81	12 ≤EER < 13
B	3.22 ≤COP < 3.51	11 ≤EER < 12	3.22 ≤COP < 3.51	11 ≤EER < 12
C	2.93 ≤COP < 3.22	10 ≤EER < 11	3.08 ≤COP < 3.22	10.5 ≤EER < 11

SOURCE: UNDP CONSULTANT

[17] Window type: All in one air conditioner, set at the position of window
Split type: Separated indoor and outdoor units, most popular

Table 5.5 Energy conservation standards for inverter room AC (2020 version)

	Window Type	Split Type	
		COP (W/W)	EER (Btu/Wh)
A^{+++++}		COP 5≥.28	EER 18≥
A^{++++}		4.99 ≤COP < 5.28	17 ≤EER < 18
A^{+++}		4.69 ≤COP < 4.99	16 ≤EER < 17
A^{++}		4.40 ≤COP < 4.69	15 ≤EER < 16
A^{+}		4.10 ≤COP < 4.40	14 ≤EER < 15
A		3.81 ≤COP < 4.10	13 ≤EER < 14
B		3.51 ≤COP < 3.81	12 ≤EER < 13

SOURCE: UNDP CONSULTANT

Room air conditioner prices in Egypt are lower than other countries, partly due to the presence of several local manufacturers. The table below shows the results of a June 2020 price survey of home appliance stores and web ads in Cairo. The most popular 1.5 hp cooler costs about 50,000-60,000 yen, while inverter units are about 25% more expensive than non-inverter units.

Table 5.6 Room AC price survey results for major brands (price: EGP)

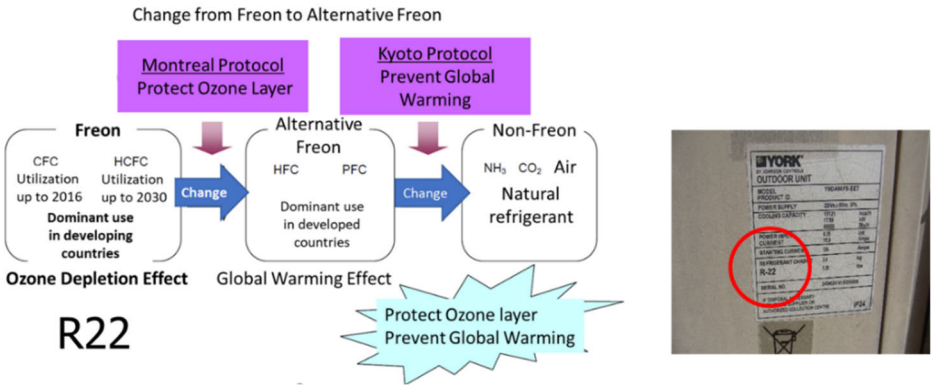
Brand	Mode Cooling / Heating	Capacity HP /(Btu/hr.)	Non-inverter AC	Inverter AC
Sharp (El-Araby)	C	1.5 / (12000)	7,635	9,525
	C+H	1.5 / (12000)	8,130	9,955
	C	2.25 / (18000)	9,935	12,765
	C+H	2.25 / (18000)	10,560	13,395
	C	3.0 / (24000)	10,970	14,320
	C+H	3.0 / (24000)	12,430	15,050
Carrier	C+H	1.5 / (12000)	8,900	10,565
	C+H	2.25 / (18000)	11,500	13,900
	C+H	3.0 / (24000)	12,900	15,990
Media	C+H	1.5 / (12000)	7,950	9,700
	C+H	2.25 / (18000)	10,500	12,800
	C+H	3.0 / (24000)	12,450	14,790
Fresh	C+H	2.25 / (18000)	9,630	12,320
Unionaire	C	3.0 / (24000)	8,585	11,615
	C+H	3.0 / (24000)	10,805	13,595

SOURCE: SURVEY TEAM

(2) Energy-efficiency retrofits to existing buildings

Most buildings use ozone-depleting refrigerant R22, banned by the Montreal Protocol from being made or replenished after 2020. The energy efficiency & conservation retrofit project of existing air conditioners will both boost economic efficiency and fade out R22. As such, it is considered a promising target. Issues

to address include: relocations to the new capital city (consider procuring equipment for new buildings plus retrofits); recovery/destruction of R22.



SOURCE: SURVEY TEAM

Fig. 5.10 Montreal Protocol and R22

(3) Chillers and VRF air conditioners

In developed and middle-income countries, including Japan, in mid- to large-scale facilities central air conditioners (chillers+ air handling units etc.) or VRF are mainly used instead of room air conditioners, due to less space needed for outdoor units, design improvements and easier management than multiple units. But Egypt has historically depended on room air conditioners. As domestic production is limited to room air conditioners, large units are imported and expensive. This situation should be gradually changed to VRF or centralized systems when energy efficiency, space utilization efficiency and design are fully evaluated.

The VRF air conditioner market size in Egypt is estimated at around 7 billion yen/year (April 2022), increasing by 10% every year.[18] (Inverters are equipped with all VRF air conditioners.) The market scale of chillers in Egypt is about 10 billion yen/year.[19] Of this, Hitachi-Johnson Controls has a share of about 30% while Mitsubishi Electric and Daikin hold about 50%.

The estimated investment required to convert 10% of the 10 billion yen/year refrigeration machine market currently sold over to “high-efficiency+inverter-equipped machine” or VRF is about 1.25 billion yen/year[20], while the resulting energy savings is estimated at 19 GWh/year[21]. In terms of cost-effectiveness, it is estimated that the additional investment (difference between inverter and non-inverter machines) for conversion to inverters is 250 million yen/year, and the benefit from energy saving is 1.6 billion yen/year[22], which is considered as payback within two years. (Targeting mainly large companies)

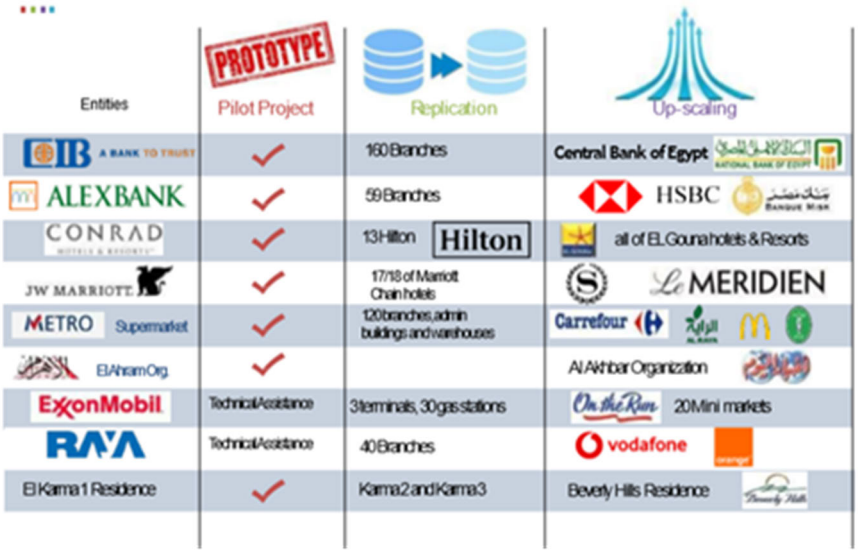
[18] Daikin information, including ducts and auxiliaries
[19] Daikin information
[20] 100 x 10% x 1.25 (Market price difference between inverter and non-inverter machines: survey by research team)
[21] Amount of energy savings for room air conditioners corrected by amount, assuming 50% energy savings rate
[22] 19,000,000 kWh x 8.3 yen/kWh (rate for commercial facilities)

SOURCE: HITACHI-JOHNSON CONTROLS AIR CONDITIONING INC.

Fig. 5.11 Centrifugal chiller with inverter

(4) LED (high-efficiency lighting)

Fig. 5.12 shows a pilot project where hotels and shopping centers shifted to LEDs under an energy-saving promotion project involving UNDP and GEF. This successful effort could and should be extended to more end users. The expected energy savings from a shift to LED from fluorescent lamps is about 50%[23]. UNDP made a breakthrough in promoting the spread of LEDs in technical cooperation projects up to 2019, and the table below shows major LED makers introduced in Egypt by the UNDP project. We recommend that JICA's energy conservation promotion finance project should inherit these achievements and knowhow.



SOURCE: IMPROVING ENERGY EFFICIENCY FOR LIGHTING & BUILDING APPLIANCES, UNDP/GEF, 2018

Fig. 5.12 LED adoption example by UNDP / GEF program in Egypt

[23] Achievements in Japan and overseas

Table 5.7 List of LED light suppliers (producers & importers)

Company	Products
El Arabiya for Integrated Industries Co (UNISTAR)	LED indoor lighting – LED street lighting - solar energy solutions
Futek Egyptian Micro Electronics (FUTEK)	LED lighting - CFLs lighting - solar street lighting - high intensity discharge
Philips Egypt	LED lamps & tubes - Indoor & outdoor luminaires - conventional lamps & tubes
Prima ELIOS for Electrical Industries	LED bulbs, tubes & spots, wiring devices, accessories
VENUS (import & export)	LED lamps- flood light- distribution panels- circuit breakers- others
Arab International Optronics Civilian Systems (AIO)	LED lamps & luminaires - solar cells & modules
El-Araby Group (TOSHIBA)	LED bulbs, spots, tubes, panels
Elsewedy Light	LED light – street light- cables - accessories
3 Brothers Lighting	Fluorescent lights, street lighting, industrial lighting- LED lighting, etc.

LED's market-share estimate (UNDP consulting) is shown in the table below. Japanese companies' (El Araby/Toshiba) share is about 10%. It should be noted that although El Araby is licensed by Toshiba and sells LEDs under product name Tornado, its market is limited to residential use.

Table 5.8 LED market share in Egypt (estimated)

Brand	Approx. market share
Venus	> 40%
Elios	15%
Philips	10%
Toshiba	10 %
Futek	10%
Others	15%

SOURCE: SURVEY TEAM

The following table summarizes economic benefits of end users in major projects where LEDs have been adopted under a UNDP support scheme. Economic benefits considering up to 50% subsidy for government-owned equipment and 25% subsidy for private equipment. It is evident that there is a high possibility of producing great end-user benefits including payback in about 1-5 years in terms of economy (lifespan is over 5 years) as well as promoting energy saving.

Table 5.9 Estimates of economic efficiency in UNDP selected lighting efficiency pilot projects

Location	Lighting share of power use	Monthly lighting consumption (kWh)			Annual savings			Investment	Payback period
	(%)	Before	After	Reduction	(kWh)	(EGP)	%	(EGP)	
New Urban Communities Auth.	37	54,273	40,875	13,399	160,783	73,960	24.7	239,140	3.2 Years
Commercial Intl. Bank, Hejaz St.	25.8	146,308	89,772	56,536	678,435	447,767	38.6	328,669	8 Months
CIB CEDARE Branch	25.8	58,523	34,634	23,889	286,672	189203	40.8	235,251	1.2 Years
Al Karma Residential, Compound,	100	9,643	4,936	4,707	56,486	32,762	48.8	222,750	6.8 Years
BTech Store, 5th Settlement	42	30,792	23,079	7,713	92,556	88,854	25	101,165	1.1 Years
BTech Store, 6th October	20	19,944	16,015	3,929	47,145	45,259	40	100,804	2.2 Years
MoE&RE Research & Design Building,	18	38,390	24,710	13,680	164,165	75,516	35.6	142,749	1.9 Years
Bank of Alexandria, Gomhoreya Branch	22	158,321	110,973	47,348	568,174	374,995	29.9	119,847	4 Months
Bank of Alexandria, Kasr El Nil Branch	27	127,524	103,912	23,612	283,345	240,843	18.5	111,945	5 Months
Nabil Waqqad Bldg, of NCEDC**	n/a+	6,477	2,647	3,830	45,958	19,992	59	96,996	4.8 Years
J.W. Marriott Hotel	13	1,955,700	1,557,958	397,742	4,772,904	2,816,013	20.3	3,378,948	1.2 Years
NREA	36.7	45,040	37,464	7,576	90,912	39,547	17	133,215	3.3 Years
Bibliotheca Alexandrina	17	196,409	341,272	22,552	270,624	117,721	8	363,600	3 Years
Egyptian Admin. Control Authority (ACA)	25	184,264	228,430	26,613	319,361	128,922	14	528,011	3.8 Years
Al Salam Shopping Center	44	22,870	13,424	9,446	113,352	96,349	42	63,646	8 Months
Min. of Foreign Affairs	25.8	931,636	606,080	325,556	3,906,672	1,953,336	35	781,631	5 Months
Nile Co. (consumer complexes	24	83,086	64,007	19,079	228,948	136,111	25	72,055	6 Months
Metro Supermarket, Maadi Branch	20	120,232	87,829	32,402	388,824	27,865	27	65,112	4 Months
Co-Op Gas Station	32	30,891	24,427	5,644	77,564	65,930	19	147,830	2.2 Years

LEDs have rapidly become widespread in Egypt in the last few years due to media dissemination and enlightenment, rising electricity prices and falling LED prices (estimated at about 30% as of 2019). By switching conventional lamps to LED, energy saving of 50% or more can be expected. Plus, since about 20% of buildings' energy consumption is for lights[24], promote this initiative will yield significant benefits. The most popular 9W type (equivalent to 40W fluorescent tube) is priced at EGP 60-90 (360-540 yen)/light.

[24] Energy saving center data (in Japan) and JICA related surveys.

Lamp (W)	5W candle	7 W Bulb	9 W Bulb	12 W Bulb	15 W Bulb	9W tube	18 W tube	6W Spot
Price EGP	15 - 55	15 - 60	15 - 60	15 - 65	20 - 75	60 - 90	70 - 120	20- 60

(NOTE) THE PRICE RANGE IS DUE TO DIFFERENCES IN SPECIFICATIONS AND BRANDS. SOURCE: SURVEY TEAM

The table below shows the price range of lamp fixtures with built-in LED lamps which are popular in Egypt. The price of a lamp fixture equivalent to 2 x 40W of popular fluorescent fixture is around 2,000 yen/lamp fixture, and equivalent to 2 x 110 W or around 10,000 yen/lamp fixture.

Table 5.10 Price of lamp fixtures with built-in LED lamps

Fluorescent fixture		**LED fixture replacement (equivalent)**		
Fixture	***Power***	***Power***	***(Lum/W)***	***Price (EGP)***
60 cm	2x20W	2x9W	85 - 100	180 - 250
120 cm	2x40W	2x18 W	90-100	260 - 380
120 cm	3x40W	3x18 W	90-100	390 - 560
120 cm	2x40W	2x22 W	100-110	300 - 400
120 cm	2x40W	3x22 W	100-110	450 - 600
240 cm	2x110W	2x36 W	100- 125	1400 - 2000

SOURCE: SURVEY TEAM

According to IEA data, the energy consumption in existing buildings in Egypt in 2018 was 3,458 ktoe, which is equivalent to approximately 40,000 GWh. Approximately 20% of them, 8,000 GWh, is estimated to be lighting demand. Assuming that 5% of them will be converted to LEDs every year, the expected annual amount of energy saving will be 200GWh, and the reduced energy cost will be of about 1.6 billion yen. Assuming that the payback period is 5 years based on UNDP information, required investment amount is approximately 8 billion yen/year. (Targets from SMEs to large companies)

(5) Refrigerators

About 1.2 million refrigerators are sold each year in Egypt, mostly low-efficiency, non-inverter types (see figure below). Shifting to an efficient model with an inverter would cut power consumption in half. The expected annual energy saving is (800kWh - 400kWh/unit) x 1,200,000 units = 480GWh.

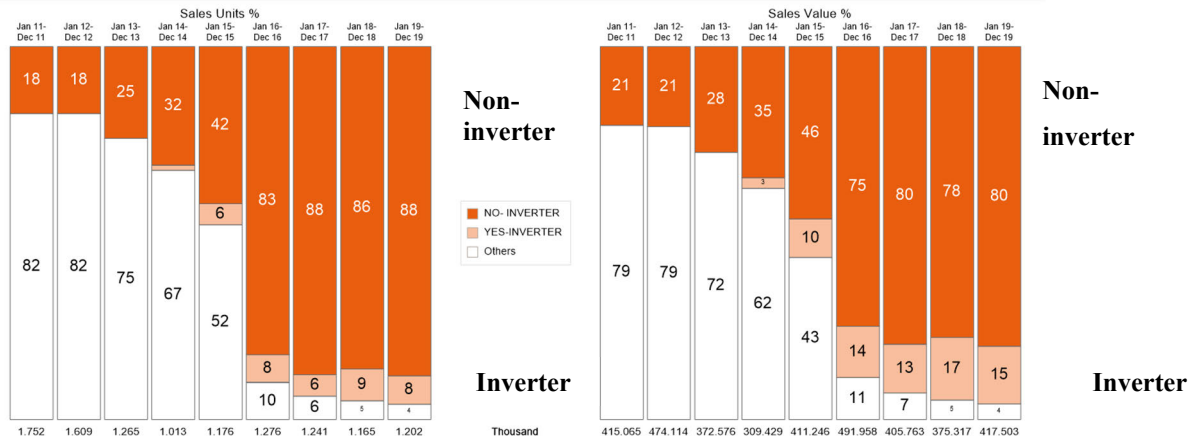


Fig. 5.13 Trends in refrigerator inverter adoption rate in Egypt

(6) Energy savings + rooftop solar, ZEB

According to information from the “Energy efficiency & rooftop solar PV opportunities in Cairo & Alexandria” project supervised by the World Bank, "The energy-saving benefits of introducing energy-saving measures (high-efficiency cooling + LED) and rooftop solar together (energy-saving/renewable energy package) in private buildings, where cooling demand is greater than in public buildings, are great." (See Table 5.11, investment recovery is 1.7 years based on economic evaluation estimate)

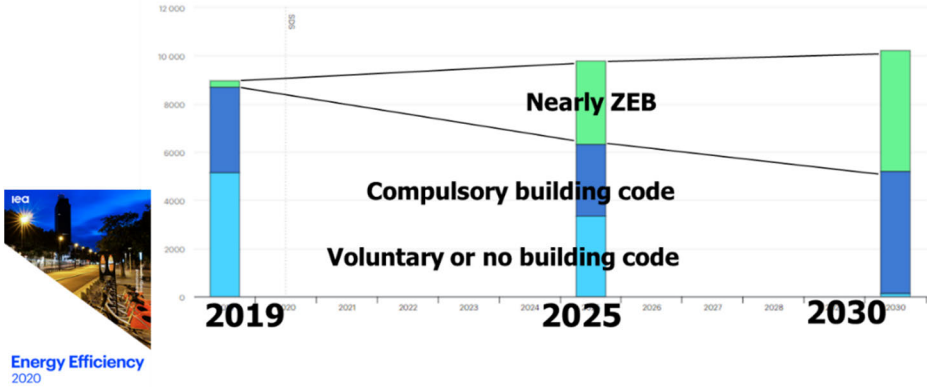
Table 5.11 RE + EE package proposed in World Bank report

Combined commercial buildings resource efficient (RE + EE) investment	
Total Investment (US$)	182,511,960
Local Content (US$)	60,837,320
Energy Savings (US$/year)	108,962,694
Equivalent kWh Produced/year	1,319,305,007
Simple Payback Period (years)	1.7
Avoided Running Costs (US$)	105,049,661

* Results in the table are estimates based on TRACE 2.0 models, and detailed pre-feasibilities are needed to improve the specific accuracy

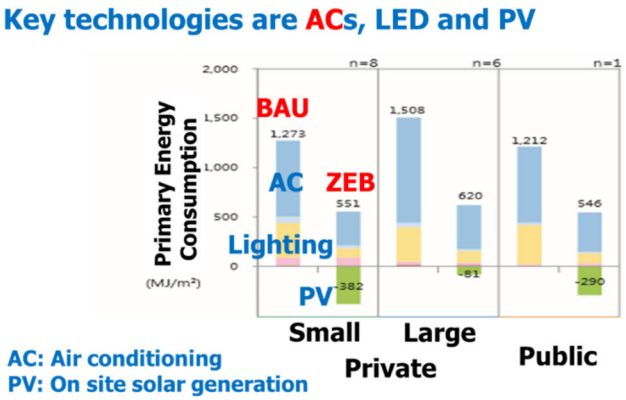
SOURCE: ENERGY EFFICIENCY AND ROOFTOP SOLAR PV OPPORTUNITIES IN CAIRO AND ALEXANDRIA, WORLD BANK

This concept is common for promoting the package of energy saving and renewable energy nZEB (super energy saving + energy supply by renewable energy) proposed by IEA and the promotion of ZEB (zero emission building) construction, which is accelerating in Japan. We will collect information on the investment in this EE + RE package (ZEB) composition in the future. (See Fig. 5.14 and Fig. 5.15)



SOURCE: IEA ENERGY EFFICIENCY 2020

Fig. 5.14 Promotion of ZEB construction in IEA energy efficiency 2020



Source: The material for presentation of Net Energy Zero Building Demonstration Project Research 2019

SOURCE: PRESENTATION MATERIAL OF NET ENERGY ZERO BUILDING DEMONSTRATION PROJECT RESEARCH 2019

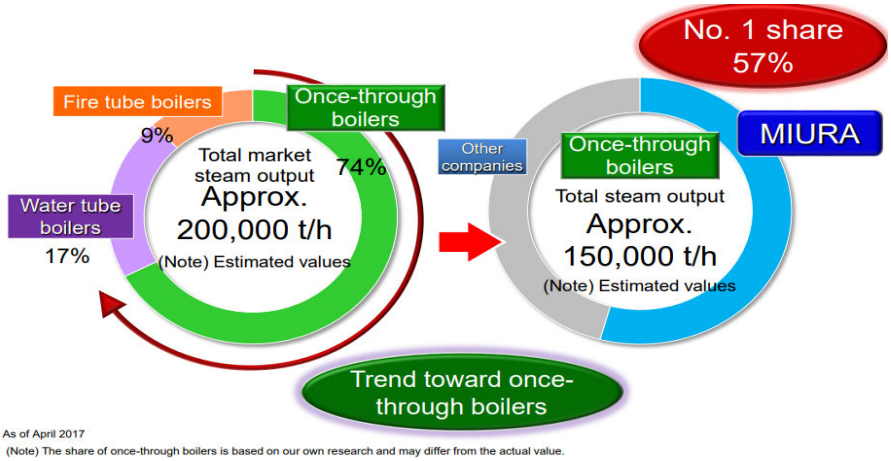
Fig. 5.15 ZEB construction underway in Japan

(7) Boilers

1) Trends in Japan, Bangladesh and the world

Fig. 5.16 shows boiler types available in Japan. Once-through boilers have a 74% market share; water-tube boilers 17%; and fire-tube boilers 9%. Compared with other types, once-through boilers have several advantages: a) unit size is smaller; b) energy efficiency is higher in fluctuating load operation; c) safer; d) quicker startup; 6) less technical experience needed for operation and maintenance.

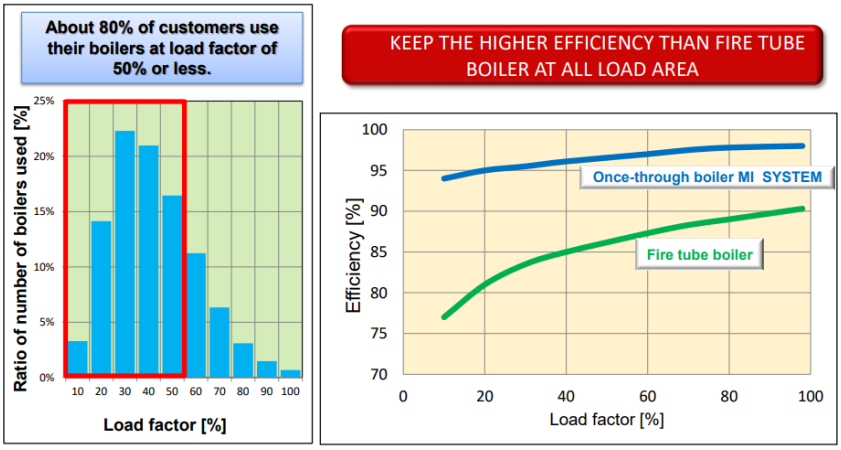
Miura has a 57% share of Japan's once-through market and is world's largest once-through boiler maker.



SOURCE: MIURA

Fig. 5.16 Share of boilers by type in Japan

In terms of energy efficiency, small once-through boilers have an advantage over other types in low-load operation. By operating once-through boilers in groups, large energy savings can be achieved compared with other large boiler types (see Fig. 5.17).



SOURCE: MIURA

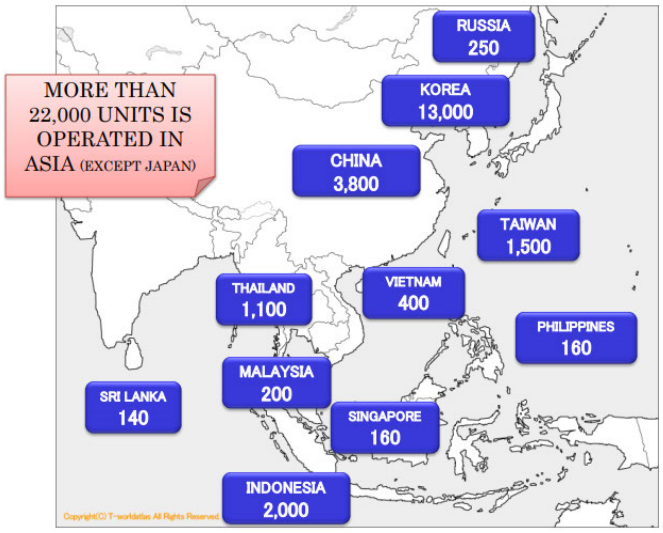
Fig. 5.17 Relationship between fire-tube boiler & once-through boiler in load factor & energy efficiency

In Bangladesh, where every year dozens of people have lost their lives due to boiler explosions (see Fig. 5.18) JICA's "Energy Efficiency and Conservation Promotion Financing Project" has led to dozens of once-through boilers being introduced. These have boosted both safety and energy efficiency.

SOURCE: LOCAL NEWSPAPER

Fig. 5.18 Recent boiler explosion in Bangladesh

Once-through boilers have become popular across Asia (see Fig. 5.19) but have yet to catch on in Europe.

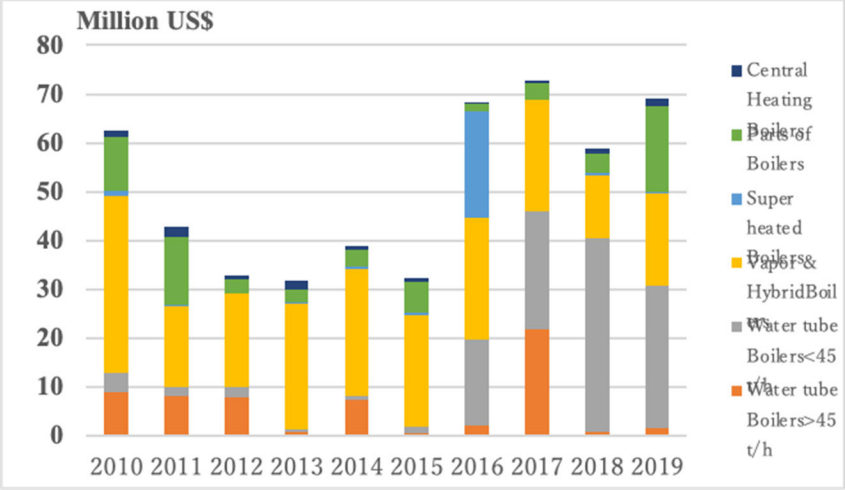


SOURCE: MIURA

Fig. 5.19 Penetration of once-through boilers across Asia (2015 data)

2) Boiler market in Egypt

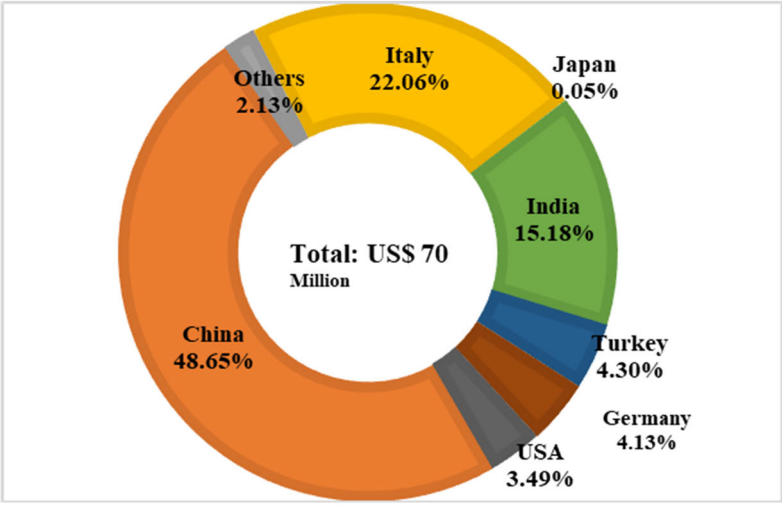
Boiler sales in Egypt in 2019 were around USD 70 million (see Fig. 5.20) with water-tube boilers having the largest share. Once-through boilers have not yet been introduced in Egypt.



SOURCE: COMPILED BY JST, BASED ON CAPMAS DATA

Fig. 5.20 Trend of Egyptian Boiler market

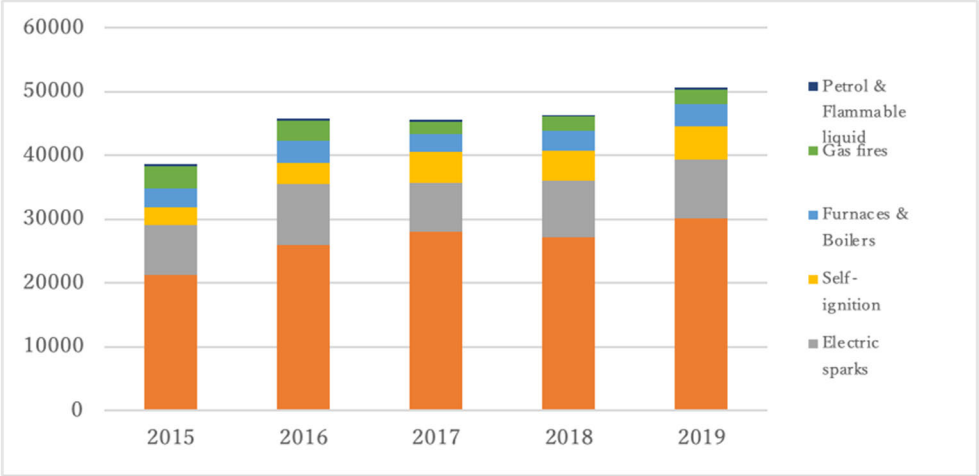
All boilers are imported in Egypt, from countries shown in Fig. 5.21. China, Italy and India are the top three sources. Japanese producers had only a 0.05% share (Yoshimine Boiler).



SOURCE: COMPILED BY JST, BASED ON CAPMAS DATA

Fig. 5.21 Boiler exporting countries to Egypt

Upper part of Fig. 5.22 shows the recent trend in boiler related accidents. 50,000/year boiler accidents have been recorded. Among these, fire accidents are around 3,400, and explosion (large problem) cases are assumed to be around 1% per year (around 30 cases). The lowest part of Table 5.12 shows the information on boiler explosion accidents.



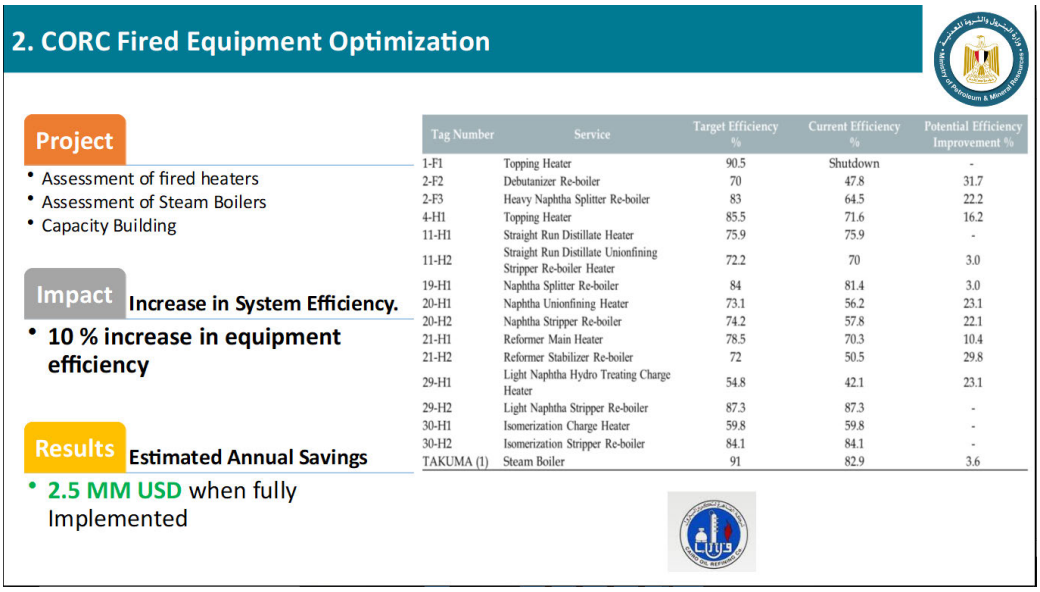
SOURCE: HTTPS://WWW.CAPMAS.GOV.EG/PAGES/PUBLICATIONS.ASPX?PAGE_ID=5104&YEAR=23546

Fig. 5.22 Boiler accident trends in Egypt

Table 5.12 Boiler accidents in Egypt

8 Aug. 2015 (Al-Ahram news)	Five workers killed and 7 others injured in boiler explosion at factory in Qaliyoubiya governorate.
28 March 2016 http://pre2020.iuf.org/w/?q=node/4914	Three more workers have died from injuries suffered following a boiler explosion and fire at the Mondelez Cadbury factory in Cairo.
16 Oct. 2020 (ED24.news)	Oil boiler explosion at meat processing plant on Ismailia Cairo Road.
4 Dec. 2020 Akhbarelyom.com/news	While cleaning a filter on a water line, 4 employees suffered burns due to malfunction of boiler in the new Al-Walidiyah plant project.

A 20-30% energy efficiency improvement in boilers in Egypt can be expected (see Fig. 5.23, right column).



Tag Number	Service	Target Efficiency %	Current Efficiency %	Potential Efficiency Improvement %
1-F1	Topping Heater	90.5	Shutdown	-
2-F2	Debutanizer Re-boiler	70	47.8	31.7
2-F3	Heavy Naphtha Splitter Re-boiler	83	64.5	22.2
4-H1	Topping Heater	85.5	71.6	16.2
11-H1	Straight Run Distillate Heater	75.9	75.9	-
11-H2	Straight Run Distillate Unionfining Stripper Re-boiler Heater	72.2	70	3.0
19-H1	Naphtha Splitter Re-boiler	84	81.4	3.0
20-H1	Naphtha Unionfining Heater	73.1	56.2	23.1
20-H2	Naphtha Stripper Re-boiler	74.2	57.8	22.1
21-H1	Reformer Main Heater	78.5	70.3	10.4
21-H2	Reformer Stabilizer Re-boiler	72	50.5	29.8
29-H1	Light Naphtha Hydro Treating Charge Heater	54.8	42.1	23.1
29-H2	Light Naphtha Stripper Re-boiler	87.3	87.3	-
30-H1	Isomerization Charge Heater	59.8	59.8	-
30-H2	Isomerization Stripper Re-boiler	84.1	84.1	-
TAKUMA (1)	Steam Boiler	91	82.9	3.6

SOURCE: PRESENTATION BY MINISTRY OF PETROLEUM EGYPT IN FEBRUARY 2019, JICA SEMINAR IN CAIRO)

Fig. 5.23 EED potential with boilers in Egypt

In January 2019, officials of Egypt's Ministry of Petroleum & Mineral Resources (MOP) visited a factory in Noda, Japan equipped with once-through boilers. After returning home, they asked JICA several times to support the introduction of once-through boilers in Egypt. Although MOP claimed there are few boiler accidents in Egypt news reports (see Table 5.11) show numerous boiler accidents. Safety conditions need to be clarified in future.

In May 2021, JICA met with Toyotsu and Miura and confirmed that these firms are interested in introducing once-through boilers in Egypt.

3) Energy efficiency improvement investment potential in boilers

Although it is too early to estimate EEC investment potential in once-through boilers, given the Bangladesh experience and Egyptian boiler market conditions, the following target has been set: introduce 30 once-through boilers (2t class) in Egypt within the next few years. As for investment size, assume USD 1.8 million/year and expected EEC gain at around 7,236,000m^3/year (30.5m^3/unit/year*7,200h/year*30units) gas reduction.

(8) Food refrigeration/freezing

According to a World Bank analysis, around 30% of Egypt's fruits and vegetables are lost to spoilage. To reduce this, improved refrigerated storage is a high priority. Japanese companies active in Egypt and this sector include Maekawa Mfg. Co., Ltd. and Sojitz which has been active in Egypt's agricultural sector, and is interested in improving the food distribution network.

Maekawa has opened a Cairo office and is working on local adoption of high-efficiency screw compressors for refrigeration and freezing processes. Since many of Egypt's compressors are old, updating is the main focus. When electricity rates were low it took more than 10 years to get payback on investments, but the situation is improving as electricity rates rise. So Maekawa looks forward to future business expansion.

Competitors are GEA from Germany (largest market share) and Johnson Controls from the U.S. Both offer turnkey solutions for the entire food manufacturing process. Maekawa is a latecomer and only provides compressors for refrigeration and freezing. Plus, energy-saving performance provided by these three companies is almost the same, but Maekawa's products tend to be slightly cheaper for the compressor alone.

Maekawa's main targets are global food companies (Nestlé, Coca-Cola, etc.), frozen vegetables, cold food, and logistics (e.g., Carrefour, hypermarkets). All projects are organized in collaboration with local construction and assembly companies, mostly SMEs. Scale is 100-200 million yen/project. Maekawa's compressors typically account for 10-20% of the total price for a packaged refrigeration/freezing system. Delivery amount for a single compressor is up to 20 million yen.

Maekawa also participated in the UNIDO "Energy-saving food freezing project," supplying a compressor. This UNIDO project was targeted at three African countries including Egypt, and up to two projects were provided per country for a total of USD 90,000. Only one project (about USD 100,000) was implemented in Egypt (customers bear the difference of tens of thousands of USD).

Fig. 5.24 Example of Maekawa Mfg.'s refrigerated compressor (Cairo)

To promote energy saving and reduce food loss in Egypt, it is important to adopt high-efficiency equipment and boost process efficiency. In order to participate, it is necessary to consider an equipment lineup which is not limited only to Japanese companies. Sojitz, whose products has been adopted in the agricultural field, is also interested in expanding into the food-processing field. We would like to explore

the formation of a collaborative project with Maekawa which has high technological capabilities in food refrigeration/freezing high-efficiency compressors.

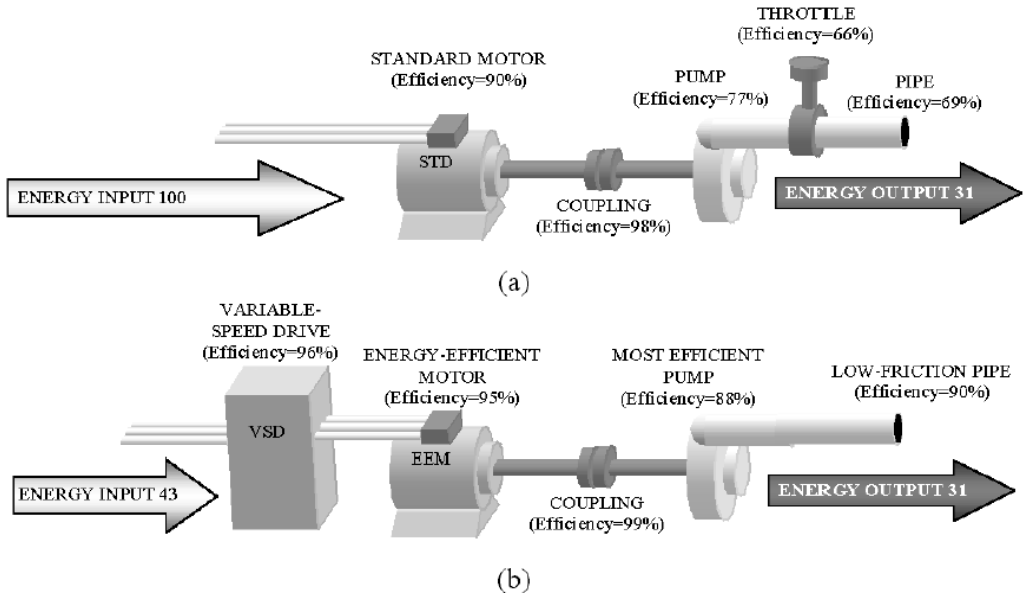
(9) Cement VRM energy saving potential

VRM, which was adopted in JICA's Bangladesh Energy Conservation Loan Project, is effective for energy saving. Although expected savings are about 30%, it is unlikely that Japanese companies will participate as EU manufacturers are competitive.

The expected investment amount is 1 billion yen / year for 1 plant / year, 12,000 MWh / year reduction expected (actual value in Bangladesh). When converted to this reduction amount, it will be reduced by 91,000 thousand yen/year (assuming an industrial electricity rate at 7.6 yen/kWh), and 11-year payback.

(10) Motors

According to the UNIDO report "Energy Efficient Electric Motors Systems, 2016" on high-efficiency motors, in terms of the efficiency of the motor alone, PM motors with inverters are the most energy efficient, and have higher efficiency than induction motors with inverters or DC motors with brushes. With a pump system, a comparison of energy consumption between a conventional system and an optimal system in terms of energy efficiency, taking into account that the overall efficiency, is determined by the efficiency of individual components and equipment, shows over 50% energy savings can be achieved for the entire system, as shown in the following figure.



NOTE: (A) CONVENTIONAL SYSTEM (TOTAL EFFICIENCY = 31%)
(B) HIGH-EFFICIENCY PUMP SYSTEM COMBINING HIGH-EFFICIENCY TECHNOLOGIES (TOTAL EFFICIENCY = 72%)

Fig. 5.25 Efficiency comparison of two pump systems with same output

As for fan system, a large amount of energy is wasted in flow control by dampers. On the other hand, in the case of inverter control, when the flow rate is 50%, the power consumption can be reduced by 60% or more compared to the damper control. And in case of 100 kW motor that operates continuously at 50% output, it saves about EUR 18,000 per year (assuming EUR 0.06/kWh, 6,000 hours per year).

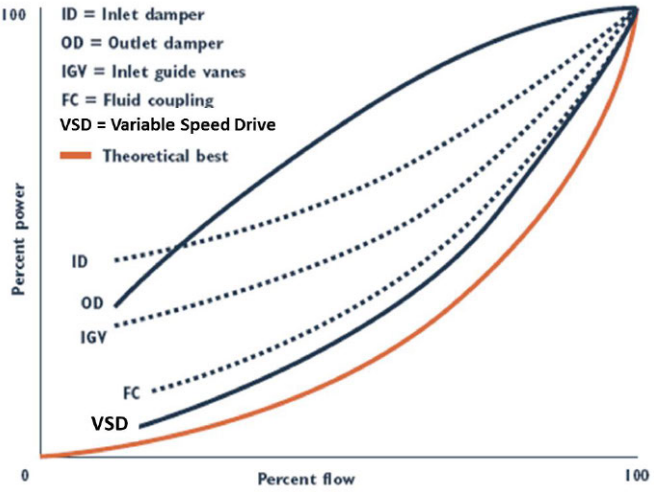


Fig. 5.26 Power consumption of each air volume control method

The table below shows the introduction status of MEPS for induction motors around the world. It is noteworthy that IE3 or IE2 motors and inverters are specified as MEPS in Europe.

Table 5.13 Global installation status of MEPS

Efficiency Levels	Efficiency Classes	Testing Standard	Performance Standard
	IEC 60034-30	IEC 60034-2-1	MEPS
Premium Efficiency	IE3	Low Uncertainty	USA 2011 (<150 kW) Canada Europe 2015* (>7,5kW), 2017 Korea 2015 Mexico
High Efficiency	IE2		USA (> 150kW) Canada (>150kW) Australia New Zealand Brazil Korea
			China Japan Saudi Arabia Switzerland
Standard Efficiency	IE1	Medium Uncertainty	Costa Rica Israel Taiwan

* IE3 OR IE2 + VSD

In 1998, a voluntary agreement supported by the European Committee of Manufacturers of Electrical Machines & Power Electronics (CEMEP) and the EU defined motor efficiency levels. Manufacturers began to self-regulate reducing sales of motors with the lowest efficiency rating (EFF3), effectively excluding low-efficiency motors from the European market.

Subsequently, the European Commission enacted MEPS to promote the use of high-efficiency motors in the EU, and began regulating motor efficiency according to this schedule:

1. Since June 2011: IE2 or higher.
2. From January 2015: IE3 or higher for motors with rated output of 7.5-375 kW, or IE2 + inverter.
3. From Jan. 2017: IE3 or higher or “IE2 + inverter” for motors with a rated output of 0.75-375 kW.

The following figure shows the trend in motor efficiency in the European market from 1998 to 2012.

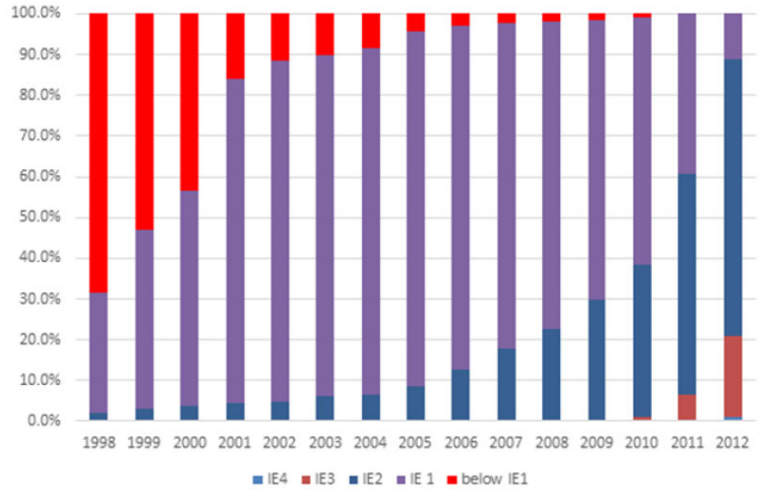


Fig. 5.27 Trends in motor efficiency in the European market

Based on the fact that efficiency regulations (MEPS) and labeling of motors are not yet established in Egypt, a trial calculation was made to gauge the energy-saving effects and payback period when the EU level efficiency regulation (IE3 or higher) is introduced. Results of the trial calculation are as follows[25].

- Energy saving rate: approximately 9%
- Simple payback period: approximately 4.6 years

5.3.3 Necessity of finance for EE investment

(1) Sources of funding for EEC promotion

There are two major sources of finance for EEC promotion: environmental investment finance facilities (green financing); and preferential financing offered by the Government of Egypt. Both of these facilities are not necessarily aimed at promoting EEC, as green finance facilities are for environmental investments in general, and as government preferential financing is meant to support MSME or specific sectors such as tourism. Green finance facilities are offered by banks to borrowers using funds made available by international organizations, international development banks and bilateral development cooperation agencies.[26] Governmental preferential finance facilities are offered by CBE as policy financing for certain government objectives. In this section, green financing facilities from banks are explained as the private funding sources for EEC promotion, while the governmental policy financing facilities are explained as the governmental funding sources for EEC promotion.

[25] Assumption 1: The motor efficiency level is raised from EFF3 (=IE0) to IE3 (30 kW class).
Assumption 2: Average unit price for industrial use = 1.144 EGP/kWh in 2024/2025 (Source: Minister of MOERE, Public Announcement of electricity tariff for the coming Five Years (2020/2021)) - 2024/2025))
Assumption 3: The exchange rate is EGP 1 = JPY 6.93.

