付属資料

目　次

付属資料 1　　第一回セミナー資料
付属資料 2　　第一回セミナーアンケート結果
付属資料 3　　第二回セミナー資料
付属資料 4　　第二回セミナーアンケート結果

付属資料 1

第一回セミナー資料

Policy and Measures of Energy Efficiency &Conservation (EE&C) in Japan

JICA Study Team

February 2011

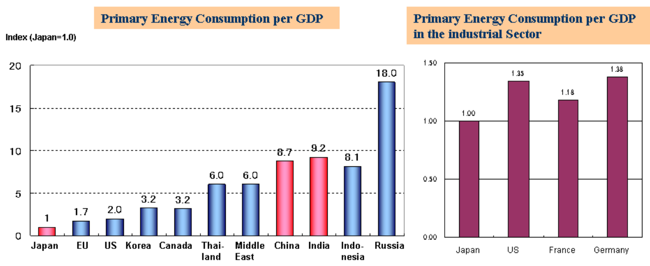
1

1

Japan's Energy Situation (1)

Primary Energy Consumption per GDP per Country

Japanese primary energy consumption per GDP is the lowest in the world owing to various energy conservation measures taken for the respective sectors. The energy consumption intensity per GDP in the industrial sector is lower than those of other major countries.



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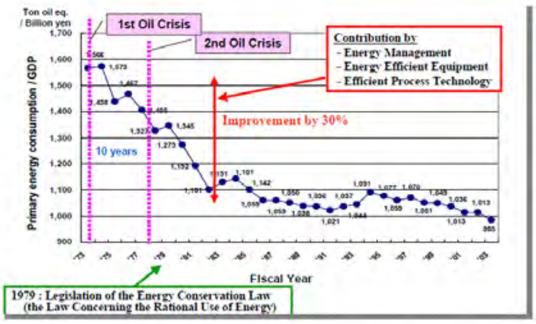
Japan's Energy Situation (2)

Changes in Primary Energy Consumption per GDP



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Laws and Plans for Energy Conservation (1)

Basic Act on Energy Policy (June 2002)

1. Securing of Stable Supply
2. Environmental Suitability
3. Utilization of Market Mechanisms with due consideration accorded to energy supply stability and environmental compliance.

The Act stipulates that the Government is responsible for formulating and implementing measures on energy supply and demand.

Basic Energy Plan (Oct 2003 rev.Mar 2007)

1. Improving Energy Efficiency in demand side and supply side
2. Comprehensive strengthening of resource diplomacy and , energy and environment cooperation
3. Enhancement of emergency response measures
4. Institutional reform of power and gas sector

To provide means for achieving the foals of the "Basic Act on Energy Policy", the Basic Energy Plan was adopted. The plan is to be reviewed and reassessed at least once every three years in response to changes in the energy environment.

To meet the policy No.1 (improving energy efficiency …) , the "Energy Conservation and Load Leveling" are described in the Plan.

4

4

Laws and Plans for Energy Conservation (2)

New National Energy Strategy (May 2006)

【Basic Objectives of the strategy】

- Establishment of energy security measures
- Establishment of the foundation for sustainable development through a integrated approach of energy and environment issues
- Contribution to Asian and the World for solution of energy problems

【Basic perspective of the strategy】

1. **Establishment of a state-of –the –art energy supply demand structure**
   Energy Conservation Frontrunner Plan (improvements of energy efficiency)
   Transport Energy for the next generation plan
   New Energy Innovation Plan
   Nuclear Power National Plan
2. **Comprehensive strengthening of resource diplomacy and Energy and Environment Cooperation**
   Comprehensive strategy for securing recourses
   Asia Energy and Environment Cooperation Strategy
3. **Enhancement of emergency response measures**
   Improvement of stockpiles system and preparation of the emergency response system
4. **Other**
   Energy Technology Strategy (technological challenges to be solved by 2030)

5

5

Laws and Plans for Energy Conservation (3)

Energy Conservation Frontrunner Plan

Japanese Economy has been achieving an energy consumption efficiency of over 30% since the two oil crises of the 1970s. By establishing a positive cycle of technological innovations and social system reforms in the future, our country aims to improve energy consumption efficiency by at lease another 30% by 2030.

Specific activities

(1) Formulation of an energy conservation technology strategy

(2) Introduction of the benchmark approach by sector and active creation of initial demand

(3) Establishment of a mechanism in which energy-saving investments are recognized by the market