[26] Funds from international organizations, international development banks, and bilateral development cooperation agencies for green finance facilities are further explained in Chapter 6.

Table 5.14 Definition of MSME

Company category	Staff headcount	Turnover		Balance sheet total
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m	or	≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

SOURCE: HTTPS://SINGLE-MARKET-ECONOMY.EC.EUROPA.EU/SMES/SME-DEFINITION_EN

5.3.4 Foreign funding sources, preferential terms for foreign & domestic firms in EEC promotion

Foreign sources of funding for EEC promotion are available in Egypt from international organizations, international development banks and bilateral development cooperation agencies. Specific funding arrangements (as explained in Chapter 6 of this report) include support from other donor organizations. Apart from these funding arrangements, there may be other promotional measures such as corporate tax relief and preferential customs duties. But, as of today, Egypt has no such specific measures for promoting EEC. Existing preferential measures for MSME and tourism are the measures which may be applicable for EEC promotion.

5.3.5 Demand for financing EEC promotion investments

In addition to policy financing offered by government, there are supports for EEC promotion investments offered by the private sector. For example, there are green finance facilities and credit risk guarantees for SMEs. There are also other facilities from international organizations, banks and bilateral development assistance organizations, which are explained in Chapter 6 of this report.

(1) Conditions of available private finance facilities and governmental preferential lending

A trend with many Egyptian commercial banks is to establish financial facilities to support environmental investments. These are termed as “green finance facilities,” although each bank uses different names. The Commercial International Bank (CIB), one of the largest private banks, started offering green finance facilities to existing clients who are environmentally conscious. To this end, CIB created a Sustainable Finance Division in 2020. Its functions, offering ESG finance and other finance facilities favoring environmentally and socially conscious investments, have become so popular among CIB’s clients that the division has grown to 23 personnel.[27]

CIB, styling itself as an environmentally and socially friendly financial institution, has adopted the Equator Principles, introduced an environmental & social risk management system, joined the Task Force on Climate-related Financial Disclosures (TCFD) and published various disclosure reports. Other major banks are following the trend in becoming environmentally and socially conscious, and have started offering green finance. So, it is a trend in Egypt for commercial banks to offer green finance facilities,

[27] From an interview conducted in June 2021.

including to support clients to become more energy efficient.[28] CBE, responding to the trend, established a Sustainability Department with a mission to encourage all banks to shift to environmentally and socially friendly management and service provision.

SOURCE: CIB

Fig. 5.28 ESG risk strategy at Commercial International Bank (CIB)

Green financing facilities available from the banks do not always offer preferential lending conditions. Instead, advisory and technical assistance accompany the fund as additional services. As such, these are not commonly described as preferential lending. Even when lower interest rates are applied, it is the rate with percentages for risks and costs added onto the CBE's policy rate (corridor lending).

As government preferential lending scheme for EEC promotion, the Energy Efficiency Fund, one of three financial mechanisms proposed under NEEAP II, is expected to be introduced. But as of August 2022, it had yet to launch. According to information from MOERE, policy-making-level decisions are yet to be made due to priorities among electricity related policies. As for the governmental financial institution to function as executing agency, CBE, as a governmental policy finance institution as well as being the central bank, and NBE as the representative state-owned bank, has shown limited interest while Banque Misr, which is also a major state-owned bank is expressing its conditional but positive reactions.

5.3.6 Reactions from Egyptian Government to proposed JICA cooperation

JICA's proposed cooperation for EEC Promotion is getting positive reactions from Egyptian authorities, including at the ministerial level in MOERE, MOF and MOIC. If it were to be a revolving fund facility, it is expected that JICA cooperation will be formulated to differentiate itself from the existing finance facilities such as EPAP and GEFF by specifying its objectives to promote EEC, and with distinctive features.

5.3.7 Expectations for supporting measures by Egyptian Government

The business sector, associations and financial institutions have strongly urged that support for SMEs to become more energy efficient is urgently required. Large-scale and financially robust enterprises are already enjoying various finance facilities offered by local commercial banks, and also foreign currency facilities offered using international development funds, financial programs that most SMEs cannot access.

[28] CBE, during an interview conducted in April 2021 mentioned that among all the commercial banks registered with CBE, there are already some banks which are proactively promoting sustainable finance, renewable energy and energy efficiency promotion, namely AAIB (Arab African International Bank), CIB, Alexbank, Banque Misr, and NBE.

Although there are various supports for EEC available, they are rarely accessible to SMEs whose credit-worthiness is not as strong as larger companies. The need to create an inclusive environment for EEC promotion is reiterated. This could be preferential loans designated specially for SME EEC promotion investments, or perhaps a credit-risk guarantee mechanism to give SMEs access to other supportive finance facilities available.

(1) Finance facility in combination with subsidy and technical assistance

EEC promotion efforts will, in many cases, require seed money for pilot projects and amassing sufficient knowledge of implementation issues the specifics of various energy-saving technologies, skills and practices. Few companies have all these competencies, which makes it tough for them to access financial facilities. Given these barriers, many will hesitate to invest despite intentions to become more energy efficient. To overcome these hurdles, measures beyond financing will be needed.

By combining subsidies and technical assistance with the finance facility, it should be possible to overcome this hesitation. Subsidies could be offered to tackle uncertainty about the possible returns from EEC investment, or pilot projects could be conducted to demonstrate the effectiveness of investments. Technical assistance could resolve issues for companies, providing appropriate designs with suitable technology and monitoring investment outcomes. Other EEC financial facility programs offered by international development partners (e.g., GEFF and EPAP as mentioned in Chapter 6) came with both subsidies and technical assistance. So that has become a standard expectation among companies in Egypt.

Chapter. 6 Egypt's financial sector

6.1 Overview of the financial sector

Since the 1952 revolution, Egypt has promoted public-sector-driven industrial development. As such, the financial sector is still strongly driven by state-owned financial institutions. At the same time, Egypt has long struggled with government deficits, huge external debts, high inflation and currency devaluations.

These trends have persisted since the 1980s. From 1991 to 1993, an economic reform and structural adjustment program (ERSAP) was implemented with assistance from IMF, WB, and AfDB. Through the program, Egypt pursued structural adjustments in industry, government finance and financial markets, aiming to shift to a market-driven economy. By 1998, the stand-by agreement was completed, marking a successful structural adjustment towards becoming a market-oriented economy. In 2016, Egypt had to seek IMF assistance, but with a steady increase in foreign currency earnings, external debt became manageable by 2018, successfully stabilizing prices and the currency.

During this period, Egypt's financial sector has also liberalized interest rates, market entry and functional leveling of private and public banks. As a result, the Egyptian financial sector is relatively liberal by global standards. But currency fluctuation remains as an issue with devaluations coming every few years.

The monetary system's function is to determine basic interest rate levels. Any proposed EEC promotion finance opportunity will also be affected by rates imposed by the CBE. The existing mechanism to control interest rates should be taken into consideration when formulating any policy financing instruments, including the proposed EEC promotion financing.

6.2 Financial supervision and fiscal policy

6.2.1 Financial supervision

Two supervisory bodies oversee the financial sector: the Egyptian Financial Supervisory Authority (EFSA) and the CBE. EFSA is responsible supervising all financial institutions except banks, which CBE supervises. CBE practices both on-site and off-site supervision at all registered banks. On-site supervision is used to plan and conduct activities based on a risk approach which to:

- Assess the financial condition of banks and risks associated with current and planned activities
- Evaluate the integrity and effectiveness of risk-management systems
- Ensure the soundness of internal control systems and compliance with corporate governance regulations issued by CBE
- Communicate inspection findings and plans bank management/directors in a clear/timely manner
- Seek commitments from bank management to correct significant deficiencies in a timely manner
- Follow up with banks and verify that significant deficiencies have been corrected

Banks are inspected and assessed. CBE uses the CAMELS rating system to evaluate bank performance.[29] Each item is validated through on-site inspections, and modifications are made to the CAMELS model prepared by off-site supervision teams according to the results of the on-site supervisor and the effectiveness of the internal bank controls as well as existing and potential risks.

Off-site supervision activity comprises ongoing surveillance (including Central Credit Registry reports and statement analysis), management information system (MIS) consolidated data analysis and the monitoring of large corporate borrowers and their connected parties. On-site supervision and off-site supervision are interactively connected to perform all-round financial sector supervision. CBE's bank supervision activities are conducted in accordance with a well-designed framework and practiced on international standards.

6.2.2 Policy framework

CBE, as the central bank, is the competent authority for the monetary policy in Egypt. In addition to its monetary policy, it is also accountable for the financial system, settlements, foreign currency management. CBE is a public legal entity established by the Law No. 64 of the Year 2004, reporting directly to the President of the Republic.[30] As it is reporting to the President, and as the Governor is deemed to be at the same rank as the ministers, CBE is an autonomous, not controlled by the government's financial authority, the Ministry of Finance. CBE is mandated to take care of the monetary policy, with a specific aim to contribute to stabilizing the price fluctuation. The measures taken to accomplish this mandate are to manage the liquidity through the operation in the short-term money market.

The current monetary policy framework is based on the Law 88 of 2003, named "Central Bank, Banking Sector and Monetary System". Based on this framework, CBE implements a monetary policy to maintain price stability, while keeping the inflation rate low. The current policy is to set and achieve price targets, as compared with the quantitative target operation. This price target (to become a full-fledged inflation targeting regime in future) was adopted from 2005.

The major monetary policy instrument for CBE is the short-term operations. CBE has adopted the policy to steer the short-term interest rate with the aim to influence the inflation rate. A "Corridor" system has been introduced since 2005, where CBE intends to achieve a target interest rate by setting overnight deposit and lending rates. The overnight deposit functions as the floor, while the overnight lending functions as the ceiling of the corridor of CBE's interest rate operational target. The consequence is that the interbank rates are effectively steered within this corridor.

[29] The CAMELS rating system: C for Capital Adequacy, A for Asset Quality, M for Management Quality, E for Earnings Quality, L for Liquidity and Funding, and S for Sensitivity to Market risk.

[30] Presidential Decree No 64 of the Year 2004 Promulgating the Statute of the Central Bank of Egypt

6.2.3 The corridor and market operation rates

The Monetary Policy Committee of the CBE determines the corridor rates. By doing so, the volatility of the overnight interbank rate has been controlled. As of June 2020, the corridor range is between 9.25% (floor = overnight deposit rate) and 10.25% (ceiling overnight lending rate). This rate was announced and set in March 2020, and has been continuously imposed as of June 2020.

CBE's short-term market operation interest rates and discount rates are mostly set within the corridor. The main open market operation rate, under the said condition, is set at 9.75%. There is another operation rate called the Cairo Overnight Index Average (CONIA)[31], which also falls within the floor and ceiling of the corridor. This index fluctuates also within the corridor, and has been between 9.3% and 9.9%.

6.2.4 Bank lending rates

Actual lending rates offered by the banks vary among the lending cases under the current liberalized financial regime. The aggregated average is being monitored and reported by the Domestic Money Monitoring System (DMMS), under CBE. For example, the weighted average interest rate during the month of April 2022 was 10.5% for EGP bank lending for corporates, for the period up to one year.[32] The actual lending rates are commonly higher than the corridor ceiling rate, reflecting the risk factors and transaction costs incurring for each lending case.

Table 6.1 Average bank lending rates

2018		2019												2020			
Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
18.1%	17.8%	18.1%	17.4%	17.1%	16.8%	16.8%	16.4%	16.5%	16.3%	15.1%	14.7%	14.4%	13.8%	13.6%	13.8%	12.7%	11.8%

2020								2021									
May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
11.4%	11.3%	11.2%	11.0%	10.1%	10.0%	9.8%	9.7%	9.5%	9.5%	9.5%	9.4%	9.6%	9.4%	9.4%	9.4%	9.3%	9.3%

2021		2022					
Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
9.3%	9.5%	9.5%	9.5%	9.7%	9.9%	10.4%	10.5%

SOURCE: DOMESTIC MONEY MONITORING SYSTEM (DMMS)

6.2.5 Foreign currency management

CBE holds foreign currency accounts and manages the country's foreign reserves. It also offers the official foreign currency exchange rate for major currencies. While CBE, as the central bank takes responsibility for its monetary policy by the national currency of EGP, the financial policy for transactions

[31] CONIA is the index aggregated by CBE based on interbank transaction data for EGP denomination risk-free rate lending / borrowing. It is serving as a benchmark for identifying price and interest rate trend. CONIA is calculated on a daily basis as the trimmed mean of the volume-weighted average rate on overnight unsecured interbank transactions.

[32] Weighted average rates for a sample of banks whose deposits represent around 80% of total deposits of the banking system and calculated on a monthly basis.

in foreign currencies is controlled only under the bank supervision administration and not under the monetary policy. CBE offers a domestic large-amount and important fund settlement facility through its real-time gross settlement system (RTGS). The service is offered not only for EGP but also for some selected foreign currencies. CBE's Supervision and Control Sector regulates foreign currencies transactions by granting licenses for operating foreign exchange bureaus, money transfers, and other dealings in foreign currencies. The foreign exchange, under this supervision is liberalized for all foreign currencies, and CBE offers the official exchange rate on daily basis.

There is no bank specifically designated to offer foreign exchange facility, meaning that the banks under the supervision of CBE can offer foreign currency facilities. Operations to offer finance (lending) in foreign currency denomination can be conducted by CBE licensed financial institutions who are also possessing foreign currency dealing permissions. There is no mechanism to regulate the interest rate for foreign currency denomination lending. Interest rates data in three foreign currencies, namely USD, EUR and GBP are being monitored and collected from selected banks, aggregated and disclosed by CBE, but there is no control over the freely fluctuating interest rate.

Among various banks offering foreign currency facilities, the National bank of Egypt (NBE), is possessing the biggest share of the entire foreign currency transactions. For this reason, NBE is the most influential bank for creating a market for foreign currency. NBE's loan interest rate status formulates the country's foreign currency market conditions.

6.2.6 Prevailing interest and discount rates

CBE aggregates information on interest rates and discount rates in the country. It regularly reports data on bank lending facilities, deposits at CBE, and loans offered at banks. The table below shows that interest rates for EGP deposits up to 1 year was 7.7%, while the loan interest rate was 10.5%, which is 2.8% percentage points more than the prevailing interest.

Table 6.2 Discount and interest rates on deposits and loans

Particulars (average June 2022)	Annual rate
EGP deposits (more than 1 month, up to 3 months)	8.6%
EGP deposits (more than 3 months, up to 6 months)	7.2%
EGP deposits (more than 6 months, up to 1 year)	7.7%
EGP loans (up to 1 year, corporate)	10.5%

SOURCE: CBE, DOMESTIC MONEY MONITORING SYSTEM (DMMS)

6.3 Major financial institutions

CBE, as the central bank, is also responsible for monetary policy and overall price stability. The table below lists banks which registered with CBE. As of June 2022, 37 banks were registered with CBE.

Table 6.3 Banks registered with CBE

No.	Banks	Registered	Head office address
1	Banque Misr	18/1/1958	151, Mohamed Farid St., Cairo.
2	National Bank of Egypt	1/1/1961	1187, Corniche El Nile St., Cairo.
3	Egyptian Arab Land Bank	18/1/1958	78 Gameat El Dewal El Arabia St., Mohandessin, Giza.
4	Agricultural Bank of Egypt	11/8/1977	1, El Seid Club St., Dokki, Giza.
5	Industrial Development Bank	27/5/1976	2 Abdel Kader Hamza St., Cairo Centre Bldg, Garden City, Cairo
6	Banque Du Caire	18/1/1958	6, Dr. Moustafa Abu Zahra St., Nasr city, Cairo.
7	The United Bank	25/6/2006	106, El Kasr El Einy St., (Cairo Center Tower), Cairo.
8	Bank of Alexandria	18/1/1958	49, Kasr El Nile St., Cairo.
9	MIDBank S.A.E	26/6/1975	21/23 Charles De Gaulle St., (ex Giza St.,), Nile Tower, Giza.
10	Commercial International Bank (Egypt)	13/8/1975	21/23, Charles Du Gaulle St., (Giza. St.,), Nile Tower, Giza.
11	Attijariwafa bank Egypt S.A.E	13/8/1975	Star Capital Tower, City Stars, 2 Ali Rashed St., Nasr City, Cairo
12	Société Arabe Internationale de Banque	9/9/1976	56, Gameat El Dewal Al Arabia St., Mohandessin, Giza
13	Blom Bank - Egypt	24/3/1977	Block No.61, 1st District, 90 St., The Fifth Compound, New Cairo
14	Credit Agricole Egypt S.A.E	12/5/1977	Touristic area No. (9/10/11/12/13) Fifth Settlement, Cairo
15	Emirates National Bank of Dubai SAE	14/7/1977	Plot 85 Block G, City center, Sector A, Road 90, 5th District - Cairo
16	Suez Canal Bank	9/3/1978	7, 9 Abdel Kader Hamza St., Garden City, Cairo.
17	Qatar National Bank Alahli S.A.E	13/4/1978	Dar Champellion,5, Champellion St., Downtown, Cairo.
18	Arab Investment Bank	29/6/1978	8, Abdel Khalek Sarwat St., (Cairo-Sky Building), Cairo.
19	AL Ahli Bank of Kuwait - Egypt	29/6/1978	Smart village, Kilo 28 Cairo-Alex. desert road, building 227B
20	First Abu Dhabi Bank	29/8/1978	84, 90th Street, Fifth Settlement, 11835, P.O. Box 278.
21	Ahli United Bank - Egypt	3/10/1978	81, Ninety St., City Centre, Fifth Compound, New Cairo.
22	Faisal Islamic Bank of Egypt	14/6/1979	3 – 26 July St., Cairo.
23	Housing and Development Bank	24/9/1979	26 El Krom St., Mohandessin, Dokki Police Station, Giza.
24	Al Baraka Bank of Egypt S.A.E.	8/5/1980	Fifth settlement P.O Box 84, Postal Code 11835
25	National Bank of Kuwait, Egypt (NBK)	26/5/1980	Plot 155, City Centre, 1st Sector, 5th Settlement, New Cairo, Cairo
26	Abu Dhabi Islamic Bank - Egypt	24/7/1980	9 Rostom St., Garden City, Cairo.
27	Abu Dhabi Commercial Bank Egypt	15/10/1981	16 Gammat El Dowel el Arabia Street, Giza.
28	Egyptian Gulf Bank	28/1/1982	Block 45, North Teseen Road, 5th settlement, New Cairo.
29	Arab African International Bank	10/6/1982	5, El Saray El Kubra St., Garden City, Cairo.
30	HSBC Bank Egypt S.A.E	15/7/1982	306, Corniche El Nile St., El Maadi, Cairo.
31	Arab Banking Corporation Egypt SAE	25/11/1982	90th St. (North), Fifth settlement, New Cairo.
32	Export Development Bank of Egypt	31/12/1984	78, South Tesseen Road, 5th District, New Cairo
33	Arab International Bank	5/6/2012	35, Abdel Khalek Sarwat St., Cairo.
34	CitiBank N A / Egypt	16/10/1975	46 Al Salam Axis Street, First Sector at 5th Settlement, New Cairo
35	Arab Bank PLC	10/6/1976	Plot 43 Sector 1- 5th Settlement, New Cairo, Cairo
36	Mashreq Bank	26/5/1977	Block No.77, 90 St., Fifth Compound, New Cairo.
37	National Bank of Greece	9/2/1978	32, Haron St., Dokki, Giza.

SOURCE: CBE

Among the banks listed, four banks (numbers 1, 2, 6, 8) have stakes owned by the government. This state ownership is due to the banks' development history, and do not influence the kinds of services they provide. In particular, No 2. National Bank of Egypt is the oldest, most influential and largest (in terms of assets, network and number of employees) bank in the country, founded in 1898. No. 1, Banque Misr also has a long heritage dating back to 1920 as the first founded with indigenous funding (i.e., not foreign investment).

Relatively large, in terms of assets held, are No. 1 Banque Misr, No. 2 National Bank of Egypt, No. 8 Bank of Alexandria, No. 10 Commercial International Bank, No. 17 Qatar National Bank Alahli, and No. 21 Ahli United Bank Egypt. These large banks mostly participate in finance facility networks offered by international financial institutions, notably the European Commission, WB, EBRD, EIB, AFD, among others. For example, No. 10 Commercial International Bank (CIB), the largest genuine private bank in the market, lists up ten international development finance facility involvements, ranging from agriculture, MSME support, environmental protection and international trade promotion (as per following table). Many of the large-scale banks are proactively participating in these existing international development finance facilities, and are expressing intentions to further widen their business scope in this area. It can therefore be said that there are already a number of banks that are experienced in the international development finance facility management business, and are well-prepared for more of these activities.

Table 6.4 Examples of bank participation in international development finance facilities

	Program	Major contributing agency
	Agriculture	
1	Agriculture sector development program (ASDP)	IFAD
2	Promotion of Rural Incomes through Market Enhancement Project (PRIME)	IFAD
3	Support to Agriculture SMEs Program (SASME)	AFD, EU
4	Sustainable Agricultural Investments and Livelihood Project (SAIL)	IFAD
5	Veterinary services program (VSP)	EU
6	Buffalo Fattening Program (10m and 50m)	EU
	MSME	
7	Financial investment and sector cooperation (FISC)	EU
	Environment	
8	Environmental Pollution Abatement Project Phase III (EPAP III)	WB, AFD, KfW, EIB
9	Environmental Compliance Office (ECO)	DANIDA, SIDA
	Trade	
10	US Export Credit Guarantee Program - GSM-102 – U.S.	FAS-USDA

SOURCE: CIB WEBSITE INFORMATION WITH JICA SURVEY TEAM INFORMATION ADDITIONS

6.4 Credit risk guarantees

In order to invest in EEC, most companies must borrow money from banks. But when banks lend for EEC investments, they tend to be more cautious in estimating the returns than they are with loans to increase production efficiency. This is because expected returns from EEC investment entail more uncertainty, and are commonly calculated as less than those for other improvements. One way to address this situation is to offer banks a credit risk guarantee mechanism. With this mechanism, a third party undertakes the credit risk of the companies (usually SMEs) borrowing money. As there are already good precedents in use of credit risk guarantees for EEC promotion investments in Egypt, it is worth considering use of this mechanism also for new EEC promotion financing.

The credit risk guarantee mechanism in Egypt was established with a collective initiative of the major commercial banks, with support from CBE. It is managed by an entity called the Credit Guarantee Company (CGC) of Egypt, established in 1989, which is dedicated to offering the mechanism to SMEs. Initially, CGC was under collective ownership of Egypt's major commercial banks. Lately, CBE has reinforced its support, and is now the top shareholder with a 20% share in CGC. The remaining 80% is held by eight major commercial banks and one insurance company. CGC has eight branches around Egypt, and has service provision agreements with every commercial bank in the country.

CGC has two major funding sources for its services. One is the trust fund, whereby funds from international organizations, banks and bilateral development organizations (in the form of grants or trusteeship) are used. The other is a sovereign fund offered by CBE. By utilizing these funds CGC currently operates seven programs listed below.

Table 6.5 Ongoing programs of the Credit Guarantee Company (CGC)

Name	Description
CBC SMEs	Targeting all projects that fall under CBE March 2017 definition; beneficiary enjoys 5% interest rate with tenure up to 10 years and up to 80% coverage. Guarantee limit could be up to LE35 million.
CBE (wages & basic operating expenses)	Performing and non-performing Egyptian companies with activities in the following: tourism sector; hotels, Nile cruises, touristic activities, ticketing & reservation, restaurants & entertainment activities within touristic zones. A grantee tenure up to 3 years and up to 100% coverage. Guarantee limit could be up to LE40 million.
CBE Corporate	Performing clients with yearly turnover/sales of LE200 million or more and bank score not exceeding grade 6. A grantee tenure up to 10 years and up to 80% coverage. Guarantee limit could be up to LE 320 million.
CGC SMEs	Targeting all projects that fall under CBE March 2017 definition; beneficiary enjoys 5% interest rate with a grantee tenure up to 10 years and up to 90% coverage. Guarantee limit could be up to LE35 million.
HCPP	Targeting private health care providers with a grantee tenure up to 10 years and up to 90% coverage. Guarantee limit could be up to LE 35 million.
IMP-CGF	Targeting industrial activities and service activities related to industrial activity with a grantee tenure up to 10 years and up to 90% coverage. Guarantee limit could be up to LE 35 million.
RSM (Agriculture)	All agricultural, animal production and small, medium scale agriculture projects existing and new in all stages of the value chain for agricultural activity provided that the share of Egyptian capital is not less than 51%. A grantee tenure up to 10 years and up to 90% coverage. Guarantee limit could be up to LE 35 million.

SOURCE: CGC, INFORMATION COMPILED BY JICA SURVEY TEAM

CGC has experience in offering credit risk guarantees for EEC promotion investments. This was done as a pilot activity component under the EEIGGR program conducted by UNDP. It was termed as the Egyptian Sustainable Loan Guarantee Mechanism: ESLGM, and a fund of USD 280,000 was allocated for this purpose. Although it was a pilot activity done on a limited scale, the significance of this activity was that it proved that credit risk guarantee functions as an effective mechanism for promoting EEC investment.

GCG intends to revive and further enhance the credit risk guarantee mechanism to promote environmentally friendly investments among SMEs, including investments for EEC promotion. Their past experience and current intention show the readiness of CGC to function as an effective mechanism to promote EEC investments immediately, by using funds available from international development finance.

Chapter. 7 Activities of other development partners and lessons learnt

7.1 EEC related activities of development partners

7.1.1 World Bank

In 2011, the World Bank provided assistance in the formation of the CEEU under the cabinet, and in 2015 it assisted in the Energy Efficiency Unit of MOERE, which used the Tetra Group of India as a consultant.

In 2014, the technical assistance through the Energy Sector Management Assistance Program (ESMAP) started. The goal was to reduce the Egyptian government's energy subsidies, for this, USD 1.1 billion in the World Bank policy loans were granted over 3 years. As part of this ESMAP, rooftop solar potential and energy efficiency were studied in Cairo and Alexandria[33]. In this study, energy conservation potential was estimated and countermeasures were proposed for the Public Buildings Sector, Commercial Buildings Sector, Residential Buildings Sector, Potable Water, Street Lighting, and Transport[34].

In addition to the above, USD3.15 billion in policy loans were granted over a 5-year period of 2015 -20, which covered the enactment of a new renewable energy law, technological cooperation on electricity tariff revisions, phased reduction of energy subsidies, review of the Feed-in Tariff (FIT) system, and electricity liberalization[35].

The World Bank is currently implementing the Household Natural Gas Connection Project (USD 300 million).

Most recently, the World Bank has supported the development of the E-mobility White Paper in MOERE and the establishment of an urban electrification public bus system, and has begun discussions with the Egyptian government on future areas of support (E-mobility, EEC, and demand-side management).

IFC, a member of the World Bank Group, is also helping the Ministry of Trade and Industry to develop a Decree for high-efficiency standards for electric motors up to 350 kW.

7.1.2 UNDP

UNDP implemented the Energy Efficiency Improvement Greenhouse Gas Reduction (EEIGGR: 1998 - 2011) and its Phase 2, the Project for efficiency improving the EE of Lighting and Building appliances (IEEL & A: 2011 -2017).

The UNDP-EEIGGR project in Phase 1 involved the use of all lighting, including street lighting. The project was previously implemented by MOERE through EEHC. Under this project, the MEPS (Minimum Energy Performance) standards and conservation labels for five electronic devices (refrigerators, washing

[33] ESMAP ENERGY SUBSIDY REFORM FACILITY (ESRF) (March 2017)
[34] WB Arab Republic of Egypt Energy Efficiency Implementation Energy Efficiency and Rooftop Solar PV Opportunities: Report Summary (June 2017)
[35] https://www.worldbank.org/en/about/partners/brief/arab-republic-of-egypt-providing-affordable-clean-energy

machines, air conditioners, electronic water heaters, and CFLs) were developed. More than 10 MEPS standards have been developed to date.

The IEELBA project in Phase 2, implemented by MOERE, is a national project that aims to promote the complete redesign of the Egyptian market to use more energy-efficient electrical equipment, as long as it proves to be cost-effective. The LED promotion project started in 2012, and 100 million LEDs have been installed in supermarkets, banks, hotels, etc.

Table 7.1 Overview of the UNDP-GCF EE Project

Project Name	Phase 1 Energy Efficiency Improvement and Greenhouse Gas Reduction (EEIGGR)	Phase 2 Project for Improving the EE of Lighting and Building Appliances **(IEEL & A)**
Period	2000-2010	2011-2017
implementing agency	EEHC, MOERE	MOERE
Target	Power Residential Commercial Public Industrial	Residential Commercial Public Gov building Street Lighting
Budget	Approximately 5M $(GEF grant) GEF grant — USD 4.11 million Co-financing: N/A	18 M $ GEF grant — USD 4.45 million Co-financing: USD 13.2 million
Main purpose	• Reduction of loss, load shift and load management in integrated systems • Support for the energy efficiency use market (support for improving energy efficiency in the industrial sector, standards and labels, setting of energy codes for new buildings, Energy Efficiency Center) • Supporting the development of ESCO • Mechanism to guarantee small and partial loans	• Elimination of inefficient lighting • Energy efficiency standards and labels for building equipment

SOURCE: JICA EGYPT ENERGY CONSERVATION TRAINING PRELIMINARY STUDY REPORT, WORLD BANK DOCUMENT

7.1.3 UNIDO

The Industrial Energy Efficiency Project, supported by UNIDO, aims to address the pressing issue of optimizing industrial energy consumption at the local level and provide a model for local industries to shift towards patterns of more sustainable energy consumption.

Table 7.2 Overview of IEE Project by UNIDO

Project Name	Industrial Energy Efficiency Project
Implementing agency	MTI and EEAA
Target	Industrial
Budget	GEF grant: USD 3,950,000 Co-financing: USD 15,675,000
Main purpose	• Development of a national energy management standard and EE services • Improvement of financial incentive programs • Demonstration of system optimization projects
Contents	1. National program to define energy benchmarks and Energy Efficiency policy 2. Awareness raising on industrial EE 3. Technical capacity building on EE service 4. Access to finance for EE improvement projects 5. Implementation of energy management systems and system optimization
Expected outcomes	• Supportive policy instruments (EnMS) for delivering EE in industry and contribute to international competitiveness • Widespread awareness on EE and Energy Management • A cadre is available of specialized / certified energy management and system optimization experts • Increased access to financial assistance for implementing EE projects • State of the art energy management practice and EE measures are demonstrated

SOURCE: JICA EGYPT ENERGY CONSERVATION TRAINING PRELIMINARY STUDY REPORT, WORLD BANK DOCUMENT

7.1.4 EU

In April 2018, the Egyptian government and the EU signed an energy partnership MOU (2018 -2022)[36].

The main support activities are listed below, with energy conservation policy support included in the fifth item. Specifically, this includes support for the implementation of NEEAP2 and support for the establishment of the EEU. In particular, the EU is involved in energy conservation governance as stipulated in NEEAP2, and is supporting the development of an energy efficiency and conservation governance roadmap in cooperation with the EBRD and the IEA. The key is support for MOERE for data collection, statistics, energy conservation indicators, system infrastructure development, etc. that enable monitoring of the current status of energy efficiency and conservation and the status of achievement.

1. Further assistance to the development of the Oil and Gas Sector
2. Continued support to the Electricity Sector Reforms
3. Development of the Energy Hub
4. Further assistance with joint measures and projects in the field of renewable energy
5. Additional support on Energy Efficiency strategies, policies and measures; across variable sectors
6. Cooperation in the technical, scientific and industrial areas across the energy field.

[36] https://ec.europa.eu/energy/sites/ener/files/documents/eu-egypt_mou.pdf

7.1.5 EBRD

The EBRD is implementing large-scale projects for the Ministry of Petroleum, the Ministry of Electricity, etc. It is investing not only in the government but also in the private sector, including cement companies.

The EBRD is also providing two-step loans to invest in energy efficiency and renewable energy in Egypt. The EE-related projects carried out so far are shown below.

Table 7.3 Energy and SME Sector Projects at EBRD

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
1	National Bank of Egypt SME Credit Line (Financial institutions) <Repaying>	01 Oct 2013	Up to USD 30 million	National Bank of Egypt	The EBRD is considering a financing package of up to USD 80 million to the National Bank of Egypt. The facility will comprise of (i) a senior loan of up to USD 30 million for on-lending to private small and medium-sized enterprises (“SMEs”); (ii) a USD 20 million pilot Women–in-Business facility (WiB) to support women-led SMEs; and (iii)a facility of up to USD 30 million for on-lending to private sub-borrowers for energy efficiency and renewable energy projects.
2	National Bank of Egypt SME Credit Line (Financial institutions) <Complete>	01 Oct 2013	Up to USD 50 million	National Bank of Egypt	The EBRD is considering a financing package of up to USD 100 million to the National Bank of Egypt. The facility will comprise (i) a senior loan of up to USD 50 million for on-lending to private micro, small and medium enterprises (‘’MSME’’); and (ii) a trade finance limit of up to USD 50 million for guarantees and cash advances. The project will be the first EBRD transaction in the Egyptian Financial Sector.
3	[PUBLIC] Power sector energy efficiency project (PUBLIC - Power and Energy) <Repaying>	12 Feb 2014	Up to USD 190 mil.	Egyptian Electricity Holding Company (EEHC) and/or subsidiary Egyptian Electricity Production Company (EDEPC)	The proceeds of the loan will be used to fund the conversion of two existing open cycle power plants to combined cycle gas turbines
4	National Bank of Egypt EE Line <Complete>	29 Oct 2014	Up to USD 30 mil.	National Bank of Egypt	The facility will comprise of (i) a senior loan of up to USD 30 million for on-lending to private small and medium-sized enterprises (“SMEs”); (ii) a USD 20 million pilot Women – in-business facility (WiB) to support women-led SMEs; and (iii) a facility of up to USD 30 million for on-lending to private sub-browsers for energy efficiency and renewable energy projects.

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
5	QNB ALAHLI SME Loan (Financial institutions) <Complete>	27 May 2015	Up to 100 million	QNB Alahli	The EBRD is considering a financing package of up to USD 140 million to QNB ALAHLI. The facility will comprise (i) a senior loan for on-lending to private small and medium enterprises (''SMEs'') for up to USD 100 million; and (ii) up to USD 40 million trade finance limit for guarantees and cash advances. The SME loan will increase the availability of finance to private SMEs allowing an increased number of SMEs, a largely underpenetrated segment, to gain access to bank credit. The trade finance limit with QNB ALAHLI will strengthen the development of trade finance in the region promoting trade which contributes to the economic development of Egypt.
6	FIF – Bank Audi Egypt SME Loan (Financial institutions) <Complete>	22 Jul 2015	Up to 30 million	Bank Audi SAE	The EBRD is providing a financing package of up to USD 60 million to Bank Audi SAE. The facility will comprise (i) a senior loan for on-lending to private small and medium enterprises (''SMEs'') for up to USD 30 million; and (ii) up to USD 30 million trade finance limit for guarantees and cash advances. The SME loan will increase the availability of finance to private SMEs allowing an increased number of SMEs, a largely underpenetrated segment, to gain access to bank credit. The trade finance limit with Bank Audi SAE will strengthen the development of trade finance in the region promoting trade which contributes to the economic development of Egypt.
7	FIF – NBK-Egypt SME Loan (Financial institutions) <Complete>	02 Sep 2015	Up to USD 70 million	National Bank of Kuwait-Egypt	The EBRD is providing a financing package of up to USD 70 million to National Bank of Kuwait- Egypt. The facility will comprise (i) a senior loan for on-lending to private small and medium enterprises (''SMEs'') for up to USD 50 million to be disbursed in two tranches; and (ii) up to USD 20 million trade finance limit for guarantees and cash advances. The SME loan will increase the availability of finance to private SMEs allowing an increased number of SMEs, a largely underpenetrated segment, to gain access to bank credit. The loan will also be supported by technical cooperation targeted at enhancing SME lending know-how at NBK-Egypt, as well as improving financial skills and general business know-how of NBK-Egypt's existing and potential SME clients. The trade finance limit with NBK-Egypt will strengthen the development of trade finance in the region promoting trade which contributes to the economic development of Egypt.

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
8	Egypt Renewable Feed-In-Tariff Framework (Power and energy) <Approved>	07 Jun 2017	USD 1,340 million	The Borrowers will be special purpose vehicles incorporated in Egypt for the sole purpose of developing, constructing and operating their respective Subproject.	Loans to multiple private developers for a total amount of up to USD 500 million (EUR 463 million equivalent) to finance the construction and operation of renewable energy projects in Egypt under its feed-in-tariff program (the "Subprojects"). The Subprojects currently proposed focus on the construction and operation of solar photovoltaic plants of 20-50 MW capacity. The Subprojects will be developed under the program implemented by the Egyptian government's feed-in tariff program aimed at stimulating private investment in over 4 GW of wind and solar power (the "FiT Scheme"). This scheme aims to support Egypt to move to a more environmentally sustainable and diverse electricity sector by exploiting the country's vast renewable energy potential. It is expected to improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption. The Subprojects will be among the first to be implemented under the FiT Scheme and will support Egypt in reaching its renewable energy targets and reducing its reliance on costly hydrocarbon imports.
9	FIF - QNB Al Ahli SME Loan (Financial institutions) <Complete>	02 Nov 2016	USD 100 million	Qatar National Bank Al Ahli SAE	A financing package of up to USD 100 million to QNB Alahli SAE. The facility will comprise a senior loan for on-lending to private small & medium enterprises ("SMEs"). The EBRD loan will assist QNB Alahli to develop its SME lending activities and expand access to finance for underserved private SMEs.
10	Egypt SEFF - NBK-Egypt	04 Oct 2016	USD 40 mil.	National Bank of Kuwait-Egypt	The project consists of a loan to National Bank of Kuwait - Egypt ("NBKE" or "NBK-Egypt") for up to USD 40 million under Egypt Sustainable Energy Financing Facility Framework ("Egypt SEFF"), out of which up USD 20 million is expected to be refinanced by Agence Française de Developpement ("AFD") under the same conditions. The project has been developed under the EBRD Green Economy Transition ("GET") approach to scale up green financing.
11	Egypt SEFF	04 Oct 2016	EUR 140 mil.	National Bank of Kuwait-Egypt	The EBRD is consulting establishing the Egypt Sustainable Energy Financing Facility ("Egypt SEFF" Framework in the amount of up to EUR 140 million (including co-financing by the European Investment Bank "EIB" or AFD. The funds will be made available to Participating Financial Institutions ("PFIs" in Egypt for on lending to eligible private sector sub-borrowers for sustainable energy investments. The Framework has been developed under the

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
					EBRD Green Economy Transition ("GET") approach to scale up green financing. The first loan under the Egypt SEFF is visited to be to National Bank of Kuwait - Egypt for up to USD 40 million, co-financing with Agence Française de Developpement "AFD."
12	Egypt SEFF-QNB Alahli	02 Nov 2016	USD 20 mil.	QNB Alahli	The project consists of a loan to QNB Alahli ("QNBAA" for up to USD 40 million under the Egypt Sustainable Energy Financing Facility Framework ("Egypt SEFF"), out of which up USD 20 million is expected to be co-financed by the European Investment Bank ("EIB") under the same conditions.
13	Access/EREN Benban PV I and II(Energy) <Repaying>	07 Jun 2017	USD 29 million	Access Egypt Solar One S.A.E.	Provision of long-term senior debt financing of up to USD 29 million (EUR 27 million equivalent) to finance the construction of a 50 MW solar photovoltaic plant located in the proposed 1.8 GW Benban solar complex in the Aswan province of Egypt (the "Project"). The Project will be one of the first utility scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project is part of a larger portfolio of two 50 MW plants developed in Benban by the same group of lead sponsors. The Project will be developed under the program implemented by the Egyptian government offering feed-in tariffs to projects of up to 50 MW capacity to stimulate private investment in over 4 GW of wind and solar power. This scheme aims to support Egypt to move to a more environmentally sustainable and diverse electricity sector by exploiting the country's vast renewable energy potential. It is expected to improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
14	Scatec Benban I Aswan Solar Project II Kom Ombo Project III Sun Infinite Project IV Red Sea Solar Project V Zafarana Solar Project VI Philadelphia Project (Energy) <Complete>	07 Jun 2017	USD 20 million	Scatec Solar ASA	Provision of long-term senior debt financing of up to USD 40.5 million (EUR 37.9 million equivalent) to finance the construction of 50 MW solar photovoltaic plant located in the proposed 1.8 GW Benban solar complex in the Aswan province of Egypt (the "Project"). The Project will be one of the first utility scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project is part of a larger portfolio totaling six 50 MW plants developed in Benban by the same group of lead sponsors. The Project will be developed under the program implemented by the Egyptian government offering feed-in tariffs to projects of up to 50 MW capacity to stimulate private investment in over 4 GW of wind and solar

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
					power. This scheme aims to support Egypt to move to a more environmentally sustainable and diverse electricity sector by exploiting the country's vast renewable energy potential. It is expected to improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
15	EDF EN Benban PV (Energy) <Repaying>	07 Jun 2017	USD 27 million	The Borrower will be a special purpose vehicle ultimately owned by two sponsor entities: (i) EDF Energies Nouvelles ("EDF EN") and (ii) Elsewedy Electric	Provision of long-term senior debt financing of up to USD 27.0 million (EUR 24.8 million equivalent) to finance the construction of 50 MW solar photovoltaic plant located in the proposed 1.8 GW Benban solar complex in the Aswan province of Egypt (the "Project"). The Project will be one of the first utility scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project is part of a larger portfolio of two 50 MW plants developed in Benban by the same group of lead sponsors. The Project will be developed under the program implemented by the Egyptian government offering feed-in tariffs to projects of up to 50 MW capacity to stimulate private investment in over 4 GW of wind and solar power. This scheme aims to support Egypt to move to a more environmentally sustainable and diverse electricity sector by exploiting the country's vast renewable energy potential. It is expected to improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
16	ELSEWEDY Benban PV (Energy) <Repaying>	07 Jun 2017	USD 27 million	The borrower will be a special purpose vehicle ultimately owned by two sponsor entities: (i) EDF Energies Nouvelles ("EDF EN") and (ii) Elsewedy Electric.	Provision of long-term senior debt financing of up to USD 27.0 million (EUR 24.8 million equivalent) to finance the construction of 50 MW solar photovoltaic plant located in the proposed 1.8 GW Benban solar complex in the Aswan province of Egypt (the "Project"). The Project will be one of the first utility scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project is part of a larger portfolio of two 50 MW plants developed in Benban by the same group of lead sponsors. The Project will be developed under the program implemented by the Egyptian government offering feed-in tariffs to projects of up to 50 MW capacity to stimulate private investment in over 4 GW of wind and solar power. This scheme aims to support Egypt to move to a more environmentally sustainable and diverse electricity sector by exploiting the country's vast renewable energy potential. It is expected to improve the environmental

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
					characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
17	Alfa Solar Benban PV <Repaying>	07 Jun 2017	USD 29 million	A special purpose vehicle ultimately owned by Al Fanar Company	Provision of long-term senior debt financing of up to USD 29 million (EUR 26.8 million equivalent) to finance the construction of 50 MW solar photovoltaic plant located in the proposed 1.8 GW Benban solar complex in the Aswan province of Egypt (the "Project"). The Project will be one of the first utility-scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project will be developed under the program implemented by the Egyptian government offering feed-in tariffs to projects of up to 50 MW capacity to stimulate private investment in over 4 GW of wind and solar power. This scheme aims to support Egypt to move to a more environmentally sustainable and diverse electricity sector by exploiting the country's vast renewable energy potential. It is expected to improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
18	Infinity/ib vogt Solar PV 1 & II <Repaying>	07 Jun 2017	USD 16.2 million	Infinity Solar Energy ultimately owned by two main sponsor entities: (i) Infinity for Solar Energy SAE, and (ii) ib vogt GmbH	Provision of long-term senior debt financing of up to USD 16.2 million (EUR 14.9 million equivalent) to finance the construction of a 30 MW solar photovoltaic plant located in the proposed 1.8 GW Benban solar complex in the Aswan province of Egypt (the "Project"). The Project will be one of the first utility scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project is part of a larger portfolio of two plants with a total capacity of 80 MW developed in Benban by the same group of lead sponsors. The Project will be developed under the program implemented by the Egyptian government offering feed-in tariffs to projects of up to 50 MW capacity to stimulate private investment in over 4 GW of wind and solar power. This scheme aims to support Egypt to move to a more environmentally sustainable and diverse electricity sector by exploiting the country's vast renewable energy potential. It is expected to improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
19	ACWA Benban Solar PV I & II & III <Repaying>	20 Jun 2017	USD 29 million	International Company for Water and Power Projects (ACWA Power)	Provision of long-term senior debt financing of up to USD 29.1 million (EUR 26.9 million equivalent) to finance the construction of a 50 MW solar photovoltaic plant located in the proposed 1.8 GW Benban solar complex in the

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
					Aswan province of Egypt (the "Project"). The Project will be one of the first utility scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project is part of a larger portfolio of three plants for a total capacity of 120 MW developed in Benban by the same group of lead sponsors. The Project will be developed under the program implemented by the Egyptian government offering feed-in tariffs to projects of up to 50 MW capacity to stimulate private investment in over 4 GW of wind and solar power. This scheme aims to support Egypt to move to a more environmentally sustainable and diverse electricity sector by exploiting the country's vast renewable energy potential. It is expected to improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
20	AAIB - SME loan (Financial institutions) <Repaying>	18 Jul 2017	USD 30 million SMEs	Arab African International Bank	The project consists of a financing package of up to USD 110 million to Arab African International Bank ("AAIB"). The facility will comprise (i) a senior loan of up to USD 30 million for on-lending to private small and medium enterprises ("SMEs"); (ii) a senior loan of up to USD 30 million under the Egypt Sustainable Energy Financing Facility ("Egypt SEFF"), of which up USD 15 million is expected to be co-financed by either AFD or the European Investment Bank ("EIB") under the same conditions; and (iii) a trade finance limit of up to USD 50 million for guarantees and cash advances. Egypt SEFF is a comprehensive financing facility program in the amount of up to EUR 140 million for sustainable energy investments. The funds will be made available to Participating Financial Institutions ("PFIs") in Egypt for on-lending to eligible private sector sub-borrowers for sustainable energy investments. The facility will promote penetration of energy efficient ("EE") and renewable energy ("RE") technologies, appliances and equipment in Egypt by stimulating demand and raising awareness of the benefits of investments in such technologies. The EBRD loan will enable AAIB to develop its SME lending activities and expand access to finance for underserved private SMEs, and to support on-lending to private sub-borrowers for EE and RE projects, which are of particular relevance in the context of high energy intensity of the Egyptian economy.