(4) Development of energy- saving cities and areas

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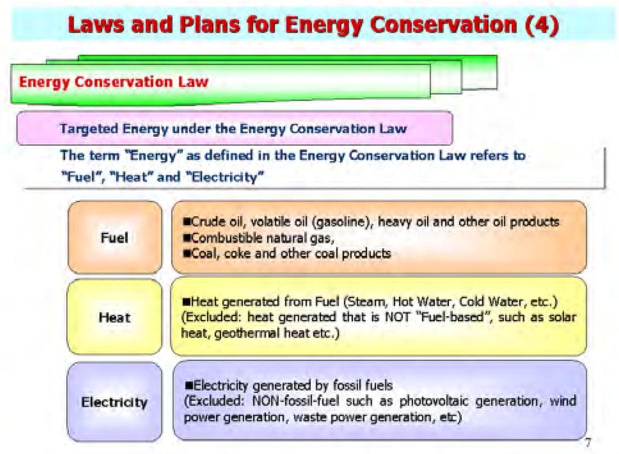
Laws and Plans for Energy Conservation (4)
Energy Conservation Law
Targeted Energy under the Energy Conservation Law
The term "Energy" as defined in the Energy Conservation Law refers to "Fuel", "Heat" and "Electricity"
Fuel
■Crude oil, volatile oil (gasoline), heavy oil and other oil products
■Combustible natural gas,
■Coal, coke and other coal products
Heat
■Heat generated from Fuel (Steam, Hot Water, Cold Water, etc.)
(Excluded: heat generated that is NOT "Fuel-based", such as solar heat, geothermal heat etc.)
Electricity
■Electricity generated by fossil fuels
(Excluded: NON-fossil-fuel such as photovoltaic generation, wind power generation, waste power generation, etc)
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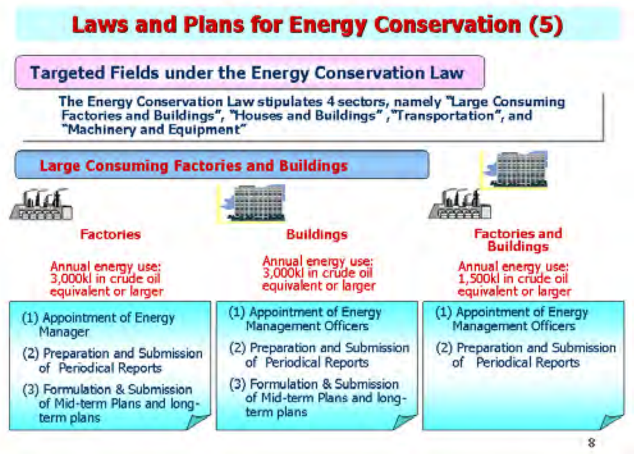
Laws and Plans for Energy Conservation (5)
Targeted Fields under the Energy Conservation Law
The Energy Conservation Law stipulates 4 sectors, namely "Large Consuming Factories and Buildings", "Houses and Buildings", "Transportation", and "Machinery and Equipment"
Large Consuming Factories and Buildings
Factories
Annual energy use: 3,000kl in crude oil equivalent or larger
(1) Appointment of Energy Manager
(2) Preparation and Submission of Periodical Reports
(3) Formulation & Submission of Mid-term Plans and long-term plans
Buildings
Annual energy use: 3,000kl in crude oil equivalent or larger
(1) Appointment of Energy Management Officers
(2) Preparation and Submission of Periodical Reports
(3) Formulation & Submission of Mid-term Plans and long-term plans
Factories and Buildings
Annual energy use: 1,500kl in crude oil equivalent or larger
(1) Appointment of Energy Management Officers
(2) Preparation and Submission of Periodical Reports
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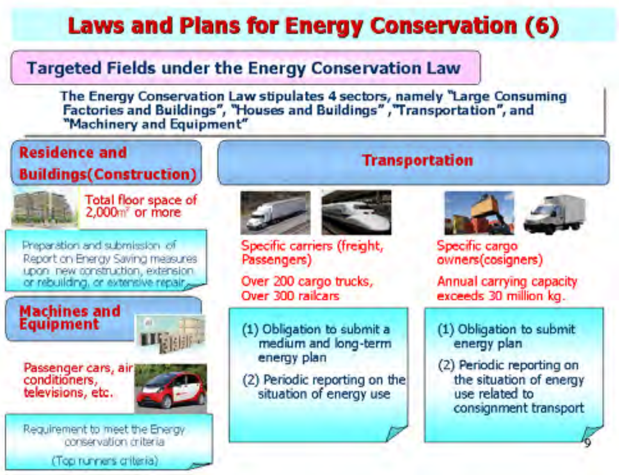
Laws and Plans for Energy Conservation (6)
Targeted Fields under the Energy Conservation Law
The Energy Conservation Law stipulates 4 sectors, namely "Large Consuming Factories and Buildings", "Houses and Buildings", "Transportation", and "Machinery and Equipment"
Residence and Buildings(Construction)
Total floor space of 2,000m² or more
Preparation and submission of Report on Energy Saving measures upon new construction, extension or rebuilding, or extensive repair
Machines and Equipment
Passenger cars, air conditioners, televisions, etc.
Requirement to meet the Energy conservation criteria
(Top runners criteria)
Transportation
Specific carriers (freight, Passengers)
Over 200 cargo trucks, Over 300 railcars
(1) Obligation to submit a medium and long-term energy plan
(2) Periodic reporting on the situation of energy use
Specific cargo owners(cosigners)
Annual carrying capacity exceeds 30 million kg.
(1) Obligation to submit energy plan
(2) Periodic reporting on the situation of energy use related to consignment transport
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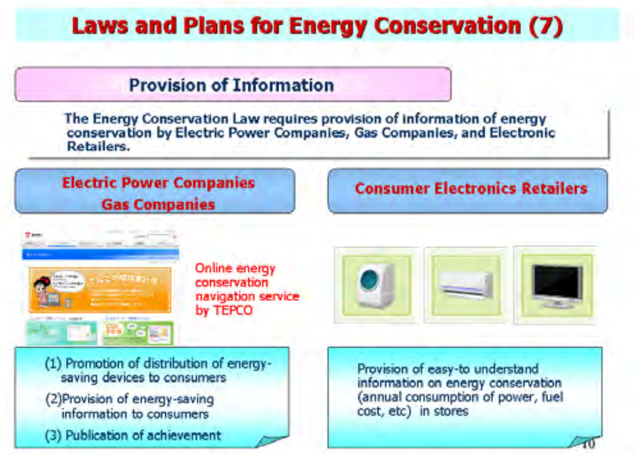
Laws and Plans for Energy Conservation (7)
Provision of Information
The Energy Conservation Law requires provision of information of energy conservation by Electric Power Companies, Gas Companies, and Electronic Retailers.
Electric Power Companies
Gas Companies
Online energy conservation navigation service by TEPCO
(1) Promotion of distribution of energy-saving devices to consumers
(2)Provision of energy-saving information to consumers
(3) Publication of achievement
Consumer Electronics Retailers
Provision of easy-to understand information on energy conservation (annual consumption of power, fuel cost, etc) in stores
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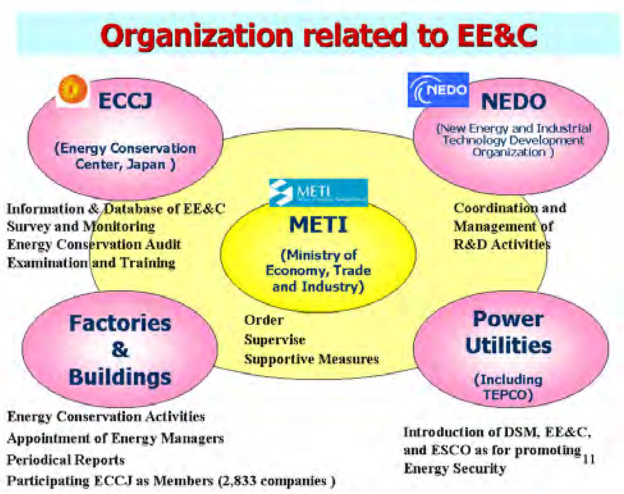
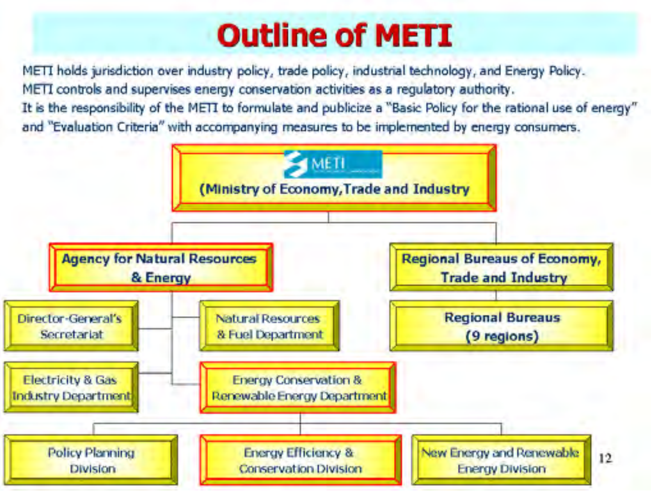

Organization related to EE&C
ECCJ
(Energy Conservation Center, Japan)
NEDO
(New Energy and Industrial Technology Development Organization)
METI
(Ministry of Economy, Trade and Industry)
Information & Database of EE&C
Survey and Monitoring
Energy Conservation Audit
Examination and Training
Coordination and Management of R&D Activities
Factories & Buildings
Order
Supervise
Supportive Measures
Power Utilities
(Including TEPCO)
Energy Conservation Activities
Appointment of Energy Managers
Periodical Reports
Participating ECCJ as Members (2,833 companies)
Introduction of DSM, EE&C, and ESCO as for promoting Energy Security
11

11

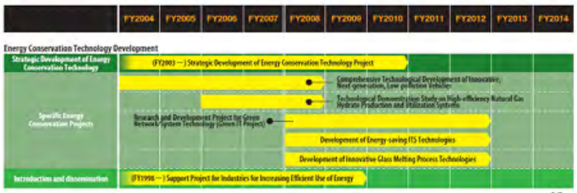

Outline of METI
METI holds jurisdiction over industry policy, trade policy, industrial technology, and Energy Policy.
METI controls and supervises energy conservation activities as a regulatory authority.
It is the responsibility of the METI to formulate and publicize a "Basic Policy for the rational use of energy" and "Evaluation Criteria" with accompanying measures to be implemented by energy consumers.
METI
(Ministry of Economy,Trade and Industry
Agency for Natural Resources & Energy
Regional Bureaus of Economy, Trade and Industry
Director-General's Secretariat
Natural Resources & Fuel Department
Regional Bureaus (9 regions)
Electricity & Gas Industry Department
Energy Conservation & Renewable Energy Department
Policy Planning Division
Energy Efficiency & Conservation Division
New Energy and Renewable Energy Division
12

12

Outline of NEDO

NEDO (New Energy and Industrial Technology Development Organization) is Japan's public management organization promoting research and development related to oil-alternative energy technology, industrial technology, and technology for the efficient use of energy.

Organization:
head office, 3 branch offices, 5 overseas offices (USA, France, China, Thailand, India)
Personnel: 1,000
Budget: Approximately 232.9 billion yen (FY2008)



13

13

Outline of ECCJ

The Energy Conservation Center, Japan
ECCJ

The Energy Conservation Center, Japan (ECCJ) is established in October 1978, just after the 2nd oil crisis.

ECCJ established as a NPO under the supervision of the Ministry of Economy, Trade and Industry (METI) .

ECCJ is the core organization responsible for promotion of energy conservation in Japan.

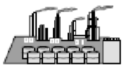
<Profiles>
Office: Tokyo Head office, 7 Branches and 1 Local Office
Established: October 16, 1978
Funds: 39 million USD
Supporting Membership: 2,861 companies (As of July, 2008)
Number of employees: 133 (As of July, 2008)

14

14

ECCJ Activities I : Industry Sector

1) Energy conservation audits services for factories
2) Education & training on energy conservation
3) State examination for energy managers (assigned by the government)
4) Dissemination (conference for successful cases of energy conservation activities, excellent energy conserving equipment, etc.)
5) Technological development and spillover



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ECCJ Activities II : Residential, Commercial & Transportation Sector

1) Energy conservation audits services for buildings
2) Ranking catalogue for energy efficient appliances (dissemination of Top Runner Program)
3) Promotion of energy labeling system
4) International Energy Star program implementation
5) Energy efficiency product retailer assessment system
6) Dissemination of energy conservation indicator "E-Co Navigator"
7) Energy education at primary and middle schools
8) ESCO research and development

16

16

ECCJ Activities III: Cross Sector

1) Energy conservation campaign & exhibition (i.e. ENEX :Energy & Environment Exhibition)
2) Commendation (grand energy conservation prize)
3) Information & data base, publicity and publishing
4) Survey and monitoring
5) International cooperation & communications

17

17

ECCJ Activities : Energy Audit Service

Energy Conservation Auditing for Buildings

2,513 Buildings (1998-2007)

Energy Conservation Auditing for Factories

2,306 Factories (1998-2007)

The Audit Includes
- On Site Discussions
- On Site Inspections
- Review of Documents required by the Energy Conservation Law
- List of areas which need remedies and give advice for energy saving potential and needed actions

18

18

ECCJ Activities : Energy Conservation Award

ECCJ selects and recommends candidates for the Grand Prizes of Energy Conservation with household appliances and office equipment to be awarded by the government (METI) at ENEX exhibitions every year.