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
21	Egypt SEFF-AlexBank	01 Nov 2017	USD 15 mil.	AlexBank	The project consists of a loan to Bank of Alexandria ("AlexBank" for up to USD 30 million under the Sustainable Energy Financing Facility for Egypt ("Egypt SEFF", out of which up USD 15 million is expected to be co-financed by the European Investment Bank ("EIB") under the same conditions.
22	National Bank of Egypt SME Loan (Financial institutions) <Repaying>	17 Jan 2018	USD 150 million	National Bank of Egypt	Provision of a US$ 150 million loan to National Bank of Egypt (NBE) alongside a US$ 600 million club deal that includes international commercial lenders. The EBRD loan will enhance the growth and development of micro, small and medium-sized enterprises (MSME) in Egypt.
23	AAIB - SME loan, Egypt SEFF loan, trade finance (Financial institutions) <Disbursing>	28 Nov 2018	USD 30 million SEFF USD 50 million trade finance	Arab African International Bank	The project consists of a financing package of up to USD 110 million to Arab African International Bank ("AAIB"). The facility will comprise (i) a senior loan of up to USD 30 million for on-lending to private small and medium enterprises ("SMEs"); (ii) a senior loan of up to USD 30 million under the Egypt Sustainable Energy Financing Facility ("Egypt SEFF"), of which up USD 15 million is expected to be co-financed by either AFD or the European Investment Bank ("EIB") under the same conditions; and (iii) a trade finance limit of up to USD 50 million for guarantees and cash advances. Egypt SEFF is a comprehensive financing facility program in the amount of up to EUR 140 million for sustainable energy investments. The funds will be made available to Participating Financial Institutions ("PFIs") in Egypt for on-lending to eligible private sector sub-borrowers for sustainable energy investments. The facility will promote penetration of energy efficient ("EE") and renewable energy ("RE") technologies, appliances and equipment in Egypt by stimulating demand and raising awareness of the benefits of investments in such technologies. The EBRD loan will enable AAIB to develop its SME lending activities and expand access to finance for underserved private SMEs, and to support on-lending to private sub-borrowers for EE and RE projects, which are of particular relevance in the context of high energy intensity of the Egyptian economy.
24	[PUBLIC] SOPC Energy Efficiency & Upgrade Program (PUBLIC - Natural	(05 Jun 2019)	USD 250 million	Egypt sovereign	Provision of an up to USD 200 million loan to the Suez Oil Processing Company (SOPC) to finance a package of energy efficiency investments and other refurbishments and installations at the Suez refinery. In particular, the Project will focus on the installation of a New Vapor Recovery Unit (VRU), the

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
	resources) <Signed>				refurbishment of the old coker units and a number of energy efficiency investments identified to improve operational performance, environmental footprint and utilization rate of the refurbishment of the old coker unit and a number of energy efficiency investments identified to improve operational performance, environmental footprint and utilization rate of the refinery. Provision of an additional USD 50 million loan to SOPC to finance the implementation of a new Asphalt Unit at the refinery so as to complete its upgrade program. The Project aims to alleviate some of SOPC's inefficiencies. It will enable SOPC to produce middle distillates in line with Euro 5 specifications, which have historically been imported thereby catering better for growing and shifting demand patterns in the country. Energy efficiency investments will lead to positive environmental benefits with greenhouse gas emissions savings estimated around 295 kt CO_2 per year thereby enabling SOPC to optimize utilization rates and improve operational performance.
25	QNB Al Ahli-GEFF Egypt, GCF GEFF, Value Chain (Financial institutions) <Repaying>	24 Jul 2019	USD 57.5 mil.	QNB Alahli	Provision of a financing package of up to USD 70 million to QNB Al Ahli Bank SAE. The facility will compare: i. a senior loan of up to USD 20 million under the Egypt Green Energy Financing Facility "Egypt GEFF"; ii. a senior loan of up to USD 20 million under the regional GCF GEFF, of which up to USD 5 million is expected to be refined by the Green Climate Fund under the same conditions; iii. a senior loan of up to USD 30 million value chain financing combined of (i) a loan under the Green Value Chain framework, of which up to USD 7.5 million is expected to be co-finalized by Green Climate Fund under the same conditions, and/or (ii) a loan for on-lending to private small and medium enterprises.
26	Infinity Energy S.A.E. (Energy) <Disbursing>	14 Oct 2019	USD 60 million	Infinity Energy S.A.E. (part of Mansour Group)	An equity investment in Infinity Energy SAE of up to USD 60 million to finance the development, construction and operation of renewable energy projects and associated ancillary business including electricity distribution and electro vehicle charging stations in Egypt and across SEMED countries. The project is in line with the efforts undertaken by the EBRD to scale up renewable energy penetration in Egypt's energy mix and promote the liberalization of the electricity sector by supporting the private-to-private (merchant) renewable energy segment.

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
27	GCF GEFF Regional National Bank of Egypt Green SME Loan (Financial institutions) <Disbursing>	24 Oct 2019	USD 75 mil.	National Bank of Egypt	Provision of a senior unsecured loan to National Bank of Egypt ("NBE") of up to USD 100 million, of which up to USD 75 million to be provided by EBRD and up to USD 25 million by the Green Climate Fund ("GCF") under the GCF-Green Economy Financing Facility ("GEFF" Regional Framework. The procedures of the loan will be used for financing investments in climate change mitigation and adaptation technologies across the industrial, commercial, transport and agricultural sectors by local private sector Small and Medium Enterprises "SMEs", in line with the standards and reporting requirements for GEFF in Egypt.
28	SPREF - Global Energy (TAQA PV) (Energy) <Disbursing>	18 Dec 2019	USD 4.5 million	Global for Energy SAE (owned by TAQA Arabia SAE)	Construction and operation of a 6MWp ground-mounted solar PV power plant located at a dairy farm owned by Dina Farms SAE (Dina Farms) in the Beheira governorate (the project). The project will sell 100% of its electrical output to Dina Farms under a 25-year Power Purchase Agreement between Dina Farms and TAQA PV for Solar Energy SAE (TAQA PV). The project supports the efforts to scale up renewable energy penetration in Egypt's energy mix and liberalization of the electricity sector by expanding the private-to private renewable energy segment.
29	Resilience Framework: NBK Egypt loan (Financial institutions) <Repaying>	04 May 2020	USD 100 million	National Bank of Kuwait Egypt	Provision of a senior unsecured loan to National Bank of Kuwait Egypt ("NBKE") of up to USD 100 million, under the Bank's Resilience Framework ("RF") developed to address the impact resulting from the COVID-19 pandemic. Proceeds of the proposed loan will be on-lent to local private Small and Medium Enterprises ("SMEs"), and to Corporates to cover liquidity needs that may arise as a result of COVID-19. The proceeds of the loan will help NBKE in providing funding to local SMEs and Corporates experiencing either a decrease in their activity, turnover and profitability, in turn leading to delays in payments and potential defaults, or growing capacity needs due to a significant fluctuation in demand in particular sectors.
30	Resilience Framework: National Bank of Egypt (Financial institutions) <Repaying>	15 Jun 2020	USD 100 million	National Bank of Egypt	Provision of a senior unsecured loan to National Bank of Egypt (NBE) of up to USD 100 million, under the Bank's Resilience Framework (RF). The RF is developed to address the ramifications of the COVID-19 pandemic. Proceeds of the proposed loan will be on-lent to local private small and medium-sized enterprises (SMEs) and corporates, supporting them in bridging the liquidity needs that may arise as a result of the outbreak. The financing will help NBE provide funding to SMEs and corporates experiencing either a

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
					decrease in their activity, turnover, and/or profitability.
31	Resilience Framework - CIB Egypt (Financial institutions) <Disbursing>	18 Jun 2020	USD 100 million	Commercial International Bank S.A.E.	Provision of a senior unsecured loan to Commercial International Bank (CIB) of up to USD 100 million, under the Bank's Resilience Framework (RF) developed to address the ramifications of the COVID-19 pandemic. Proceeds of the proposed loan will be on-lent to local private Small and Medium Enterprises (SMEs), and to Corporates, supporting them in bridging liquidity needs that may arise as a result of the pandemic.
32	Gulf of Suez Wind II (Energy) <Concept reviewed>	(07 Aug 2020)	USD 50 million	Red Sea Wind Energy S.A.E. owned by ENGIE Energie Services ("ENGIE" i 35%), Toyota Tsusho Corporation & Eurus Energy Holdings Corporation Consortium (holding collectively 40%) and Orascom Construction (25%)	Provision of long-term senior debt financing of up to USD 50 million (EUR 42 million equivalent) to finance the construction of a 500 MW wind power plant located in the Gulf of Suez, approximately 40 km North-West of Ras Ghareb in Egypt. The project will be one of the largest privately developed utility scale wind power plants in Egypt and will support the country in increasing its renewable energy capacity. Through delivery of clean power at one of the most competitive wind tariffs in the region and wider, the project will support Egypt's renewable transition and exploitation of the exceptional wind resources in the Gulf of Suez area. The Project is expected to further improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
33	Kom Ombo (Energy) <Signed>	(28 Aug 2020)	USD 54 million	ACWA Power Kom Ombo for Energy (directly owned by "ACWA Power Kom Ombo Project Holding Company Ltd)	Provision of a senior debt financing of up to USD 40 million, in addition to an equity bridge loan of up to USD 14 million, to finance the construction and development of a 200 MW solar PV project located in Kom Ombo, Egypt. The Project will be one of the largest privately developed utility scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project will further promote private sector participation in the Egyptian power sector and increase the share of renewable energy in the energy mix in line with the nationally declared targets. The Project is expected to further improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
34	FIF - Banque du Caire - SME loan (Financial institutions)	29 Oct 2020	USD 50 million	Banque du Caire (ultimately owned by Banque Misr)	Provision of a senior loan of up to USD 50 million to Banque du Caire ("BDC") for on-lending to private micro, small and medium-sized enterprises ("MSME") in Egypt.

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
	<Disbursing>				The EBRD loan will assist BDC to develop its MSME lending activities and expand access to finance for underserved private MSME.
35	Kom Ombo EBL (Energy) <Signed>	(04 Nov 2020)	USD 14 million	ACWA Power Kom Ombo for Energy (directly owned by "ACWA Power Kom Ombo Project Holding Company Ltd)	Provision of a senior debt financing of up to USD 40 million, in addition to an equity bridge loan of up to USD 14 million, to finance the construction and development of a 200 MW solar PV project located in Kom Ombo, Egypt. The Project will be one of the largest privately developed utility scale solar plants in Egypt and will support the country in increasing its renewable energy capacity. The Project will further promote private sector participation in the Egyptian power sector and increase the share of renewable energy in the energy mix in line with the nationally declared targets. The Project is expected to further improve the environmental characteristics of Egypt's power sector by reducing emissions of local pollutants and CO_2, as well as water consumption.
36	GCF GEFF Egypt Commercial - NBK II (Financial institutions) <Disbursing>	20 Apr 2021	USD 21.25 million	National Bank of Kuwait Egypt S.A.E.	Provision of up to USD 25 million senior unsecured loan to National Bank of Kuwait i Egypt ("NBKE"), under the regional GCF GEFF program. Up to USD 3.75 million of this loan is expected to be co-financed by the Green Climate Fund ("GCF") under the same conditions. The EBRD loan will enable NBKE to (i) support on-lending to private sub-borrowers for green, energy efficiency and renewable energy projects, which are of particular relevance in the context of high-energy intensity of the Egyptian economy, and (ii) to support high performance technologies and services supporting a green economy.
37	NBE- Green SME Loan II (Financial institutions) <Disbursing>	11 May 2021	USD 100 million	National Bank of Egypt	Provision of a senior unsecured loan to National Bank of Egypt ("NBE") of up to USD 100 million. The proceeds of the loan will be used for financing investments in climate change mitigation and adaptation technologies across the industrial, commercial, transport and agricultural sectors by local private sector Small and Medium Enterprises ("SMEs"), in line with the standards and reporting requirements for GEFF in Egypt.
38	GCF GEFF Regional-Egypt II - QNB Al Ahli (Financial institutions) <Disbursing>	08 Jun 2021	USD 42.5 million	Qatar National Bank Al Ahli SAE	Provision of a senior unsecured loan to QNB ALAHLI SAE ("QNB ALAHLI") of up to USD 50 million under the regional GCF GEFF program, of which up to USD 7.5 million is expected to be co-financed by the Green Climate Fund ("GCF"). The EBRD loan will enable QNB ALAHLI to (i) support on-lending to private sub-borrowers

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
					for green, energy efficiency and renewable energy projects, which are of particular relevance in the context of the high energy intensity of Egypt's economy, and (ii) to support high performance technologies and services supporting a green economy. Sub-borrowers include micro, small and medium-sized enterprises (MSME) and individual households that operate across the residential, agribusiness, industrial, commercial, and service sectors.
39	Egypt GEFF - QNB Al Ahli Line II (Financial institutions) <Approved>	08 Jun2021	USD 12.5 million	Qatar National Bank Al Ahli SAE	Provision of a senior unsecured loan to QNB Al Ahli SAE of up to USD 12.5 million under the Egypt Green Economy Financing Facility ("Egypt GEFF"). The EBRD loan will enable QNB Al Ahli to support on-lending to private sub-borrowers for green, energy efficiency and renewable energy projects, which are of particular relevance in the context of high energy and carbon intensity of the Egyptian economy.
40	GCF GEFF Egypt Commercial - AUB Egypt GVC (Financial institutions) <Pending approval>	(13 Aug 2021)	USD 9 million	Ahli United Bank Egypt SAE	Provision of a senior unsecured loan to Ahli United Bank Egypt ("AUBE") of up to USD 12 million (EBRD financing of USD 9 million and GCF co-financing of up to USD 3 million) for on-lending to private small and medium-sized enterprises ("SMEs") within certain value chains for capex investments in climate change mitigation and adaptation technologies and services. The proceeds of the loan will be on-lent to private SMEs within certain value chains (in such sectors as agribusiness, manufacturing and services, and information and communication technologies ("ICT")) for capex investments in climate change mitigation and adaptation technologies and services.
41	FIF - AUB SME Loan (Financial institutions) <Pending approval>	(13 Aug 2021)	USD 30 million	Ahli United Bank Egypt SAE	Provision of a senior unsecured loan to Ahli United Bank Egypt ("AUBE") of up to USD 30 million for on-lending to private small and medium-sized enterprises ("SMEs") in Egypt. The EBRD loan will support AUBE's SME lending activities and expand access to finance for underserved SMEs, especially in the remote regions through attracting new clients.
42	Banque Misr - Green SME Loan I (Financial institutions) <Approved>	11 Nov 2021	USD 100 million	Banque Misr SAE	Provision of a senior unsecured loan of up to USD 100 million to Banque Misr ("BM"). The proceeds of the loan will be used for financing investments in climate change mitigation and adaptation technologies across the industrial, commercial, transport and agricultural sectors by local private sector Small and Medium Enterprises ("SMEs"), in line with the standards and reporting requirements for GEFF in Egypt.

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
43	Intro Sustainable Resources (Energy) <Signed>	(23 Nov 2021)	USD 4.83 million	Intro Sustainable Resource (100% owned by Intro Investments Holding Ltd.)	Provision of a senior secured loan of up to USD 4,830,000 to Intro Sustainable Resources & Intro Solar S.A.E. (the "Borrowers") to finance a pipeline of green projects the most advanced of which includes the expansion of a plastic bottle recycling facility, replacing an inefficient diesel steam energy generation with combined heat and power plant ("CHP"), and refinancing a solar project developed under round 1 of the Egyptian Feed-in-tariff ("FiT") program (the "Projects"). The Projects will support: i) the company's expansion of resource recovery facilities; ii) its ambitions to expand its long-term low-carbon energy transition strategy; and iii) the expansion of private-to-private utility projects in Egypt.
44	Scatec Green Bond Egypt (Energy) <Signed>	(13 Jan 2022)	USD 100 million	Scatec Solar ASA	An investment in a green bond issuance of up to USD 340 million (the "Bond"). The Bank's participation will consist of up to USD 100m in the form of a direct subscription in the Bond, and the provision of up to USD 30m stand-by liquidity facility for the benefit of the participating private institutional investors. The Bond will obtain the verified certification from the Climate Bond Initiative (CBI) and will be the first private green renewables-backed bond issued in Egypt. The Bond proceeds will support a portfolio of six operational solar power plants located in Benban, Egypt (the "Projects").
45	Scatec Green Bond Egypt (Energy) <Signed>	(25 Jan 2022)	USD 30 million	Scatec Solar ASA	An investment in a green bond issuance of up to USD 340 million (the "Bond"). The Bank's participation will consist of up to USD 100m in the form of a direct subscription in the Bond, and the provision of up to USD 30m stand-by liquidity facility for the benefit of the participating private institutional investors. The Bond will obtain the verified certification from the Climate Bond Initiative (CBI) and will be the first private green renewables-backed bond issued in Egypt. The Bond proceeds will support a portfolio of six operational solar power plants located in Benban, Egypt (the "Projects").
46	GCF GEFF Regional - Egypt II - CIB (Financial institutions) <Approved>	09 Jun 2022	USD 42.5 million	Commercial International Bank SAE	Provision of a senior unsecured loan under the GCF-GEFF Regional Framework ("GEFF") of up to USD 50 million, of which up to USD 7.5 million is expected to be co-financed by the Green Climate Fund ("GCF") The Project will support on-lending to private sub-borrowers for green, energy efficiency and renewable energy projects, which are of particular relevance in the context of the high energy intensity of Egypt's economy, and (ii) to support high performance technologies and

No.	Project Name (Sector) <Stage>	Approval Date (project description disclosure date)	EBRD Finance (inc. equity, debt and credit line)	Borrower (implementing agency)	Project description
					services supporting a green economy. Sub-borrowers include private micro, small and medium-sized enterprises (MSME) and individual households that operate across the residential, agribusiness, industrial, commercial and service sectors.

SOURCE: COMPILED FROM EBRD EGYPT PROJECT SUMMARY DOCUMENTS WEBPAGE (BROWSED ON 18 JUNE 2022)

In addition, as noted above, the EBRD, in cooperation with the EU and the IEA, is supporting the development of an energy efficiency and conservation governance roadmap.

7.1.6 AfDB

In 2011, AfDB provided USD 100 million Sector Budget Support focused on the power sector. The main focus was on energy efficiency and conservation, renewable energy and Tariff Support.

Since 2015, together with the IMF and the World Bank, it has provided General Budget Support to the Ministry of Finance of Egypt in the amount of USD 150 million annually for 3 years (annual tranche). (See the website: EGESP)

The Bank has implemented the Electricity and Green Growth Support Program (EGGSP) since 2019, co-financed by JICA. EGGSP is a Sector Budget Support of EUR 450 million over 2019/20 to 2020/21[37]. The main goal of the project is to promote a sustainable, competitive and diversified electricity sector for ensuring security of electricity supply and supporting climate change mitigation and green growth. The following five items are identified as expected outcomes of the program.

1. Rationalization of the electricity tariff;
2. Enhanced financial sustainability of the electricity sector;
3. Improved corporate governance and competitiveness of the key electricity sector institutions;
4. Enhanced security of energy supply through promotion of renewable energy and energy efficiency for fostering climate change mitigation and green growth; and
5. Stronger engagement of the private sector for better service delivery.

AfDB is currently focusing on projects to replace energy-inefficient appliances (such as refrigerators and A/Cs) with more efficient appliances. A baseline study for this purpose will be conducted. The ToR will be announced in July 2021, and the study is scheduled to be completed by the end of 2021.

[37] https://www.afdb.org/en/documents/egypt-electricity-and-green-growth-support-program-eggsp-appraisal-report

7.1.7 AFD

It participates in the Southern and Eastern Mediterranean Sustainable Energy Financing Facility (EMED-SEFF) with EBRD, EIB, and the EU. It also provides loans in the energy sector.

Currently, the following projects are under consideration in Egypt, but have not yet started.

1. Green Economy Financing Facility (GEFF) - EBRD: AFD will provide a credit line for energy efficiency and conservation within this scheme.
2. Capacity building to promote EEC in building sector – GIZ: AFD works with GIZ to support the development of policies to promote energy efficiency and conservation. In particular, it will also provide technical assistance.
3. Sector Development Policy Loan (DPL) and TA: Discussions are underway with MOERE on measures to make the DPL more effective.
4. Capacity building support for MOERE-EECCD: Technical cooperation to strengthen energy conservation auditing capacity for transmission and distribution companies.
5. TA for demand response: Technical assistance for the design of a utility pricing scheme based on a demand response model.

7.1.8 KfW

The following projects are under consideration in Egypt.

1. KfW's EE fund: An EUR 8 million fund to promote energy efficiency. At present, a basic study on needs identification and fund structuring is being planned (ToR is being prepared).
2. EEC promotion in public universities: A project to promote energy efficiency and conservation in public universities. Consultant selection is now in progress.
3. EE credit line: Provision of energy efficiency credit line for SMEs.

7.1.9 GIZ

GIZ is implementing a technical cooperation project, Egyptian-German Joint Committee on Renewable Energy, Energy Efficiency and Environmental Protection. Phase 1 (2015 -2019) has a budget of EUR 8 million and phase 2 (2019 -2023) has a budget of EUR 7.5 million. This project has two tasks[38].

Firstly, it functions as the secretariat of the High-Level Joint Committee (HLJC), a platform for high-level policy dialogue between Egypt and Germany in the energy sector. The HLJC meetings are held once a year and investors from Egypt and Germany discuss the policy-related developments in Egypt's energy system. On the Egyptian side, the committee members include several ministries such as MOERE, as well as downstream and subordinate agencies such as NREA, Egypt ERA, and DISCOs.

[38] http://jcee-eg.net/

Secondly, the JCEE and its partners implement activities in the five fields to strengthen the capacity of partners and related institutions:

- NEEAP II,
- Advisory services for distribution grids,
- Energy efficiency technologies,
- Sustainable energy and climate protection
- Renewable energy

Specifically, it plans to support the collection of good practice examples of energy efficiency and conservation technology in the industrial sector, human resource development of power distribution companies (under the EEHC) and energy service companies, support for the strengthening of ERA regulatory operation, and overall promotion of energy efficiency and conservation. In addition, it plans to promote renewable energy such as the spread of PV. With regard to PV deployment, it is providing support to MOERE to utilize NAMA's financial assistance schemes (specifically, support for application to NAMA). The NAMA scheme would allow SMEs considering PV deployment to obtain credit guarantees for bank loans of EUR 2 million. MOERE's applications to NAMA with GIZ support are expected to be reviewed by 2022, with implementation scheduled for 2023 - 2027.

In addition to the above, the GIZ has implemented Policy dialogue and knowledge management on low emission strategies in the MENA region (DIAPOL-CE) in six countries including Egypt (Egypt, Algeria, Iran, Jordan, Morocco, and Tunisia). The project term is 2014 -2021 and the budget is EUR 15.25 million[39].

The project provides technical and economic support for innovative technologies to improve the financing of climate-friendly technologies in the MENA region.

In addition to Egypt, training has been conducted in Morocco, Tunisia, and Jordan for financial sector decision-makers on renewable energy and energy efficiency. The knowledge gained through this program enables financial institutions to evaluate project proposals, business plans, technologies and mechanisms. The project operates regional training courses to exchange knowledge on the integration of economic and legal systems related to renewable energy and energy efficiency improvements.

Recently GIZ is looking at an opportunity to finance super-ESCO in Egypt. The market study has been conducted and further considerations are to be made.

[39] https://www.giz.de/en/worldwide/32164.html

7.2 Specific EE-related projects by other development partners

7.2.1 Energy Efficiency Improvement Greenhouse Gas Reduction (EEIGGR) – project for efficiency improving the EE of Lighting and Building appliances (IEEL&A)

(1) Overview of the EEIGGR Project

The Energy Efficiency Improvement and Greenhouse Gas Reduction Project was a nationally project executed by the Egyptian Electricity Holding Company (EEHC), Ministry of Electricity and Energy (MOEE) and supported with a grant from the Global Environment Facility (GEF) with the United Nations Development Program (UNDP) as the GEF-implementing agency and the United Nations Department for Economic and Social Affairs (UNDESA) as cooperating agency. The project started in 1999 with a total GEF budget of USD 5.895 million. This project phase ended in year 2010.

This project was to assist Egypt in reducing the long-term growth of GHG emission from electric power generation and consumption of non-renewable fuel resources.

The project has had three main components which are listed with the main achievements listed below.

Table 7.4 Main Components and Achievements of EEIGGR Project

Component	Main Achievements
1. Loss reduction, load shifting and load management in the Unified Power System (UPS) of EEHC	
• Reduce transmission losses of EEHC's UPS and improve capabilities of transmission network loss reduction measurements • Set priorities for dynamic response from thermal units • Network analysis and control strategies • Encourage load shifting through time-of-use (TOU) tariff	• Calibration of all measuring devices and program set up for periodical calibration of equipment • Mitigation actions to improve the dynamic response of generating units (automatic generation controls, improvement of power factor by installing capacitor banks, maximizing use of reactive power by generators and optimization of network planning) • Installation of time-of-use (TOU) meters and load shifting projects implemented. Unfortunately, a TOU tariff structure was proposed, but not approved by Government.
2. EE market support	
• EE industry support (promotion of energy service industry through customer awareness, business transformation and capital financing), including audits, business advice and CFL leasing • Energy standards and labelling (for three classes of equipment) • Develop and apply energy codes for new buildings • Create an EE Centre to promote awareness and strategic action on EE	• Training of energy auditors and energy audits accomplished • CFL program: encouragement of Egyptian manufacturers to manufacture CFL locally (6 factories), public awareness program and cooperation with NGOs (through GEF Small Grants Program) and power distribution companies • Support given to technical testing labs of domestic appliances (air conditioners, washing machines, refrigerators, electric water heaters, CFLs) and a Ministerial Decree on specifications of energy labels for refrigerators, A/C, washing machines, CFLs), but without a clear enforcement mechanism • Loan guarantee mechanism implemented with Credit Guarantee Company (37 projects are implemented at a total cost of EGP 49 million and a guarantee of EGP 15 million, the later provided to CGC by the project).

	• Around 400 audits carried out in buildings (of which 200 in government buildings). The measures introduced include efficient lighting and mounting of capacitors to improve power factor. • A decree (482/2005) has been issued by the Ministry of Housing Utilities and Urban Communities on EE in residential and commercial buildings (but legislation is still needed to ensure a credible enforcement mechanism)
3. Promotion of Cogeneration	
• Establish and train a small power group within EEHC • Establish safety and interconnection requirements for parallel grid connections with small producers • Develop industrial cogeneration and agricultural waste projects for small power production	• Establishment of a 'small power' group within EEHC • Cogeneration system guidebook and a model PPA for grid connection and technical specifications for safe interconnection are currently under study • Report on the potential capacity and proposals for agri-waste fired combined heat-power (CHP) projects • Appropriate tariff setting was shelved.

SOURCE: FINAL EVALUATION REPORT OF ENERGY EFFICIENCY IMPROVEMENT AND GREENHOUSE GAS REDUCTION PROJECT, APRIL 2010

In EEIGGR project, there are two important activity outcomes;

1. Minimum energy performance standards (MEPS) and EE labeling system, and
2. Loan guarantee mechanism implemented with Credit Guarantee Company.

Minimum energy performance standards (MEPS) and EE labeling

EE standards and labels developed for 5 appliances and formally adopted for 3 appliances (refrigerators, air conditioners and washing machines). A ministerial decree now makes it compulsory for local manufacturers and importers to abide by the specifications and label their products with their energy consumption information.

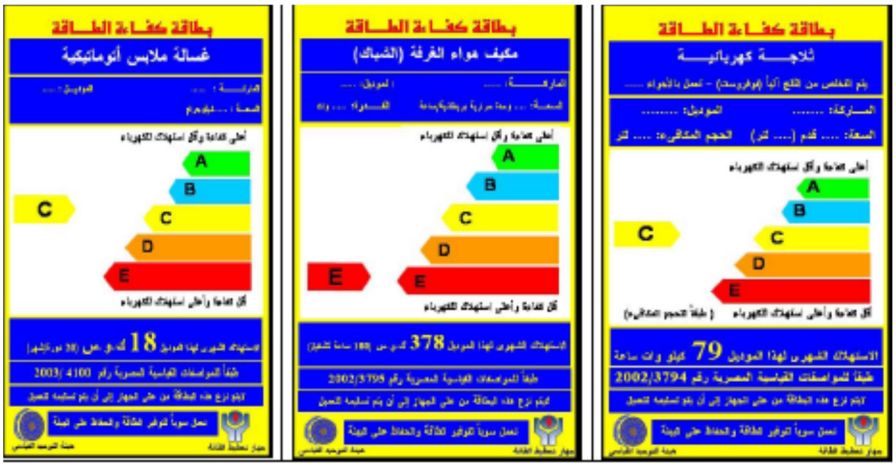


Fig. 7.1 Examples of EE labels for washing machines, air conditioners and refrigerators

(2) Egyptian Sustainable Loan Guarantee Mechanism (ESLGM)

EEIGGR developed the Egyptian Sustainable Loan Guarantee Mechanism (ESLGM) to enable access to finance to the ESCOs for their projects. EEIGGR allocated a budget of USD 280,000 to this mechanism. The mechanism is being executed through a local financial institution. The Credit Guarantee Company (CGC) for small and medium size enterprises was selected as the financial institution. CGC is an Egyptian company that was established by twelve public and private banks to enable access to finance for SMEs.

For the projects which are executed through the mechanism, the customer will be requested to pay a down payment in the range of 10-20% of the project cost (including cost of finance). The ESCO will be eligible to get a loan which will be 70% of the project cost minus the down payment. CGC will offer 100% credit guarantee to the loan. The guarantee will be effective as the ESCO sign the contract with the end user and present a bank document showing that the end user has already paid the down payment

EEIGGR provided a back guarantee of 70% to the guarantee offered by CGC for the loan, while CGC provided the remaining 30% from its own resources. CGC contribution was 50% after two years from the start of the mechanism. The aforementioned shares represent the proportional loss in case of the customer default. CGC would be eligible to collect a fee of 2% of the offered guarantee for the projects approved after two years from the start of the mechanism.

The proposed financing mechanism is shown in the following Figure:

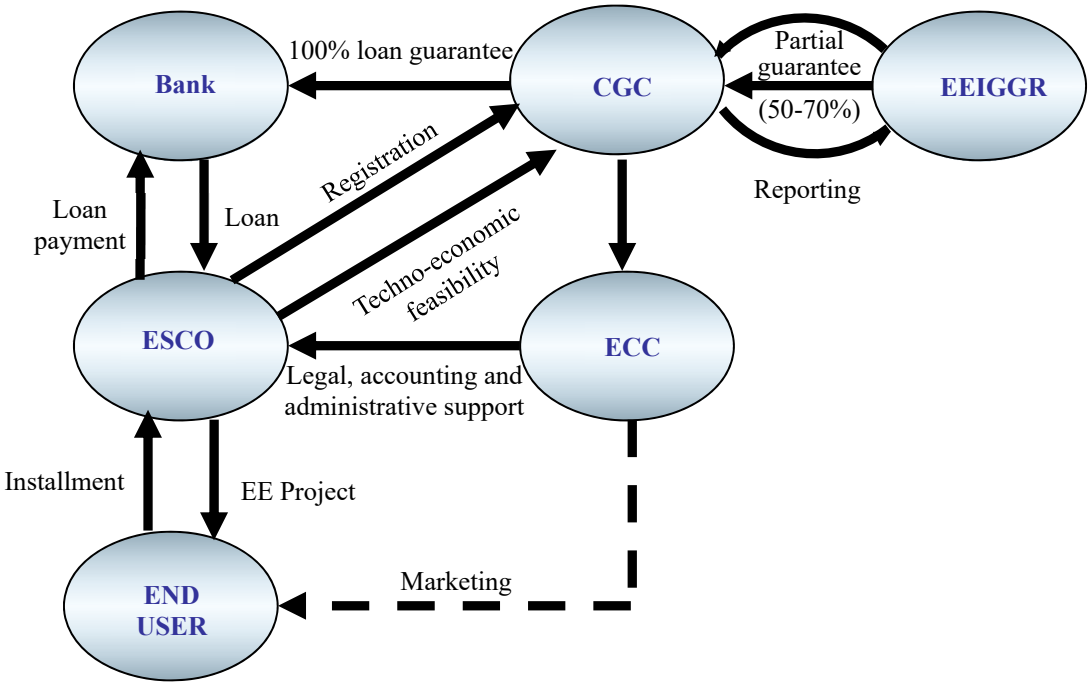


Fig. 7.2 Egyptian Sustainable Loan Guarantee Mechanism (ESLGM)

The EEIGRR component started in October 2005 and guaranteed 37 loans reaching a total loan amount of EGP 46.25 million of which EGP 15.37 was guaranteed by CGC (December 2009). Thus, the leveraging by the Fund is with a ratio of about 1 to 3. CGC added non-EEIGR money in addition to projects (with a

total value of EGP 68.85 million) with credit provided at the amount of EGP 14.76 million (of which 50% is guaranteed). The management cost of the fund is reported to be covered from its own operations and interest gain of the initial capital.

The energy saving and GHG emission reduction impacts by the EEIGGR Project were:

- Transmission losses were reduced to 3.79% by year 2008/09 in comparison with the losses of 5.99% in the base year 98/99.
- Fuel savings from lighting appliances (total sales over 2000-2009 of 13.5 million) estimated at 3.3 Mtoe.
- In total, energy savings resulted in about 8.3 - 12 million tonnes of CO_2 per year, but the estimate varies depending on the assumptions and calculation methods used.

(3) Overview of the IEEL&A project

The project for efficiency improving the EE of Lighting and Building appliances (IEEL&A) is a project that assists the Government of Egypt (GoE) to facilitate a comprehensive market transformation of the Egyptian market towards the use of more energy efficient electrical appliances at a level where cost-efficiency is proven. This is achieved through the combination of regulatory tools such as minimum energy performance standards (MEPS) and information labels, enhanced public awareness, capacity building and attractive financing mechanisms.

The project was implemented by the Ministry of Electricity and Energy and the Egyptian Electricity Holding Company. The project started in January 2011 and had a duration of 5 years.

The project had three main components which are listed with the main achievements below.

Table 7.5 Main components and achievements of IEEL&A project

1. Accelerated growth of the EE lighting market in Egypt.
• An enabling regulatory framework for phasing out energy inefficient lighting
• Innovative and attractive financing mechanisms in place to support and leverage financing for EE lighting and other related EE investments, including the continuation and expansion of the Government-supported CFL incentive programs and the EE loan schemes with complementary funding leveraged
• Improved energy management of public buildings by appointment and capacity building of energy managers and improvement of the public procurement processes
• Updated guidelines and regulations for implementing energy efficient street lighting with related capacity building and awareness raising of the municipal authorities
• A completed study on improving the energy efficiency of lighting in industry elaborating the options, applicable technologies and required other measures to improve energy efficiency of industrial lighting with related recommendations and awareness raising materials
• Joint marketing / public awareness campaigns with local lamp manufacturers and vendors, including at least 3 market segment-specific marketing and awareness raising campaigns targeting i) the residential sector; ii) public buildings and offices; and iii) street lighting with the co-financing share of these campaigns reaching 50% at a minimum.
• Improved quality control system and, as applicable, complementary procurement support to provide non-partial information to the targeted customers on the quality and performance of the lamps
• All local manufacturers are exposed to information and capacity building to improve the quality of their products
• A finalized study and proposal for the different options to manage and recycle the components and/or materials of the lighting appliances that have reached the end of their lifetime.

2. A comprehensive S&L scheme for building appliances developed and effectively implemented, matching international and regional best policy and technology practices. • Monitoring and data collection studies for end-use sales and appliance energy use in the residential and commercial sector. • A detailed proposal for a strengthened compliance checking and enforcement scheme for both locally produced and imported products that are adopted S&L schemes, including required legal amendments to effectively follow-up non-compliance. • Established institutional mechanism and finalized implementation arrangements for monitoring, enforcing and regularly updating the S&L schemes, including training of all key staff of the public entities responsible for the implementation of these schemes. • A detailed proposal and draft legal documents for an expanded, mandatory EE S&L scheme for the agreed new appliances with concluded stakeholder consultations. • Upgraded testing facilities with adopted testing standards, trained staff and internationally verified testing procedures and results for checking compliance of all targeted appliance groups with the adopted standards and labelling schemes. • Specific promotional campaigns, dedicated websites and other materials to raise public awareness about adopted S&L schemes and, as applicable, to expedite the phase-out of old, inefficient appliances. • Trained sales staff in the main retail stores (complemented, as applicable, by specific incentives such as premiums for the sales personnel for the sale of EE products) to market the products on the basis of their energy performance and related life-cycle costs beside other characteristics.
3. Sustained project results • An updated baseline study, against which the impact of the project can be measured. • A permanent market monitoring system for assessing the impact of the project and to provide a basis for identifying new energy saving opportunities, EE policy measures and programs with finalized market monitoring methodology and agreements with the key stakeholders to submit the required initial market data. • Project mid-term evaluation and other required reviews, including annual reports from continuing monitoring of and evaluation of all the financial support programs facilitated by the project. • Further elaboration and financing leveraged for applicable financial support mechanisms (including, as applicable, carbon finance) to continue the implementation of EE investments • Strengthened institutional and inter-agency co-ordination mechanism, including capacity building of the Technical Secretariat of the Supreme Energy Council and the EE Unit at the Cabinet of Ministers, to support further energy efficiency policy measures. • Final project report consolidating the results and lesson learnt from the implementation of the different project components and recommendations for the required next steps.

SOURCE: FINAL REPORT - TERMINAL PROJECT EVALUATION OF IMPROVING THE ENERGY EFFICIENCY OF LIGHTING AND OTHER BUILDING APPLIANCES, UNDP AND MOERE, DEC 2018

In IEEL&A project, there are two important activities/ outcomes; 1) Compliance to MEPs and 2) Promotion of LED Lighting Systems.

(4) Compliance to MEPs

As for the compliance of the appliances sold with the developed MEPS, the three testing laboratories (New & Renewable Energy Authority, the General Organization for Import and Export Control and the Egyptian Organization of Standards) confirmed that all tested appliances were complying with MEPS. The target was to improve and update 5 MEPS for 5 appliances but the IEELA developed and updated 9 MEPS. The target related to compliance was 80% of the selected equipment to comply with new MEPS. Because of the new testing equipment and improvements to testing facilities (3 sites highlighted above), all targeted appliances (9) must comply with the related MEPs. Three laboratories lack equipment for testing and certifying the compliance of import and local manufactured appliances.

(5) Promotion of LED Lighting Systems.

At the end of the project timeframe (2015) the market transformation of EE lightening bulbs was supposed to reach an annual sale of 35 million LEDs, but in 2018 the total sales were about 85 million LED bulbs. The target has been drastically overpassed.

In addition, the project has developed technical specifications for all types of used LED lighting systems sold out in Egypt in accordance with the international standards. Fewer than 10% of the LED bulbs of all the random samples tested at the end of the project show non-compliance. Most of the non-compliant bulbs are locally manufactures (more or less handicraft) other than the two largest manufacturers (Philips and Venus).

Direct GHG emissions reduction are from the implementation of pilot projects and the replication (causality 60%) without the GEF's co-financing by the pilot beneficiaries.

Table 7.6 Direct GHG Emissions Reduction

Initiative	Amount of CO2(MTons) Year 2018	Accumulated Amount of CO2(MTons) Years 2015-2018(within the project time timeframe) NOTE 1	Accumulated 2019-2025 CO2 (Mt) Direct extended impacts	Total Cumulative 2015-2025 (MtCO2)
Street Lighting	0.69	1.74	4.83	6.57
Led Market Transformation Attributed to the project Causality factor 60%	0.548	1.476	3.83	5.30
Total (NOTE 2)	1.238	3.216	8.666	11.88

NOTE 1: THE FIRST PILOT PROJECTS WERE IMPLEMENTED IN 2015 AND LATER.

NOTE 2: THE TARGET SET IN THE PRODOC WAS 0.95 MT. THE PROJECT OVER PERFORMED WITH 11.88 MT. EVEN WITHIN THE TIME BOUNDARY (PROJECT TIMEFRAME), THE GHG EMISSIONS REDUCTION OF 11.88 $MtCO_2$ IS MORE THAN 3 TIMES HIGHER THAN EXPECTATIONS.

SOURCE: FINAL REPORT - TERMINAL PROJECT EVALUATION OF IMPROVING THE ENERGY EFFICIENCY OF LIGHTING AND OTHER BUILDING APPLIANCES, UNDP AND MOERE, DEC 2018

The Indirect GHG emissions reduction resulting of the market transformation others than replication of pilots by the pilot project beneficiaries:

Table 7.7 Indirect GHG Emissions Reduction

Initiative	Amount of CO2(MTons) Year 2018	Accumulated Amount of CO2(MTons) Years 2015-2018	Cumulative Indirect MtCO2 2019-2025	Total Cumulative 2015-2025 (MtCO2)
Led Market Transformation Causality factor 60%	0.822	2.214	5.75	7.96

7.2.2 Industrial Energy Efficiency Project

The "Industrial Energy Efficiency in Egypt" project was implemented by the United Nations Industrial Development Organization (UNIDO) with a financing grant provided by the Global Environment Facility (GEF). The Project was a full-size GEF project, having the objective of facilitating EE improvements in the industrial sector through supporting the development of a national energy management standard and EE services for the Egyptian industry as well as the creation of demonstration effects.

The project started in January 2013 with a total budget of USD 28,071,000 (donor funding USD 3,950,000 and co-financing USD 24,121,000). This project phase ended in year 2018.

The activities were directed to ten industrial sectors: 1) iron and steel, 2) petrochemicals; 3) cement; 4) engineering, 5) chemicals, 6) ceramics, 7) fertilizers, 8) glass, 9) building materials and 10) food.

National cooperating partners in the project included:

- Egyptian Environmental Affairs Agency (EEAA) – National Executing Partner
- Ministry of Trade and Industry (MoTI)
- Egyptian Organization for Standardization and Quality (EOS), MoTI
- Industrial Development Authority (IDA), MoTI
- Industrial Modernization Centre (IMC), MoTI
- Federation of Egyptian Industries (FEI), Environmental Compliance Office (ECO)

The main project components and related expected outputs as described in the project document are:

Table 7.8 Main Components and Achievements of UNIDO Project

1. National program to define energy benchmarks and implement ISO-compatible Energy Management Standard (EnMS) for industry
Outputs: 1.1) EnMS was developed and adopted (compatible with ISO 50001 EnMS) 1.2) Structure in place for measurement and verification (M&V) of compliance with EnMS 1.3) Development of an industrial energy database and energy consumption benchmarks 1.4) Development of UNIDO's guide for the implementation of ISO 50001 1.5) Post-project action plan
2. Awareness raising on industrial EE and management in industry
Outputs: 2.1) Peer-to-peer network established (to assist companies in energy management plan design and implementation) 2.2) National information campaign 2.3) Monitoring and evaluation of project achievements; and knowledge sharing
3. Capacity building for EE services
Outputs: 3.1) Energy management training provided 3.2) Systems optimization training provided 3.3) Vendor training provided

4. Access to finance for industrial EE improvement
Outputs: 4.1) Awareness raised on source of IEE financing and EE project financing 4.2) Support existing financial institutions and government- sponsored incentive programs in the technical evaluation of industrial energy efficiency projects
5. Implementation of energy management systems and system optimization
Outputs: 5.1) Energy management plans formulated and implemented 5.2) Industrial systems assessed and demonstration of system optimization projects

SOURCE: INDEPENDENT TERMINAL EVALUATION INDUSTRIAL ENERGY EFFICIENCY IN EGYPT, UNIDO, DEC 2018

The project's achievements for GHG emission reductions were 358 $ktCO_2$/year; energy saved was 1,246 GWh/year and IEE investment mobilized was USD 18.46 million, this met nearly all respective targets.

7.2.3 Egypt Sustainable Energy Financing Facility Framework ("Egypt SEFF")/Egypt Green Energy Financing Facility ("Egypt GEFF")

(1) Overview of Egypt SEFF

Egypt SEFF was launched in 2015, and it was a credit line dedicated to energy efficiency and renewable energy investments in Egypt. The credit line was developed by the European Bank for Reconstruction and Development (EBRD) and is available to clients in Egypt through the National Bank of Egypt (NBE). The credit line of USD 30 million offers an attractive financing package, consisting of commercial loans with a repayment period of up to five years, free technical assistance and investment incentive grants (depending on the loan and project conditions).

(2) Overview of Egypt GEFF

The GEFF program operates through a network of more than 130 local financial institutions across 24 countries supported by almost EUR 4 billion of EBRD finance. Egypt GEFF has €140 million available to finance energy efficiency and small-scale renewable energy investments. GEFF operates locally through participating banks such as QNB ALAHLI, ALEXBANK, and National Bank of Egypt.

Types of eligible beneficiaries:

- Businesses that undertake eligible projects on their own behalf
- Service providers implementing eligible projects on behalf of any individual or entity that satisfies the criteria for an eligible beneficiary
- Vendors of equipment listed in the technology selector
- Energy Service Companies (ESCOs): providing third-party financing
- Producers of equipment listed in the technology selector

Maximum financing amounts and other conditions depend of the type of company and project. A brief summary is provided below.

Table 7.9 Maximum financing amounts and other conditions

Maximum financing amounts	Project type
Up to USD 300,000	For small and clearly defined projects that comprise high-performing equipment and materials from the technology selector
Up to USD 5 million	For larger energy efficiency and renewable energy projects (up to USD 15 million investment), where GEFF team can provide advice
Up to USD 4.5 million (or up to 30% of eligible construction costs)	For commercial building construction projects that meet high standards of energy performance, quality and health & safety standards
Up to USD 2 million	For supply-chain developments for energy efficient or renewable energy technologies to help meet growing demand. Contact the GEFF team for more information on eligible supplier and vendor finance schemes.

Source: GEFF

The GEFF website provides a "Technology Selector," an online tool to identify the most suitable high-performing equipment and materials eligible for GEFF financing.

Egypt GEFF Technology Selector provides a list of high-performing technologies and materials by area of use (industry, agriculture, building), by type of saving (energy, water, soil erosion), by technology and by manufactures. For example, there are 23,013 technologies and materials listed in the energy sector.

Table 7.10 Type of High-performing technologies and materials for energy sector

CATEGORY	NUMBER
Windows & doors	4,456
Insulation	3,505
Boilers	4,185
Heat pumps	1.280
Power & cogeneration	2,246
Cooling	403
Motors & pumps	1,242
Process technologies	1,199
Transport	1,321
Domestic Appliances	1,069
Lighting	2,107

SOURCE: GEFF, WWW.EBRDGEFF.COM/EGYPT

7.2.4 The Egyptian Pollution Abatement Program (EPAP II &EPAPIII)

The Egyptian Pollution Abatement Program (EPAP) is major initiative of the Ministry of Environment/Egyptian Environmental Affairs Agency (EEAA) to help the industries to improve their performance and comply with the corresponding environmental regulations.

EPAP was created with the goal to decrease pollution in project hot spots and thereby improve local and global environmental conditions, by enabling private and public sector industrial enterprises to invest in pollution abatement measures. The project supported the application of suitable enforcement approaches,

inspection activities and the development of technical capacity in environmental institutions and participating banks. The project also helps improve public information, awareness and activities related to industrial environmental affairs in Egypt, particularly in Alexandria and Greater Cairo and to strengthen the capabilities in the fields of monitoring follow-up and implementation.

The Egyptian Pollution Abatement Program Phase I (EPAP I) consisted of soft loans for industrial enterprises and technical assistance. It was jointly implemented among Government of Egypt (EEAA), World Bank (WB), European Investment Bank (EIB), European Union (EU), and Government of Finland over the period from 1997 until 2005.

The EPAP II (2007-2015) was jointly implemented among the Government of Egypt, World Bank (WB), European Investment Bank (EIB), European Union (EU), Government of Finland, and JICA.

The EPAP III (2015-2020) also provided a package of loans and grants totaling 145 million euros, supported by the European Investment Bank (EIB), the French Development Agency (AFD), KFW Development Bank, the European Union (EU) and the Government of Egypt.

Table 7.11 Outlines of the EPAP II (2007-2015)

Item	Description
Overview	The Egyptian Pollution Abatement Program is a major initiative of the Ministry of Environment to help industry improve performance and comply with environmental regulations. The eligible industries in Greater Cairo and Alexandria can take advantage of funds available through the Egyptian Pollution Abatement Project (EPAP II) while those in Upper and Lower Egypt can apply for funding through the Private Public Sector Industry Project (PPSI).
Financiers	**Investment Component (soft financing packages)** European Investment Bank 40 million euro French Development Agency 40 million euro Japan Bank for International Cooperation[40] 4.7 billion yen World Bank 20 million US$ **Technical Assistance Component (Institutional and technical support)** European Investment Bank 3 million euro Government of Finland 0.9 million euro Government of Egypt 17.5 million LE
Sub-projects	**Eligible sub-projects** Funding is available for industrial activities in Greater Cairo and Alexandria. Companies applying must be credit worthy. Projects should: a) comply with Egyptian environmental law b) decrease pollution loads by 50% c) be technically and economically feasible; and d) fall under the following areas • End of pipe treatment for air emissions and waste water • In-process modifications and cleaner technologies • Work environment • Energy conservation and conversion to cleaner fuels • Hazardous waste management • Environmental services Civil works and projects with substantial production increases are not eligible for EPAP financing
Loan and Grant Facility	For MSEA approved projects funding can be obtained through the National Bank of Egypt or one of their approved participating banks based on: Loan: Up to 90% of project investment costs with a maximum loan of US$15 million and a minimum loan of US$100,000. Grant: 20% of loan for projects achieving environmental objectives. Interest: Foreign loans: 2% above Libor/Euribor for 6 months plus 0.1% monthly on highest debit balance Local currency: 12% annually plus 1.5% monthly commission on highest debit balance. Repayment: 5-8 years with 1-2 years grace period
Responsibilities of Sub-borrowers	Borrowers should, in accordance with guidelines available from MSEA: a. Prepare environmental assessment of project. b. Submit compliance action plan for the entire facility for EEAA approval. c. Prepare technical feasibility. d. Undertake procurement following EPAP requirements. Enter into an MSEA technical agreement on environmental objectives, monitoring and implementation.

SOURCE: MINISTRY OF ENVIRONMENT, EGYPT. HTTP://INDUSTRY.EEAA.GOV.EG

[40] It seems that it indicates JICA.

Table 7.12 Credit Condition of the EPAP III (2015-2020)

Eligibility Criteria	1. Address one of the following: • Treatment of air emissions and wastewater • In-process modifications and cleaner production • Industrial solid waste management (at facility only) • Work environment 2. Move from non-compliance to regulatory compliance with respect to the target pollutant being addressed by the project. 3. Decrease pollution loads by >50% percent of at least one target pollutant of priority to the enterprise. Not applicable to work environment projects. 4. Be technically and environmentally feasible. 5. Be implemented in an industrial facility that has been operating for more than 5 years. 6. Have a pay-back period of more than 2 years.
Project Eligible Cost (PEC):	Up to 90 % of project investment costs with a maximum loan of EUR15 million and a minimum loan of EUR 200,000.
Grant:	20% of PEC for financially nonviable projects achieving environmental objectives. 10% of PEC for financially viable projects achieving environmental objectives.
Loan:	About 90% of the PEC for financially non-viable projects. 100% of the PEC for financially viable projects.
Interest rate:	Foreign loans: Libor/Euribor 6 months + 2.3%, plus up to 1% (one per mill) monthly commission on highest debit balance. Local Currency: Lending corridor +1-2%, plus up to 1% (one per mill) monthly commission on highest debit balance
Grace period:	1- 2 years
Loan repayment period:	5- 8 years
Maximum financing for project:	EUR 15 million or equivalent
Minimum financing for project	EUR 0.2 million or equivalent
EPAP III banks:	Apex Bank: National Bank of Egypt (NBE) Participating Banks: QNB, CIB, IDBE

SOURCE: MINISTRY OF ENVIRONMENT

Chapter. 8 Recommendations on issues & lessons in promoting EEC in Egypt

8.1 Addressing the issues and lessons learned in promoting EEC in Egypt

When designing or proposing any kind of public or international finance supporting measures for EEC promotion in Egypt, three factors should be considered. First, considerations on setting targets should respect the potential funding needs and the possible mechanisms to realize the financing. Second, discussion continues to examinations of the potential needs and possible delivery mechanisms for financing needs by proposing financing schemes in the market. Third, discussions conclude with recommendations on the resources required to better deliver the financing services and obtain effective outcomes.

8.2 Proposal for concessional loans for EEC in buildings

In light of lessons learned, based on information on Egypt's energy-saving promotion policies, the status of energy conservation promotion by the public and private sectors, and initiatives by other donors, the potential technologies and materials have been listed, which may be effective to promote EEC in the introduction of concessional loans in Egypt. At that time, among the numerous candidate technologies and materials, those that are relatively small in scale and widely used in businesses have been selected as particularly suitable for dissemination in the concessional two-step loan scheme.

As mentioned in Chapter 4, primary energy consumption in Egypt is overwhelmingly electricity in the residential, industrial, commercial and business sectors. In particular, the introduction of efficient cooling and LED lighting will greatly contribute to the reduction of power consumption in residential, industrial, commercial and business facilities. In light of this situation, representative technologies and materials that are considered to be the most effective to promote EEC in Egypt are listed below.

Table 8.1 Target technologies/equipment for EEC concessional loans

EEC technology	Space cooling	Lighting	Energy Management (EMS)	Ancillary works
Present condition in Egypt	Penetration of inverter equipment is still quite low	Mainly fluorescent lamps but LED is gradually spreading	Systems are still quite rare	Ducts, piping, electrical works and control systems, etc.
Target tech/ equipment	Inverter equipped space cooling (room AC, VRF, chiller), absorption chiller with heat recovery	LED lighting	Energy management systems	Same as above

SOURCE: JICA SURVEY TEAM

As described in previous chapters, other development partners have supported the power/energy sectors via various initiatives, some with financing facilities to promote renewables or energy efficiency. To avoid duplication and to differentiate the proposed program, its scope should be narrowed and focused on a simple and clear program component. To narrow the scope, energy efficiency potential must be assessed. Building space cooling is highlighted, as this consumes 10% of Egypt’s primary energy. From a financial point of view, some other programs focused on credit lines for MSME in order to overcome their difficulties in accessing finance. As MSME financial needs are still left unfilled, focus on MSME is recommended.

Chapter. 9 Needs analysis for EEC

9.1 The need for and suitability of EEC promotion in Egypt

The critical necessity of demand-side EEC promotion in Egypt is increasing due to several factors. First, the government launched energy schemes such as SDS2030 & ISES2035 that cite EEC as a key component. Plus, electricity tariff reform is underway and the electricity law has been enacted. So, now that the legislative infrastructure to promote EEC is in place, implementation becomes the challenge. Second, such policy strategies have been enhanced the government's increased commitment to climate change mitigation actions. Directions for climate change mitigation were stipulated in recent policy documents such as NCCS-2050 and the updated NDC, which highlights the importance of demand-side EEC as a key measure to reduce CO_2 emissions. Third, given the recent global energy situation and natural gas price spike, the government decided to reduce use of natural gas in power plants and allocate it for export. This leads to additional pressure to cut electricity consumption, i.e., to promote demand-side EEC. Lastly, with the gradual ending of power subsidies, as electricity rates rise, so too do the financial benefits of energy efficient technologies. All these factors combine to heighten the need for EEC promotion in Egypt.

9.2 Significance of Japan's support

9.2.1 Significance and need for JICA's financial support

High-efficiency air conditioning equipment is still quite rare in Egypt, and conventional, low-efficiency air conditioners are prevalent, especially in older buildings. Plus, for new buildings, since high-efficiency air conditioners are most costly than conventional ones, many end-users choose the less expensive option. Although the higher price of a high-efficiency air conditioner can be recouped through electricity savings over its lifetime, the economic benefits are not fully understood by end users. So, they choose a slightly cheaper initial investment. But with concessional loans, offered mainly at low interest rates, is expected that high-efficiency air conditioners will come to dominate the market.

Egypt's current financing programs for energy efficiency and conservation are insufficient in terms of program scale, coverage of end-users and participation of financial institutions. The program does not meet the needs of end users. But it is expected that the yen loan program can make a decisive difference.

9.2.2 Risk of crowding out private funds through JICA's provision of financial assistance

Current capital demand for energy efficiency and conservation is expected to be larger than the actual financing results and supply of funds. Although yen loans would cover only a small portion of the overall financing demand, they are expected to play a priming role in promoting the introduction of energy efficiency and conservation. As a result, financing for energy efficiency and conservation by private-sector funds is also expected to increase, and thus the risk of crowding out private-sector funds is considered low at this point.

9.2.3 Added value that Japan can provide

As mentioned, Japan's energy-saving technology is at the world's top level and highly regarded for reliability and price competitiveness. In Egypt, although some products are manufactured in cooperation with Japanese makers, and Japanese companies have established sales branches and introduced high-quality energy-saving products, in general, world-class technologies have not yet fully reached end users. So, there is great potential for Japan to contribute to strengthening efforts toward zero emissions by providing Japanese technologies that cut power use and reduce lifetime costs. In this way, Japan can make a meaningful contribution.

9.2.4 The importance and need for climate change mitigation

As climate change does not stop at national borders, it is essential for all countries to strive towards mitigation and adaptation. At the same time, many developing countries need to achieve economic development, and some of them face difficulties in implementing adequate climate change measures with the resources and capacity they have.

The responsibility of developed countries to support developing countries is stipulated in international frameworks. The United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992, aimed at stabilization of greenhouse gases in order to prevent global warming. It committed developed countries to providing financial resources, transferring technology and enhancing capacity.

Japan has been supporting developing countries in implementing climate change countermeasures. During the Leaders Event at COP 21 in Paris in 2015, the Action for Cool Earth 2.0 (ACE 2.0) was announced. In it, Japan pledged a new set of contributions to reinforce the world's strategy against climate change.

At the 2021 G7 Summit in Cornwall, Japan further committed to continuing its assistance with public and private finance totaling 6.5 trillion yen over the period from 2021 to 2025, and that Japan will further enhance its adaptation assistance to vulnerable countries.

Japan has advantageous technologies for energy conservation measures and will also contribute to technology transfer and capacity building.

9.2.5 Meaning of support from Japan

In April 2018, the Egyptian government and the EU signed an energy partnership MOU (2018 -2022)41.

The main support activities are listed below, with energy conservation policy support included in the fifth item. Specifically, this includes support for the implementation of NEEAP2 and support for the establishment of the EEU. In particular, the EU is involved in energy conservation governance as stipulated in NEEAP2, and is supporting the development of an energy efficiency and conservation governance

[41] https://ec.europa.eu/energy/sites/ener/files/documents/eu-egypt_mou.pdf

roadmap in cooperation with the EBRD and the IEA. The key is support for MOERE for data collection, statistics, energy conservation indicators, system infrastructure development, etc. that enable monitoring of the current status of energy efficiency and conservation and the status of achievement.

Chapter. 10 Direction for cooperation

10.1 JICA ODA loan assistance

10.1.1 Implementation methods and institutional setup

(1) Selection of target industries for cooperation and EEC equipment

Among the measures investigated, EEC for buildings is considered as the priority focus, as it is expected to yield the greatest benefits in a cost-effective way. In proposing support measures to promote EEC in buildings, it is possible to set targets (numbers/volume of EEC equipment) that can be introduced by the proposed financial scheme, based on market trend data in air conditioning equipment in Egypt. Target EEC equipment would include room air conditioners, chillers, VRF air conditioners, lighting and energy management systems (EMS). The requirements considered necessary to change the Egyptian market are summarized below as a list of eligible equipment list for financing (draft). By accelerating the introduction of equipment that meets this standard, it is possible to change the market to be more EEC conscious.

Table 10.1 Eligible technology/equipment list (draft)

Category		Criteria	
Space cooling	Air conditioners	1) Room air conditioners with inverter, whose EER (kW/kW) is equal or over 6.0, or whose EER ((BTU/h)/W) is equal or over 20.47.	
		2) Valiable Refrigerant Flow (VRF) air conditionaers, whose rated EER is equal or over 4.0, or whose rated EER ((BTU/h)/W) is equal or over 13.64 with inverter.	Including ducting, piping and ancillary electricity works etc.
	Chillers	1) Centrifugal chillers 2) Screw type chillers, whose rated EER (kW/kW) is equal or over 4.0 with inverter, or whose rated EER ((BTU/h)/W) is equal or over 13.64 with inverter. 3) Absorption chillers utilizing waste heat	Including the following ancillary items: (a) Air handling unit (b) Fan coil unit (FCU) (c) Chilled water pump (d) Chilled water pipe (e) Duct, dampers (f) Cooling tower (g) Cooling water pump (h) Cooling water pipe ,valves (i) Control device (j) electricity works etc.
Lighting		Lighting fixtures with LED light with 100 lm/W or more, life time: 40,000 hours or more, number of lamps is 500 or more	
Energy management system (EMS)		Building and factory energy management system, which can monotor, control or record the facility's energy consumption	Including the following ancillary items: (a) sensors (b)dampers, valves (c) electricity works etc.
Common		Related bulding construction or renovation works, which is necesaary to complete above described works can be included.	

(2) Comparative analysis of cooperation schemes

Proposed measures to save energy may be implemented with the support of a finance facility. It may be a subsidy, a preferential loan, and/or technical assistance. The combination of these supportive measures will make it convenient and accessible to all. Together with these directly contributing supportive measures, there should also be policy supports in the form of awareness-raising, training, regulation setting, etc.

Supportive measures including lending, credit risk guarantee, subsidies (including tax incentives), technical assistance and awareness-raising and policy supports are listed in the table below.

Categories 1 to 4 are measures that make use of funds, while measures 5 & 6 are non-fiscal policy supports to be implemented as administrative activities, differentiated as shaded rows. Among these listed measures, relevant, feasible and desired measures may be selected with further considerations of the actual status, and also in harmony with other ongoing and planned measures aimed at similar goals. Based on results of discussions with Egyptian authorities, appropriate measures will be selected.

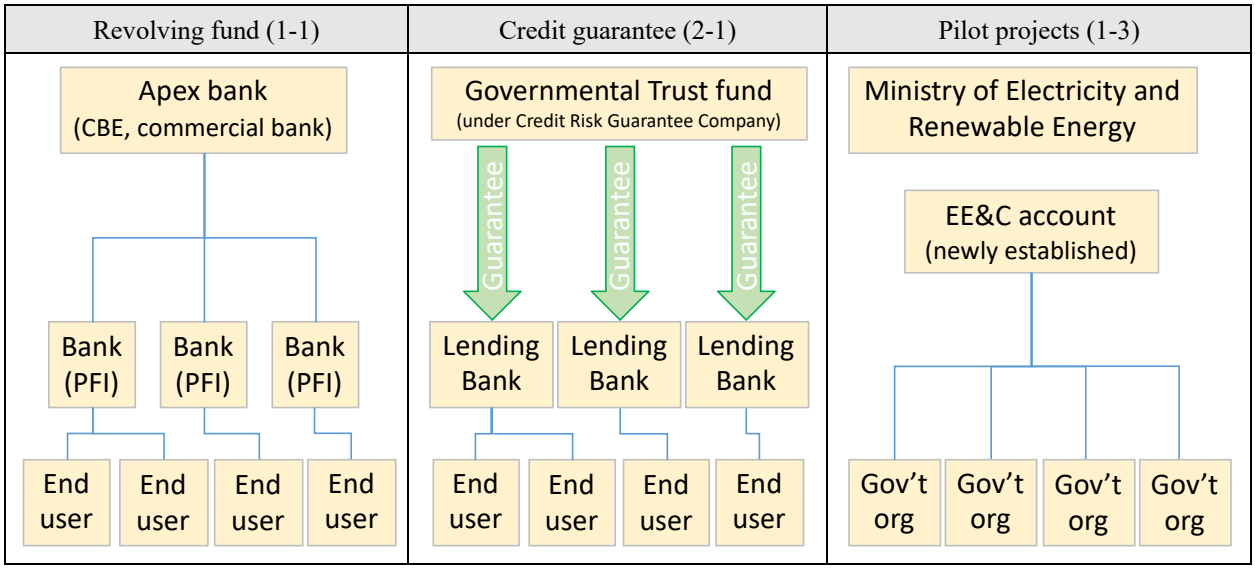
Table 10.2 EEC promotion supportive measures by category

Category	Model	Particulars
1. Loan (debt/equity)	1-1	Low interest loans (revolving fund) for EEC investment through banks
	1-2	Funding (debt/equity) super ESCO / green fund / development project
	1-3	Lending to government for pilot projects
	1-4	Topping-up existing EEC fund
2. Credit guarantee	2-1	Guarantee to cover EEC investment risks, MSME credit risks (accompanying 1-1)
3. Subsidy (grant) / tax relief	3-1	Subsidy or rebate for EEC investment
	3-2	Tax incentives or relief for specific EEC investment
	3-4	Fiscal incentives for corporate accounting against EEC investment
4. Technical assistance	4-1	Support for EEC investment plan preparation
	4-2	Support for operation & maintenance of EEC equipment / process management
	4-3	Support for monitoring and evaluation
5. Awareness-raising	5-1	Awareness among end-users, financial institutions, government officers and other experts
	5-2	Information dissemination/education for public and feedback on information gathered
	5-3	Recognition / certification of efforts / achievements
6. Policy-making	6-1	Development/integration of government policy and instruments for further EEC promotion
	6-2	Addressing business opportunity costs (e.g., penalties, mandatory savings, carbon tax and other penalties)

SOURCE: JICA SURVEY TEAM

Implementation structures focused on the flow of funds, include low-interest loan revolving funds for EEC investment through banks (1-1), EEC investment risks guarantees, MSME credit risks (2-1), and lending to government for pilot projects (1-3). These are simplified and visualized in the figure below. 1-1 is a model where funds are entrusted to an apex bank that manages the revolving fund, to be supplied

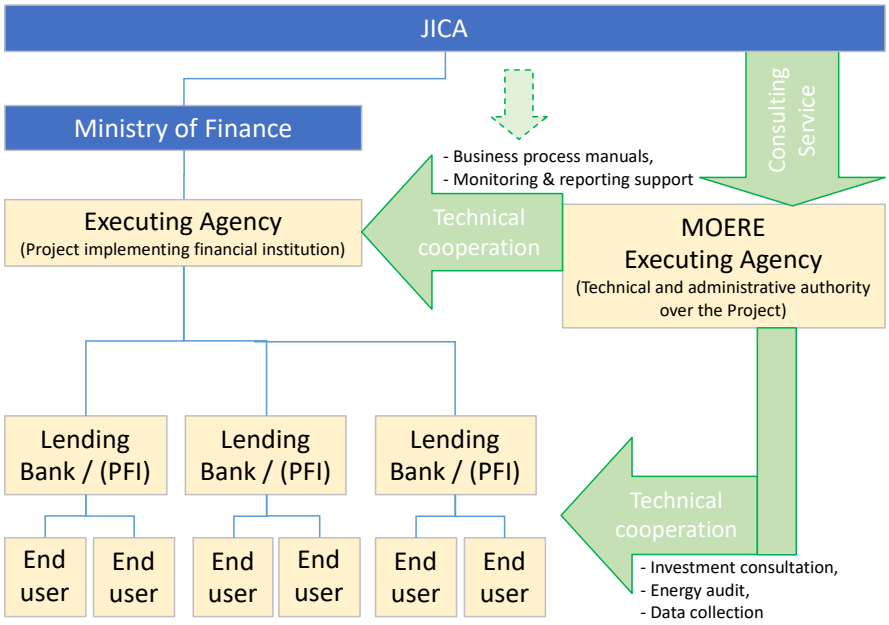
through commercial banks as participating institutions lending to the MSME (also called "two-step loan"). If CBE became the apex bank, it would follow the same structure as existing CBE initiatives, with the lowest interest rate EGP loan offered. If a commercial bank such as NBE, Banque Misr or CIB were to become the apex bank, it would be the same structure as many existing finance facilities under international development organizations such as EPAP, with loan offered in foreign currency. 2-1 is the credit risk guarantee whereby the fund is managed as a trust under CGC, with which guarantees are offered to lending banks. 1-3 is a model where the fund is managed as an alternative special budget under MOERE, to be extended for EEC promotion investments by the public sector, including ministries, state-owned enterprises, regional and municipal governments, etc.



SOURCE: JICA SURVEY TEAM

Fig. 10.1 Implementation structure for financial support measures

EEC support measures will likely be offered in a combined form. For example, low-interest loan revolving funds for EEC investment via banks (1-1), as it is, is nothing new in financial support measures. If combined with guarantees to cover investment and MSME credit risks (2-1), the revolving fund will become accessible to MSME. If the revolving fund is offered in combination with technical assistance with any of the variations among 4-1 to 4-4, the revolving fund will become open to those lacking technical knowledge. The following figure is an example of a combination of a revolving fund and technical assistance (aka "two-step loan with consulting services"). In this figure, funds flows as described in model 1-1 for a revolving fund from the apex bank (which may also become an executing agency) through participating financial institutions to the borrowers. In parallel to the financial flow, there is a technical assistance flow starting from MOERE functioning as the technical executing agency, offering technical assistance to the apex bank, participating financial institutions and also to borrowers. This combination of financial and technical assistance results in a generous support offering that should inspire more companies to become energy efficient.



SOURCE: JICA SURVEY TEAM

Fig. 10.2 Support measures with financial and technical assistance features

Based on the information gathered, and also on the discussions with the Egyptian Government, the most appropriate measures to promote EEC will be selected and combined as required so that the set goal will be achievable. See Chapter 9 of this report for a detailed explanation of the selected structure. As there is also a need to consider the resources required, brief examinations of what is required, and how such requirements can be met, is offered below.

(3) Other cooperation schemes considered

Development funds for private-sector trade and MSME promotion are already offered by international development banks and bilateral development agencies (WB, EBRD, EIB, AfDB, KfW, AFD and others) through local banks in Egypt. These are offered through mechanisms similar to JICA two-step loans but mostly in the form of other official funds (OOF), not through government-to-government arrangements. To differentiate these from existing models, the initial intention of the Egyptian Government was to make use of JICA's EEC promotion ODA loan solely for government and social sectors, not for the private sector. Based on such understanding, the initial ideas proposed by the Government of Egypt were to allocate the loan to the following governmental sector expenditures:

- Project for renovating air conditioners in government buildings: When many of government offices are relocate to the new capital, there will be a large demand for new air conditioning equipment and refits for previous buildings. Although the plan was strongly endorsed as an effective government-led measure to promote EEC on a large scale, the uncertain timing of government office relocations and building renovations emerged as constraints for JICA EEC promotion ODA loan project formulation.
- State-owned enterprises rehabilitation project: An idea was offered by Egypt's government, with the Ministry of Public Sector Businesses as proposed executing agency, to allocate JICA funding to rehabilitating large-scale state-owned enterprises that are in need for investment in their facilities.

These include: Misr Aluminium Co. (aluminum smelting), Egyptian Ferro Alloys Co. (alloy refinery), Misr Spinning and Weaving Company (Mahalla), (spinning and weaving), Kafr Al Dawar Textile Co. (spinning and weaving). The observation was that the investment amount required for rehabilitation was far in excess of the proposed JICA ODA loan for EEC promotion. It was therefore acknowledged that the JICA ODA loan can only cover a small portion of the investment, with implementation heavily dependent on availability of other investment money, which was yet to be identified.

After considering these two initial proposals, they were deemed too challenging. It was after these considerations that the financial intermediary (two-step) loan to be offered for a wider scope of private and public investments was identified as the most appropriate form of the JICA ODA loan utilization.

10.1.2 Clarification of funding needs

Specific measures to achieve EEC targets in NEEAP II have not yet been sorted out. Information collected in this survey shows that among the various EEC measures, the building sector is expected to have the greatest potential in EEC promotion, and should be the priority.

When constructing a financing scheme for building EEC, as described above, the main targets are seen as room air conditioners, chillers, VRF air conditioners, lighting and EMS. Funding needs for "space cooling" (room air conditioners, chillers, VRF air conditioners) are analyzed below.

As detailed in Chapter 5, interviews with numerous companies and manufacturers of EEC equipment have been conducted. Estimates of funding needs based on this input are described below.

(1) Room AC

As mentioned, (1) annual air conditioner sales total about 65 billion yen, and (2) about 89% of this total is for low-efficiency non-inverter types. Plus, it is estimated that (1) 50-60% energy saving is expected by exchanging conventional for inverter models, and (2) the payback from this efficient inverter air conditioner is two years or less. From this, it is estimated that potential demand for energy-saving room air conditioners is more than 50 billion yen.

(2) VRF AC

As detailed in Chapter 5, according to local interviews in April 2022, the market size of VRF air conditioners is estimated at about 7 billion yen/year, and increasing by about 10% per year as of 2022. [42] (All VRF air conditioners are equipped with efficient inverters)

(3) Chiller＋ancillaries

As detailed in Chapter 5, the market size of chillers in Egypt is about 10 billion yen per year. About 50% of this is sold by Hitachi/Johnson Controls and about 30% by Mitsubishi Electric and Daikin. By adding an appropriate inverter control function on chillers, EEC can be promoted.

[42] Daikin, including ducts and ancillary works

Financial needs for EEC equipment in the space cooling field throughout Egypt are estimated to exceed 70 billion yen per year, and over the five-year period of this project is estimated to exceed 350 billion yen/year. Of this, demand for funds by SMEs, the main target of this loan project, is expected to be about 30%[43] of the total, exceeding 100 billion yen over five years, which greatly exceeds the planned loan scale of 10 billion yen in this project.

10.1.3 Proposed cooperation scheme (including financial implementation structure)

(1) Executing agency candidates

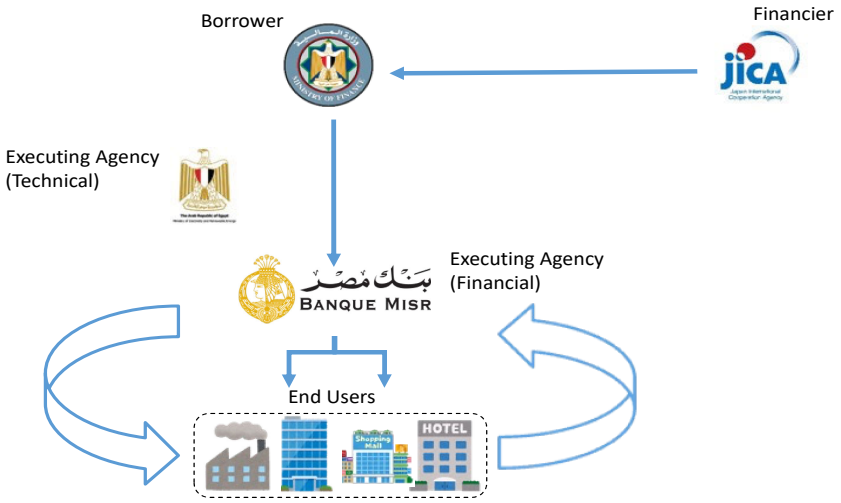
A technical executing agency should be designated to stipulate EEC technologies to be promoted. The agency should also be responsible for implementation promotion, monitoring and reporting. Considering the function of MOERE, the ministry was identified as the most appropriate authority to fill this role. And MOERE has signaled its intention to fulfill this role. Since JICA's assistance will be formulated as a two-step loan, there is also a need for a financial executing agency. Candidates include public-sector financial institutions including the CBE, which already serves as a policy financing institution. But it was concluded that CBE cannot play this role. However, two major state-owned banks, NBE and Banque Misr were proposed as candidates by the Ministry of Finance. JICA's survey team, after consultations with both state-owned banks, concluded that Banque Misr would be the most appropriate candidate, and entered into detailed discussions with the bank.

As Banque Misr has extensive national branch coverage and strong links with MSME, it was deemed capable of making the proposed assistance available to targeted end users through its own network. PFIs are therefore are not required, at least from the start of the project. However, Banque Misr prefers to leave the PFIs option open with the aim of enhancing its business relations with the other financial institutions.

(2) Implementation structure

The project's implementation structure will be based on a two executing agency model, with MOERE as technical executing agency and Banque Misr as financial executing agency. JICA ODA loan funds will be received by MOF, representing the Government of Egypt, to be channeled to Banque Misr via a subsidiary loan agreement. Banque Misr will then make the funds available to end users in the form of preferential loans. Banque Misr will open and use a revolving fund account so that funds can be used multiple times until the ODA loan repayment is due, which will be 30 years from the loan agreement between JICA and MOF. The conceptual figure below shows the implementation structure for the proposed project.

[43] Source: The Result of the 5th Economic Census 2017/18, CAPMAS. The capital ratio of small and medium-sized enterprises (SMEs) in Egypt is about 60%. Considering the subordination of purchasing power of mid-sized firms to large companies, this was assumed to be 1/2.



SOURCE: JICA SURVEY TEAM

Fig. 10.3 Implementation structure concept

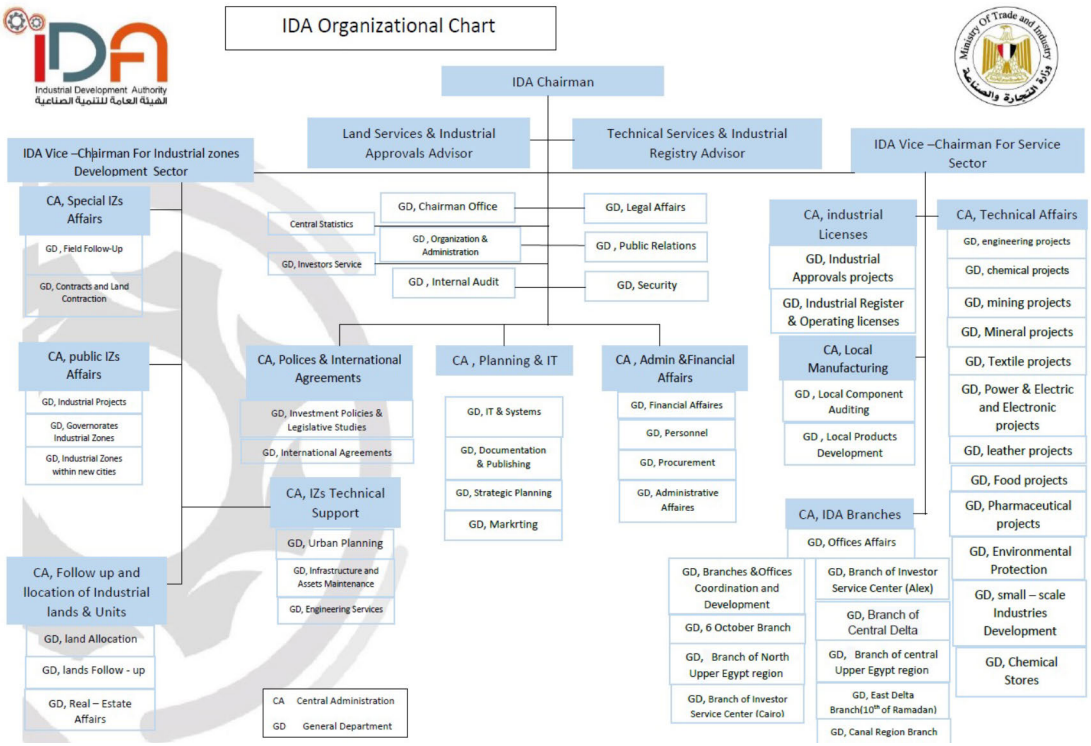
(3) Collaboration with IDA

The Industrial Development Authority (IDA), under the Ministry of Trade and Industry, is a governmental institution established in 2018. Its main responsibility is licensing industrial activities, mainly manufacturing. IDA's administrative mandate is as listed in the following table:

Table 10.3 Administrative mandate of IDA

- Studying the legislations concerning industry and setting pertinent proposal.
- Preparing industrial development studies and plans, sectoral and geographically, and following up and encouraging their implementation.
- Setting the general policies and plans necessary for developing the industrial zones, in coordination with governorates and other competent authorities.
- Decide on requests to establish industrial zones or expand existing ones and set the conditions and rules.
- Setting conditions and rules enabling the private-sector companies to establish utilize and manage industrial zones and provide areas and lands for investors, besides licensing them to set up and manage industrial zones.
- Deciding on industrial activities and products and related service activities in industrial zones in coordination with other competent government and private-sector authorities.
- Setting regulatory conditions and rules for servicing, development, and pricing of the lands of industrial zones in coordination with governorates and other government and private sector authorities.
- Setting regulatory conditions, rules of approving, licensing industrial projects, and issuing industrial licenses and registry certificates.
- Issuing and publishing books, magazines, bulletin, and brochures to promote industrial zones and projects.
- Making general policies and planning for vocational training in the industrial sector and supervising the project financed with foreign grants and loans to meet the needs of industry.
- Setting policies &mechanisms to link the needs of development and activate the use of scientific research & projects results to fulfil industrial development requirements.
- Develop industrial zones and publicize and promote them locally and internationally to increase investments in them in cooperation competent authorities.
- Provide industrial project owners and stakeholders with information, data, statistics, research, technical and survey maps they need to establish or expand a specific industry.

SOURCE: TENTATIVE TRANSLATION FROM THE ACT ESTABLISHING IDA



SOURCE: IDA

Fig. 10.4 IDA organogram

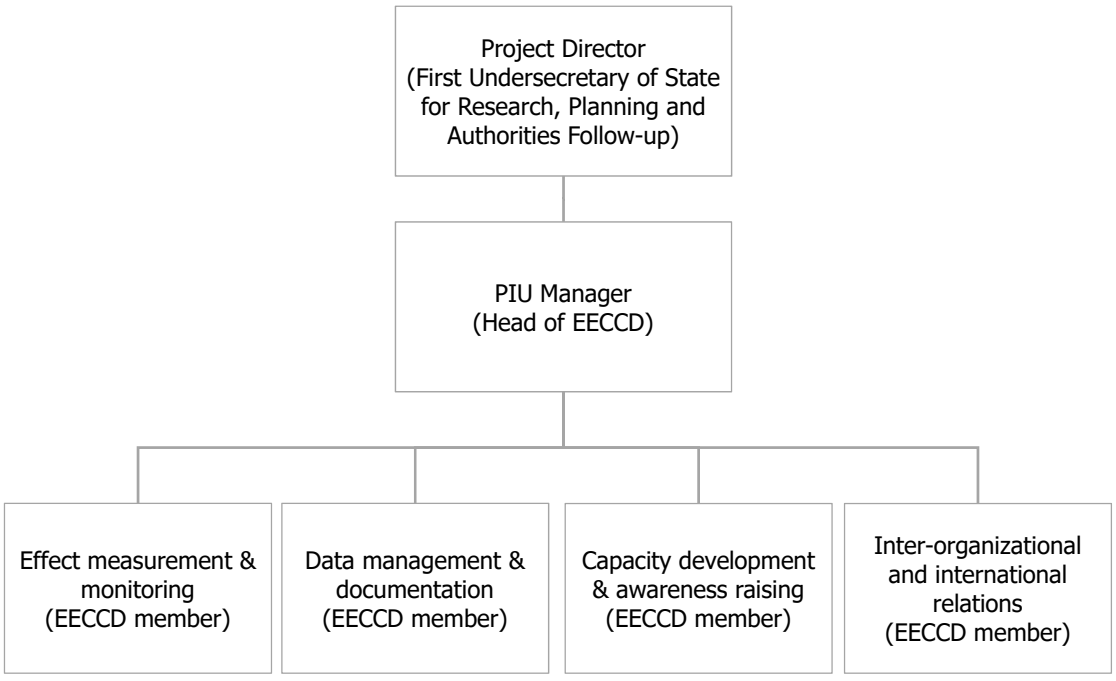
(4) Organizational arrangements for sustainable implementation of the cooperation scheme

Institutional arrangements, resources allocation and environment creation are required in both MOERE as technical executing agency and Banque Misr as financial executing agency. Such arrangements will also be required for a mechanism for continuous institutional capacity development. A Project Implementation Unit (PIU) at each executing agency should be established, not only to implement project activities but also to deal with technical advisory service rendering, awareness-raising campaigns, information management and dissemination (with database and workflow applications). The establishment of PIU Meeting for cooperation and coordination against the issues and challenges incurred during the project implementation is also recommended. Consulting services along with the ODA loan fund, as explained later in this chapter, will be required to enable these institutional arrangements.

Table 10.4 Proposed project implementation unit (PIU) at MOERE

Positions	Role	Proposed staffing	No. of staff
Project director	• Coordinate with all concerned agencies including BM. • Internal & external communications representing the project • Decision-making and managerial tasks for the project	• First Undersecretary of State for Research, Planning and Authorities follow-up	1
PIU manager	• Prepare, compile quarterly reports submitted by IFIs and submit Quarterly Progress Reports (QPRs) to JICA • Overall management of project implementation	• Head of EECCD	1
Effect measurement & monitoring	• Measuring/monitoring progress and effects of project, based on data collected from end users and the financial executing agency	• EECCD member	1
Data management & documentation	• Data management including ICT environment development • Day to day administration including reporting document preparation and document archiving.	• EECCD member	1
Capacity development & awareness raising	• Capacity assessment, gap analysis, baseline and target setting. • Capacity development action plan drafting and implementation management. • Seminars, workshops, training and publicity	• EECCD member	1
Inter-organizational and international relations	• Communications, coordination & info sharing with other EEC promotion initiatives within and outside Egypt.	• EECCD member	

SOURCE: JICA SURVEY TEAM



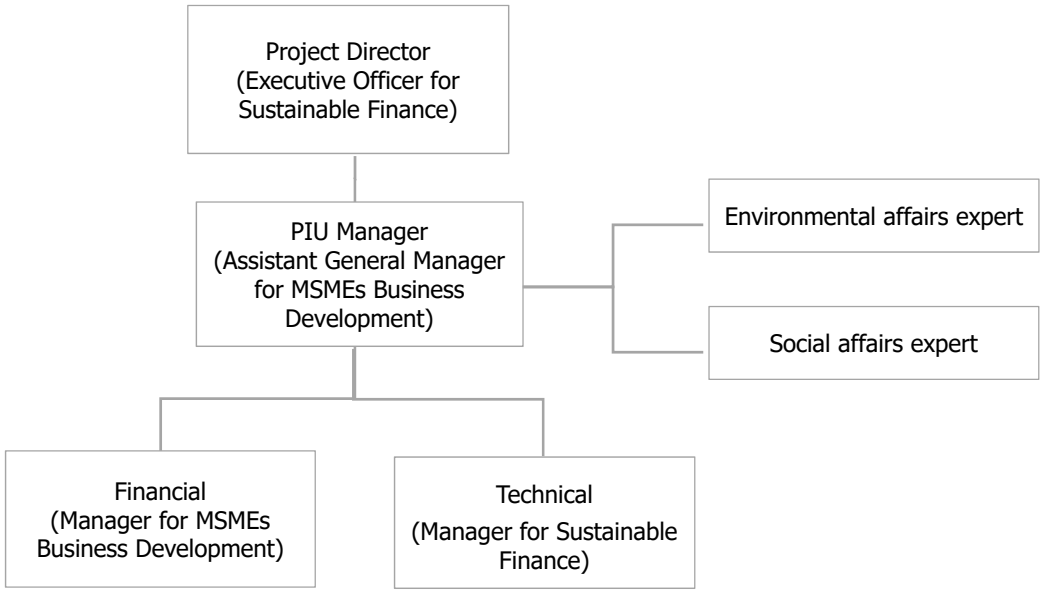
SOURCE: JICA SURVEY TEAM

Fig. 10.5 MOERE PIU Structure

Table 10.5 Proposed project implementation unit (PIU) at Banque Misr

Position	Role	Proposed staffing	No. of staff
Project director	• Interface with JICA & other international & government organizations	• Executive officer for sustainable finance	1
Manager	• Internal/external communications representing the Project • Decision-making and managerial tasks for project	• Assistant General Manager for MSME Business Development	1
Financial	• Financial appraisal responsibility • Fund management • Marketing and promotions • Preparation of reports	• Manager for MSME Business Development	1
Technical	• Technical aspect appraisal responsibility • Capacity development • Effect monitoring • Preparation of reports	• Manager for Sustainable Finance	1
Compliance (environmental & social)	• Responsible for ESPR preparation and routine sub-project checking during D/D • ESMS maintenance/improvement • Environmental & social considerations checklist	• Environmental affairs expert • Social affairs expert	2

SOURCE: JICA SURVEY TEAM



SOURCE: JICA SURVEY TEAM

Fig. 10.6 Banque Misr PIU Structure

Table 10.6 Proposed PIU Meeting

Tasks	• To monitor the implementation status • To report to SC on any problem or challenges
Chairperson	• PD of MOERE PIU
Member	• MOERE PIU • BM PIU • Observer(s) from JICA as required
Meetings	• Anytime required

SOURCE: JICA SURVEY TEAM

10.1.4 Lending structure and conditions

(1) Structural arrangements for transactions among stakeholders

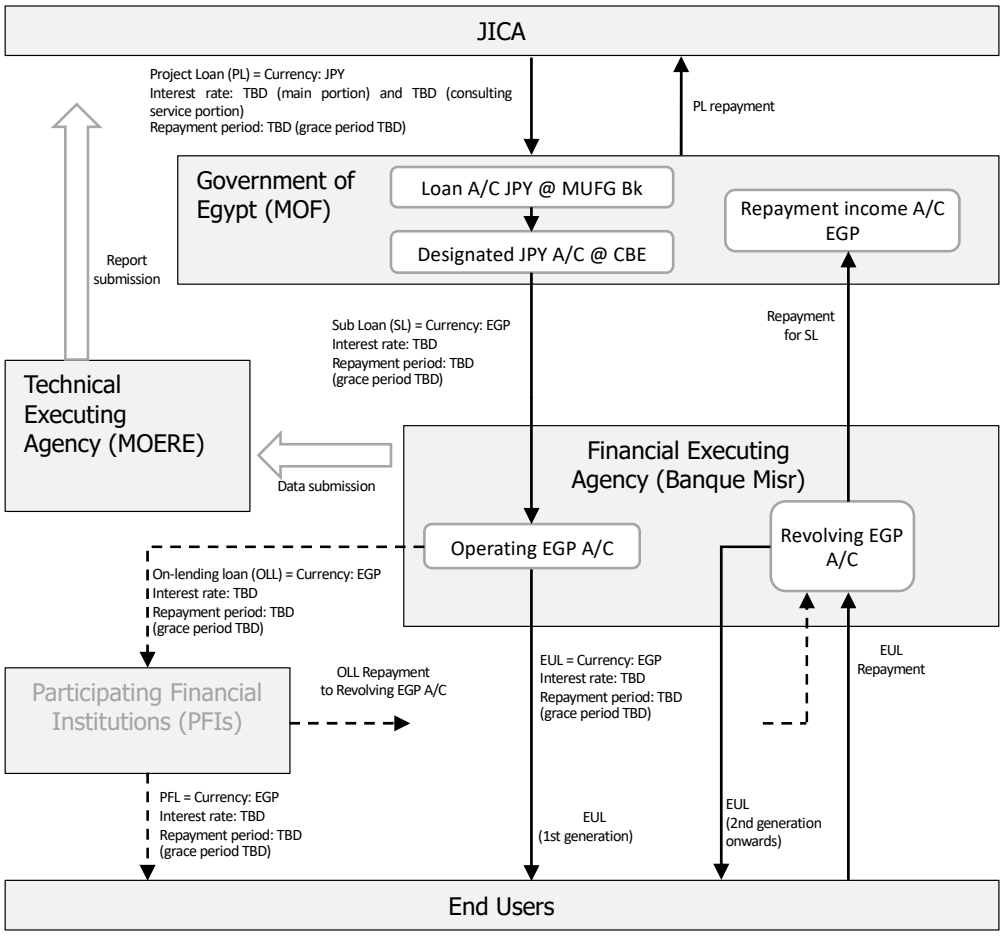
Key role players in the project are MOF (borrower), MOERE (technical executing agency), Banque Misr (financial executing agency), PFIs (optional, as required) and JICA as the financier. The expected roles of each player are summarized in the table below. MOERE is also expected to function as administrative authority in the project, responsible for submitting quarterly monitoring reports to JICA, by compiling inputs from Banque Misr with its own reports. This role definition may also contribute to strengthening MOERE's ownership for the project.

Table 10.7 Roles & responsibilities among relevant organizations

Stakeholder	Roles & responsibilities
Ministry of Finance: MOF	• Borrower of ODA loan fund • Receive, manage and pay back ODA loan fund.
Ministry of Electricity & Renewable Energy: MOERE (Technical executing agency)	• Set criteria on technical eligibility for the fund. • Promote fund utilization through awareness-raising campaigns, seminars, workshops, investment consultations and other activities. • Monitor and report energy saving potentials and effects realized through EEECP. • Publicize EEECP achievements nationally and globally. • Submit quarterly progress and annual reports to JICA by compiling monitoring status information from its own analysis and from Banque Misr.
Banque Misr (financial executing agency)	• Make fund available to end users for investment in energy efficient space cooling based on business process manual. • Collect repayments from end users to be made available for succeeding generations of the project loan. • Appoint PFIs to extend loan to wider scope of end users as required. • Submit quarterly status report to JICA via MOERE or as required.
PFIs (optional)	• Offer loan to the end-users at preferential terms stipulated in the business process manuals for PFIs.
End users	• Invest in energy efficient buildings, repay loan on maturity, make energy consumption data available to MOERE.
JICA	• Offer ODA loan to GoE at preferential terms for lower middle-income countries. • Extend comprehensive technical assistance and consulting services to MOERE, CBE (also to other stakeholders indirectly) for implementation promotion and capacity development.

SOURCE: JICA SURVEY TEAM

The relations, fund flows, report submissions and other transactions among key project role players is shown below, along with features where banking arrangements are made as required in the advance transfer method and the use of revolving funds. Funds flow, in principle, from JICA to MOF, then onto Banque Misr to be made available to end users. Appointing PFIs is left optional for future requirements. The revolving fund will be under the management of Banque Misr, while PFIs function as the agents for the financial executing agency. Implementation progress reporting will be from Banque Misr on a quarterly basis, compiled by MOERE, then submitted to JICA.



SOURCE: JICA SURVEY TEAM

Fig. 10.7 Lending structure

(2) Terms & conditions of the end-user loan

The key factor the project's effectiveness is the attractiveness of the end-user loan. As the project does not possess a grant-funding source, the only way to improve the end-user loan's attractiveness is to offer low-interest, long-tenure loans. The project loan may be referred to terms and conditions of the existing CBE Initiatives, Egypt's existing policy financing instruments as follow.

- Interest rate = 5% (additional rate, up to 3% may be applicable considering end users' credit risk
- Loan tenure = longest possible options (3 years for MSME with respect to existing products)
- Grace period = first year(s) of tenure (1 year for MSME with respect to existing products)

However, CBE Initiative for MSME is going to be terminated in the near future. In case that it is not possible to apply the same terms and conditions of CBE Initiative to the project, the preferable terms and conditions to the market should be achieved.

(3) Setting up revolving fund account & options for incentivizing

The mechanism for this project requires repayments collected from end users to be credited to the revolving fund account held by the financial executing agency. It will then be used for succeeding generations of the end-user loans. It will be until an amount equivalent to 50% of total fund received by the financial executing agency as subsidiary loans that the JICA reporting requirement will remain.

Existing financial intermediary loans for environmental purposes available from various banks in Egypt, mostly offer either technical advisory (as with green finance facilities) and/or grant portion (with GEFF and EPAP) as incentives. JICA's ODA loan does not, however, have any option for a grant portion. The only available way to incentivize end users is to offer them technical advisory services by making use of the consulting service accompanying the ODA loan. So, the consulting service specification to include such extensive end-user-support activities becomes essential in making this JICA ODA loan product attractive.

(4) Relation with energy efficiency fund stipulated in NEEAP II

The proposed JICA ODA loan project will be introduced prior to the realization of the Energy Efficiency Fund (EEF), one of the major actions to be taken by MOERE in NEEAP II. As of today, there is no information on the operational structure and procedures for the fund's utilization. Once EEF mobilization starts at MOERE, JICA's ODA loan project should coordinate to maintain good linkages with EEF.

(5) PFI selection criteria and process

Initially, no PFIs will be involved in the project. But once it has some implementation experience, the financial executing agency may prefer to introduce the PFI channel option with the aim to enhance its financial institutions network. At that stage the PFI selection criteria and process will be considered.

10.1.5 Implementation capacity

(1) Capacity to appraise eligibility in lending

Appraisal of eligibility for loans will be based on a list of eligible technology and equipment to be prepared by MOERE. The list will be made so that appraisal can be done simply, on specifications basis. This will enable appraisals to be done even at bank branches where technical expertise is unavailable. Furthermore, the list will be accompanied by a business process manual (to be prepared jointly by the two executing agencies) which will enable appraisals to be made easily, transparently and traceably.