Prizes are awarded to consumer equipment and systems that provide excellent energy efficiency.

2008 Energy Conservation Award

METI Minister's Award	An All-in-one washer-drier produced by Hitachi Appliances An Air conditioning system for offices and stores made by Toshiba Carrier Corporation An online eco-driving monitoring system developed by Isuzu Motors Ltd
the Agency for Natural Resources and Energy Director-General's Award	5 products
the ECCJ Chairman's Award	1 product
the Small and Medium Enterprise Agency Director-General's Award	13 products

Super Flex Module Chiller System developed by Toshiba& Tokyo Electric Power Company

(Using an improvement system of the METI Minister's Award 2007 winning system)

19

19

Thank you for your attention!

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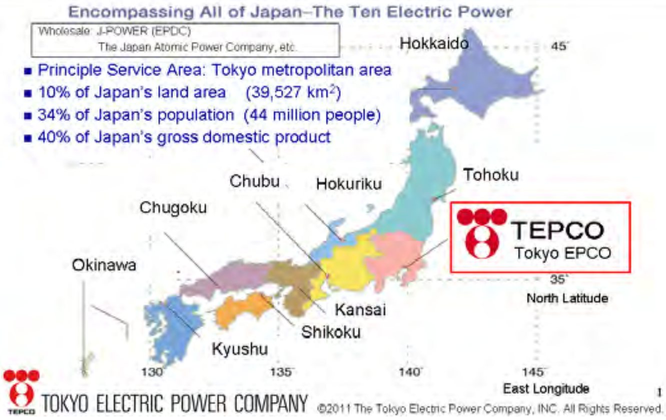
20

- Energy Efficiency Technologies in Japan -

February 2011

1

Electric Power Industry in Japan



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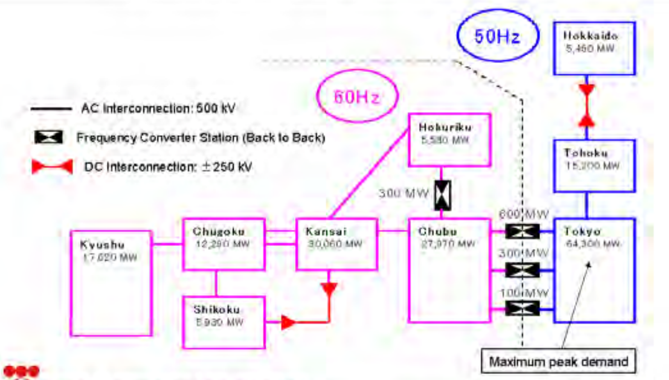
Electric Power System in Japan



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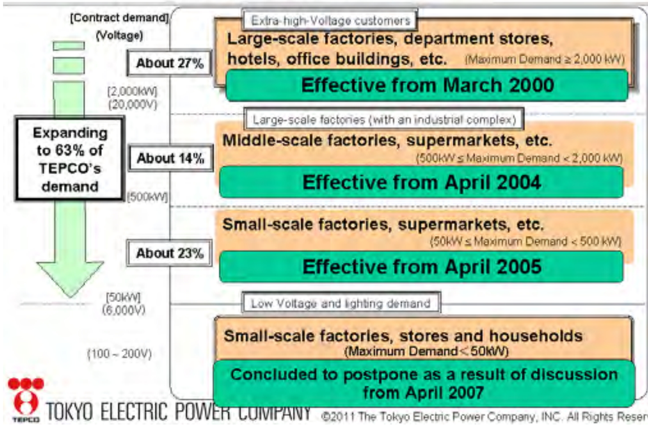
Deregulation of Retail Market



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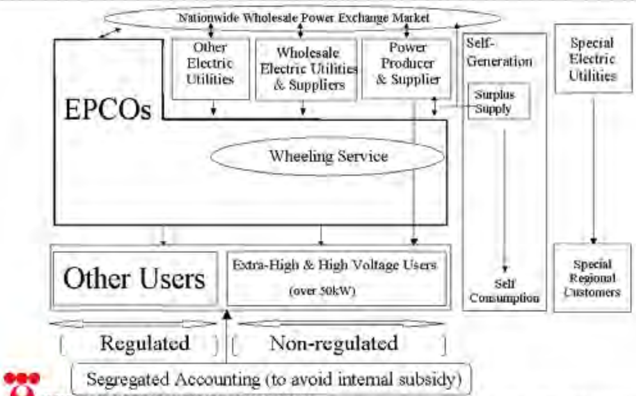
Electricity Market Structure



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Corporate Outline (FY 2009)

Date of Establishment		May 1, 1951
Number of Shareholders		794,653
Operating Revenues		¥ 4,804 billion (US$ 44 billion)
Number of employees		38,227
Electricity Sales		280.2 TWh
Peak Demand		64.3GW (July 24, 2001)
Number of Customers		28,842 thousand
Number of Power Stations &		
Generating capacity	190	64,486MW
Thermal	26	38,191MW
Nuclear	3	17,308MW
Hydro	160	8,986MW
Wind	1	500kW*
Substation Facilities	1,591	256.7 mil. kVA
Transmission Line		
Overhead (Circuit Length)		28,541km
Underground Transmission Line (Circuit Length)		11,760km

*Eurus Energy, one of TEPCO's subsidiary, owns 1,903MW wind turbines as of January, 2010

6

Generation Capacity by Energy Source

At FY end (planned)		2009 TEPCO capacity Output	MW(%) Including purchased power Output
Hydro	Conventional	2,178 (3)	4,105 (5)
	Pumped storage	6,808 (11)	10,533 (14)
	subtotal	8,986 (14)	14,638 (19)
Thermal	Oil	10,831 (17)	12,072 (16)
	Coal	1,600 (3)	4,274 (6)
	LNG/LPG	25,252 (39)	25,970 (33)
	Geothermal	3 (0)	3 (0)
	Other gases	- (-)	1,613 (2)
	subtotal	37,686 (59)	43,933 (57)
Nuclear		17,308 (27)	18,188 (24)
New Energy		1 (0)	1 (0)
Total		63,981 (100)	76,759 (100)