(2) Functions, responsibilities and organizational structure of IDA

As explained earlier in this chapter, IDA is mainly responsible for licensing manufacturing operations. Initially at least, this project does not intend to link up with IDA's industrial licensing scheme. But it may

be left open as an option for future consideration. MOERE requires that this project to be formulated as simply as possible with a minimum number of implementing agencies involved. Once experience is accumulated MOERE may consider further linkages with other administrative schemes.

(3) Implementation capacity of PFIs

At the start of this project, PFIs will not be appointed. But requirements for PFIs will be considered as the project progresses.

(4) Terms & conditions of end-user loans to be offered by PFIs

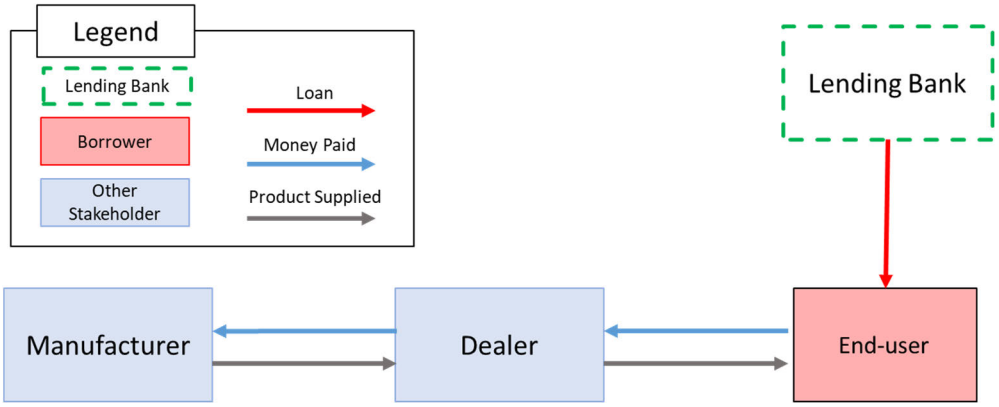
Since PFIs act as agents for the financial executing agency, loans they offer will be, in principle, identical to those directly from the financial executing agency. However, there may be cases where end-user evaluation results differ between the financial executing agency and a PFI. In such a case, loan terms and conditions might differ.

10.1.6 TSL end-user and sub-project candidates

This project envisages MSME as a major target for lending. Many Egyptian MSME are small, and many face challenges in raising funds. Among them, borrowing for capital investment in utility equipment, which is not necessarily directly related to sales, is often a lower priority than working capital or capital investment for manufacturing, which are directly related to production and sales activities. However, interviews with equipment manufacturers, wholesalers, equipment installation & construction companies, and some end users revealed several patterns in acquisition of energy-saving equipment by MSME. These can be broadly categorized as follows:

- **Case 1**: Companies doing equipment installation on a relatively large scale: When installing large air conditioning equipment, the company purchases the equipment separately and orders installation of the equipment and related work from a contractor.
- **Case 2**: SMEs installing medium-sized equipment: In this case the size of each piece of equipment is not large, but multiple pieces of equipment are installed by ordering from an installation company.
- **Case 3**: Small and micro companies: In this case the size and quantity of equipment is small, but the company purchases equipment from a distributor and orders installation.

The following tables show the assumed fund flow and equipment flow for each case and the amount of money that could be considered as a subproject.



SOURCE: JICA SURVEY TEAM

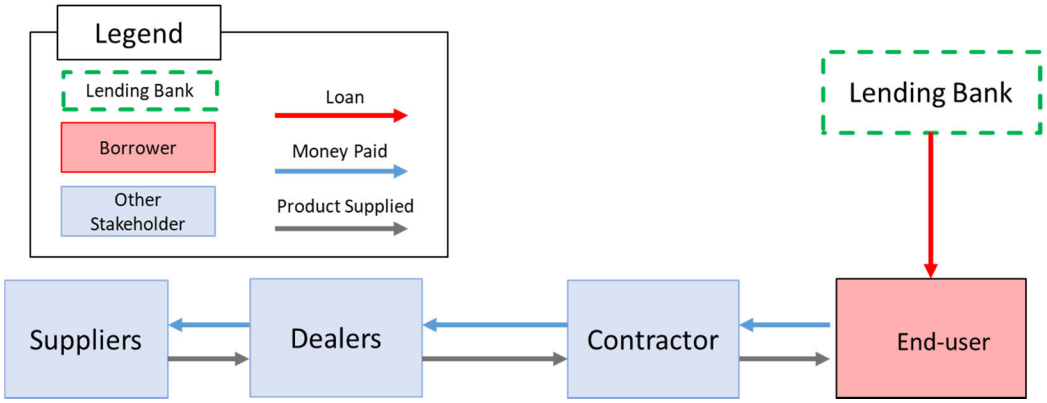
Fig. 10.8 Case 1: Companies conducting large-scale equipment installation work

Table 10.8 Cost for Case 1 enterprises (unit; EGP '000s)

#	Cost item	Formulae	Specification/ remarks	Quantity	Unit price	Amount	Remarks
(1)	EEC equipment		Chiller with inverterm 200kW	1	7,365	7,365	
(1)	Grand cost total					7,365	

Exchage rate: US $1.00 = EGP 18.4121 (as of 2022 March 24; https://www.oanda.com/currency-converter/ja/?from=USD&to=EGP&amount=1)

SOURCE: JICA SURVEY TEAM



SOURCE: JICA SURVEY TEAM

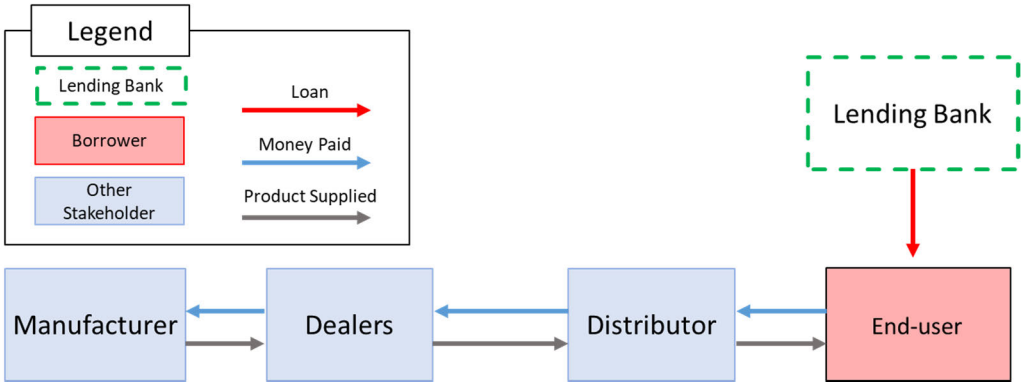
Fig. 10.9 Case 2: SMEs installing medium-sized equipment

Table 10.9 Cost for Case 2 enterprises (unit; EGP '000s)

#	Cost item	Formulae	Specification/ remarks	Quantity	Unit price	Amount	Remarks
(1)	EEC equipment		VRF 10kW	20	368	7,365	approx. 10kW for 50m2
(2)	Auxiliary equipment		other related material	1	4,419	4,419	60% of EEC equipment
(3)	Sub-total equipment	(3)=(1)+(2)				11,784	
(4)	Installation/ construction work		incl. temporary facilities	1	1,178	1,178	10% of equipment cost
(5)	Consultancy services			1	65	65	5% of total works
(6)	Grand cost total	(6)=(3)+(4)+(5)				13,027	

Exchage rate: US $1.00 = EGP 18.4121 (as of 2022 March 24; https://www.oanda.com/currency-converter/ja/?from=USD&to=EGP&amount=1)

SOURCE: JICA SURVEY TEAM



SOURCE: JICA SURVEY TEAM

Fig. 10.10 Case 3: Small and micro companies

Table 10.10 Cost for Case 3 enterprises (unit; EGP '000s)

#	Cost item	Formulae	Specification/ remarks	Quantity	Unit price	Amount	Remarks
(1)	EEC equipment		Room AC 2kW	3	37	111	
(1)	Grand cost total					111	

Exchage rate: US $1.00 = EGP 18.4121（as of 2022 March 24; https://www.oanda.com/currency-converter/ja/?from=USD&to=EGP&amount=1)

SOURCE: JICA SURVEY TEAM

The estimated loan amount for subprojects in each case is summarized in the table below. The number of subprojects were estimated based on statistics of Egypt's Central Agency for Public Mobilization and Statistics (CAPMAS). This estimation assumes an average equipment replacement interval of 20 years and a project period of 5 years and expects that 25% of companies identified by CAPMAS will be eligible for loans. Potential demand for loans is expected to be relatively large: in the next 5 years over 400 billion yen.

Table 10.11 Summary of estimated fund amount by case

(unit; EGP '000s)

	Sub-project category	# of expected sub-project	Sub-project unit cost	Total Cost
#1	Medium enterprize	3,200	7,365	23,568,000
#2	Medium/small enterprize	3,200	13,027	41,687,078
#3	Micro enterprize and residential	1,600	111	177,600
			Total Project Cost in EGP mil.	65,433
			In JPY (mil.)	481,222

*1) # of subprojects are estimated by the corporate number data in CAPMAS 2017. 25% (5 year/ 20 years) of the companies would be the target of the loan.

*2) The target of the loan would be tourism and real estate industries.

SOURCE: JICA SURVEY TEAM

10.1.7 Proposed implementation and management structure

(1) Implementation & management capacity of the financial executing agency

Since it was established in 1920, Banque Misr (BM) has been one of Egypt's leading financial institutions. The century-old bank has mainly focused on establishing companies in various fields and sectors. The BM has also been awarded "Best provider of money market funds in the Middle East" several times. BM has programs supported by donors and the list is shown in the below. Responses to COVID and gender are considered.

Table 10.12 List of Donor Funded Projects

Donor	JICA	EBRD	EIB	IFC
Project Name	Micro Enterprise Assistance Project	Green SME Loan I	Technical assistance	ZAAT (financing program supporting Egyptian women entrepreneurs)
Amount	USD 100 mil.	USD 100 mil.	TBA	TBA
Period	2022/03 -	2022/01 -	2022/07 -	2022/03 -
Description	Supporting the expansion of loans to MSME including those owned and operated by women, and contributing to Egypt's sustainable economic growth.	Based on GEFF criteria and reporting requirements in Egypt, the funds will be applied to finance investments in climate change mitigation and adaptation technologies in the industrial, commercial, transportation, and agricultural sectors by local private sector SMEs.	Further strengthen support for SMEs lending and cooperation to increase lending to firms in sectors most affected by the COVID-19.	Promoting responsiveness to women's needs, access to global best practices, and the development of sustainable business models for programs for women in banking.
Technical Assistance / Grant	None	A comprehensive technical cooperation program that provides implementation assistance to BM and its clients and verification of completed project results.	TBA	TBA

SOURCE: JICA SURVEY TEAM

The implementation capacity of BM is assessed by the following four aspects: a) Organization and capacity of management, (b) Financial stability, (c) Lending record, and (d) Future prospects.

1) Organization and capacity of management

BM is one of the top banks not only in Egypt but in North Africa. Its capital size of USD 3,414 million in 2021 ranks 2nd in Egypt after National Bank of Egypt and 4th in North Africa.

Table 10.13 North Africa's Top Banks in 2021

Rank	Name of Bank	Country	Capital ($ mil.)	Assets ($ mil.)	Net Profit ($ mil.)
1	National Bank of Egypt	**Egypt**	6,745	124,901	809
2	Attijariwafa Bank	Morocco	6,097	63,798	416
3	Banque Centrale Populaire	Morocco	4,716	49,892	144
4	**Banque Misr**	**Egypt**	**3,414**	**57,931**	**515**
5	Banque Nationale d'Algerie	Algeria	3,356	29,284	160
6	Banque Exterieure d'Algerie	Algeria	3,177	27,358	525
7	Commercial International Bank (CIB)	**Egypt**	3,160	27,189	651
8	Bank of Africa - BMCE Group	Morocco	3,059	37,274	153
9	QNB Al Ahli	**Egypt**	2,043	18,440	476
10	Credit Populaire d'Algerie	Algeria	1,989	21,085	184
11	Arab African International Bank	**Egypt**	1,738	12,017	191
12	Societe Generale Marocaine de Banques	Morocco	1,160	11,625	130
13	Banque de 'Agriculture et du Developpement Rural	Algeria	1,137	13,216	41
14	Credit Agricole du Maroc	Morocco	934	13,927	23
15	Banque du Caire	**Egypt**	923	13,143	203

SOURCE: COMPILED FROM MOODY'S ANALYTICS, AFRICAN BUSINESS, BANKERS ALMANAC, AND OTHER SOURCES.

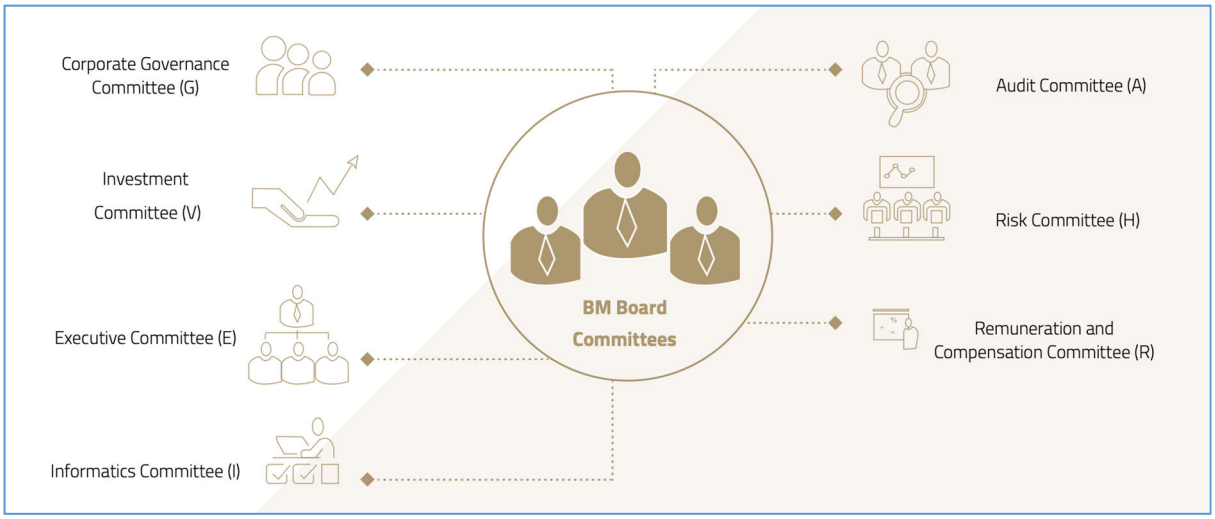
BM established a digital interface delivery arm, the Digital Factory, to re-imagine and re-invent banking in Egypt in years to come. The Digital Factory brings software developers, IT specialists, product owners, analysts and scrum masters under one roof to develop, test, design and program new, intuitive applications and products in close collaboration with BM business divisions. The factory was founded on design thinking and agile methodologies to bring products and new releases faster to the market. BM is the first Egyptian bank to offer a wide array of digital banking services through user-friendly platforms.

Corporate payment systems assist the customers and BM also provides Corporate Payment Services (CPS) to make it easier for customers to pay their taxes, tariffs, social insurance, and other government dues electronically.

BM Wallet service also allows users to deposit and withdraw cash using their mobile phones. The service enables customers to process cash transfers quickly from one mobile wallet to another. Customers can use Fawry payment services, including bill payments, top-ups, donations, and ticket payments. Customers can also receive foreign transfers and complete purchases at registered vendors. The wallet can be topped up using BM Debit, Credit, or Prepaid cards. BM is the first bank to supply Mobile Wallet customers with QR codes for electronic payment at points of sale.

The MSME Express loan is the first product launched by the digital factory and it is the first in Egypt to support small businesses to operate and grow their businesses by simplifying and accelerating access to funding with a transparent process, flexible terms, and seamless digital experience. SME Express was later added to our Islamic portfolio introducing an online Murabaha scheme based on Islamic Shariah rules with the same enhanced customer experience.

BM has a well-established organizational structure including the board committee and senior committee. The board committees comprise the following functions. The roles and responsibilities of the board committees are summarized in the following table.



SOURCE: BM. 2020. ANNUAL REPORT. P167

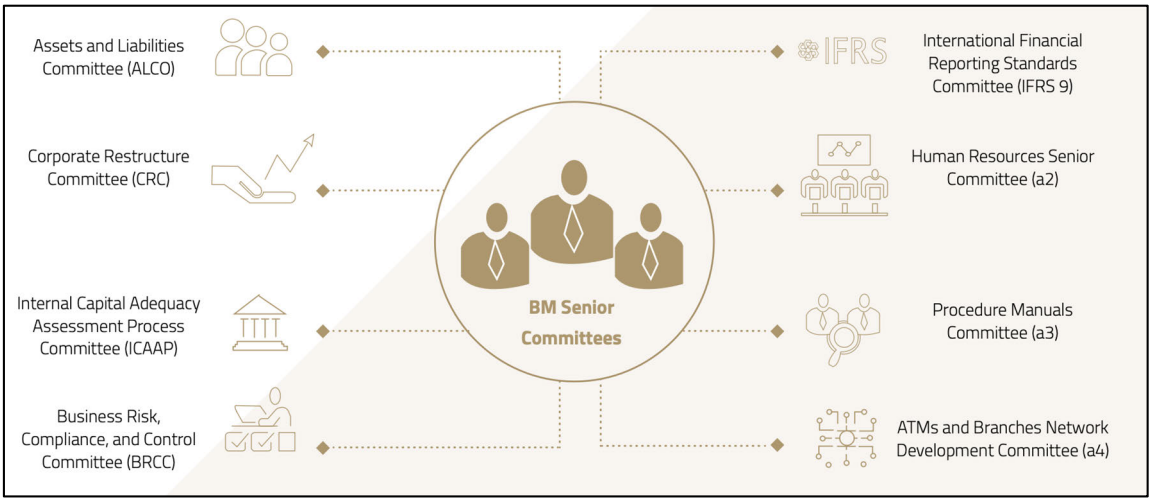
Fig. 10.11 Structure of board committees in Banque Misr

Table 10.14 Functions of the board committees in Banque Misr

No.	Committee	Function
1	Audit Committee (A)	The Audit Committee (A) is responsible for overseeing the financial reporting process, including the risks and controls in that process. The committee should supplement figures received from the Executive Management with further information and assurance from both internal and external auditors.
2	Corporate Governance Committee (G)	The Corporate Governance Committee (G) ensures strict adherence to the principles of corporate governance. The committee handles a number of responsibilities that include: Defining clear boundaries of responsibility and accountability in the bank and ensuring the clarity of rules and ensuring enforcement of applicable policies, systems and means.
3	Investment Committee (M)	Investment Committee (V) conducts assessments and monitors the bank's equity investments, corporate and securitized bond portfolio, and real estate asset disposal program.
4	Remuneration and Compensation Committee (R)	The Remuneration and Compensation Committee (R) governs and leads the decision-making process regarding Banque Misr's entire reward strategy, taking into consideration the following indicators: Egypt's gross domestic product, the most recent inflation rates and market changes in terms of reward structures in the banking sector, ensuring that BM's remuneration structure meets the standard structure adopted by its market competitors. The committee's role is to establish and maintain a competitive and equitable policy for remuneration/compensation and benefits; as this policy will, in return, enhance the entire reward strategy designed to attract, engage, and retain a professional workforce that essentially contributes to both short and long-term sustainable success.
5	Executive Committee (E)	The Executive Committee (E) oversees all aspects of retail administration, customer service, automation, new products and services, advertising, and employee training.
6	Informatic Committee (I)	The Informatics Committee (I) monitors the offered services, ensuring that all needs are being catered to, up to the highest standards, so as to maximize the bank's return on investments in the field of informatics.
7	Risk Committee (H)	The Risk Committee (H) ensures that all relevant business risks are accurately identified, that their impact has been properly assessed, and that sufficient policies and regulations have been set to effectively manage all risks. The committee assists the Board of Directors in carrying out its roles in relation to the control and supervision of the overall risk management framework at Banque Misr. Risk management represents an integral part of the banking business. BM's strategy should incorporate policies and actions the committee is willing to take for effective risk management and the means by which it will manage and mitigate any risks.

SOURCE: COMPILED FROM BM. 2020. ANNUAL REPORT.

The senior committees assume the authority and responsibility for the bank's strategic guidance while ensuring competence and diligence while undertaking their supervisory responsibilities to assess the performance efficiency and ensure accountability.



SOURCE: BM. 2020. ANNUAL REPORT. PP175

Fig. 10.12 Structure of the senior committees in Banque Misr

The roles and responsibilities of the major senior committees are summarized in the following table:

Table 10.15 Functions of the senior committees in Banque Misr

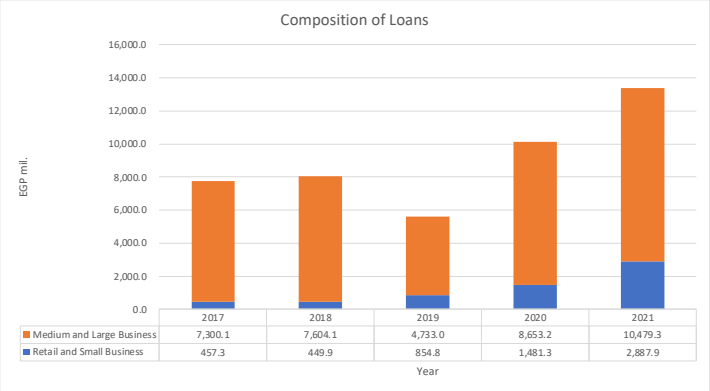
No.	Committee	Function
1	Assets and Liabilities Committee (ALCO)	Steers the assets and liability management to efficiently use the bank's resources and gain market share through better pricing of the BM products in light of the market economic conditions and risk factors. Assesses market risk activities as well as business and investment initiatives to better manage the bank's liquidity. Monitors liquidity regulatory ratios, cost of funds, and funding structure of the bank.
2	Corporate Restructure Committee (CRC)	Governs and oversees new structures, in which new manpower is requested and job leveling is reviewed for endorsement, ensuring that there is no duplication of functions and the bank's resources are fully utilized. This review can result in the approval, boundary change, reallocation, merger, or rejection of business proposals, based on the bank's strategic direction aligned with modeling the best applied practices in the peer group.
3	Internal Capital Adequacy Assessment Process Committee (ICAAP)	Responsible for the bank's Internal Capital Adequacy Assessment Process (ICAAP). The ICAAP was formed as a result of Pillar 2 of the Basel II accords, which targets a better quality of regulatory capital, along with better risk management and supervision. The committee is responsible for coordinating and implementing a comprehensive vision for all the bank's divisions, to implement the Internal Capital Adequacy Assessment.
4	International Financial Reporting Standards Committee (IFRS 9)	Implements new financial instruments through developing an action plan, follows up on implementation in accordance with the adopted timeline and ensures the bank's compliance with the Central Bank of Egypt's guidelines in this regard. IFRS 9 introduces new requirements on how an entity should classify, measure and reflect impairments to financial instruments.

No.	Committee	Function
5	Business Risk, Compliance & Control Committee (BRCC)	The committee aims at developing, reviewing, and overseeing the bank's compliance strategy and its consistency with BM's evolving plans and adopted policies. The committee monitors high risks, concentrations or exposures, and recommends reform procedures. The committee also evaluates mitigation procedures and ensures that inherent risks are controlled effectively within the scheduled timeline.
6	Senior Management Committee (a1)	Under its authority and BM's credit policy, the committee control BM's funding operations, capital contributions, and credit facilities, including sovereign, economic, and service bodies.
7	Human Resources Senior Committee (a2)	Reviews and approves various HR-related policies, including and not limited to hiring, job transfers, leaves, temporary assignments, promotions, disciplinary actions, post-graduate educational support, etc. This is in addition to reviewing staffing structure and succession planning. It also reviews reports related to confirmed changes in the types of contracts for employees, from limited term contracts to permanent contracts. In addition, the committee further oversees rehiring cases, and unpaid leaves for reasons apart from childcare. It is worth highlighting that the committee does not hold any HR-related financial authority.
8	Procedure Manuals Committee (a3)	Aims to ensure the bank's compliance with and adoption of the guidelines and other procedures as referred to in all new, updated, and amended instruction manuals across all sectors and divisions.

SOURCE: COMPILED FROM BM. 2020. ANNUAL REPORT

2) Financial stability

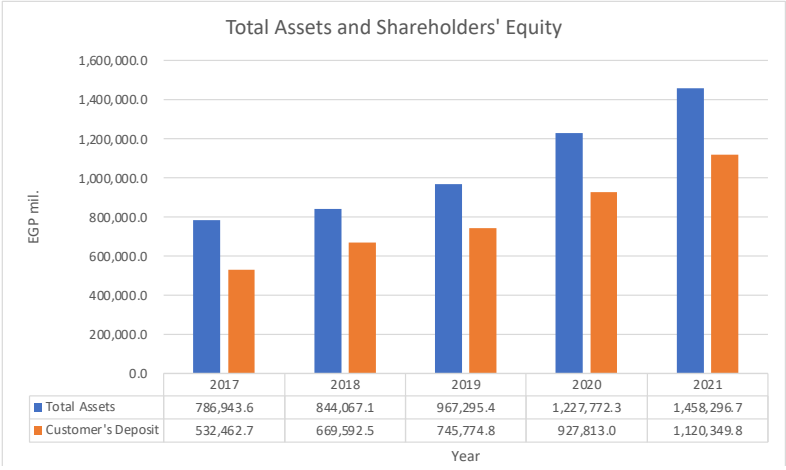
The status of end-user loans is shown for retail/small business and large/ medium business. Total loans in 2021 were about EGP 13 billion, of which medium and large business accounted for EGP 10 billion and loans for retail & small business EGP 3 billion. Total loans have been increasing except for 2019.



SOURCE: COMPILED FROM BM. 2017-2021. ANNUAL REPORT.

Fig. 10.13 Composition of loans at Banque Misr

The trend of the major items in the balance sheet is illustrated in the table below for total assets and customer deposits. Total assets and customer deposits in 2021 were EGP 1,458 billion and 1,120 billion, respectively. The figures have been steadily increasing over the past five years.



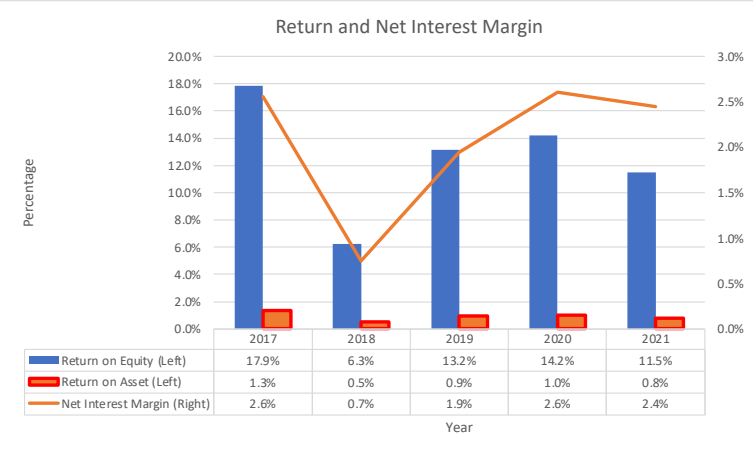
SOURCE: COMPILED FROM BM. 2017-2021. ANNUAL REPORT.

Fig. 10.14 Total assets and shareholder equity in Banque Misr

Operational performance is measured by return on equity, return on assets, and the net interest margin. The net interest margin is

calculated by dividing net interest income by average total assets. Return on equity and return on assets in 2021 were 11.5% and 0.8%, respectively. The net interest margin in 2021 was 2.4%. Those figures show the sound operation of BM although the figures may not be the best in the country.

Minimum capital requirements and minimum capital adequacy ratio are required by CBE. The capital adequacy ratio (CAR) is calculated by dividing own capital by assets and contingent liabilities (weighted by risk). The indicator shows the soundness of the capital reserve of the bank. The central bank also set the minimum requirement for the banks each year.

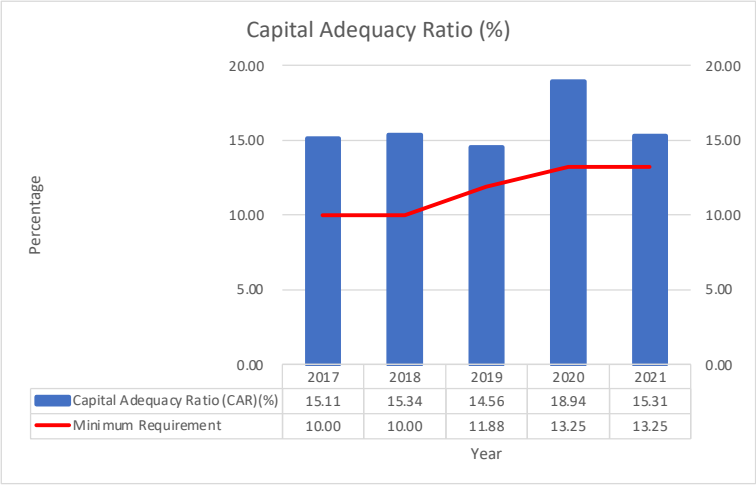


SOURCE: COMPILED FROM BM. 2017-2021. ANNUAL REPORT.

Fig. 10.15 Return and net interest margin at Banque Misr

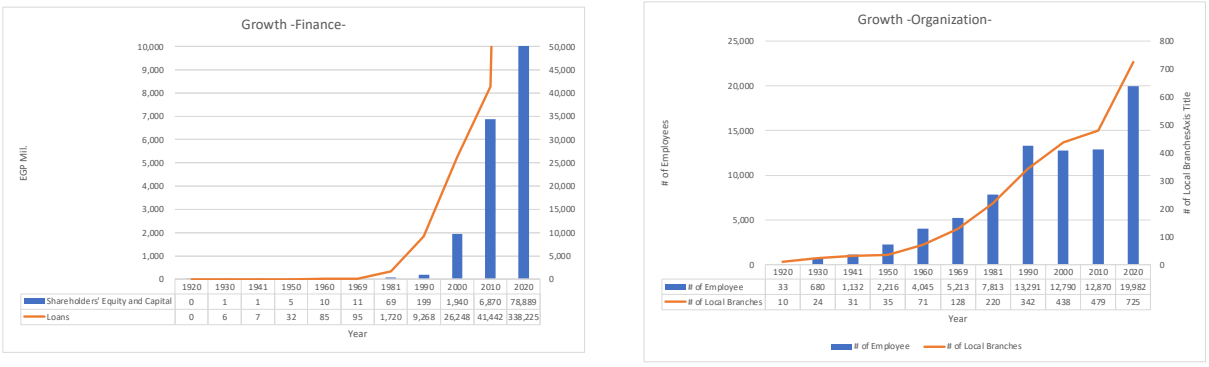
3) Lending records

The five-year trend of the performance is shown in the following chart. The CAR in 2021 is 15.31% whereas the central bank requirement is 13.25%, demonstrating that BM meets the minimum requirement. BM have not failed to meet the requirement for the past five years. The growth path of BM is illustrated in the following charts including shareholder equity, amount of loans, number of employees and the number of local branches. BM has shown significant growth in the last several decades. In particular since 2000, the lending operation has been growing.



SOURCE: COMPILED FROM BM. 2017-2021. ANNUAL REPORT.

Fig. 10.16 Capital adequacy ratio at Banque Misr



SOURCE: PREPARED BY JICA SURVEY TEAM BASED ON BM DATA.

Fig. 10.17 Growth path of Banque Misr

4) Future prospects

The IMF expected Egypt's economy to grow by 2.8% in FY 2020-2021 and 5.2% in FY 2021-2022. Given the government-led insight and timely response to the COVID-19 pandemic, the Egyptian economy achieved its pre-pandemic development levels. JP Morgan recognized Egypt as the only Middle East and Africa (MEA) country to successfully conclude the annual cycle of reviewing credit ratings and retain the confidence of the largest international credit rating agencies, including Standard & Poor's, Moody's and Fitch Ratings. According to Moody's, Egypt will remain the only MENA country to continue its pre-COVID-19 growth trend in 2021 on the back of significant government efforts to fuel demand-led growth.

BM's core mission does not solely focus on attaining financial profits but extends to sustainable development. For over a century, Banque Misr has sought to provide an array of banking services to all Egyptians. BM has been propelling economic growth through investing Egyptian savings. BM investments support Egyptian industries, generate high social returns, and contribute to private sector activity and job creation. It is therefore expected that BM would continue leading the banking sector in Egypt.

(2) Considerations for management of equipment installed under the project loan

Equipment to be introduced through support from this JICA project is mostly simple HVAC and chiller machinery which commonly operates without significant maintenance. The basic process for following up operational status of the equipment will therefore be on a document basis, with a limited number (10% for example) of on-site inspections. If the end user volunteers, operational data from the equipment may be monitored online for analysis purposes, which may also contribute to continued follow up of the equipment.

(3) High-level managerial structure – project steering committee

SC will work as a mechanism for smooth coordination between the Executing Agencies and MOF on project implementation. MOERE will provide secretarial service for the Committee.

SC is responsible for the following tasks:

- Convene regular meetings (hereafter "Annual Reporting Meetings") inviting all stakeholders to discuss the status of implementation and possible improvement of the project
- Identify problems and bottlenecks and recommend necessary corrections at policy level such as rules and regulations, taxes, etc.

SC will be comprised of the following members:

- First undersecretary, MOERE
- Executive officer, BM
- One representative from MOF
- One representative from MOIC
- One observer from JICA
- Any other person who may be deemed to be appropriate

Meetings:

- Annual Reporting Meetings, which will be convened annually, within 3 months of the end of the fiscal year. The Chairperson will instruct the secretariat to arrange and call for the meetings.
- Special meetings may be arranged on short notice with consent of the members.

(4) Disbursement procedure & documents to be prepared by financial executing agency

The project will apply the Advance Procedure for disbursements with the Statement of Expenditure (SOE) method. MOF will hold the Designated Account. Banque Misr needs to submit the financial forecast on the forthcoming two terms and SOE which proves the 70% usage of the withdrawn amount from the Designated Accounts for the next disbursements. Banque Misr shall retain the original invoices and receipts submitted from by end users. The receipts and invoices are to be inspected by Independent Auditors annually who submit an annual audit report to JICA.

Possibility of streamlining the fund disbursement procedure may be sought once Banque Misr acquires substantial experience in the procedure to find any room for improvements. Examples of improvement may be considered to realize more frequent disbursement at shorter intervals, or disbursement in mass for the ease of fund management.

(5) Risks and readiness in project operation and management

BM, as the financial executing agency, can be deemed sufficiently capable to manage the project, from the viewpoints of institutional/financial status and experience. Risks related to the operation and management of this project are likely to be with the implementation scheme design which inevitably restricts the use of end user loans to certain purposes (promotion of EEC). Underlying risks may also arise in the attractiveness of the product compared with those available from other initiatives. Once the restrictions become a burden, or, if attractiveness diminishes, demand for end-user loans may shrink. This must be anticipated as there are only limited instruments to manage the attractiveness, i.e., lending terms and technical advisory service.

To mitigate the risk of decline in demand for the project loan, there is a need for certain flexibility in the terms and conditions of the loan as well as in technical advisory services. Market trends, especially the conditions offered from various green finance facilities should be monitored closely throughout the implementation period. Based on the monitoring results, the executing agencies may make adjustments to the products offered to end users. To enable such flexibility, there may be a need for autonomy among MOF and Banque Misr on the sub-loan lending terms including interest rate and repayment conditions.

(6) Management after disbursement of end-user loans

The financial executing agency, as well as PFIs, after disbursement of the end-user fund, will continue to be responsible for ensuring correct and prompt repayment from end users. It may also be required, for the financial executing agency, and for PFIs, to have some flexibility in rescheduling or restructuring the loan repayment plan.

(7) Fund resources for operation and maintenance of the project

Three elements in resources are required for implementing public support measures to promote EEC. These are: financial means, technical expertise and implementation managerial skills. These three elements are elaborated as in the following paragraphs.

First, the funding needs for EEC promotion in Egypt is enormous, and there cannot be sufficient fund resources for this purpose. Public support measures being considered in this report will merely cover a fraction of the country's funding requirements. As the fund is short for the needs to fulfil the requirement to achieve the national target, it is essential that the available fund is utilized in the most efficient, cost-effective manner. Therefore, whether the fund is from the Egyptian Government's own sources or from international development funds, the preferable way of using the limited fund is with a revolving fund or guarantee fund, against one-off subsidy or tax relief usage. With a revolving fund and guarantee fund utilization, the fund will not be depleted, enabling the money to be utilized repeatedly.

Next, with the technical expertise required to implement EEC promotion measures, it is necessary to acknowledge that expertise on energy efficiency usually exists at a crossover point of energy use and industry process domains, and is mostly accrued through on-site experiences. An internationally recognized certification of an energy auditor/manager (preferably from a country advanced in energy efficiency) may coincide with such required skills. It is therefore necessary to have such designated experts involved in the supportive measures to be conducted.

Finally, the third point of implementation is the management skill to bridge energy efficiency technologies with the financial service knowledge. It is required to let the finance people understand the benefits and risks in EEC investment. Management should be capable of making the bankers conduct feasibility analysis on investment for EEC promotion. The manager bridging the two fields of expertise should also let the stakeholders understand the social benefit of companies becoming more energy conscious. If it were not for the bankers' understanding of EEC promotion, the fund would not likely be mobilized and the project would fail to reach its goal. Implementation managerial skill requires engineers, bankers, government officials and business people reach a common understanding to achieve their common target.

Table 10.16 Three resources for EEC promotion measures

	Funding	Technical expertise	Implementation management
Requirements	• Sufficient funding should be provided to fill the gap between the costs of energy efficient equipment / process and conventional ones.	• EEC investment project design • EEC investment evaluation • Energy saving calculation, monitoring and reporting	• Sharing with stakeholders, understanding of significance, risks/benefits of EEC investment • Risk assessment of EEC promotion activities.
Points to be considered	• Fund need to promote EEC in Egypt is enormous. Available funds must be utilized in most efficient manner, not given away. • Revolving fund and trust fund are probably most appropriate way of using available money, regardless of the source.	• Internationally recognized certification of energy management / audit, preferably of advanced energy efficient country is desired. • Egyptian experts (government engineers, specialized consultants, etc.) should be assigned to ensure technical expertise is transferred.	• Reciprocal understanding between the financial and technical stakeholders is essential. • Managerial skills will be useful for the financial institutions to further design and introduce environmentally and socially friendly finance facilities.

SOURCE: JICA SURVEY TEAM

These three resource elements to enable public support measures for EEC promotion should be secured without omission. The Egyptian Government may seek these resources within the context of capacity development for sustainability in energy, industry and finance sectors. International organizations, banks and bilateral development cooperation organizations can offer these resources together as a package of financial and technical assistance. By obtaining these three elements of resources, the Egyptian Government can reinforce its EEC promotion policies and activities, making a significant difference.

(8) Anti-corruption measures

A JICA-standard format anti-corruption monitoring sheet will be filed by both financial and technical executing agencies. The use of this monitoring sheet will not only be a preventive tool against corruption but may also become effective for better understanding of recommended processes and practices.

10.1.8 Analysis of effects of proposed loan scheme and project monitoring

(1) Macro analysis (national benefit)

Table 10.17 shows the results of estimating energy conservation, CO_2 reduction, and economic effects of promoting EEC investment "at the national level," assuming a loan size of 9.6 billion yen[44] under the current plan. In the estimate of economic effects, savings in electricity consumption are evaluated as a reduction in gas consumption as fuel. And the economic effect is calculated as the total of reduced gas value (the international gas market price) and CO_2 market price (the EU-ETS market price).

[44] Total loan amount: 10 billion yen, Excluding in-direct expense, then 9.6 billion yen for pure loan

Conditions of calculation

1. Introduction of efficient room air conditioners, VRF air conditioners, chillers, lighting fixtures, EMS, and peripheral auxiliary equipment for SMEs (lighting fixtures and EMSs are excluded from the calculation because the composition ratio is assumed to be small.)
2. The period of effect estimation is 7 years (project period) and 15 years (lifetime of energy-saving equipment) two types.
3. The investment amount includes the amount of construction-related work in the renovation work.
4. The period of covered by the estimation of effects is assumed to be the lifetime of energy-saving equipment of 15 years.
5. Grid electricity CO_2 emission factor: 0.458 ㎏-kWh
6. Grid electricity primary energy conversion factor: 0.352 (1toe=11.63MWh)
7. Conversion: 2.5E-08 toe = 1 Btu
8. Natural gas prices: EU Prices over past 5 years: USD 11.5/Mbt
   Source: IEA Natural gas report
9. CO_2 price: Average EU ETS price over past 5 years: USD 36/t-CO_2
   Source: https://sandbag.be/index.php/carbon-price-viewer/

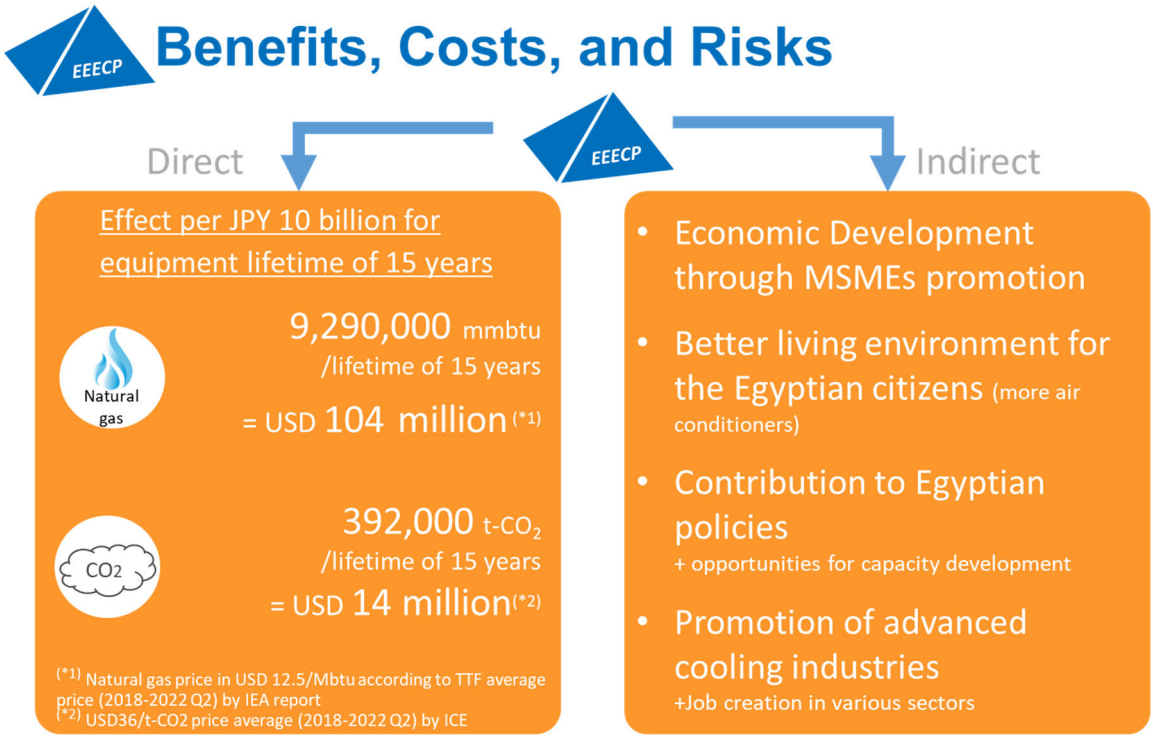
From the calculations it is estimated that the primary energy reduction effect during the seven-year project period is about 43,000toe, and the CO_2 reduction effect is equivalent to about 80,000t-CO_2 for an investment of 9.6 billion yen. Thus, a significant effect can be expected. It is possible to set this as a target value for this proposed project.

Table 10.17 Analysis of obtained benefit from proposed financial scheme

Equipment	Unit price (1,000JPY)		Unit capacity (kW)	Installation	Investment (mil JPY)	EEC ratio (%)	Lifetime EEC amount (MWh)	Lifetime EEC amount (toe)	Primary energy reduction (toe)	CO2 reduction (t-CO2)	Life time monetary saving due to CO2 saving (million JPY) (15 years)	Life time monetary benefits due to natural gas saving (million USD) (15 years)	Life time monetary benefits due to natural gas saving (million JPY) (15 years)
	Equipment	Related works											
1) Room AC	190	8	1.7	35,000	6,930	50%	634,375	54,546	154,961	290,544	1,378	77	10,293
2) Chiller with inverter	40,000	10,000	200	35	1,750	50%	76,125	6,546	18,595	34,865	165	9	1,235
3) VRF	2,000	500	10	350	875	50%	38,063	3,273	9,298	17,433	83	4.6	618
Total					9,600			7 years >>	42,666	79,996	1,627	91	12,146
								15 years >>	182,855	342,842			

This project proposal not only reduces fuel and CO_2 emissions via EEC in space cooling. It also has qualitative effects including economic development via promoting investment by SME borrowers and domestic production of inverter control equipment (industrial promotion and job creation opportunities) accompanying the increase in demand for EEC air conditioning equipment can also be expected as indirect effects. Plus, as these effects are consistent with Egypt's environmental and energy policies and industrial promotion policies, the project proposal that will also contribute to policy support. Fig. 10.18 lists direct benefits of air conditioners, which are the main technologies of this proposed project over a lifetime of 15 years (shown in Table 10.17), are listed on the left and indirect benefits on the right. The economic effect

of the 9.6 billion yen investment is expected to be equivalent to about 13.7 billion yen (gas price reduction benefit: 12.1 billion yen, CO_2 credit: 1.6 billion yen), which is expected to exceed the investment amount.

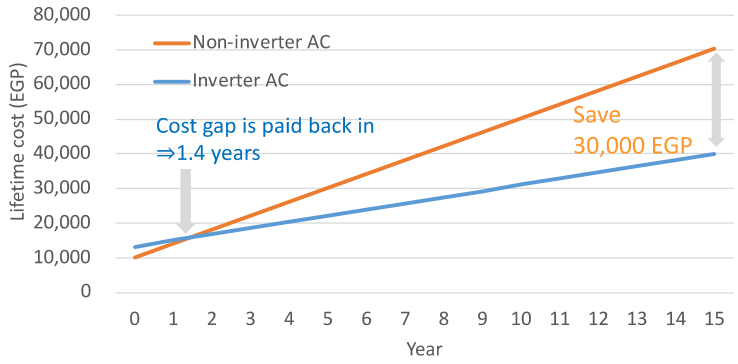


SOURCE: JICA SURVEY TEAM

Fig. 10.18 Direct and indirect benefits from proposed scheme

(2) Micro analysis (benefits for end users)

Comparing efficient inverter AC with conventional non-inverter (non-energy-saving) with the same output, purchase prices are about 30% higher for energy-efficient models. While annual power consumption is almost half, by counting the reduced power consumption amount multiplied by the commercial electricity price (EGP 1.60 / kWh) in Egypt, simple payback period for the investment in efficient AC is as short as about 1.4 years. The balance in the initial investment is already appropriated by reducing the electricity bill, and the accumulated total cost of EEC and conventional ACs will be at the same level in 1.4 years of operation. As the lifecycle of AC is supposed to be 15 years, the calculation result of efficient AC is quite advantageous (inexpensive) by EGP 30,000 in terms of life cycle cost of 15 years. (See Fig. 10.19)



NOTE: LIFETIME COST: EQUIPMENT PURCHASE COST (5 HP AC UNIT), OPERATION EXPENSE (ANNUAL OPERATING PERIOD: 4 MONTHS/YEAR)

SOURCE: JICA SURVEY TEAM

Fig. 10.19 Comparison between conventional AC and EE AC (Lifecycle cost)

(3) Monitoring

Regarding the monitoring of financing projects, the following four indicators are expected to be applied. As for the organization in charge of monitoring, MOERE is in charge of the technical aspect and BM is in charge of the financial aspect. As for the monitoring frequency, every quarter is appropriate.