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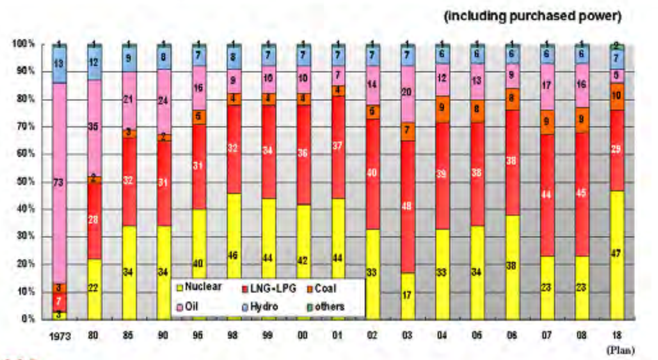
TEPCO Energy Output by Energy Source



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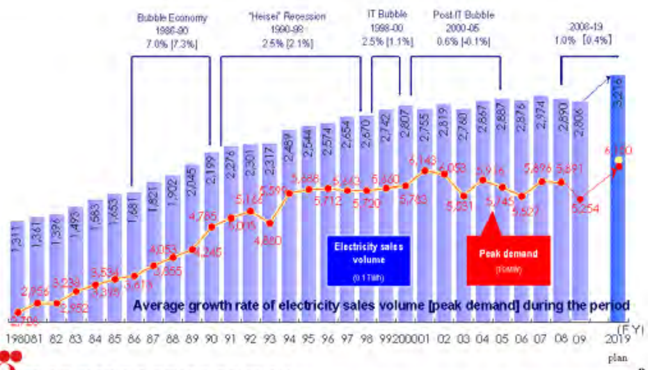
Peak Demand and Electricity Sales



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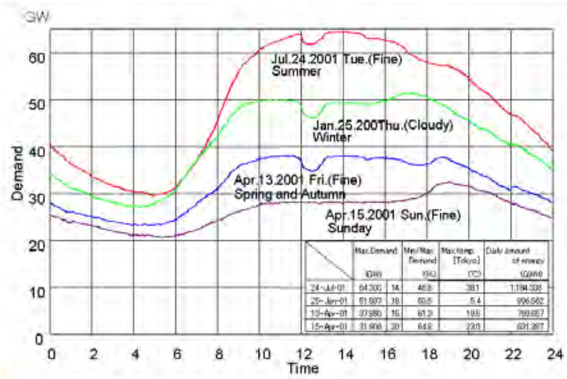
Characteristics of Power Demand



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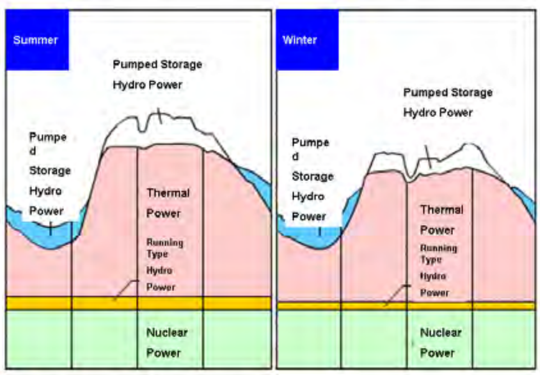
Generation Mix to Meet Changing Demand



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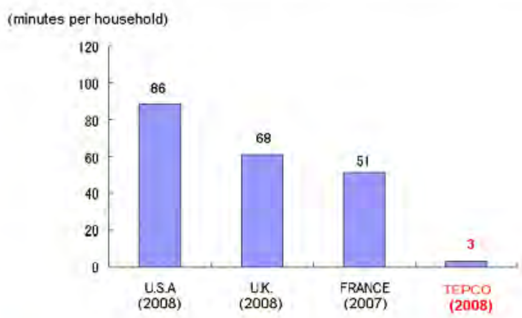
Quality Supply - Annual Forced Outage -



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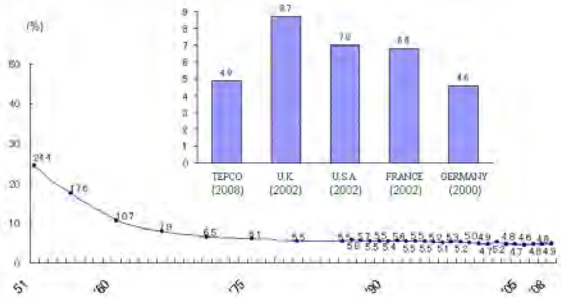
Transmission & Distribution Loss Rate



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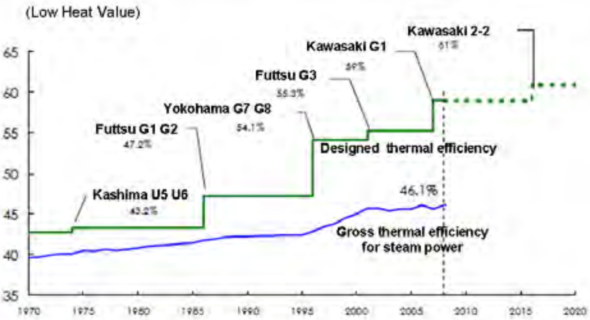
Thermal Power Generation Efficiency



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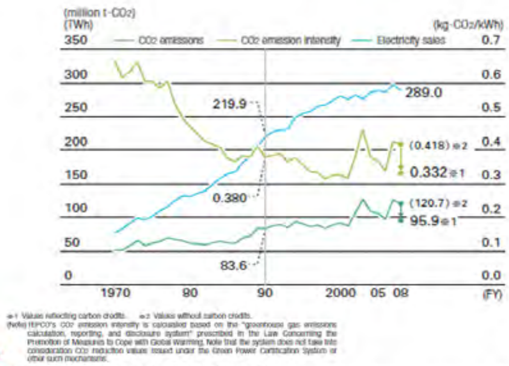
CO2 Emissions, Intensity and Electricity Sales



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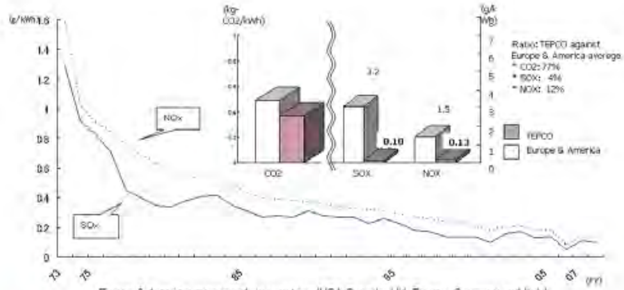
Efforts for "Clean" Thermal Power Generation



Europe & America: average of six countries (USA,Canada, UK, France, Germany and Italy)
(Sources) SOx & NOx: OECD Environmental Data Compendium 2002 and Energy Balances of OECD Countries 1996-1997, 1997-1998,1999-2000
CO2: Energy Balances of OECD Countries 1999-2000

16

Energy Efficiency
and System Improvement technology

17

Technologies for the Supply Side

18

More Advanced Combined Cycle (1,500℃-class Combined Cycle Power Generation)

Kawasaki Power Station

Generation Efficiency: 59% (low heat value)

MACC Operation started from
June 2007: No. 3 Axis of No. 1 Unit 500 MW
June 2008: No.2 Axis of No. 1 Unit 500 MW

● Gas turbine

Model:	Open cycle single-shaft type
Output:	Approx. 330 thousand kW (air temperature of 5°C)
Inlet gas temperature:	Approx. 1,500°C
Pressure ratio:	Approx. 21
Combustor:	Premixed combustion type
Fuel used:	Re-gasified LNG

● Steam turbine

Model:	Three-pressure reheated double-flow exhaust condensation type
Output:	Approx. 170 thousand kW (air temperature of 5°C)
Steam pressure:	High pressure ... Approx. 13 MPa Medium pressure ... Approx. 3 MPa Low pressure ... Approx. 0.4 MPa
Steam temperature:	High pressure ... Approx. 560°C Medium pressure ... Approx. 570°C Low pressure ... Approx. 270°C

TOKYO ELECTRIC POWER COMPANY 18

19

Ultra Super Critical Coal Power Generation

- **Improvement of thermal efficiency (38%HHV → 43%HHV)**
- **Reduction of CO_2 emission**

Hitachinaka Power Station

Location	Boiler Contractor	Turbine/ Generator Contractor	Capacity (MW x unit)	Construction	First operation
Hitachinaka #1	BHK	HTC	1000 x 1	12/1998 - 12/2003	12/2003
Hirono #5	MHI	MHI/ME	600 x 1	7/2000 - 7/2004	7/2004

Specification	Main steam Press (MPa)	Main steam Temp (℃)	Reaheater Temp (℃)	Efficiency (%, HHV)	Fuel
Hitachinaka #1	24.5	600	600	43.1	Coal
Hirono #5	24.5	600	600	43.0	Coal

(Under construction)

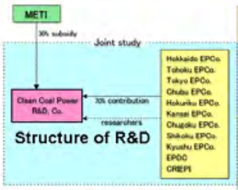
Location	Boiler Contractor	Turbine/ Generator Contractor	Capacity (MW x unit)	Construction Schedule	Expected first operation
Hitachinaka #2	BHK	HTC	1000 x 1	10/2009 - 12/2013	12/2013
Hirono #6	MHI	MHI/ME	600 x 1	12/2008 - 12/2013	12/2013

BHK: Babcock-Hitachi K.K., HTC:Hitachi,Ltd.
MHI:Mitsubishi Heavy Industries,Ltd. ME: Mitsubishi Electric

TOKYO ELECTRIC POWER COMPANY 19

20

IGCC (Integrated Coal Gasification Combined Cycle) - R&D with All Power Utilities-



Capacity	Gross	•250 MW class (coal consumption : 1700ton/day)
Targets of thermal efficiency	Gross efficiency	•48%(LHV), 46%(HHV)
	Net efficiency	•42%(LHV), 40.5%(HHV)
Plant System	Gasifier	•air-blown, entrained-flow gasifier •dry coal feed
	Gas clean-up	•MDEA chemical absorption •limestone-gypsum method for sulfur recovery
	Gas turbine	•1200℃- class gas turbine(50Hz)

Source: Clean Coal Power R&D

Now it is under demonstration stage.
It succeeded 3 months operation during summer.

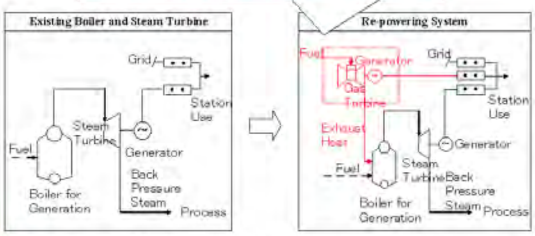
TOKYO ELECTRIC POWER COMPANY 20

21

Combined Cycle Re – powering System

- **Improvement of the thermal efficiency without scraping the conventional power station**

Additional High – performance Gas Turbine



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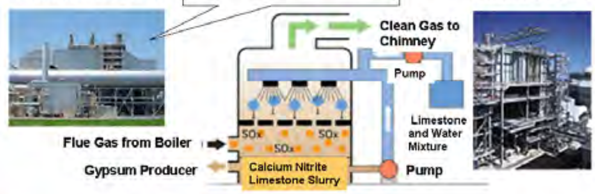
22

Flue Gas Desulfurization

- **Reduction of SO_2 emitted from thermal power plants (oil/gas)**
- **Mitigation of air pollution and acid rain**