Table10.18 Monitoring index (draft)

Operation and Effect Indicators: Indicator	Baseline (actual figure in 202X)	Target (in 202X) (Two years after the Project completion)
Energy saving potentials (toe/yr) introduced	-	12,200
CO_2 emissions reductions achieved (t-CO_2)	-	80,000
Amount of end-user loan (EUL) extended	-	Over 10,000
Number of end-user loan (EUL) cases	-	1,000

10.1.9 Need for consultancy service

(1) Proposed work descriptions for international experts

As this project will be the first ODA loan finance facility execution for both technical and financial executing agencies, it is recommended that they be supported by internationally-active consultants and experts with relevant experience in in managing similar ODA loan projects outside Egypt. Some of the highly-recommended support by consultants and experts includes bank account administration, monitoring and reporting, as well as technical works like calculation and reporting of EEC effects.

(2) Capacity development for financial executing agency, PFIs and end users

Task items to be conducted by international consulting services will cover capacity development for the financial executing agency, EEC promotion advisory for end users, public awareness-raising, plus monitoring and reporting mandates for project implementation. The table below outlines major points to be noted concerning the task items:

Main client served will be Banque Misr but services will need to coordinate with MOF, MOERE and related financial institutions.

1. Facilitating implementation

- Support for overall project administration
- Support for BM and Participatory Financial Institutions' (PFIs) loan management and administration
- Investment consultation to End Users
- Development of Project Monitoring System (PMS) (needed to monitor subprojects)

2. Monitoring

- For implementation monitoring, consultant to assist BM in creating financial management monitoring framework including report forms and assist BM, MOERE and PFIs to measure and evaluate project effect.

3. Promotion

- Promotion and public relations for project to encourage loan applications

4. Review and improvement

- Consultant to encourage PFIs to make use of profits from project for further EEC promotions, by means of relevant business development, R&D, awareness-raising, etc.

10.1.10 Environmental & social considerations

As climate change does not stop at national borders, it is essential for all countries to strive towards mitigation and adaptation. At the same time, many developing countries need to achieve economic development, and some of them face difficulties in implementing adequate climate change measures with the resources and capacity they have.

The responsibility of developed countries to support developing countries is stipulated in international frameworks. The United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992, aimed at stabilization of greenhouse gases in order to prevent global warming. It committed developed countries to providing financial resources, transferring technology and enhancing capacity.

Japan has been supporting developing countries in implementing climate change countermeasures. During the Leaders Event at COP 21 in Paris in 2015, the Action for Cool Earth 2.0 (ACE 2.0) was announced. In it, Japan pledged a new set of contributions to reinforce the world's strategy against climate change.

At the 2021 G7 Summit in Cornwall, Japan further committed to continuing its assistance with public and private finance totaling 6.5 trillion yen over the period from 2021 to 2025, and that Japan will further enhance its adaptation assistance to vulnerable countries.

Japan has advantageous technologies for energy conservation measures and will also contribute to technology transfer and capacity building.

Since no land need be acquired or developed to install energy efficient equipment, this project will have little undesirable impact on the environment and society. As such, it corresponds to Category C in JICA's "Guidelines for Environmental & Social Considerations (January 2022)." Also, in Egypt, an Environmental

Impact Assessment (see "3.2 Analysis of electricity, energy and environment policies") is not required for this energy efficient equipment installation project.

In replacing inefficient equipment with energy-efficient equipment, disposal of existing equipment will be required. However, as such equipment would in any event be replaced at the end of its lifecycle, this is a case of "business as usual." Therefore, energy-efficient equipment promotion cannot be considered as causing additional negative environmental impacts.

However, there is a possibility that alternative CFCs such as HCFCs and HFCs (which have low ozone depletion potential, but high global warming potential) are used in existing air conditioning equipment. In order to enhance CFCs recovery, it is important to share information with related organizations such as the Ministry of Environment's National Ozone Unit.

10.2 Proposal for technical assistance

10.2.1 Objectives

The objective of technical assistance for MOERE is to assist in the efficient and effective implementation of the Japanese ODA loan project proposed in 9.1 through the following tasks:

1. Implementation work support, including planning, monitoring and reviewing
2. Publicity, including convening seminars plus training and information dissemination
3. Capacity development for introduction of model energy audit practice

10.2.2 Scope of services

MOERE will be the main counterpart, but services will need to coordinate with BM and related financial institutions that will distribute financing.

(1) Implementation work support

1) Support for overall project administration

Consultant shall:

1. Assist PIU in MOERE in sharing information with PIU in BM for reporting requirements to JICA
2. Assist in preparing the progress report to be submitted to JICA.

2) Overall monitoring

Consultant shall:

1. Prepare overall monitoring framework and propose to PIU in MOERE
2. Conduct regular monitoring, including but not limited to, confirmation of progress, appropriateness and effects of project implementation
3. Assist MOERE in developing operating guidelines for project implementation

4. Assist MOERE in developing mechanism, in collaboration with PIU in BM, to automatically collect information on amount of energy saved and CO_2 emissions reduced by the program utilizing a smart meter developed by E-JUST
5. Assist MOERE in collecting implementation status information from PIU in BM on regular basis. Consultant should also conduct an energy audit if necessary for potential sub-projects
6. Assist MOERE in conducting site visits to selected sub-projects to gather information on business operations and energy saving status
7. Assist MOERE in reporting monitoring results to JICA (including the preparation of PSRs) and to other related organizations as required

3) Promotion

Consultant shall:

1. Assist MOERE in convening EEC seminars and training (physical and online) inviting government officials, university professors, business executives as resource persons as public-private information exchanges for awareness-raising (including advertising)
2. Assist MOERE in creating awareness among end-users and widely disseminate program information through web-based platform
3. Assist MOERE and other relevant organizations such as EEHC in promoting the project among targeted end users such as MSME.

4) Capacity development

Consultant shall:

1. Facilitate meetings for MOERE with manufacturers of energy efficient equipment so that MOERE may deepen its knowledge on latest EEC equipment and technology
2. Introduce model energy audit practice (including measurement equipment)
3. Provide training on how to conduct walk-through and investment grade energy audit
4. Provide international technical exposure training (inviting MOERE, MOF, BM officials to Japan & 3rd countries)
5. Assist MOERE in coordinating with other development partners willing to provide financing to enhance energy efficiency
6. Assist MOERE in synchronizing the project with other policy programs to promote energy efficient buildings. For example, draw policy implications from the project, and reflect them in other policy programs such as standard & labeling system and green building certification schemes.

Chapter. 11 Seminar and Training in Egypt

11.1 Seminar in Egypt

A seminar was held in Egypt to present the proposed financing scheme and high-efficient air conditioning technologies available in Egyptian market, and to seek feedback from the participants. The overview of the seminar is shown in Table 11.1.

Table 11.1 Overview of the seminar

Purpose	To present proposed financing scheme and high-efficient air conditioning technologies
Date & Time	27th of March 2022, 10:00 AM to 12:45 PM (Egypt time)
Venue	Cairo
Participants	JICA, MOERE, Green Star Hotel Program, El Araby, Daikin, E-JUST, Commercial International Bank Egypt, National Bank of Egypt, Credit Guarantee Company, ICONIC

The program of the seminar is shown on Table 11.2 Through the seminar, the proceed financing scheme and high-efficient air conditioning technologies available in Egypt were announced and the feedback from the participants was received. The participants and the minutes of the meetings are shown in the Appendix.

Table 11.2 Program of the seminar

10:00AM -10:10AM	Opening remark from Dr. Engr. Ahmed Mohamed Mahina, Ministry of Electricity and Renewable Energy (MOERE)
10:10AM -10:20AM	Opening remark from Mr. Yoshifumi Omura, Chief Representative, Japan International Cooperation Agency (JICA) Egypt Office
10:20AM -10:40AM	Presentation of NEEAP II from Ms. Engr. Tagrid Saeed El Ayotti, MOERE
10:40AM -11:00AM	Presentation of the proposed “Egyptian Energy Efficient Cooling Program” from Mr. Yoshihiko Kato, JICA survey team
11:00AM -11:10AM	Q&A Session (First Part)
11:10AM -11:30AM	Tea break
11:30AM -11:40PM	Introduction of “Green Finance” from Mr. Walid Ali, General Department Head, Governor’s Office Unit, Central Bank of Egypt
11:40PM -12:10PM	Technical session on advanced cooling technologies (1) El Araby, (2) Daikin, (3) E-JUST (JICA - AC demonstration pilot project)
12:10PM -12:20PM	Perspectives of users of advanced cooling technologies from Green Star Hotel Program
12:20PM -12:40PM	Q&A Session (Second Part)
12:40PM -12:45PM	Closing remarks by Mr. Hirotsugu Kato, Team Leader of JICA survey team

11.2 Training in Egypt

A training was held in Egypt for MOERE to understand the roles and responsibilities of technical executing agency and discuss the contents of the technical assistance to fulfill such roles and responsibilities. The overview of the seminar is shown in Table 11.4.

Table 11.3 Overview of the training

Purpose	To understand the project and discuss the required technical assistance
Date & Time	28th of October 2022, 10:00 AM to 12:00 PM (Egypt time)
Venue	Cairo
Participants	MOERE

The program of the training is shown on Table 11.4. Through the lectures and discussion conducted in the training, the working-level officers in MOERE understood what to do and its deadline under the project implementation stage and identified the contents of the technical assistance required to conduct such tasks. The participants and the material of the training is shown in the Appendix-2.

Table 11.4 Program of the training

10:00AM -10:30AM	Lecture: Description of the Project
10:30AM -11:00AM	Lecture: Roles and Responsibilities of MOERE
11:00AM -11:30AM	Lecture: Consulting Services / Technical Assistance
11:30AM -12:00PM	Discussion and Q&A

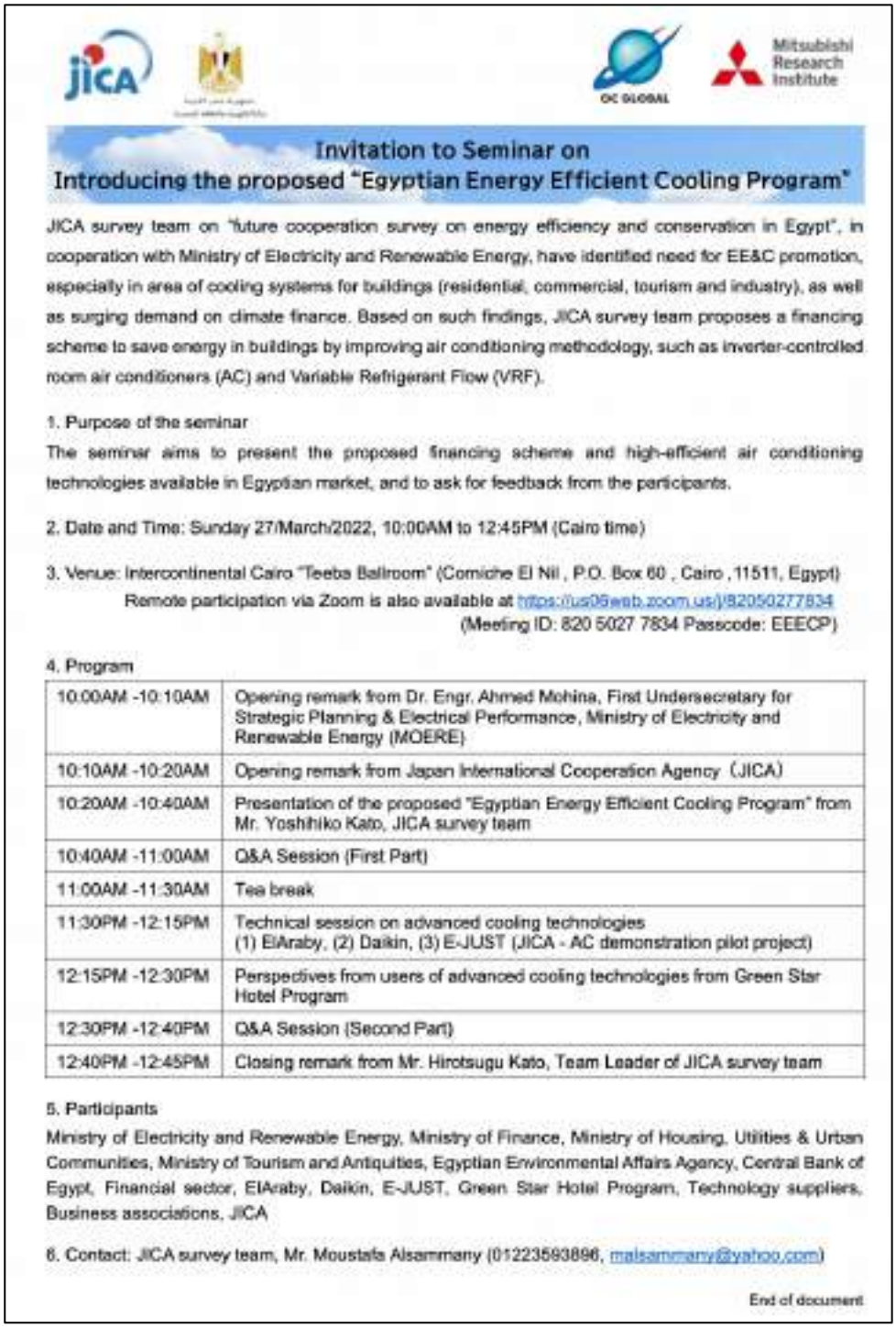
Fig. 11.1 Training Scene

Appendix-1

JICA internal use version
Not for circulation outside-JICA

Record of Seminar on
Introducing the proposed "Egyptian Energy Efficient Cooling Program"

1. Overview of seminar



Invitation to Seminar on
Introducing the proposed "Egyptian Energy Efficient Cooling Program"

JICA survey team on "future cooperation survey on energy efficiency and conservation in Egypt", in cooperation with Ministry of Electricity and Renewable Energy, have identified need for EE&C promotion, especially in area of cooling systems for buildings (residential, commercial, tourism and industry), as well as surging demand on climate finance. Based on such findings, JICA survey team proposes a financing scheme to save energy in buildings by improving air conditioning methodology, such as inverter-controlled room air conditioners (AC) and Variable Refrigerant Flow (VRF).

1. Purpose of the seminar
The seminar aims to present the proposed financing scheme and high-efficient air conditioning technologies available in Egyptian market, and to ask for feedback from the participants.

2. Date and Time: Sunday 27/March/2022, 10:00AM to 12:45PM (Cairo time)

3. Venue: Intercontinental Cairo "Teeba Ballroom" (Corniche El Nil , P.O. Box 60 , Cairo ,11511, Egypt)
Remote participation via Zoom is also available at https://us06web.zoom.us/j/82050277834
(Meeting ID: 820 5027 7834 Passcode: EEECP)

4. Program

10:00AM -10:10AM	Opening remark from Dr. Engr. Ahmed Mohina, First Undersecretary for Strategic Planning & Electrical Performance, Ministry of Electricity and Renewable Energy (MOERE)
10:10AM -10:20AM	Opening remark from Japan International Cooperation Agency (JICA)
10:20AM -10:40AM	Presentation of the proposed "Egyptian Energy Efficient Cooling Program" from Mr. Yoshihiko Kato, JICA survey team
10:40AM -11:00AM	Q&A Session (First Part)
11:00AM -11:30AM	Tea break
11:30PM -12:15PM	Technical session on advanced cooling technologies (1) ElAraby, (2) Daikin, (3) E-JUST (JICA - AC demonstration pilot project)
12:15PM -12:30PM	Perspectives from users of advanced cooling technologies from Green Star Hotel Program
12:30PM -12:40PM	Q&A Session (Second Part)
12:40PM -12:45PM	Closing remark from Mr. Hirotsugu Kato, Team Leader of JICA survey team

5. Participants
Ministry of Electricity and Renewable Energy, Ministry of Finance, Ministry of Housing, Utilities & Urban Communities, Ministry of Tourism and Antiquities, Egyptian Environmental Affairs Agency, Central Bank of Egypt, Financial sector, ElAraby, Daikin, E-JUST, Green Star Hotel Program, Technology suppliers, Business associations, JICA

6. Contact: JICA survey team, Mr. Moustafa Alsammany (01223593896, malsammany@yahoo.com)

End of document

2. Opening remarks

(1) Dr. Engr. Ahmed Mohina, MOERE

- Energy efficiency should be considered as a powerful tool to reach sustainability and achieve the goals of the Paris agreement.
- Egypt has a huge potential in promoting energy efficiency and conservation in a lot of sectors. Especially in the energy sector, industrial sector, residential sector and the tourism sector. To maximize the benefits from this potential, it is necessary to maximize the efficient use of the available recourses.
- This project, the “Egyptian Energy Efficient Cooling Program” in cooperation with JICA, is due to determine the needs and challenges to promote energy efficiency in Egypt and can be a help to the Egyptian people. However, a media campaign over TV, radio and social media to raise awareness about the significance of this program’s targets will be needed.

(2) Mr. Ken Kato, JICA Egypt office

- We are looking forward to strengthen the bilateral cooperation between Egypt and Japan through this, and other JICA projects.
- Energy efficiency and climate change have always been an important topic and JICA was always keen to promote environmental protection and sustainable energy policies and programs.
- We hope, this project will become a good occasion for Egypt, to set a model for the whole world. We consider it as a good step forward towards a cleaner and better environment for us and future generations.

3. Overview of Presentations

(1) JICA survey team

- The JICA survey team introduced the outline of the draft project design such as the policy background, energy efficiency situation, over view of prospective planned JICA loan, and organizational setup.
- The participants were also informed of the financial, economic and social benefits of the impacts of the loan.

(2) ElAraby

- ElAraby explained the Sharp inverter technology, its benefits, and the application to cooling system.

- The technology also allows the flexible adaptation to wide-ranging compressors, refrigerant control and fast and strong cooling even in tough conditions including high ambient temperature and voltage fluctuation.

(3) Daikin

- The participants learned the Daikin corporate, products, and services, particularly the cooling system of different size and volume.
- The detail technical information and data have also been shared on the energy efficiency.

(4) E-JUST

- E-JUST presented the current status of the ongoing JICA technical assistance project, “Project for capacity development on energy efficiency and conservation in the Arab Republic of Egypt”, in which the energy efficiency of air-conditioners has been measured and verified.
- The smart meter developed in the project has also been presented. It is expected that the technology would be applicable in other places as well.

(5) Green Star Hotel Program

- The program is an internationally recognized certification program designed for Egyptian hotels, encouraging the hotels to improve green efficiency in energy, water, and chemical consumption.
- The program in interested in coordinating with the proposed JICA loan to provide the facilities to the member hotels on the program, requesting specific, possible loan conditions.

4. Q & A session

Refer to attachment 1

5. Closing remarks

(1) Mr. Hirotsugu Kato, JICA survey team

- The team leader, Mr. Kato, stressed the important position of the proposed loan given the recent world-wide economic, social conditions including the COVID, war in Ukraine, and the economic situation in Egypt.
- The proposed loan would also be a direct solution to the concerns at COP 26, and an effective demonstration to the upcoming discussions at COP 27.

6. Conclusion

- The participants have been informed of the findings on the current status of the energy efficiency in Egypt and the directions of the possible financing program by JICA.
- The technical knowledge and expertise have been transferred from the manufacturing companies. The viewpoints from the end-users have also been presented to the stakeholders on the energy efficiency community.
- It is also effective to coordinate with the initiatives of the academia. The views from the financial institutions have also shed the light on the financing aspect of promoting the energy efficiency.
- The seminar concluded with the common understanding on the needs of the continued joint efforts of the stakeholders.

7. Participants

Refer to attachment 2

end

Attachment

1. Presentation

(1) JICA survey team

(2) ElAraby

(3) Daikin

(4) E-JUST

(5) Green Start Hotel Program

(6) Closing remarks

2. Q&A

<1st session>

Dr. Mohina, MOERE

Q1; Slide #8; request to create new partners to promote EE&C such as ESCO particularly for end-users who do not have knowledge.

A1; The technical assistance will contribute to assist end-users thereby promoting EE&C.

Q2; Slide #11; Does the slide show cumulative benefits?

A2; Yes. The benefit for each year may be small, but the cumulative lifetime saving will be eventually large

CIB

Q3; We have direct relation with end-users and understand the importance of the technical knowledge. It is suggested that the project would provide the non-financial services and technical knowledge.

A3; The technical assistance is designed to address the issue.

Q4; It is recommended to provide the incentives for replacement of AC.

A4; Agree. The project would also target the new construction in addition to the replacement. The new construction would be often easier. The incentives will be provided through the concessionary loan.

Q5; Who would be the main target to the loan end-users?

A5; SME business would be initial target while the household will also be important given the size of the energy saving potential.

ICONIC

Q6; Only AC would be the eligibility of loan?

A6; The needs of the end-users would not be addressed without financing non-AC component. This will be examined.

CIB

Q7; Does the TA include awareness raising only? In the similar activity in our bank, sample components include others such as the preparation of monthly report, and price information.

A7; It will also include the technical assistance to the stakeholders including the borrowers.

The assistance for the routine work will also be a component to promote the loan.

NBE
Q8; Does the project finance the agricultural sector such as storage system?
A8; The cooling system for agriculture would also be a target as well as the other industrial sector.

E-JUST
Q9; comment. The energy assistant and audit center in the university provide the technical assistance and facilitate end-users in financing from the banks. The activity of E-JUST would also be able to contribute.
A9; n/a

<2nd session>
Q10; The Green Star Hotel Program will be a good example to address the environmental issues. Is the program interested in collaborating with the loan program?
A10; Yes.

JICA Egypt
Q11; What do you think are important to promote EE&C in addition to the measures such as low interest rate loan, government promotion and others.
A11; To establish the technical standard. To raise awareness.
Government to provide incentives to use appropriate technology.

JICA team
Q12; What are the issues of the smart meters?
A12; The high-quality equipment is usually expensive. The industry use will require high-specification equipment for high current and three-phase. There will also be a need to conduct the nation-wide survey to examine the country data.

Q13; There are labeling system in Japan to show the economic benefit of the inverter ACs. Is this replicable in Egypt? What about Daikin, for instance.
A13; The use of the electricity can be monitored by the application software of the mobile phone. The annual monitored data will show the benefit. The awareness raising is also important. The efficiency of the Daikin products is measured in the factory.

3. List of Participants

Seminar on Introducing the proposed "Egyptian Energy Efficient Cooling Program (EEECP)" - 27/March/2022

	No.	Organization	Position	Name
A	1	MOERE	First Undersecretary for Research, Planning & Authorities follow up	Dr. Eng / Ahmed Mohamed Mahina
A	2	MOERE	EECCD Department Director	Ms. Marwa Mahmoud Nonsowa
A	3	JICA Egypt office	Chief Representative	Mr. Ken Kato
A	4	JICA Egypt office	Country Senior Representative	Ms. Ragheb Mayada Magdy
A	5	JICA Egypt office	Representative,	Mr. Yuta Iwai
A	6	JICA Egypt office	Chief Program Officer	Ms. Zaky Ghaly Salem Nevine
A	7	JICA Egypt office	Program Officer	Ms. Yasmin Afifi
N	8	MOF	Vice Minister	Mr. Ahmed Kouchouk
N	9	MOF	Senior Assistant to Deputy Minister	Ms.Doaa Hamdy
N	10	Ministry of Housing, Utilities & Urban Communities	Housing & Building Research Center	Prof. Dr. Ashraf Kamal
N	11	Ministry of Tourism	Consultant of minister for sustainable tourism affairs	Dr. Nashwa Talaat
N	12	MOIC		Ms. Shaimaa Beheiry
N	13	Egyptian Environmental Affairs Agency	Head of Climate Change Central department	Mr. Eng. Sherif Abd Rahim
Z	14	Green Star Hotel Program	Director of Green Star Hotel Program	Mr. Eng Ahmed Khaled
N	15	Chamber of Real Estate Development	Counsellor & Executive General Manager	Mr. Ossama Saad El Din
N	16	Contrack Facilities Management Egypt	Managing Director	Mr. Nagi Aboutar
N	17	Gas Cool		
A	18	El Araby	Head Of Marketing (AC&AP)	Mr. Eslam Omar
A	19	El Araby	Head of AC Product Group Development	Mr. Osama Said Mostafa
N	20	El Araby	Verification Manager from R&D	Mr. Ahmed Salah
Z	21	Daikin	Consulting Sales - Assistant Manager	Ahmed Al Kady
Z	22	Daikin	Serice Planning Manager	Mr. Shinji Yamashita
A	23	E-JUST		Prof. Amr Eltawil
A	24	CIB		Mr. Kamel Sallam
A	25	CIB	*Colleague of Mr. Kamel Sallem*	Ms. Alyoa Yehia Hatez
N	26	CIB	*Colleague of Mr. Kamel Sallem*	
Z	27	National Bank of Egypt	General Manager, International Financial Services	Mr. Shahir Zaki
A	28	Credit Guarantee Company	Business Development Executive Director	Mr. Amr Riad
A	29	ICONIC	Founder & CEO	Mr. Ahmed Assem
A	30		MEP Managing Partner	Mr. Sayed Abdelgawas
A	31	JICA survey team		

A attendants
N non-attendants
Z zoom participants

End of attachment

Introducing the proposed "Egyptian Energy Efficient Cooling Program"

JICA Survey Team

27th March 2022

OUTLINE OF SURVEY

Survey Name	Future Cooperation Survey on Energy Efficiency & Conservation（EE&C）in Egypt
Survey Objectives	• Based on data collection and analysis, issues/ challenges for EE&C Promotion in Egypt will be clarified. • New Projects for EE&C Promotion supported by JICA will be proposed.
Counterpart	• Ministry of Electricity and Renewable Energy
Survey items	• Governmental policy and support for EE&C Promotion • Current energy balance and EE&C Potential • Trends of other development partners in EE&C field • Issues/ challenge, countermeasures, benefit of EE&C promotion • Necessity and validity of EE&C promotion supported by JICA
Expected Outputs	• Proposals for solutions and supporting measures to be implemented as Japanese ODA Loans / technical cooperation projects
Survey period	• Sep. 2019 - ongoing

MEMBERS OF SURVEY TEAM

Position	Name
Team Leader / EE&C Policy 1	Hirotsugu KATO
Deputy Team Leader / EE&C Policy 2	Mari IWATA
Energy Management	Kimio YOSHIDA
Business Scheme & Support Policy	Yoshihiko KATO
EE&C Technology	Yasuhiro SAKAMOTO
Marketing Analysis & Demand Forecast	Ulysses COULMAS
Organization Analysis 1	Takeshi KIKUKAWA
Organization Analysis 2	Eiko WATATSU
Capacity Development & Promotion	Kazuhiro NAKAGAWA
Environmental and Social Considerations	Kohei KUWAMORI
National Energy Efficiency Expert	Moustafa Alsammany

Policy Background

- Egyptian Energy Efficient Cooling Program (EEECP) contributes to;

"Egypt Vision 2030".
"Integrated Sustainable Energy Strategy (ISES) 2035"
"National Climate Change Strategies" &
"Second National Energy Efficiency Action Plan - NEEAP II".
through fuel saving and emissions reduction.

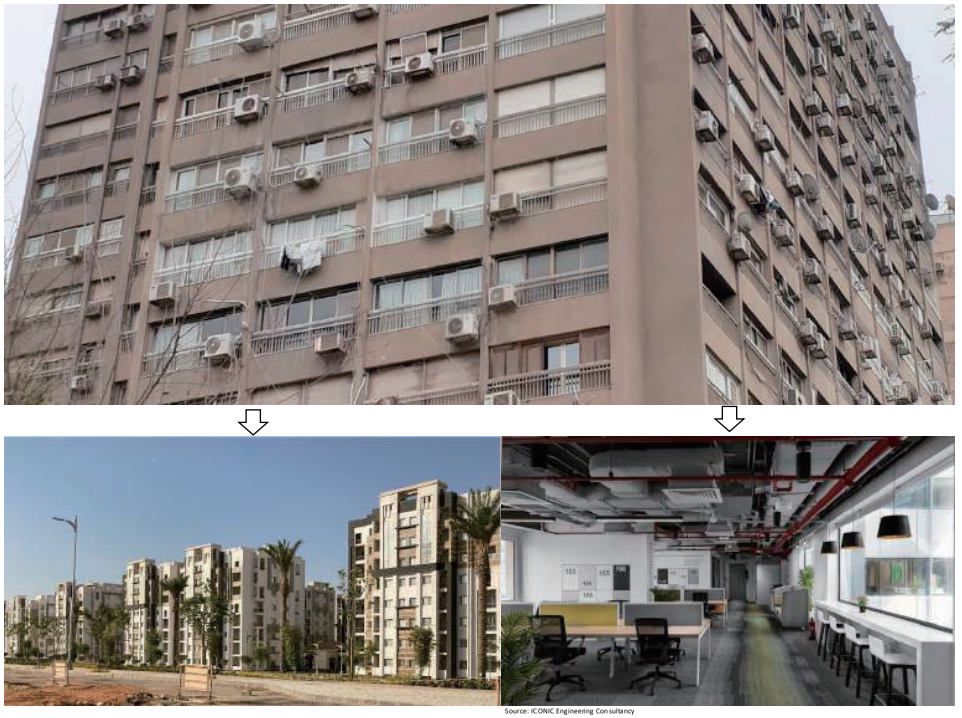
- EEECP facilitates the introduction of efficient and innovative cooling technologies which enables 5% fuel saving in Egypt.
- EEECP echoes with Egypt's long-term climate change strategies including emissions reduction by maximizing energy efficiency.

"Enterprise Development Law 152 of 2020"
through MSMEs finance

- EEECP improves access to finance for 3.7 million MSMEs and stimulates them to play a greater role in advancing the economy and development.

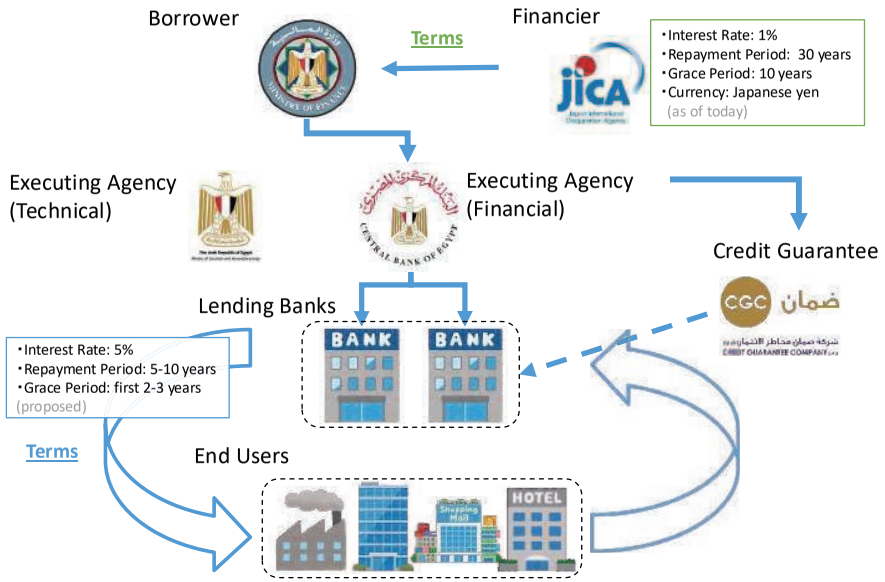
Egyptian Energy Efficient Cooling Program

Name	Egyptian Energy Efficient Cooling Program (EEECP)
Objective	• Building energy efficiency => saves electricity consumption => reduces natural gas usage for power generation => alternative (higher added-value) use => carbon emissions reduction. • Support for MSMEs through better access to finance (offering credit guarantee).
Target Area	• Entire territory of Egypt
Loan agreement	• Between JICA and the Government of Egypt
Loan amount	• Under discussion
Executing Agency	• Technical = Ministry of Electricity and Renewable Energy • Financial = Central Bank of Egypt
Implementing organization	• Banks (lending banks) • Credit Guarantee Company Ltd
Implementation Period	• 5 years (first cycle of the revolving fund) • 30 years (revolving period)

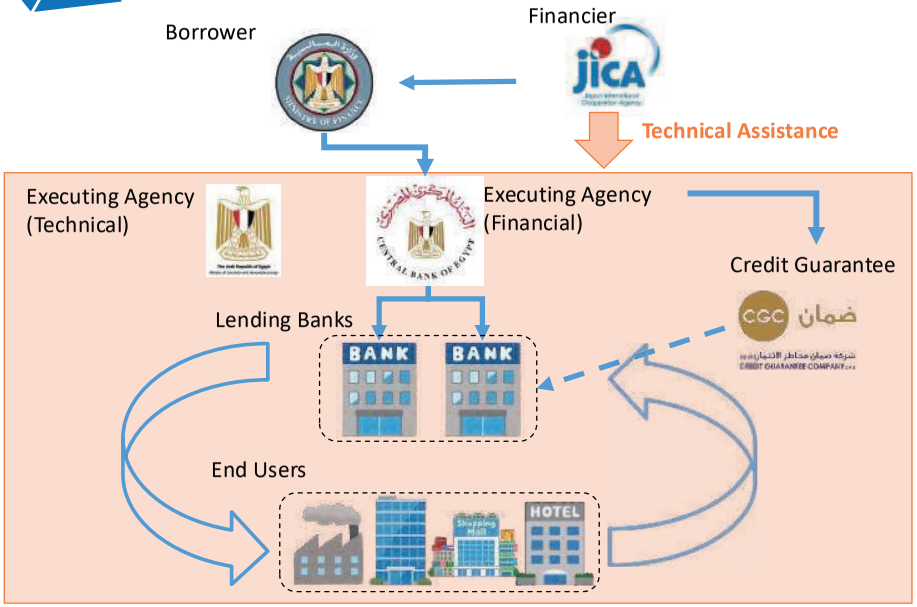


Source: ICONIC Engineering Consultancy

How It Works



Technical Assistance



Benefits, Costs, and Risks

Direct

Indirect

Effect per USD 100 million

Natural gas

58 ktoe/year saving
= 13 million USD/year(*1)
+ alternative use of saved gas

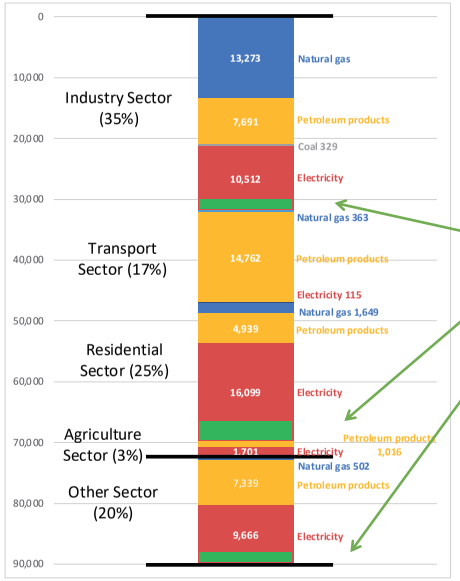
CO_2

121 kt-CO_2/year reduction
= 2.7 million USD/year (*2)

(*1) Natural gas price in Egypt basis
(*2) EU ETS CO_2 2020 price basis

- Economic Development through MSMEs promotion
- Better living environment for the Egyptian citizens (more air conditioners)
- Contribution to Egyptian policies
  + opportunities for capacity development
- Promotion of advanced cooling industries
  +Job creation in various sectors

Around 10% of Egypt's Energy is Consumed for Building Space Cooling



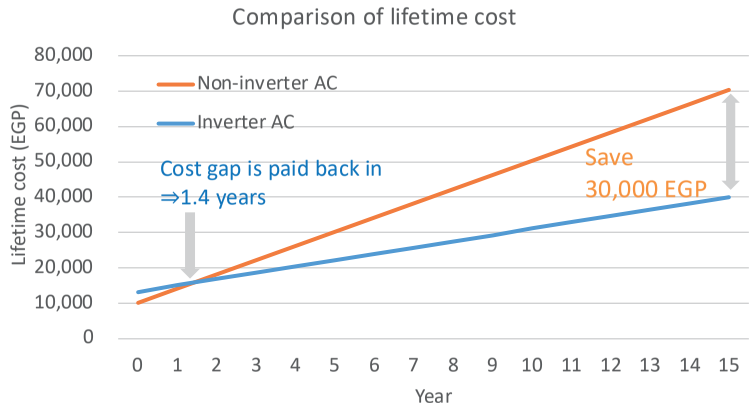
Total energy (primary energy basis) consumed for space cooling in building accounts for approx. 10%

Note:
Egypt's National Energy Consumption FY 2017-18 (primary energy basis) by sector and kind of energy, compiled in JICA Technical Cooperation Project in collaboration with CAPMAS, MOERE, and MOPMR.

Unit: ktoe

With Inverter ACs, End-users Save EGP 30,000 During the AC's Lifetime Cost

Inverter air-conditioner vs Non-inverter air-conditioner



Note
Lifetime cost: Equipment purchase cost(3 HP AC unit), operation expense (annual operating period: 4 months/year)

EEECP is a Response to the Egyptian President's Speech at COP26 Glasgow

"Despite not being responsible for the climate crisis, the African continent faces the most negative consequences of the phenomenon and its economic, social, security and political effects."

"Egypt calls for the necessity of granting the African continent special treatment within the framework of the implementation of the Paris Agreement."

"We are concerned about the gap between the available funding and the size of the actual needs of developing countries, Therefore developed countries must fulfil their pledge to provide $100 billion annually in favour of climate finance in developing countries."

Source: Egyptian President's Speech at COP26 meeting

A Program for COP27 at Sharm el-Sheikh

COP 27

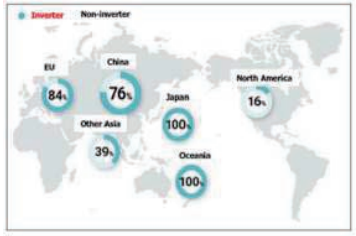
United Nations Climate Change

- A joint program between Egypt and Japan to be launched at COP27 under Egyptian Presidency.
- A direct response to the need for climate change financing addressed at COP26 by the Egyptian President.

شكرا جزيلا

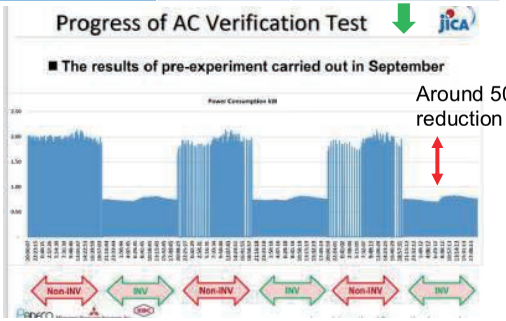
Inverter-controlled Building Space Cooling Reduces 50-60% of energy

Global room AC inverter ratio



Country	Room AC Inverter (%)	Note
Japan (cooling heating)	100	
India (cooling)	50	
Pakistan (cooling)	90	JICA TA in progress
Vietnam	60	JICA TA done
Egypt	11	JICA pilot project at E-JUST (in progress)

By accelerate the introduction of efficient cooling system, 50-60% cooling energy and related CO2 emission can be reduced.



Source: JICA TC project

Expected EE&C Potential by EEECP

Average annual primary energy reduction effect using USD 100 million in 30 years:

83,000 toe/year (5.75 USD/mmbtu = 228 USD/toe natural gas sales price)

175,000 t-CO2/year (1,024,000 USD/y: EU ETS CO2 price basis) reduction

Equipment	Unit capacity (hp)	Annual install (unit/y)	EE&C ratio (%)	EE&C amount (GWh/y)	Primary energy reduction (toe/y)	CO2 reduction (t-CO2/y)
1) Inverter-controlled split / package AC	2.25	20,000	50%	310	74,000	155,000
2) Chiller with inverter	225	25	50%	39	9,200	19,000
3) VRF (variable refrigerant flow)	11.25	20	50%	1.6	400	800
Total					**83,000**	**175,000**

Source: JICA Survey Team

Egyptian Energy Efficient Cooling Program

ELARABY
صُناع الثقة

SHARP ELARABY AC

Inverter Technology

MARCH.27.2022

Content

1 What is Inverter Technology ?

① Inverter AC **VS** Non-Inverter AC
② SHARP Inverter Control Technology

2 Concept for SHARP EL-ARABY Inverter Model

① What should be considered for Egypt & Middle East Market
② Solutions by SHARP Inverter

3 Summary & Latest SHARP Models

ELARABY
صُناع الثقة

El-Araby Journey with AC Inverter

- **2015** — EL-ARABY started to sell Inverter AC
- **2016** — EL-ARABY started with EOS to make the standard of Inverter AC
- **2017** — EL-ARABY started fully manufacturing Inverter AC in EGYPT; EOS issued the standard ES 3795-2
- **2020** — EL-ARABY introduced the Max EER level in inverter AC
- **2022** — SHARP EL-ARABY models will be : A++++++

ELARABY every Year since 2015 investing money to increase the awareness of End-User of Inverter AC

ELARABY
صُناع الثقة

Inverter is…

Technology To Control Compressor rotation speed

Power supply 220V / 50Hz

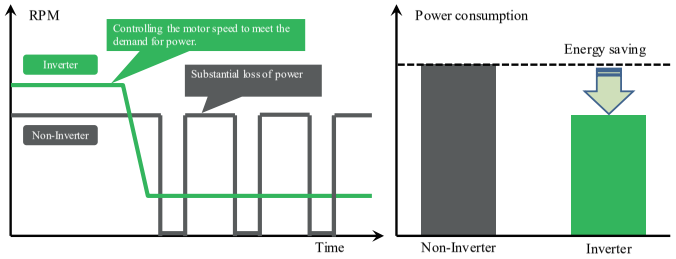
AC → Converter → DC → Inverter → AC

Variable Voltage, Variable Frequency (VVVF)

ELARABY
صُناع الثقة

What is the benefit of Inverter?

Energy saving



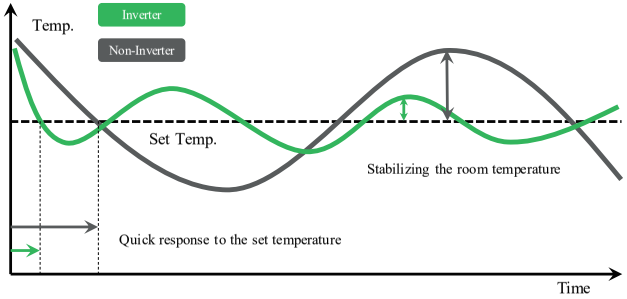
● Variable-speed motor control

An inverter modulates power supply frequency to control motor speed, while a non-inverter is driven at the rated power supply frequency.

As a result, an inverter can substantially reduce the energy consumption adjusting the motor speed appropriately.

What is the benefit of Inverter?

Stabilizing the room temperature



Comfort

● Stabilizing the room temperature

The motor is controlled at the lower speed after the room temperature reaches to the set temperature.

Fast cooling

● Quick response to the set temperature

The motor runs at the higher speed on starting.

What is the challenge to Inverter at Egypt & Middle East?

Wide range reliability is necessary.

High Temperature

- Heat protection
- Over load
- Over current

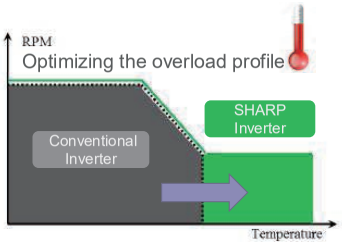
Voltage fluctuation

- Lower supply voltage
- Surge protection

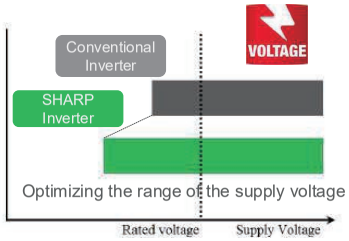
Solutions by SHARP Inverter

System optimization

High Temperature



Voltage fluctuation



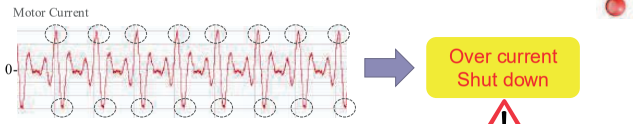
* Those are the tentative outlines.

SHARP inverter will be able to run at higher temperature and lower supply voltage optimizing the overload profile and the range of the supply voltage.

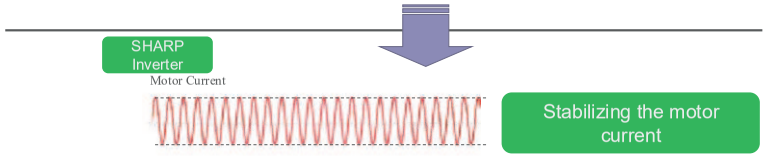
Motor peak current control(stabilization)

Conventional Inverter

The higher load torque causes the significant motor current fluctuation.

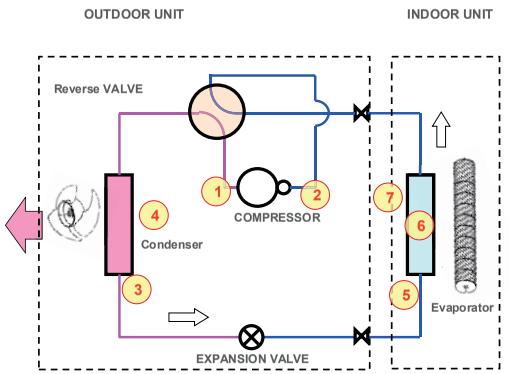


Stabilize the motor current with SHARP inverter software.



SHARP inverter software enables the inverter voltage to be synchronized with the rotor position so that the peak current is substantially reduced.

Protection control



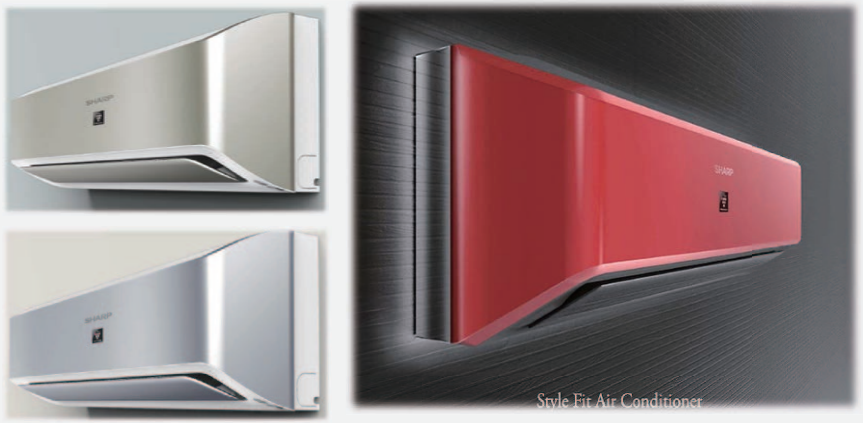
① Compressor Discharge
→ Detect overheat for compressor
② Suction
→ Expansion valve control
③ Condenser (outlet)
→ Detect overheat for condenser
→ Expansion valve / Defrost control
④ Outdoor Temp.
→ Defrost / Outdoor fan control
⑤ Liquid tube (inlet of evaporator)
→ Expansion valve control
⑥ Evaporator (Mid)
→ Detect freezing/overheat for evaporator
→ Detect refrigerant shortage
⑦ Room Temp.
→ Comp/ Fan speed control

Summary

Strong points of SHARP ELARABY Inverter System

- High Efficiency and High reliability by the advanced motor control
- Flexible adaptation to various kind of compressor by the advanced system control
- Wide range refrigerant control by using the latest sensing technology and prediction method
- Providing fast and strong cooling even in the tough condition like high ambient temperature and voltage fluctuation

SHARP ELARABy Latest Models



EER weighted = 21BTU/w.h >> A+++++

ありがとうございます

شكراً

Thank You

DAIKIN

Daikin Business Overview

DAIKIN INDUSTRIES, LTD.