95% Efficiency
SO_2 Concentration Value:
Inlet 772ppm / Outlet 39ppm

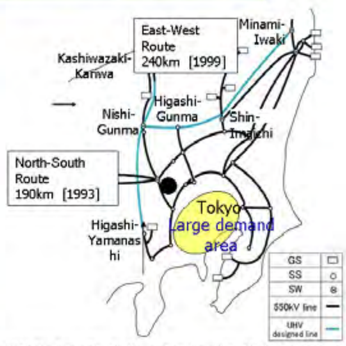


TOKYO ELECTRIC POWER COMPANY 22

23

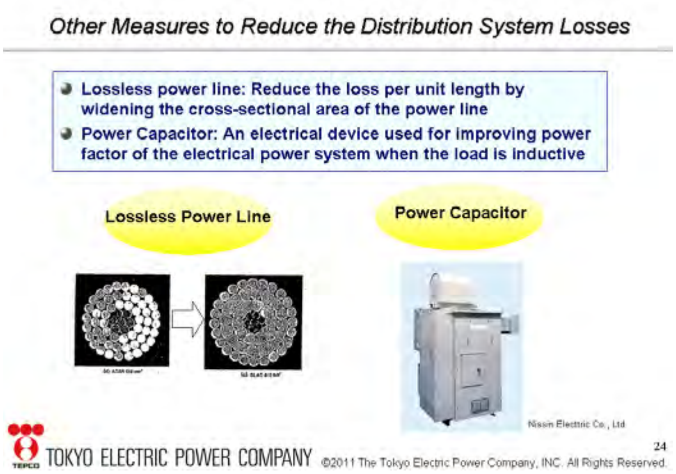
Ultra High Voltage (UHV) Technology - 1,000 kV Transmission Facilities -

- **Reduction in transmission loss (550kV ; 1 UHV (1100kV) ; ¼)**



TOKYO ELECTRIC POWER COMPANY

24



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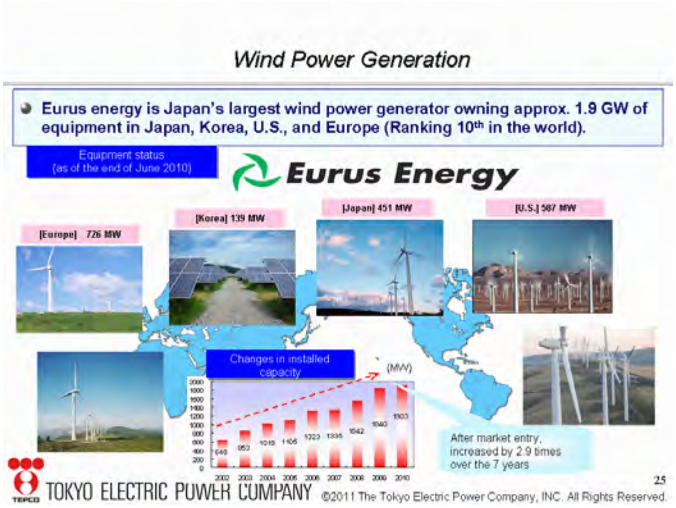

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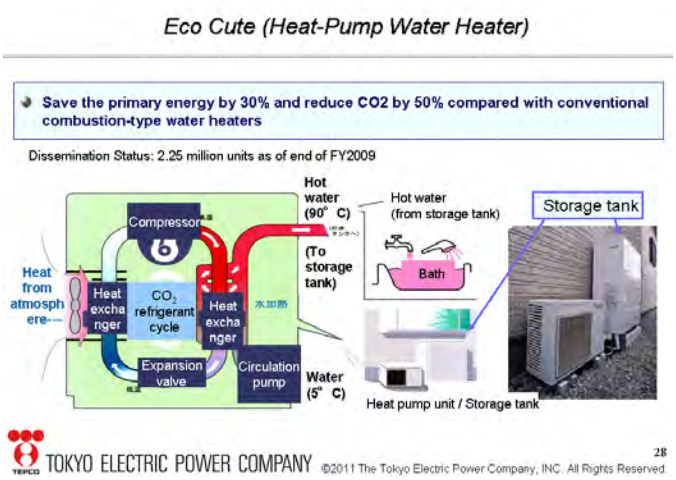
27

Technologies for the Demand Side

28



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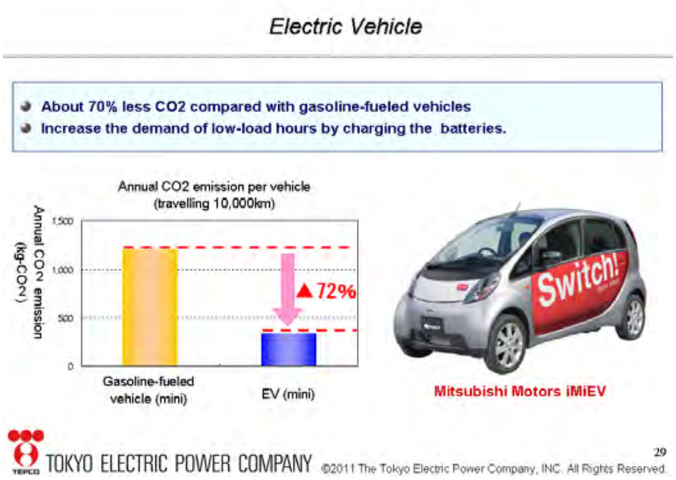

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Thank you for listening !