313 Subsidiaries

23.8 Billion $ Sales (FY2019)

80,369 Employees

Corporate Data (as of March 31, 2020)	
Company name	Daikin Industries, Ltd.
Head office	Osaka (Japan)
President & CEO	Mr. Masanori Togawa
Founded	Oct 25 , 1924
Cons. Turnover	23.8 billion USD
# Employees	80,369
# Group Companies	313 consolidated subsidiaries (29 in Japan; 284 overseas)

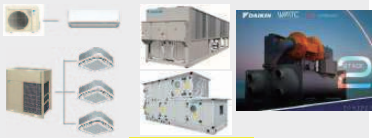
DAIKIN ROTEX McQuay J&E Hall AAF ACSON AIRFEL Goodman ZANOTTI AHT Tewis HUBBARD

Business Overview

DAIKIN

HVAC-R

Residential Commercial

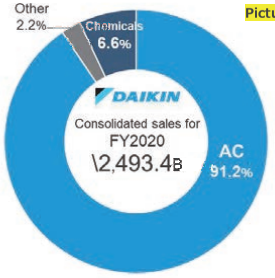


HVAC Equipment

After Sales Service

Refrigeration

Product Pictures



Other Businesses

Oil Hydraulic Equipment

Oxygen Concentrators

Chemicals

Refrigerant

Semiconductor Applications

Automotive Applications

Initiatives in Business Activities

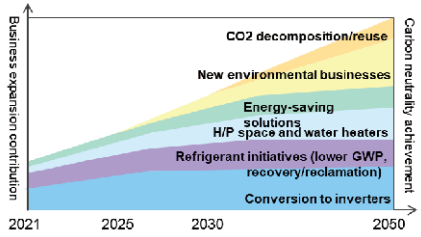
DAIKIN

Declaration of challenge to achieve carbon neutrality – as a part of 5 years business strategy

Net CO2 emissions (= Emissions − Contribution to emissions reductions) **will be reduced by 30% or more in 2025. and 50% or more in 2030 as Daikin aims for zero emissions by 2050.**

As a leading company in air conditioning, **Daikin will lead the air conditioning industry in decarbonization.**

In addition to conversion to **Inverterization** and adoption of **lower GWP refrigerants**, we will reduce net CO2 emissions by **promoting heat pump, energy-saving solutions, and refrigerant recovery and reclamation**

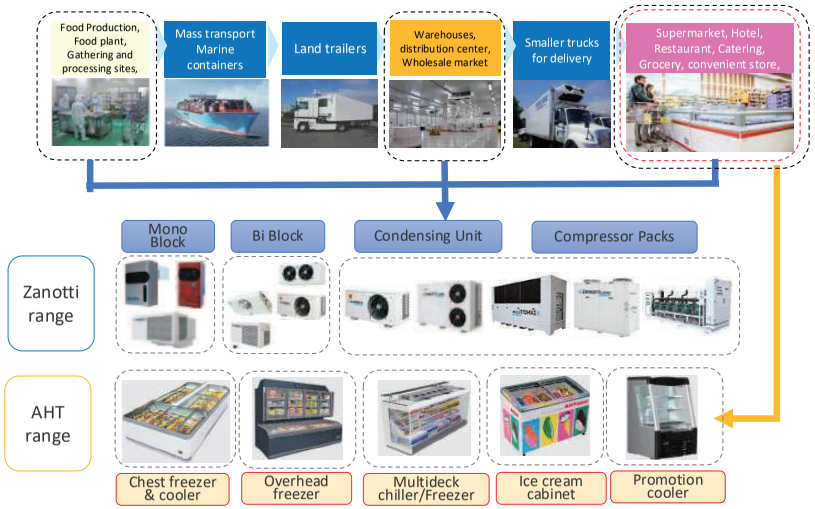


Six specific initiatives for carbon neutrality

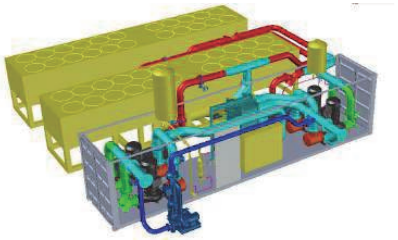
- CO2 emissions reductions during manufacturing
- Expansion of the H/P space and water heating business
- Challenge of environmental businesses such as smart cities and energy creation
- Reduction of power consumption during product use
- Refrigerant initiatives to support the AC business
- Research of advanced technologies related to CO2 separation, recovery, and reclamation

Smart City Project (Singapore)

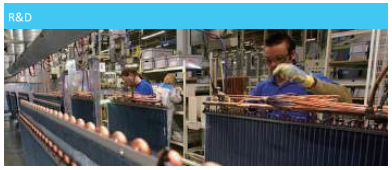
COLD CHAIN AND OUR STATIONARY REFRIGERATION PRODUCTS

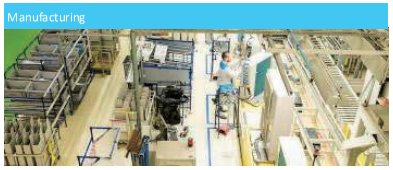


Offsite Modular Solutions



Air Specialists for all HVAC systems





From heating and cooling to refrigeration and freezing, we have a team of air specialists that stand united in the mission of helping you resolve issues in air comfort and quality and provide you with unparalleled service.

DAIKIN

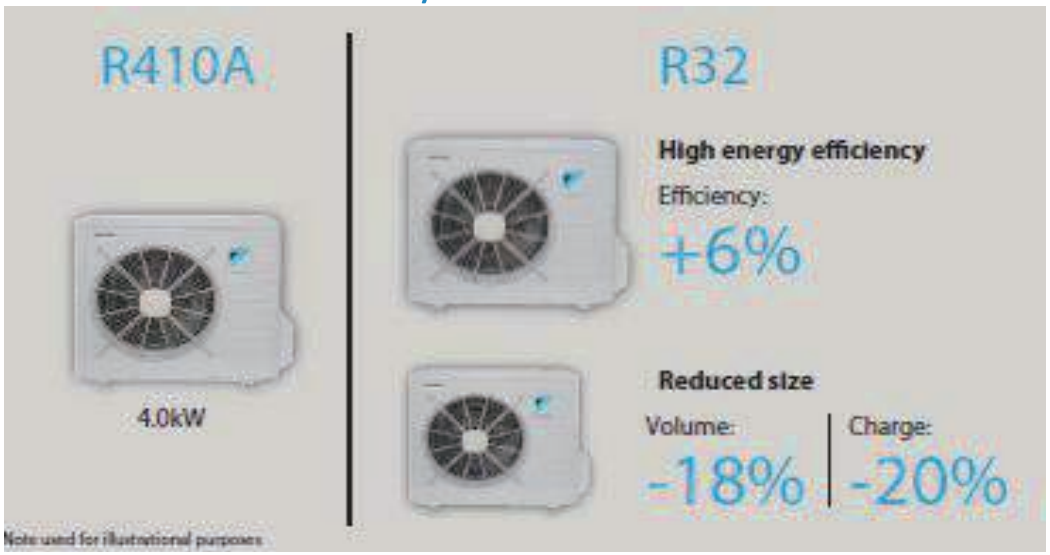
Handle any space anywhere from 10m² to ∞

We support all project sizes - from the smallest villa to the tallest tower

Refrigerant

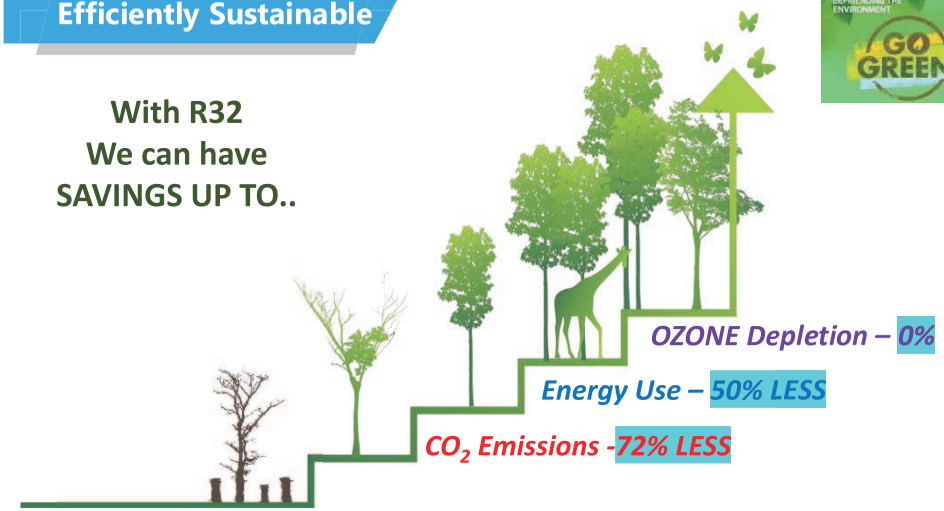
Important to meet higher Efficiency

Why R32



Efficiently Sustainable

With R32
We can have
SAVINGS UP TO..

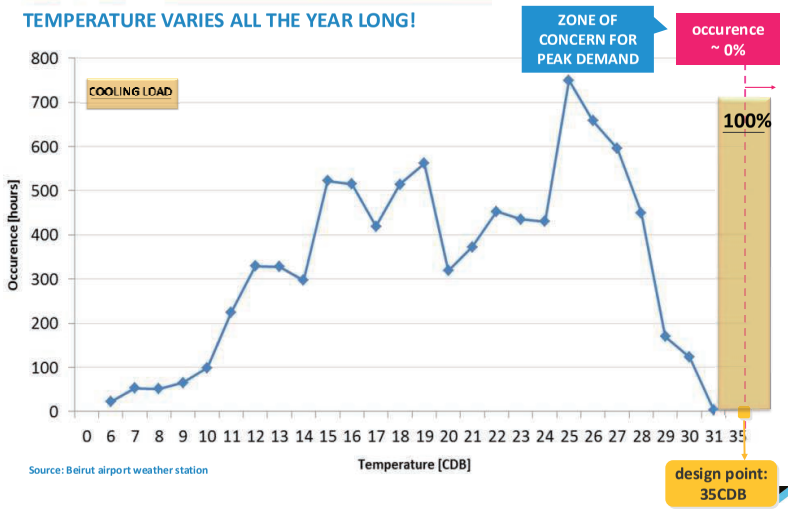


INVERTER TECHNOLOGY

A sustainable approach:
Variable technology for variable needs!

TEMPERATURE DISTRIBUTION vs AC LOAD

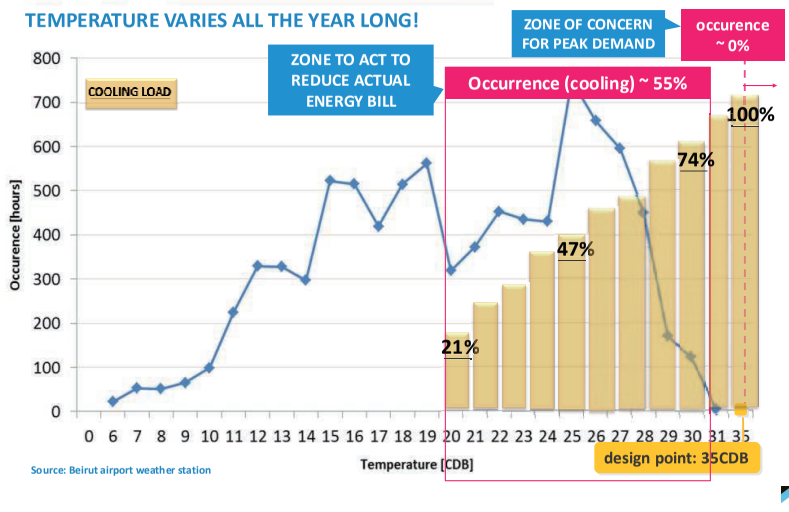
TEMPERATURE VARIES ALL THE YEAR LONG!



Source: Beirut airport weather station

TEMPERATURE DISTRIBUTION vs AC LOAD

TEMPERATURE VARIES ALL THE YEAR LONG!

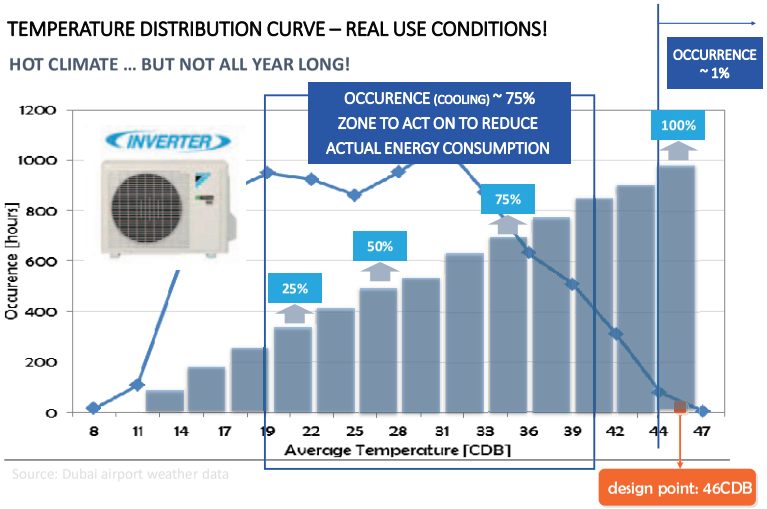


Source: Beirut airport weather station

• Why Inverter?

TEMPERATURE DISTRIBUTION CURVE – REAL USE CONDITIONS!

HOT CLIMATE … BUT NOT ALL YEAR LONG!



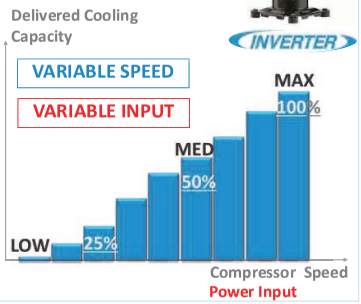
Source: Dubai airport weather data

WHAT IS INVERTER?

2 MAIN DIFFERENT TECHNOLOGIES AVAILABLE

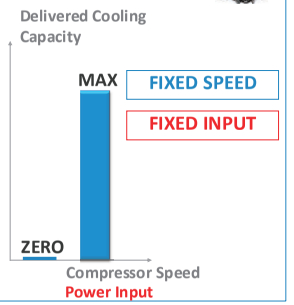
INVERTER

Uses very smart control that will regulate the compressor speed according to the cooling need (load).



NON INVERTER (ON/OFF)

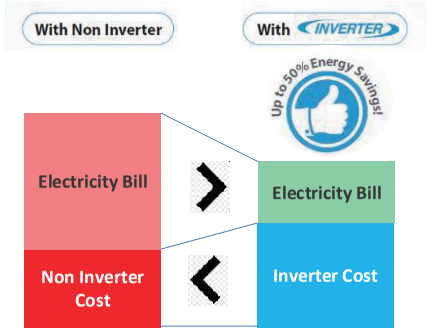
Has NO intelligence: it will try to meet the cooling need by using 2 fixed speeds – Zero or Maximum speed



INVERTER EFFICIENCY

EFFICIENT COOLING – ALL THE YEAR ROUND!

INVERTER – NOT EXPENSIVE: A REAL ECONOMICAL SOLUTION!

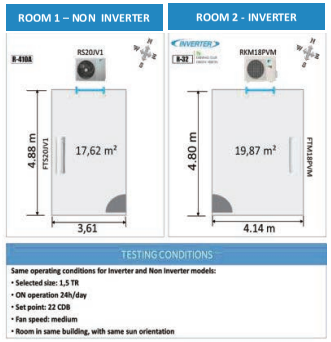


To make real savings, always compare total cost, including operation cost.
Inverter will help you to save money!

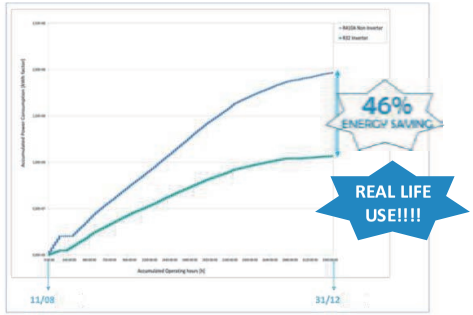
REAL COST THAT YOU PAY = UNIT COST + ELECTRICITY COST

INVERTER EFFICIENCY

EFFICIENT COOLING – REAL LIFE CONDITIONS!



ACCUMULATED POWER CONSUMPTION



EXCELLENT REAL LIFE EFFICIENCY!

INVEST MORE, TO SAVE MORE

SEASONAL EFFICIENCY

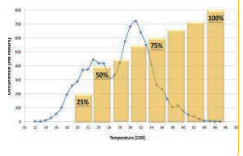
Important to evaluate your real efficiency!

ENERGY CONSUMPTION SIMULATION

HOW TO SIMULATE ELECTRICITY CONSUMPTION?

ELECTRICITY CONSUMPTION

OPERATION LOAD:
DEPENDS ON OUTDOOR TEMPERATURE



EFFICIENCY
CALCULATION METHOD

- EER
- ESEER
- SEER

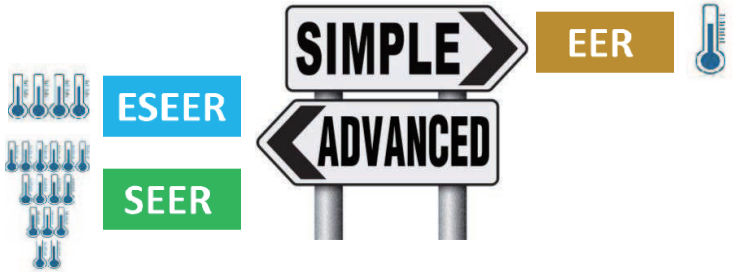
EQUIPMENT EFFICIENCY:
DEPENDS ON TECHNOLOGY

INVERTER
VRV
Variable Refrigerant Temperature
R-32
DRIVING OUR GREEN VISION

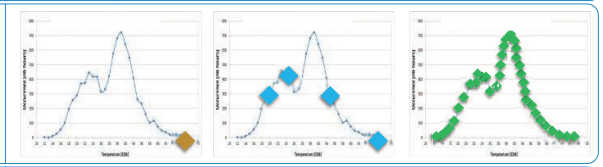
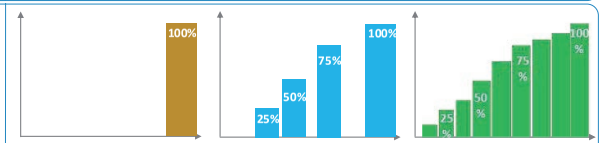
EFFICIENCY REPRESENTATION

WHAT IS EFFICIENCY – WHY IS IMPORTANT?

- Energy Efficiency gives you an indication on how your system is performing.
- The more efficient, the less energy use.
- It is crucial to have a correct representation of efficiency to enable selection of system that will save energy.
- Several ways to represent efficiency:

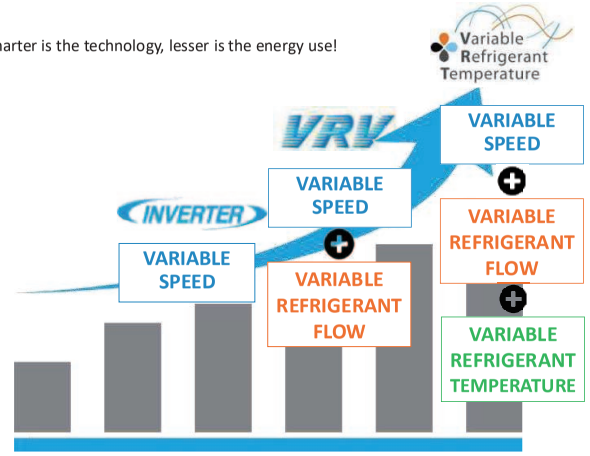


MORE ADVANCED … MORE ADVANCED … EFFICIENCY?

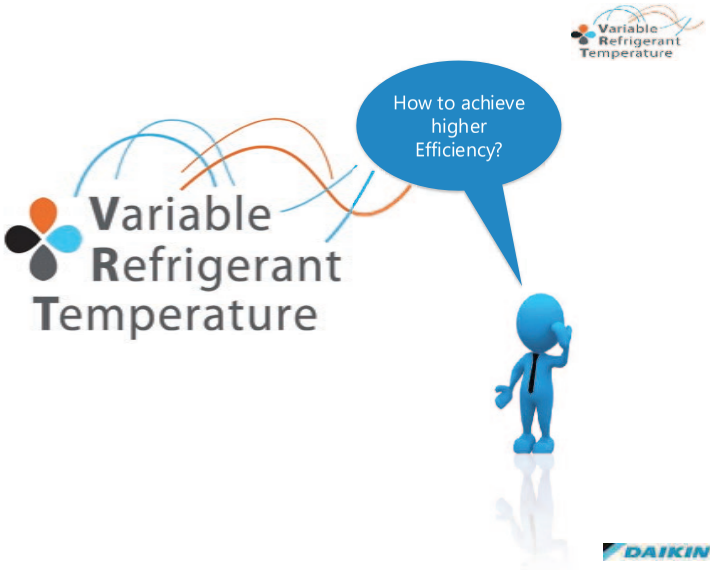
CONDITIONS	EER	ESEER	SEER
NUMBER POINTS:	1	4	FULL CURVE
TEMPERATURE:			
LOAD:			
	EER indicates the efficiency of AC 1 defined point (eg 46 or 35CDB)	ESEER indicates the efficiency of AC based on 4 points.	SEER indicates the efficiency of AC over the full temperature distribution curve

RAISE THE BAR OF EFFICIENCY – THROUGH TECHNOLOGY

Smarter is the technology, lesser is the energy use!

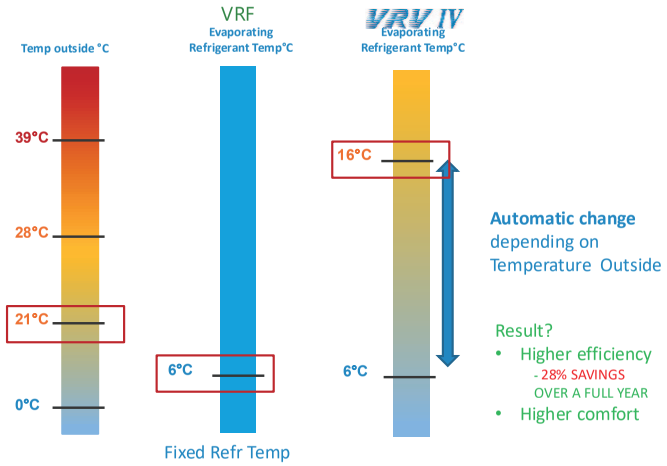


DAIKIN



DAIKIN

VRT Concept



Automatic change depending on Temperature Outside

Result?

- Higher efficiency
  - 28% SAVINGS OVER A FULL YEAR
- Higher comfort

DAIKIN

DAIKIN

Solution for Every need!

VRV-X

VRV-4 S 10-12 HP

Mini VRV 4-5-6 -8 HP

Multi split

Inv. Split

DAIKIN

Thank You For Your Time

THE PROJECT FOR CAPACITY DEVELOPMENT ON ENERGY EFFICIENCY AND CONSERVATION IN THE ARAB REPUBLIC OF EGYPT

PILOT PROJECT

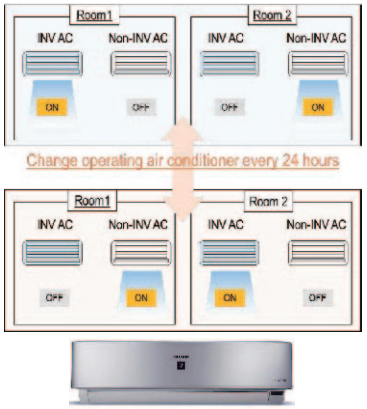
ELECTRICITY CONSUMPTION BY END-USERS (ECEU)

PILOT PROJECT

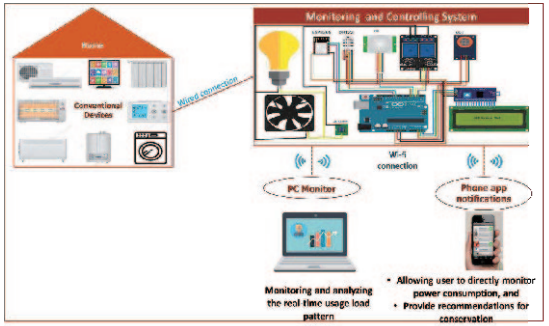
PERFORMANCE VERIFICATION TEST OF ROOM AIR CONDITIONER

March 2022

The pilot project



AC TEST



SMART HOME TEST

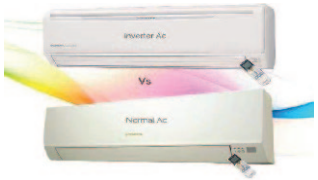
Project Goal

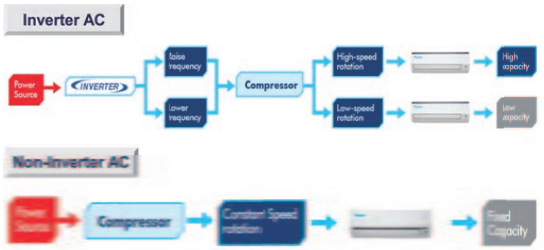
Pilot Projects	Outline of the Projects
Performance Verification Test of Room Air Conditioner (AC Test)	**To promote energy efficient products by applying the results of a performance verification test (PVT) of room air conditioners.** PVT will be performed by **comparing non-inverter air conditioners and inverter air conditioners**. Inverter air conditioners are expected to provide highly effective energy efficiency and conservation for space cooling and heating energy demand by households as well as public and private buildings.
Electricity Consumption by End-users (Smart Home Test)	**To visualize the energy consumption patterns and data of typical households in Egypt.** The project will be performed using a prototype for a compact device that can be connected to any conventional home appliance to **monitor the power consumption of the appliance** and to present the data in a visually attractive way. This would provide the basic data **to formulate highly effective Energy Efficiency and Conservation policies**.

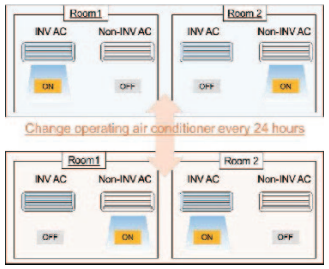
1) Project of Performance Verification Test of Room Air Conditioner

Monitoring the load consumption of Inverter Vs. Non-Inverter ACs

With a total fund of (EGP 1,528,375)







Goals for pilot test (AC test)

- Saving energy by spreading high efficiency ACs (INV AC)
- Enhance the awareness of people on Energy saving

To be

Step 3: Promotion

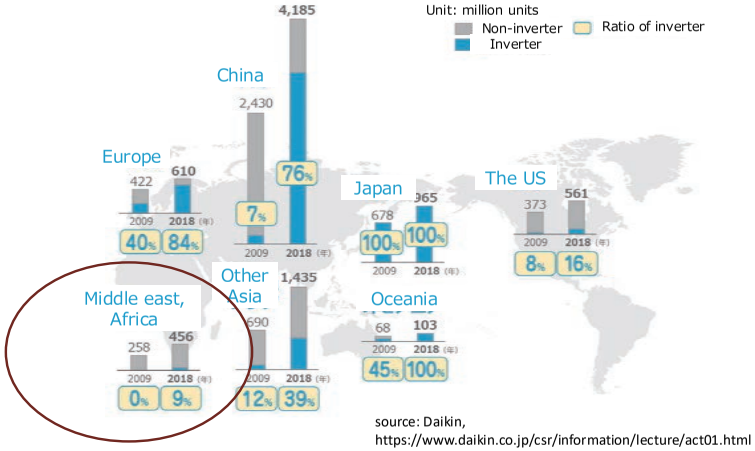
Step 2 : Economic evaluation

Step 1: Data collection (ongoing)

As is

- Usage rate of Inverter AC in Egypt is around 10 %
- Awareness of people on EEC is not so high

Usage rate of inverter ac



source: Daikin,
https://www.daikin.co.jp/csr/information/lecture/act01.html

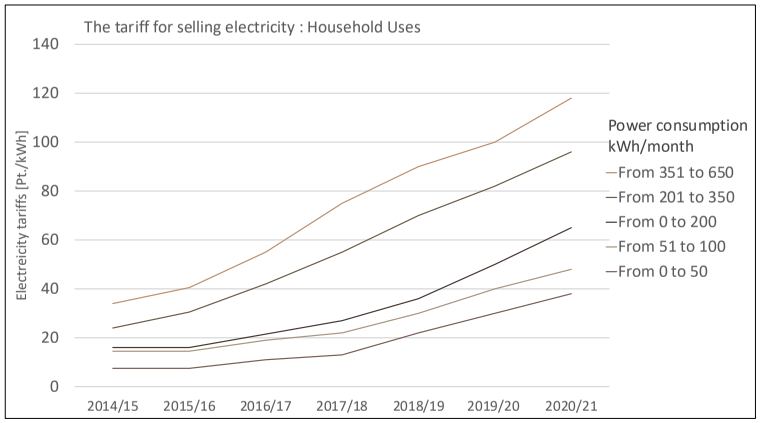
Why people select non-inverter ac?

People are tend to consider only an initial price when they select AC.
So, non-inverter AC can be selected.

Inverter AC (3 HP)
Type: AY-XP24UHE
Cooling capacity: 22,400 BTU/h
Heating capacity: 26,100 BTU/h
EER: 21.1
Price: **14,449** **EGP**

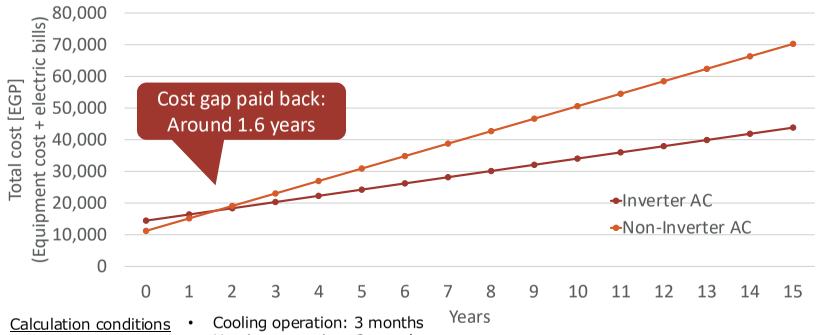
Non-inverter AC (3 HP)
Type: AY-A24USE
Cooling capacity: 22,400 BTU/h
Heating capacity: 26,100 BTU/h
EER: 10.5
Price: **11,220** **EGP**

Electricity tariffs in Egypt



Source: Egyptian Electricity Holding Company, Annual Report

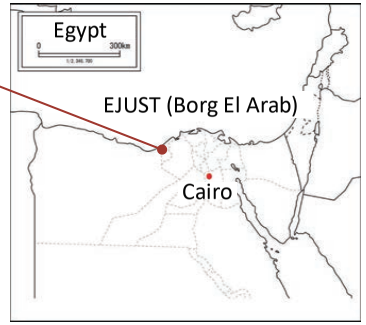
Economic evaluation(reference)



Calculation conditions
- Cooling operation: 3 months
- Heating operation: 2 months
- Operating hours are 300 hours/month
- Electricity price is calculated with electricity tariff in 2024/2025 for Household
- The power consumption of AC is calculated with the rated value.

AC is not always operating under the rated condition.
⇒This is why we will perform the verification test to confirm the power consumption under actual conditions.

AC Verification Project Site



General Layout of EJUST dormitory

AC Verification Project Site

General Layout of EJUST dormitory

AC Verification Project Site

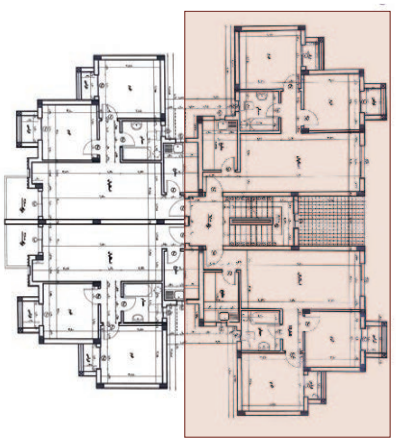
Selected Building and Apartments

Southern Apartments – South Side – 4th Floor
Building I

Selecting Appropriate ACs HorsePower

13

- The proposed apartment areas are as follows:
  - Reception area (6.7x3.2m + 2.4) = 23.8 m2
  - Room #1 (3.1x3.1m) = 9.6 m2
  - Room #2 (3.5x3.25m) = 12.25 m2
  - Bathroom (2.2x2m) = 4.4 m2
  - Kitchen (2.8x2m) = 5.6 m2
  - Small hall (2.7x0.9m) = 2.43 m2
  - Total area = 58.08 m2
  - The halls area = 26.23 m2
  - 1Hp -> 8 m2 (3 m high)
  - So the hall area needs a 3Hp AC.
  - For all of the apartment a larger AC may be needed.
  - 3 Hp Ac is the minimum to be installed.



Air conditioner installation

14

Apartment.12

Apartment.9

Data Collection

15

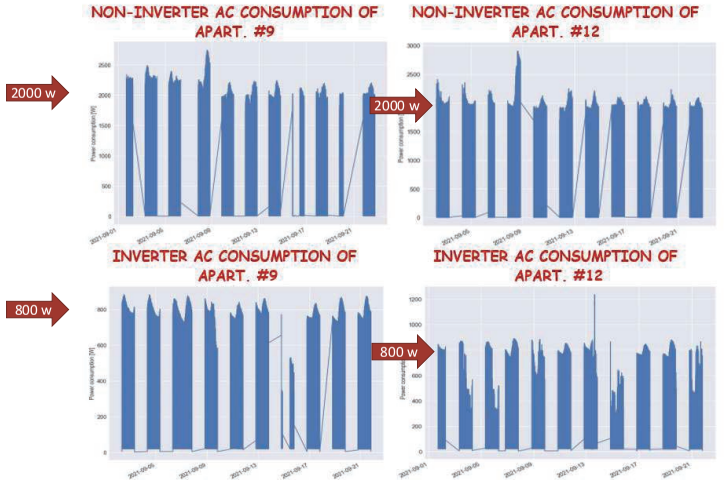
- **Measuring Devices**
  - The device is in box to save it from dust
  - There is cooling circuit to save it from high temperature.
- **Temperature and humidity measurement**
  - Hioki LR 5001 Temperature and humidity sensor is used
- **Data Collection**
  - The work of a local network has been completed to connect the digital power meter and the computers in the project office for monitoring and data collection

Temperature & Humidity sensor
HIOKI (LR5001)

Power Logger
Yokogawa (WT310)

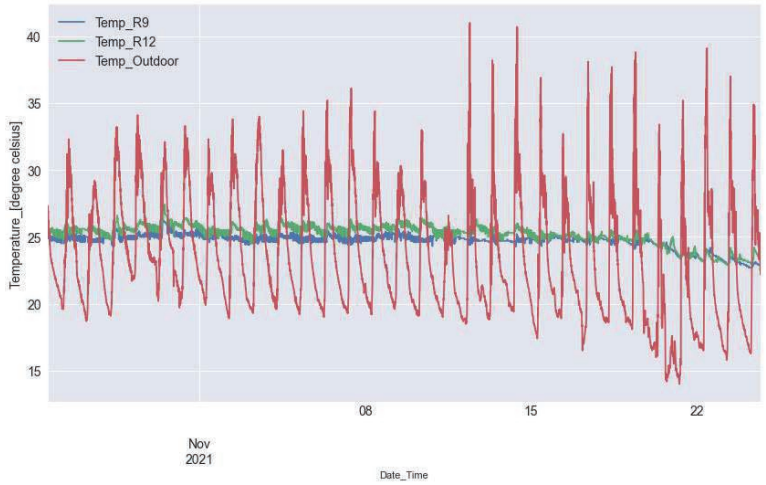
Comparison between Inverter and Non-inverter AC power Consumption (Cooling)

16



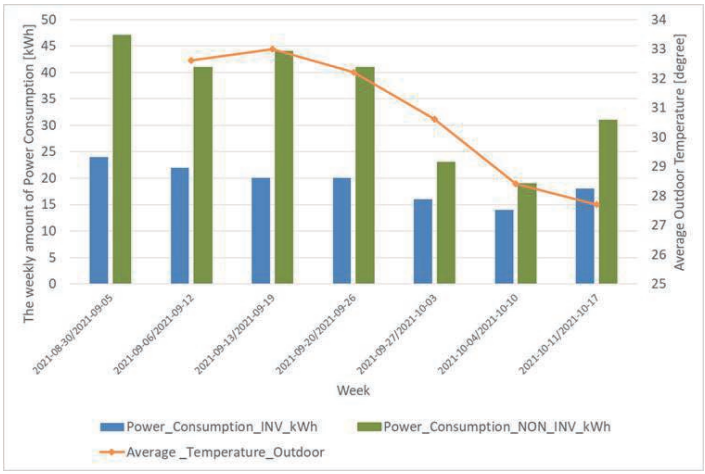
Temperature Measurement

17



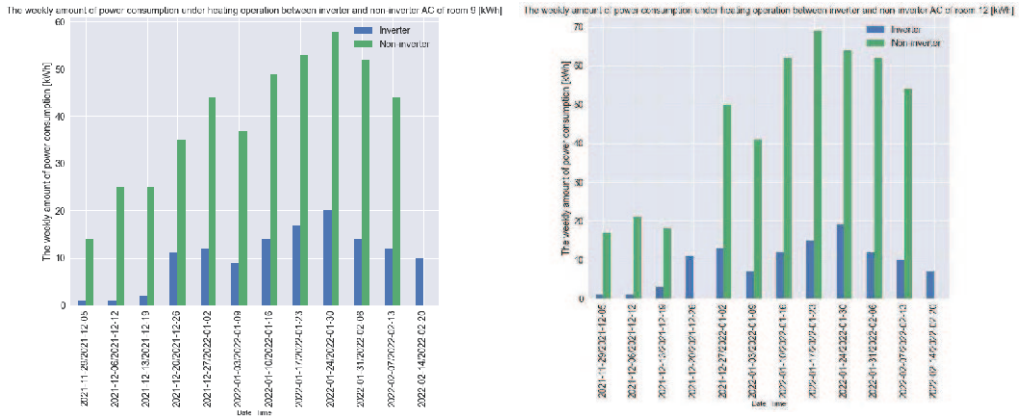
Comparison between Inverter and Non-inverter AC weekly power Consumption

18



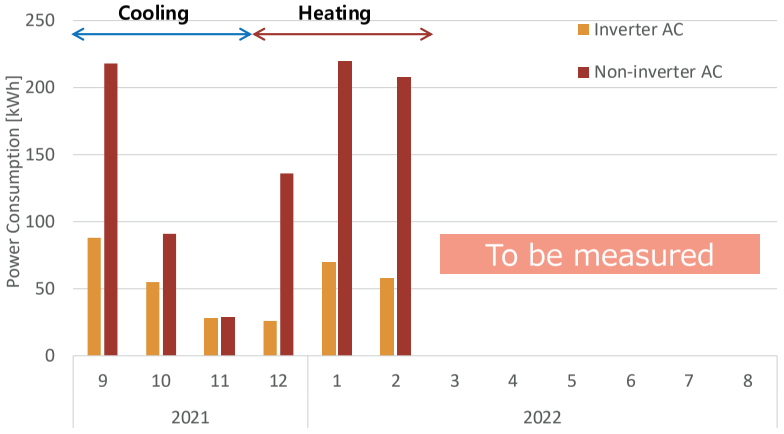
Comparison between the two apartments (Heating)

19



Comparison between Inverter and Non-inverter AC monthly power Consumption

20



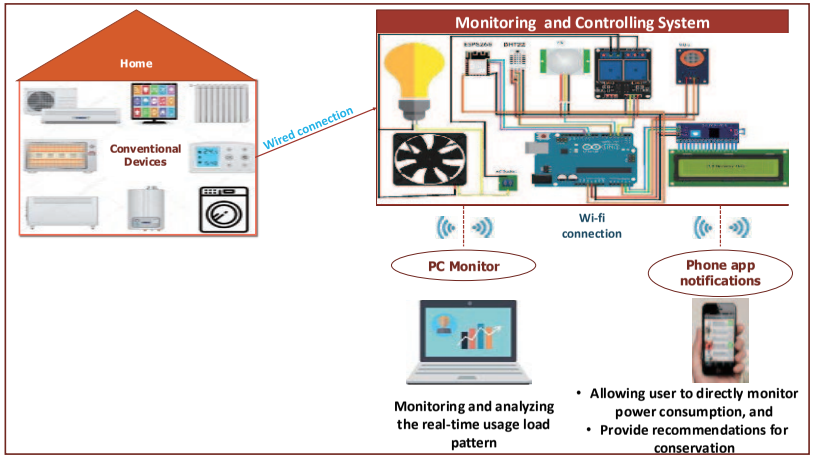
AC Verification Project Timeline

		MONTHS																						
WORK TIME		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Plan (preparation)																								
2	Procurement																								
3	Installation																								
4	System construction																								
5	Verification Test (data acquisition)																								
5 1	Comparison of INV AC and Non-INV AVC																								
2	Room Temperature setting																								
3	Intermittent Operation VS Continuous Operation																								
4	Thermal insulation effect																								
5	Filter Cleaning effect																								
6	Project administration and Public relation																								
Deliverables and events																									
Tentative schedule (Reference)		2020			2021												2022								
		10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9

2) Project of Electricity Consumption by End-Users (ECEU)

Monitoring the load consumption of various home appliances

With a total fund of (EGP 1,001,556)



Energy Consumption (in Egypt)

Residential sector consumes the highest amount of electricity.

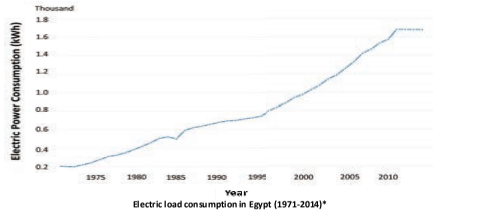
*All 30 million "Traditional electricity Meters" will be converted to "**Smart Meters**".

- Within **8-10 years**.
- Cost of **60 billion** Egyptian pounds

How to Manage – Control – Save Energy ??

Electricity consumption by sector (GWh) 2006-2013

Sector	2009/2009	2009/2010	2010/2011	2011/2012	2012/2013
GWh					
Industries	37,273	38,918	40,702	42,058	39,987
Agriculture	4,617	4,634	4,927	5,560	6,230
Homes	4,714	[illegible]	[illegible]	[illegible]	[illegible]
Public lighting	6,302	7,050	6,165	6,537	6,210
Governmental entities	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Residential	43,811	47,431	51,370	56,964	59,767
Commercial & others	6,754	9,671	10,236	10,715	14,065
Total	111,714	116,903	125,160	133,060	140,257



Electric load consumption in Egypt (1971-2014)*

https://www.iea.org/data-and-statistics/charts/world-electricity
https://energypedia.info/wiki/Egypt_Energy_Situation#Electricity
* http://www.egyptoday.com/Article/
*https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC

From A Customer Perspective

- **High electricity bill cost.**
- **Real-time consumption is unknown.**
- **Which appliance causes a peak load.**
- **How to manage unknown consumption.**
- **Only able to switch off unnecessary appliances.**
- **Has no time for tracking each appliance usage.**

A customer needs a practical, easy, smart, and low-cost solution

Project Objective

Monitor the home appliances energy usage

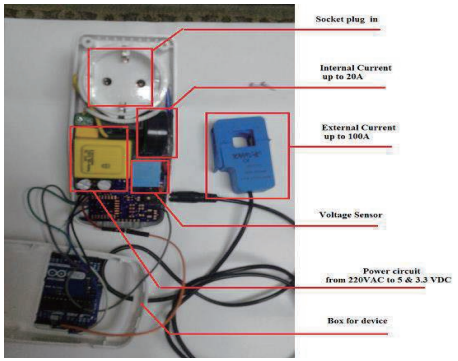
Consumer controlled	Utility side controlled
• Conservation • Efficient buildings and appliances • Automation	• Demand response • Conservation voltage reduction • Load control • Real-time pricing

The Developed Prototype

A smart device that can be connected to the home appliance for recording its load consumption and sending the data and usage recommendations through a mobile application

➢ ***Helps:***
- **Customers** to make decisions regarding their energy consumption and their electricity bill.
- **Energy providers** to reduce the peak load demand & reshape the load profile.

➢ ***Results in:***
- **Increasing** in Smart Grid sustainability.
- **Reducing** overall operational cost & carbon emission levels.



E-JUST Smart Eco Meter

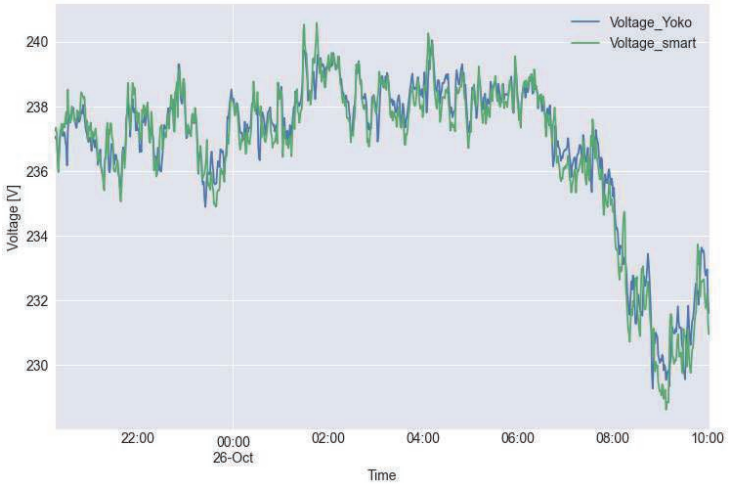
❑ **Device Box**

Smart sensor V.S. Yokogawa power meter (Calibration)

Item	Condition
Location	Room 9
Date Time	25th Oct 2pm – 26th Oct. 10 am
Target	INV AC 25th 2 pm – 8 pm Non- INV AC 25th 8 pm – 26th 10 am
Setting temp.	26 degree (Both INV and Non-INV)

Verification of the smart sensor

29

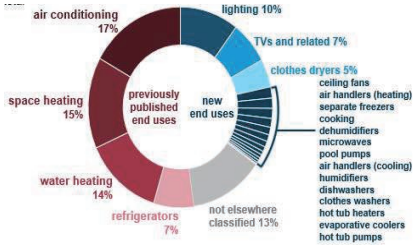


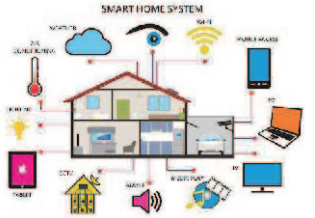
29

System Functions

30

- The system is connected to all devices 24x7x365
- The power consumption patterns are continuously collected.
- The collected date is displayed on a life dashboard.
- The power consumption of different household patterns are studied and reported, giving a good indicator of the impact of different lifestyles on the distribution of power consumed by different appliances.
- The mobile application recommends action (turning on/off the appliances).
- The user approves and executes actions or dismisses it.





The smart home experiment

31

❑ **The candidate test site**

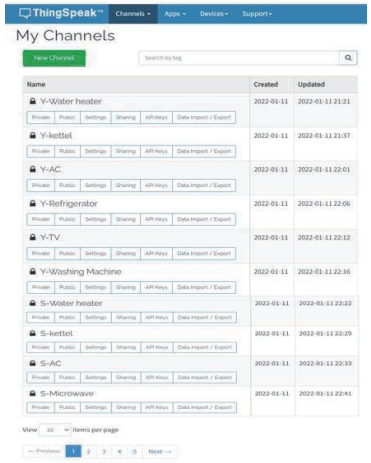
- https://earth.google.com/web/data=Mj8KPQo7CiExdlFROEUycE9nd2QvTG41N2NkcmxEQksvX19HdEhGdGYSFgoUMERGNEFFNTMzMzFGQzgwRDk1Mzk

The smart home experiment

32

❑ **Data Visualization and Real-time data are uploaded**

- Completed setup of ThingSpeak data collection platform
- There is a shortcut to distinguish apartments from each other where:
  - Y- is short to Mrs. Yasmine apartment
  - S- is short to Mrs. Sara apartment
  - T- is short to Dr. Tamer apartment
  - A- is short to Dr. Ahmed apartment
  - E- is short to Mr. Eslam apartment

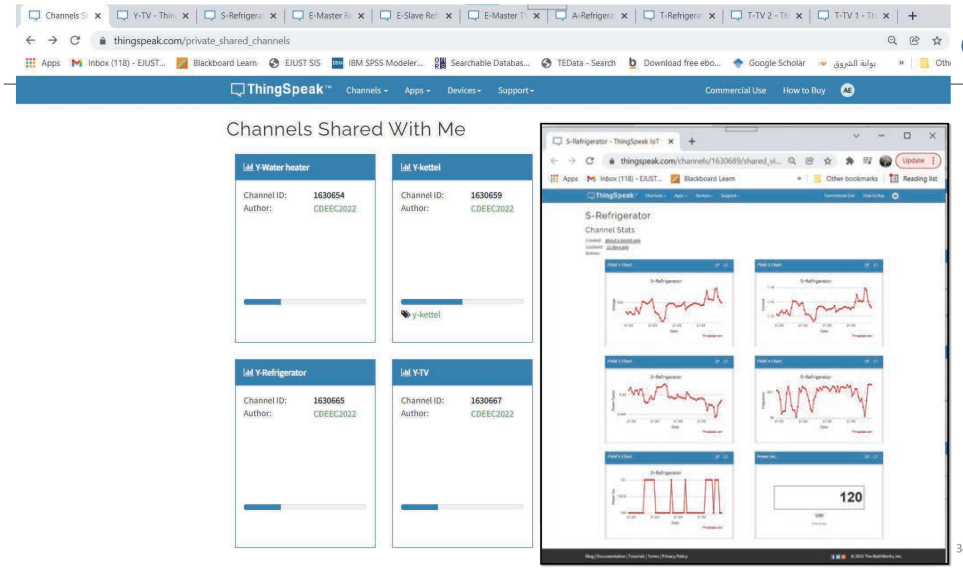


The smart home experiment

❑ **Home appliances:**

- We have finished installing smart meter devices in 5 test apartments as shown in the following table
- The devices were installed in
  Dr. Tamer's apartment on the 2nd of Feb
  Dr. Ahmed's apartment on the 7th of Feb
  Mr. Eslam's apartment on the 7th of Feb
  Mrs. Sara's apartment on the 8th of Feb
  Mrs. Yasmine's apartment on the 15th of Feb

No.	Device Name	Dr.Tamer P5	Dr.Ahmed P4	Mr.Eslam P3	Mrs.Yasmine P1	Mrs.Sara P2	
1	Water heater	2	1	1	1	1	
2	Kettle	1	0	1	1	1	
3	Iron	1	1	0	0	0	
4	AC	0	0	0	1	1	
5	Microwave	1	0	1	0	1	
6	Deep Freezer	1	0	1	0	0	
7	Refrigerator	1	1	2	1	1	
8	water cooler	*	0	0	0	0	
9	TV	2	1	2	1	2	
10	Radio	*	0	0	0	0	
11	Blender	1	1	0	0	0	
12	Washing Machine	1	1	1	1	1	
13	vacuum cleaner	1	0	0	0	0	
14	Printer	0	0	0	0	*	
15	Water Filter	0	0	0	0	*	
16	kitchen hood	0	0	0	0	*	
	Total	12	6	9	6	8	41



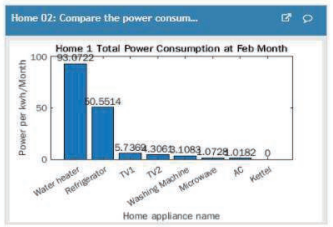
The smart home experiment

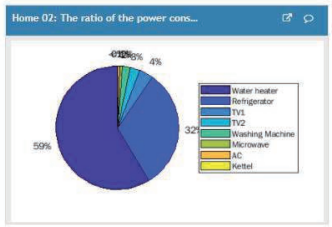
❑ **Home appliances – Apt # 1:**

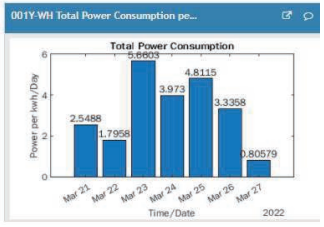
- The devices for which the energy consumption is measured in the apartment of Dr. Tamer

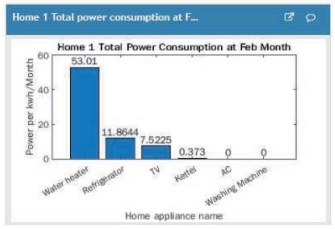
No.	Device Name	Dr.Tamer
1	Water heater	2
2	Kettle	1
3	Iron	1
4	AC	0
5	Microwave	1
6	Deep Freezer	1
7	Refrigerator	1
8	TV	2
9	Blender	1
10	Washing Machine	1
11	vacuum cleaner	1
	Total	12

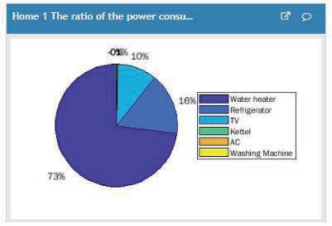
Energy Consumption Dashboard Example

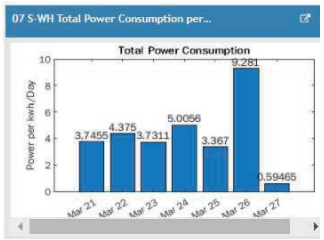












Prof. Amr B. Eltawil
eltawil@ejust.edu.eg

THANK YOU

Green Star® Hotel

GREEN STAR HOTEL PROGRAMME

Supporting Sustainable Tourism in Egypt

An internationally recognized certification system for Egyptian hotels…

PPP – Partnership Project

Private Partners

Public Partners

TUI Aktiengesellschaft

Green Star® Hotel

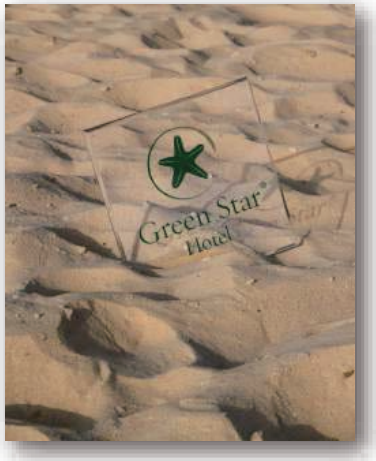
EGYPTIAN HOTEL ASSOCIATION

giz

Federal Ministry for Economic Cooperation and Development

Improvement of the environmental performance and competitiveness of the Egyptian hotel industry

„Green Star Hotel Programme“ - An internationally recognized certification system designed for Egyptian hotels



The Green Star Hotel (GSH) is:

- A **national certification and capacity-building Programme** developed under the patronage of the **Egyptian Ministry of Tourism**
- to support hotels and resorts interested in improving their **environmental performance and social standard**.
- This customized certification distinguishes hotels that demonstrate **sustainable environmental management** through compliance with a carefully designed standard.
- The GSH Programme standard is internationally **recognized by the Global Sustainable Tourism Council (GSTC)**.

The Green Star Hotel Programme Objectives

Motivating the Egyptian hotel sector to go „green“

- The Green Star Hotel Programme aims to have a profound impact on the further development of the main tourism destinations in Egypt by motivating the hotel sector to become active and move towards more sustainability

… becoming a lighthouse for other tourism sectors in Egypt

- By starting with the key sector in the Egyptian tourism industry, the hotel sector, a first step is take to make Egypt a sustainable destination

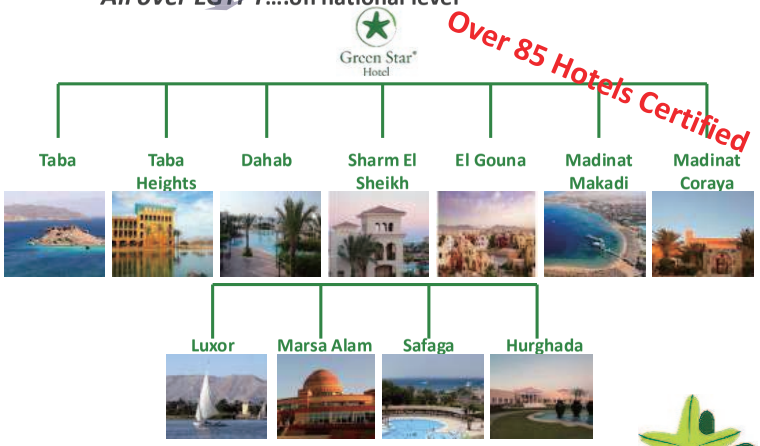
The Green Star Hotel Programme Objectives

- significant reduction of water, energy and chemical consumption (up to **30%**)
- increased use of renewable energy (up to **25%**)
- reduction of waste accumulation (up to **20%**) and proper waste handling
- awareness raising among hotel staff and guests
- capacity building for sustainable hotel management

Capacity Building (Hotels Training)

Certified Green Star Hotels in Key Tourism Destinations in Egypt

.....from local to regional level.....the upscaling from one pilot destination...to the *All over EGYPT*....on national level



What aspects of hotel operation are impacted by the Green Star Hotel Programme?

- Sustainable Management
- Environmental Management
- Training and Instructions
- Water
- Energy
- Waste
- Guest Information
- Food and Beverage / Kitchen
- House Keeping / Guest Rooms
- Gardening and Beach Area
- Interior and Exterior Appearance

How to join the GSH Programme?

Register → Subscribe → Training → Audit → Award

Green Star® Hotel

What resources does GSH offer?


Green Star Hotel Sustainability Standard for Egypt


Green Star Hotel Rating Supporting Tools (Monitoring, Staff Instructions


Green Star Hotel Capacity Building (Training, Coaching)


Green Star Hotel Communication Tools and Branding


Green Star Hotel International On-site Audit


The Green Star Hotel Collection Webpage


Green Star Hotel Getting Started Manual


Green Star Hotel Newsletter

Recommendations

- Incentive to the green hotels
- Loan with interest 5%
- Free Technical support
- Include others energy aspects rather than the ACs

Green Star® Hotel

www.greenstarhotel.org info@greenstarhotel.org

Appendix-2

Appendix-2: Participants' List and Training Material

1. Participants' List

MOERE

Name	Title
Eng. Rehab Beder Hassan	Team Leader of EECCPD
Eng. Marwa Konsowa	First engineer of EECCPD
Eng. Nora Saad	First Engineer of EECCPD
Mr. Ramy Mossa	Department of International Cooperation

2. Training Material

Objectives of the Seminar

- To grasp the current idea of the Project, the roles and responsibilities of MOERE under the Project for coming JICA appraisal mission
- To discuss and identify the contents of the technical assistance required for MOERE to implement the Project

Seminar Outlines

1. Description of the Project
   1) Project Scope
   2) Implementation Schedule
   3) Project Cost
   4) Organizations for Implementation
   5) Qualitative and Quantitative Data of Monitoring Indicators
   6) Monitoring Plan for the indicators
2. Roles and Responsibilities of MOERE
3. Consulting Services / Technical Assistance
   1) Contents of Technical Assistance for MOERE
   2) Case: Energy Efficiency and Conservation Promotion Financing Project in another country
4. Discussion and Q&A

1. Description of the Project
1) Project Scope

Product and service

Category 1:

Preferential loan to encourage the penetration of energy-efficient and energy-conserving equipment, made available at terms and conditions comparable to CBE Initiatives. It will be made available to any organization, enterprise or an individual who plans to install energy-efficient and energy-conserving equipment for buildings which they own, use, or manage anywhere in Egypt.

Category 2:

Technical assistance, in the form of consulting services resources will be offered to the Executing Agencies to enable effective and efficient implementation (including monitoring and reporting) of the Project, as well as for the capacity development of the stakeholders, promotion of the Project through awareness raising.

1. Description of the Project
1) Project Scope

Implementing Bodies

1. Borrower

Ministry of Finance, representing the Government of Egypt, is the Borrower who receives the Japanese ODA loan fund from JICA, to make it available for the Executing Agencies.

2. Executing Agencies

There are two Executing Agencies, with one being the Ministry of Electricity and Renewable Energy (MOERE) as the Technical Executing Agency, and Banque Misr (BM) as the Financial Executing Agency.

1. Description of the Project
2) Project Schedule

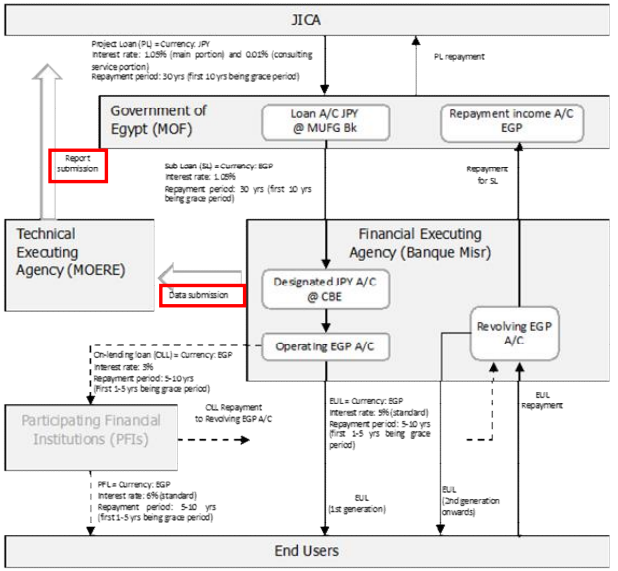
Event	Expected Schedule
Loan Agreement (L/A)	by April 2023
Loan Effective	by August 2023
Selection of Consultant	December 2023
Consulting Service for MOERE	February 2024 - February 2029
Consulting Service for BM	February 2024 - February 2029
Provision of Funds to End Users	February 2024 – February 2029
Project Completion Date	February 2029

1. Description of the Project
3) Project Cost

Project Cost: 10 billion JPY

(Around 70 million USD or 1,350 million EGP)

1. Description of the Project
4) Organizations for Implementation



1. Description of the Project
4) Organizations for Implementation

- Roles and Responsibilities of the Executing Agencies

(1) MOERE

MOERE is responsible for administration and supervision of the Project (including collective reporting) as the Administrative Authority, and also responsible for monitoring the technical effects of the Project the regulatory body for EE&C measures.

(2) BM

BM will act as the Financial Executing Agency to extend preferential loan for the purpose of promoting the technologies and equipment as stipulated by the Technical Executing Agency, MOERE. BM is responsible for the management of the Project loan fund and for periodical reporting to MOERE on specified reporting formats.

1. Description of the Project
4) Organizations for Implementation

- Project Implementation Unit (PIU)

Each Executing Agency will establish its Project Implementation Unit. Responsibilities and methodology of the Project implementation works to be pursued by the PIU will be summarized in a Business Process Manual, which will be jointly prepared among the two Executing Agencies upon the commencement of the Project. A simple information system (the Project Management Information System: MIS) to facilitate the data submission from BM to MOERE may also be developed and introduced upon the start of the Project.

1. Description of the Project
4) Organizations for Implementation

- PMU in MOERE

Positions	Role	Proposed staffing	No. of staff
Project Director	• Coordinate with all the concerned agencies including BM. • Internal & external communications representing the Project • Decision making and managerial tasks for the Project	• First Undersecretary of State for Research, Planning and Authorities Follow-up	1
PIU Manager	• Prepare, compile the quarterly reports submitted by the PFIs and submit Quarterly Progress Reports (QPRs) including ESMS to JICA. • Overall management of the Project implementation.	• Head of EECCD	1
Effect measurement & monitoring	• Measuring and monitor the progress and effect of the Project, based on data collected from the end users and the Financial Executing Agency.	• EECCD member	1
Data management & documentation	• Data management including ICT environment development • Day to day administration including reporting document preparation and document archiving.	• EECCD member	1
Capacity development & awareness raising	• Capacity assessment, gap analysis, baseline and target setting. • Capacity development action plan drafting and implementation management. • Seminars, workshops, training and publicizing.	• EECCD member	1
Inter-organizational and international relations	• Communications, coordination and information sharing with the other EE&C promotion initiatives within Egypt and outside Egypt.	• EECCD member	1

1. Description of the Project
4) Organizations for Implementation

- Project Steering Committee (SC)

Responsibilities:

- ✓ Convene regular meetings (Annual Reporting Meetings) inviting all the stakeholders to discuss on the status of the implementation and possible improvement in the Project
- ✓ Find out the problem and bottlenecks and recommend necessary correction in policy level such as rules and regulations, taxes, etc.

Members:

- ✓ First undersecretary, MOERE
- ✓ Executive officer, BM
- ✓ One representative from MOF
- ✓ One representative from MOIC
- ✓ One observer from JICA
- ✓ Any other person who may be deemed to be appropriate

Meetings:

- ✓ Annual Reporting Meetings, which will be convened annually, within 3 months of the end of the fiscal year. The Chairperson will instruct the secretariat to arrange and call for the meetings.
- ✓ Special meetings may be arranged with short notice based on the consent of the members.

1. Description of the Project
4) Organizations for Implementation

- Project Implementation Unit Meeting (PIUM)

  Responsibilities:
  - ✓ To monitor the implementation status
  - ✓ To report to SC on any problem or challenges

  Chairperson:
  - ✓ PD of MOERE PIU

  Members:
  - ✓ MOERE PIU
  - ✓ BM PIU
  - ✓ Observer(s) from JICA as required

1. Description of the Project
5) Qualitative and Quantitative Data of Monitoring Indicators

Indicators Measured by MOERE

- Energy saving potentials (toe/yr) introduced
- CO2 emissions reductions (t-CO2)

Indicators Measured by BM

- Amount of end-user loan (EUL) extended
- Number of end-user loan (EUL) cases

1. Description of the Project
6) Monitoring Plan for the indicators

MOERE

- Quarterly Progress Reports (QPR)s shall be compiled by MOERE, based on its own reports and reports submitted from BM, and submitted to JICA until project completion. QPR is to be contain the updated Project Status Report (PSR).

- The Technical Assistance Consultants' activities monthly report shall also be shared with JICA throughout the duration of the consultants' activities.

1. Description of the Project
6) Monitoring Plan for the indicators

BM

- On-site Physical Inspection Report
- Ongoing Lending Cases Status and Financial Report
- Environmental and Social Performance Report
- Statement of the Designated Account, Operating Account, and the Revolving Fund Account of the Proceeds of the Loan
- Current repayment and Overdue Status Report
- Environmental and Social Management Systems Checklist
- Certified Audit Report on Statements of Expenditures and internal audit report

1. Description of the Project
6) Monitoring Plan for the indicators

<u>MOERE and BM</u>

- Anti-corruption Monitoring Sheet
- Project Completion Report
- Implementation status information, whenever requested by JICA

2. Roles and Responsibilities of MOERE

- Roles and Responsibilities' Matrix

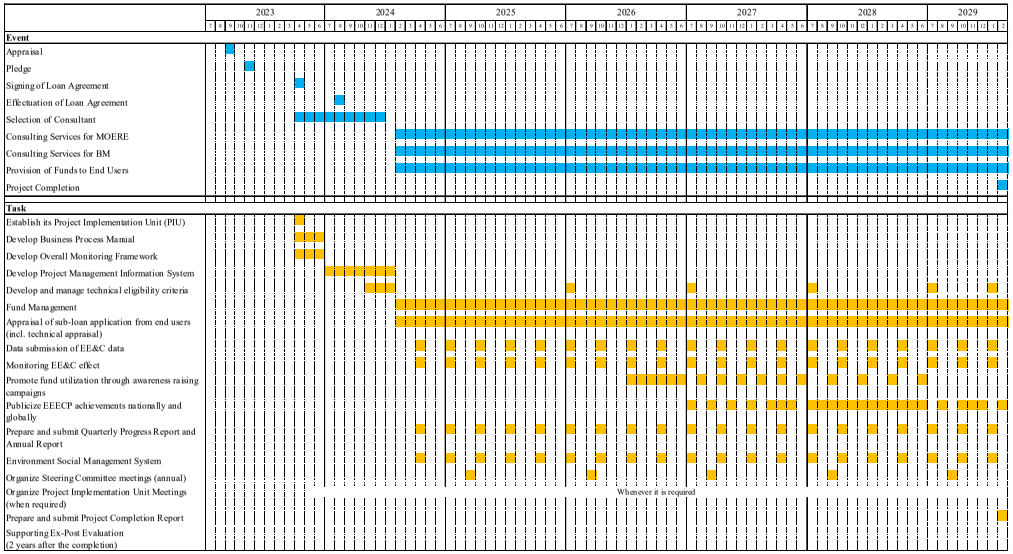
Stage	No.	Task	MOERE	Consultant's Support	BM	MOF
Initial stage	1	Establish its Project Implementation Unit (PIU)	✓ (MOERE's PIU)		✓ (BM's PIU)	
	2	Develop Business Process Manual	✓	✓	✓	
	3	Develop Overall Monitoring Framework	✓	✓ ← (Opinions & Feedback)		
	4	Develop Project Management Information System	✓	✓ ← (Opinions & Feedback)		
	5	Develop and manage technical eligibility criteria	✓	✓ ← (Opinions & Feedback)		
Implementation	6	Fund Management			✓	
	7	Appraisal of sub-loan application from end users (incl. technical appraisal)			✓	
	8	Data submission of EE&C data			✓	
	9	Monitoring EE&C effect	✓	✓		
	10	Promote fund utilization through awareness raising campaigns	✓	✓	✓	
	11	Publicize EEECP achievements nationally and globally	✓	✓	✓	

2. Roles and Responsibilities of MOERE

- Roles and Responsibilities' Matrix

Stage	No.	Task	MOERE	Consultant Support	BM	MOF
Implementation	12	Prepare and submit Quarterly Progress Report and Annual Report	✓ (Compile and submit to JICA)	✓	✓ ← (Report to MOERE)	
	13	Environment Social Management System	✓ (Submit to JICA)	✓	✓ ← (Implement & report to MOERE in QPR/AR)	
	14	Organize Steering Committee meetings (annual)	✓	✓	✓	✓
	15	Organize Project Implementation Unit Meetings (when required)	✓ (Chair)	✓	✓ (attend)	
Completion	16	Prepare and submit Project Completion Report	✓ (Compile and submit to JICA)	✓	✓ ← (Report to MOERE)	
	17	Supporting Ex-Post Evaluation	✓		✓	✓

2. Roles and Responsibilities of MOERE



2. Roles and Responsibilities of MOERE

1) Early Stage of the Project
   - Establish its Project Implementation Unit (PIU)
   - Development of Technical Eligibility Criteria
   - Development of Business Process Manual (BPM)
   - Development of Overall Monitoring Framework
   - Development of Project Management Information System (MIS)
   - (Selection of Consultant)

2. Roles and Responsibilities of MOERE

2) During the Project implementation
   - Regular monitoring of the Project (incl. site visits)
   - Awareness-raising (incl. advertising) of EE&C
   - Preparation/Submission of Quarterly Progress Reports / Annual Report
   - (Sharing Technical Assistance Consultants' activities monthly report with JICA)

3) After the Project completion
   - Preparation/Submission of Project Completion Report
   - Supporting Ex-Post Evaluation

2. Roles and Responsibilities of MOERE

(FYI: Outline of QPR / AR)
- Project Status Report(PSR) (Prepared by MOERE, Quarterly)
- On-site Physical Inspection Report (BM, Quarterly)
- Ongoing Lending Cases Status and Financial Report (BM, Quarterly)
- Environmental and Social Performance Report (BM, Quarterly)
- Statement of the Designated Account, Operating Account, and the Revolving Fund Account of the Proceeds of the Loan (BM, Quarterly)
- Current repayment and Overdue Status Report (BM, Quarterly)
- Environmental and Social Management Systems (ESMS) Checklist (BM, Annually)
- Certified Audit Report on Statements of Expenditures and internal audit report (BM, Annually)
- Anti-corruption Monitoring Sheet (MOERE & BM, Quarterly) 

3. Consulting Services / Technical Assistance
1) Contents of Technical Assistance for MOERE

<u>1. Objectives</u>

a) Implementation work support, including planning, monitoring and reviewing
b) Publicizing, including convening seminars and training and information dissemination
c) Capacity development for introduction of model energy audit practice
d) Conduct an energy audit if necessary for potential sub-projects

3. Consulting Services / Technical Assistance
1) Contents of Technical Assistance for MOERE

2-1. Implementation Work Support

- Support for the overall Project administration

The Consultant shall:

i. Assist Project Implementation Unit (PIU) in MOERE in sharing information with PIU in BM for reporting requirements to JICA; and
ii. Assist in preparing the progress reports (QPR and AR) to be submitted to JICA.

3. Consulting Services / Technical Assistance
1) Contents of Technical Assistance for MOERE

2-1. Implementation Work Support

- Overall monitoring

The Consultant shall:

i. Prepare an overall monitoring framework and propose to PIU in MOERE;
ii. Conduct regular monitoring which includes, but not limited to, the confirmation of progress, appropriateness and effects of the project implementation;
iii. Assist MOERE in developing the operating guideline for project implementation;
iv. Assist MOERE in developing a mechanism, with collaboration with PIU in BM, to automatically collect information on amount of energy saved and CO2 emissions reduced by the program utilizing a smart meter developed by E-JUST;
v. Assist MOERE in collecting implementation status information from PIU in BM on regular basis. The Consultants should also conduct an energy audit if necessary for potential End User lending cases;
vi. Assist MOERE in conducting site visits to selected End User lending cases to gather information on the business operation and energy saving status;
vii. Assist MOERE in reporting the monitoring results to JICA (including the preparation of Quarterly Progress Reports (QPRs) and Annual Reports (ARs)) and to other related organizations as required.

3. Consulting Services / Technical Assistance
1) Contents of Technical Assistance for MOERE

2-1. Implementation Work Support

- Eligibility Criteria Supports

The Consultant shall extend support to the PIU on technical advisory for the implementation of the Project, by:

i. Revising the Eligible Technology and Equipment List;
ii. Providing technical inputs and guidance on the eligibility of the applications for the Project loan.

3. Consulting Services / Technical Assistance
1) Contents of Technical Assistance for MOERE

2-2. Publicising

The Consultant shall:

i. Assist MOERE in convening EE&C seminars and trainings (physical and online) inviting government officials, university professors, business executives as resource persons as public-private information exchanges for awareness-raising (including advertising),
ii. Assist MOERE in creating awareness among end-users and widely disseminate program information through web-based platform; and
iii. Assist MOERE and other relevant organizations such as Egyptian Electricity Holding Company (EEHC) in promoting the Project among target end-users such as Micro-, small and medium-sized enterprises (MSMEs).

3. Consulting Services / Technical Assistance
1) Contents of Technical Assistance for MOERE

2-3. Capacity Development

The Consultant shall:

i. Facilitate the meeting for MOERE with manufacturers of energy efficient equipment so that MOERE may deepen its knowledge on the latest EE&C equipment and technology.
ii. Introduce model energy audit practice (including measurement equipment).
iii. Provide the training on how to conduct walk-through and energy audit to support decision makings for EE&C investments.
iv. Provide international technical exposure trainings (inviting MOERE, MOF, BM officials to Japan and third countries);
v. Assist MOERE in coordinating with other development partners who are willing to provide financing to energy efficiency.
vi. Assist MOERE in synchronizing the Project with other policy programs to promote energy efficient buildings. For example, draw policy implications from the Project, and reflect them in other policy programs such as Standard & Labelling system and green building certification schemes.

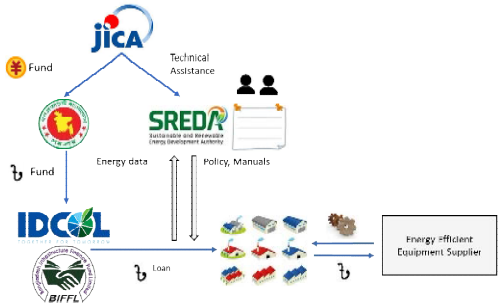
3. Consulting Services / Technical Assistance
2) Case: Energy Efficiency and Conservation Promotion Financing Project in another country

Case Study: Energy efficiency and conservation promotion financing project

Project Structure

A two-step loan between Japan and Bangladesh

- JICA awards a fund to Bangladesh's Ministry of Finance.
- Two financial institutions were selected, handling the loans to the end users.
- Technical assistance is given by the Sustainable and Renewable Energy Development Authority (SREDA), as the executing authority.



Case Study: Energy efficiency and conservation promotion financing project

Executing authority

- In SREDA's case, a Project Implementation Unit (PIU) was established, consisting the following three positions.
  - Project Director
  - Assistant Director
  - Deputy Project Director

Case Study: Energy efficiency and conservation promotion financing project

Executing authority

Tasks of the Executing Authority		
1	Maintain & Update Eligibility List	• The list of equipment, eligible for the loan hast to be updated every now and then. • This is done conferring with the consultants and the technical advisory committee.
2	Loan Process Execution	• At the beginning of the project, the consultant team developed a business process manual. • This allows to routinize the communication with the financial institution and the general execution of the loan process.
3	Monitoring & Recording of Loan Impact	• A project management information system was developed by the consultant team to monitor the amount of CO2 emissions and energy saved by the equipment introduced through the loan. • Energy saving and CO2-reduction data is reported by the sub-project owners, and calculated by the consultant.
4	Reporting	• Progress reports of the project have to be delivered to JICA. • The reports are prepared by the consultants on a monthly, quarterly and annual basis.

Case Study: Energy efficiency and conservation promotion financing project

Task1) Maintain & Update Eligibility List

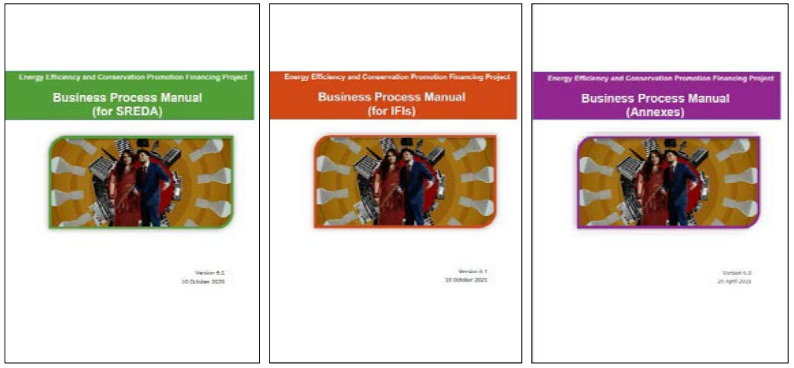
- List should only be updated when there are significant changes on the market or newly interested parties.

Code number, Sub-sector and item			Specification	Eligible portion	Energy source
9	Common technology				
9.1	Power receiving and distribution				
	9.1.1	Transformer	Transformer with amorphous metal core		Electricity
9.2	Water pump				
	9.2.1	Pump with inverter	Pump with inverter control, whose motor output is 10 kW or more (motor should meet the standard which is stipulated in item 9.7.1).		Electricity
9.3	Fan and blower				
	9.3.1	Fan and blower with inverter	Fan and blower with inverter control, whose motor output is 10 kW or more (motor should meet the standard which is stipulated in item 9.7.1)		Electricity
9.4	Air compressor				
	9.4.1	Air compressor (single)	(1) Screw compressor with inverter control, (2) Centrifugal compressor, whose motor output is 10 kW or more.	Compressors may be accompanied by the following functions: (a) Dryer (b) Motor starter (c) Filter	Electricity
	9.4.2	Multi air compressor with control unit	(1) Screw compressors with inverter control. The numbers of air comoressors being 2 sets or more, equipped with an optimum control unit. (2) Centrifugal compressors, in a set of 2 or more, whose motor output is 10kW or more each, with an optimum control unit.		Electricity

Case Study: Energy efficiency and conservation promotion financing project

Task2) Business process manual

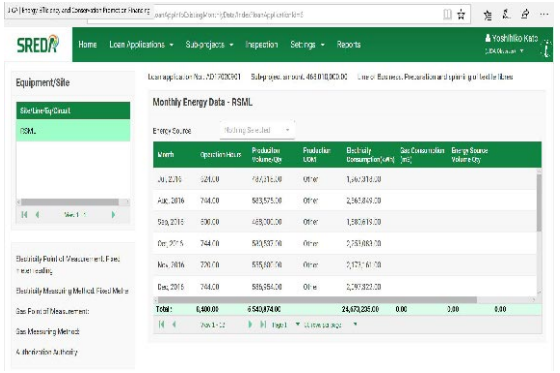
- The consultant team developed for executing agency and financial institutions.



Case Study: Energy efficiency and conservation promotion financing project

Task3) Project management information system

- All loan activities are recorded in the MIS.
- The executing authority can track and monitor each step of the loan.
- Loan permission after the eligibility check can be done digitally.
- After the purchased equipment is installed, the loanee reports their energy savings and CO2 emission reductions.



4. Discussion and Q&A

Appendix-3

Project Concept Paper

1. Name of project

Country; Arab Republic of Egypt

Name of project; Egyptian Energy Efficient Cooling Program
(Two Step Loan Project for Energy Efficiency)

2. Background and Necessity

(1) Current status and issues

Egypt will host the 27th Conference of the Parties of the UN Framework Convention on Climate Change (COP27) in Sharm El Sheikh in November 2022. The conference will be an opportunity for Egypt to show their commitment to climate change mitigation and adaptation. It will also be a historic occasion to announce the government-to-government collaboration between Egypt and Japan. The Government of Egypt updated Nationally Determined Contributions (NDCs) for the first time in June 2022, where Egyptian Energy Efficient Cooling Program is listed as one of mitigation projects which require international funding.

In Egypt, electricity consumption increased by more than 30% in the past decade (from 157,406 GWh in 2011/12 to 204,794 GWh in 2020/21). Number of customers also increased by 35% (from 28.1 million in 2011/12 to 37.9 million in 2020/21). Electricity demand will continue to increase in the future due to stable economic development, development of new cities and growing population.

According to strategies such as "Sustainable Development Strategy 2030 (SDS 2030): Egypt Vision 2030" and "Egypt's Integrated and Sustainable Energy Strategy 2035 (ISES 2035)", the Government of Egypt made significant efforts to promote energy efficiency in both supply and demand sectors. JICA (Japan International Cooperation Agency) has been supporting energy efficiency policy and measures since 2017.

Significant energy efficiency potential still lies especially in space cooling in buildings which currently consumes 10% of total energy in the country (primary energy basis). Further funding is essential to unlock such potential.

(2) Necessity of the project

In the future, energy efficiency in demand sector will become more and more important for the following reasons.

1) In August 2022, the cabinet approved a plan to significantly reduce the electricity consumption to conserve natural gas, so that more natural gas can be allocated for export. Coupled with the soaring international price of natural gas, this policy is contributing to the country's foreign currency earnings, thus leading to fiscal stability.
2) With gradual phase out of electricity subsidy programs, electricity tariff is set to increase. To avoid negative impact on private sector, measure such as reducing electricity consumption per unit of production is an urgent issue for achieving environmentally friendly and sustainable growth.
3) According to the updated NDCs, the electricity sector is expected to reduce greenhouse gas emissions by 33% by 2030 compared to business-as-usual case. One of the measures to achieve the target is to improve energy efficiency.

From industry policy perspectives, the Government of Egypt is committed to support Micro, Small and Medium sized Enterprises (MSMEs)' development. In Egypt, 3.7 million MSMEs exist. It is in the Government of Egypt's policy that MSME's access to finance should be improved.

3. Overview of project

(1) Objectives of project

The purpose of the project is to promote energy efficiency and conservation measures through facilitating the installation of energy-efficient and energy-conserving equipment in Egypt by extending two-step concessional loans, thereby stabilizing the balance between supply and demand for electricity and contributing to mitigation of climate change.

(2) Project site/ target area

Whole Egypt

(3) Beneficiaries of project (target group)

End-users of energy-efficient and energy-conserving space cooling equipment in Egypt

(4) Project implementation schedule

2024 – 2029 (five years)

(5) Project cost

Up to JPY10 billion. (tentative)

(6) Source of Finance and Borrower

Source of Finance: JICA, the Government of Japan

Borrower: Ministry of Finance

(7) Executing agencies in Egypt

Ministry of Electricity and Renewable Energy (MOERE) (technical)

Banque Misr (BM) (financial)

(8) Terms of Amounts of loan (Indicative sample condition)

Item		Tentative figure
Currency		JPY
Amount		Up to JPY 10 billion
Annual interest rate (%)	Project	1.5 %
	Consulting services	0.01%
Repayment period (years)		30 years
Grace period (years)		10 years

* Front-End Fee of 0.2% is also imposed.

Terms will be revised in October 2022

(9) Others

The details of the project design is summarized in the attached presentation.

End

————————————————————————————————

Attachment:

Presentation “Egyptian Energy Efficient Cooling Program - EEECP” in August 2022.

Egyptian Energy Efficient Cooling Program - EEECP

JICA Survey Team

August 2022

Egyptian Energy Efficient Cooling Program

COP 27 at Sharm el-Sheikh in November 2022

- A direct response to Egypt's first updated Nationally Determined Contributions (NDCs), which lists "Energy efficiency cooling in building" as one of mitigation projects to be pursued with financial support from developed countries.

What Program?

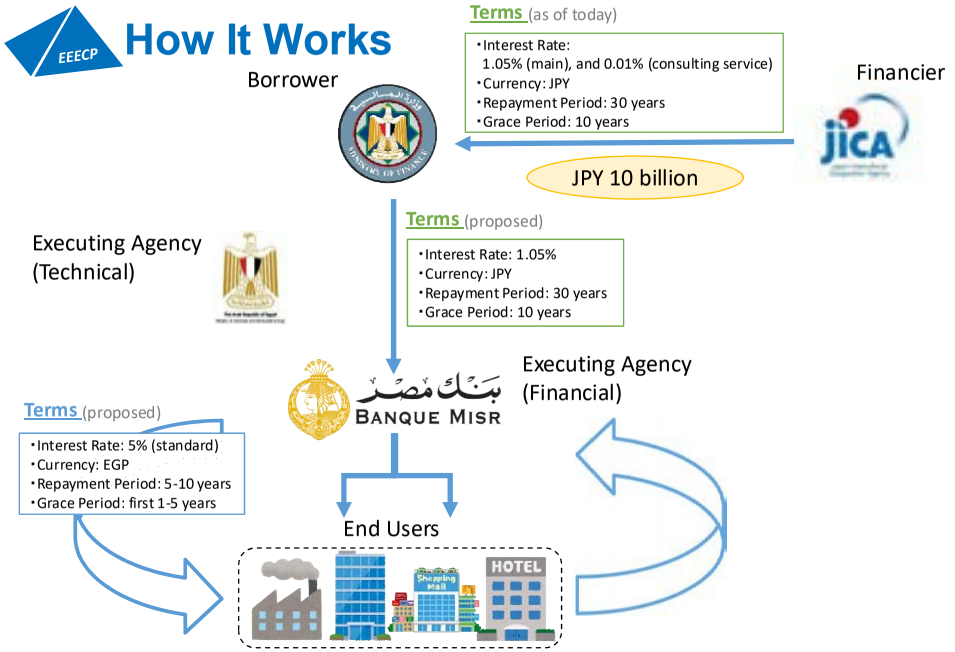
"Egyptian Energy Efficient Cooling Program"

- Preferential lending facility to promote energy efficient air conditioning technologies in buildings (as mentioned in NEEAP II).
- It will contribute to electricity saving. It is in line with the plan recently approved by the cabinet to significantly reduce electricity consumption to conserve natural gas which will be allocated for export to earn .
- We may use JICA concessional loan as a "revolving fund" and technical assistance.

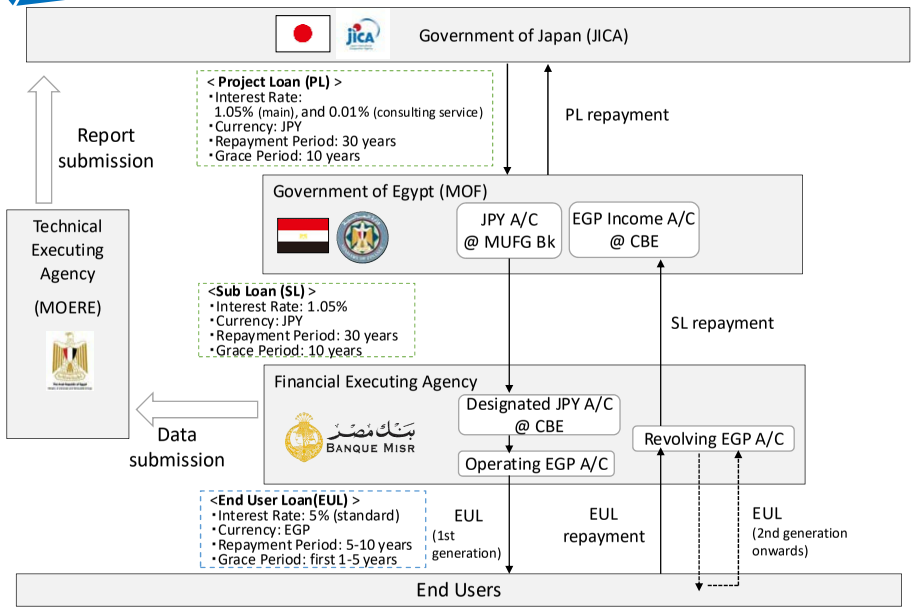
Egyptian Energy Efficient Cooling Program

Name	Egyptian Energy Efficient Cooling Program (EEECP)
Objective	• Building energy efficiency => saves electricity consumption => reduces natural gas usage for power generation => increased natural gas export, foreign currency earnings => carbon emissions reduction. • Support for MSMEs through better access to finance
Project Area	• Entire territory of Egypt
Loan agreement	• Between JICA and the Government of Egypt
Loan amount	• Up to JPY 10 billion
Executing Agency	• Technical = Ministry of Electricity and Renewable Energy • Financial = Banque Misr
Implementation Period	• 5 years (first cycle of the revolving fund) • 30 years (revolving period)

How It Works



How It Works



Benefits, Costs, and Risks

Direct

Effect per JPY 10 billion for equipment lifetime of 15 years

Natural gas

9,605,839 mmbtu /lifetime of 15 years

= USD 120 million(*1)

CO_2

450,260 t-CO_2 /lifetime of 15 years

= USD 16 million(*2)

(*1) Natural gas price in USD 12.5/Mbtu according to TTF average price (2018-2022 Q2) by IEA report

(*2) USD36/t-CO2 price average (2018-2022 Q2) by ICE

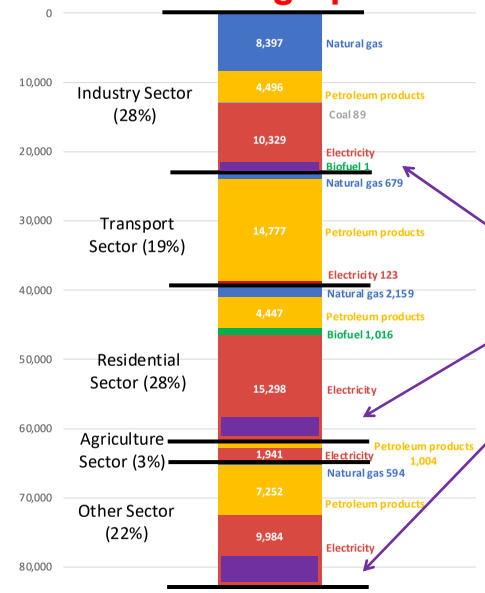
Indirect

- Economic Development through MSMEs promotion
- Better living environment for the Egyptian citizens (more air conditioners)
- Contribution to Egyptian policies
  + opportunities for capacity development
- Promotion of advanced cooling industries
  +Job creation in various sectors

Cost: JPY 301 million to be borne by Government of Egypt

Referential Data

Around 10% of Egypt's Energy is Consumed for Building Space Cooling



Total energy (primary energy basis) consumed for space cooling in building accounts for approx. 10%

Note:
Egypt's National Energy Consumption FY 2020-21 (primary energy basis) by sector and energy product, compiled in JICA Technical Cooperation Project in collaboration with CAPMAS, MOERE, MOPMR, and MOE.

Unit: ktoe

Policy Background

- Egyptian Energy Efficient Cooling Program (EEECP) contributes to;

"Egypt Vision 2030".
"Integrated Sustainable Energy Strategy (ISES) 2035"
"National Climate Change Strategies 2050"
"Second National Energy Efficiency Action Plan - NEEAP II".
"Egypt's First Updated NDCs" through **fuel and CO2 emissions reduction.**

- EEECP facilitates the introduction of efficient and innovative cooling technologies which enables 5% fuel saving in Egypt.
- EEECP echoes with Egypt's long-term climate change strategies including CO2 emissions reduction.

Recently approved plan to **reduce electricity consumption** to expand **natural gas export** through electricity saving in building sector.

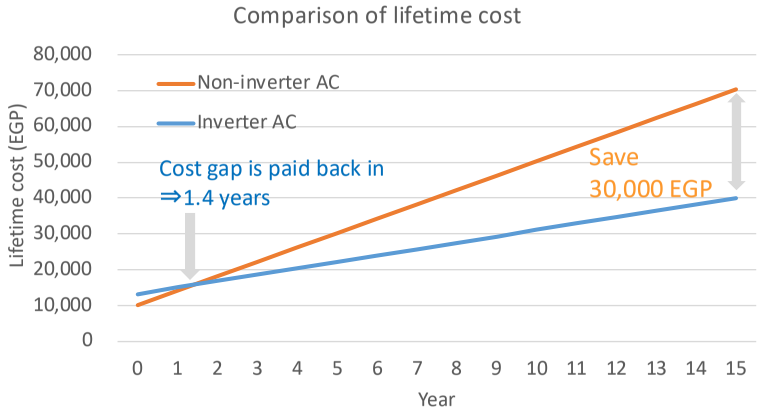
- Fuel saved from EEECP will contribute to expansion of natural gas export, resulting in foreign currency earnings and fiscal stability.

"Enterprise Development Law 152 of 2020" through **MSMEs finance**

- EEECP improves access to finance for 3.7 million MSMEs and stimulates them to play a greater role in national economy.

An Inverter AC user Saves EGP 30,000 During the AC's Lifetime Cost

Inverter air-conditioner vs Non-inverter air-conditioner



Note
1) Lifetime cost: Equipment purchase cost(3 HP AC unit), operation expense (annual operating period: 4 months/year)
2) Initial cost gap = EGP 3,232, running cost benefit = EGP 2,246 every year.

Inverter-controlled Building Space Cooling Reduces 50-60% of energy

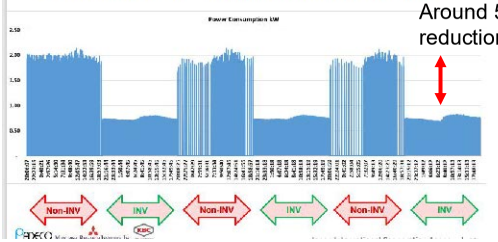
Global room AC inverter ratio

Country	Room AC Inverter (%)	Note
Japan (cooling heating)	**100**	
India (cooling)	50	
Pakistan (cooling)	90	JICA TA in progress
Vietnam	60	JICA TA done
Egypt	**11**	JICA pilot project at E-JUST (in progress)

By accelerate the introduction of efficient cooling system, 50-60% cooling energy and related CO2 emission can be reduced.

Progress of AC Verification Test

■ The results of pre-experiment carried out in September



Around 50% reduction

Source: JICA TC project

Eligibility for the Loan

Who?	Technical criteria	Financial criteria	Subject of loan
Any organization, enterprise or an individual who plans to install energy-efficient and energy-conserving equipment for buildings which they own, use, or manage anywhere in Egypt.	• Space cooling (air conditioners, chillers) • Lighting • Energy management systems	The end user clears the financial evaluation conducted by the lending bank(s) (a common format for the evaluation will be prepared during the program formulation). Lending decision will remain under the discretion of the lending bank(s).	Related building construction or renovation works, which is necessary to complete installation of eligible equipment can be included.

شكرا جزيلا