31

Mitsubishi UFJ Morgan Stanley

JICA Study on the Energy Efficiency and Environment in Kazakhstan

Trends and Developments in the International Carbon Market

February 14, 2011

Mitsubishi UFJ Morgan Stanley Securities
Clean Energy Finance Committee

1

Mitsubishi UFJ Morgan Stanley — Presentation Outline

1. Japanese Involvement in Global Climate Change Policy
2. The Kyoto Protocol Mechanisms
3. Kazakhstan and the Carbon Market
   - Current Status
   - Opportunities
4. Developments in the Global Carbon Market
   - New mechanisms

2

Mitsubishi UFJ Morgan Stanley — Japanese Involvement in Global Climate Change Policy

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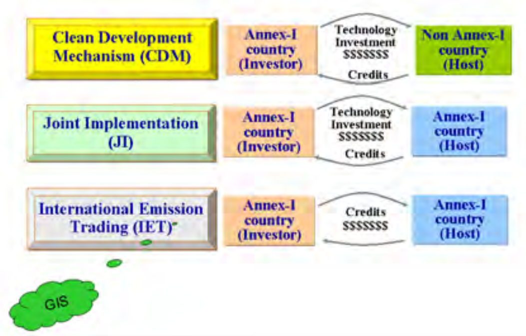
Mitsubishi UFJ Morgan Stanley — The Kyoto Protocol Mechanisms



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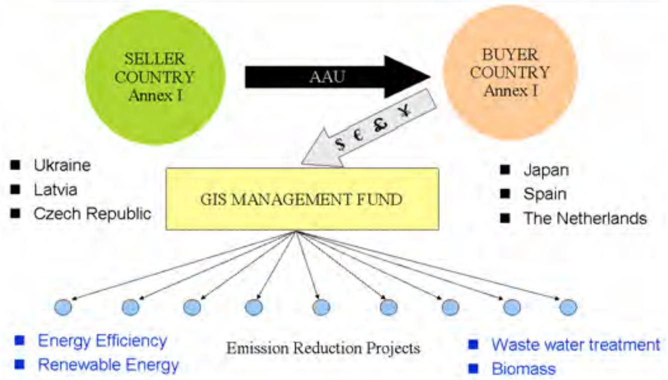
Mitsubishi UFJ Morgan Stanley — Green Investment Scheme



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Mitsubishi UFJ Morgan Stanley

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- **Description**: Installation of 35 wind power generators on the Black See coast in Bulgaria
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- **CDM component**
  - 48,303 CER/yr

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Mitsubishi UFJ Morgan Stanley

Developments in the Global Carbon Market

- COP 16
  - No clear message regarding the future of JI and CDM
  - Carbon Capture and Storage (CCS) approved as a potential project type
  - Design of new mechanisms (NAMA and REDD+)
- Negotiating positions
  - **EU:** Extension of the Kyoto Protocol
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  - **Most developing countries:** Require extension of the Kyoto Protocol

9

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Proposals for New Mechanism

The following mechanisms are currently considered in order to overcome some of the issues of the current emission trading framework.

1. NAMA:
   National Appropriate Mitigation Actions by developing country parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a Measurable, Reportable, and Verifiable manner.
2. REDD:
   Reduce Emission from Deforestation and Forest Degradation in developing countries.
3. Bilateral Trading: proposed by Japan. Structurally close to JI Track 1.

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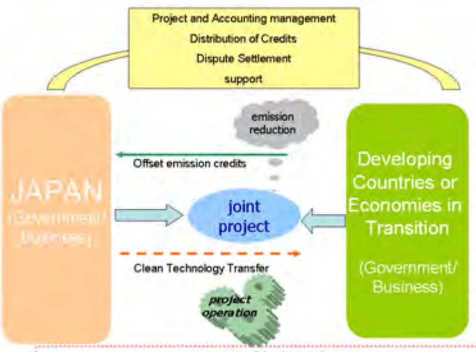
Bilateral Trading



EXAMPLES

- Ultra super-critical coal power plant
- Geothermal power plant
- Nuclear power
- Energy efficiency technology in steel, cement, etc.
- Highly efficient manufacturing with IT
- Eco-driving
- REDD+
- CCS

Modified METI's presentation

11

Mitsubishi UFJ Morgan Stanley

Thank you for your attention!

Vladislav Arnaoudov
CDM/JI Senior Consultant
Clean Energy Finance Committee
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12

Discussion Paper

Assistance for Energy Efficiency Project
- JICA Loan Scheme -

JICA Study Team
2010/02

1

1

1. Energy Efficiency in Japan

2

2

Advantage of Japanese Experience and Technology

- Energy efficiency of Japan is positioned at the top level in the world. Especially the Industry sector of Japan has not increased the final consumption even though the GDP has increased since 1973 (the first oil shock).
- Japan has various energy efficiency measures since the oil shock. Institutional schemes, Energy Management System (reporting system of energy efficiency and assignment of Energy Manager) and Top Runner System (Minimum Standards and Labeling System) have contributed to the energy efficiency. In addition, a central organization, Energy Conservation Center of Japan (ECCJ) has played an important roles in promotion of energy efficiency.
- Power sector of Japan has so many unique system for energy efficiency. For example, Ultra Super Critical Coal Power Station (thermal efficiency: 45 % in LHV), More Advanced Combined Cycle (Gas: thermal efficiency: 59 % in LHV), Ultra High Voltage Transmission Line (1,000 kV), etc.

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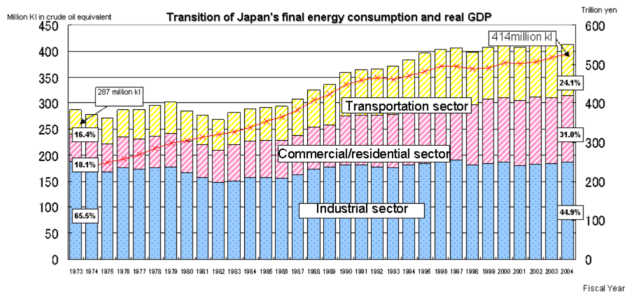
Trend of Energy Efficiency the Final Consumption

- O Japan's final energy consumption has increased almost continuously, except immediately after the two oil crises and during the recent economic recession.
- O The ratio of industrial: commercial/residential: transportation uses shifted from 4:1:1 (oil crisis) to 2:1:1 (FY2004).



Source: Energy Balance Tables in Japan, Annual Report on National Accounts
(Note) Note that, due to revision of the aggregation method in Energy Balance Tables in Japan, values for FY1990 onwards and values for preceding years are the results of utilizing different methods.

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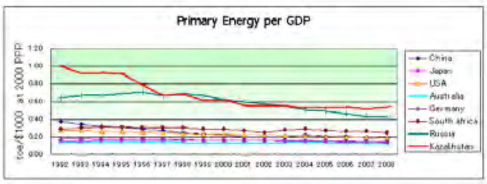
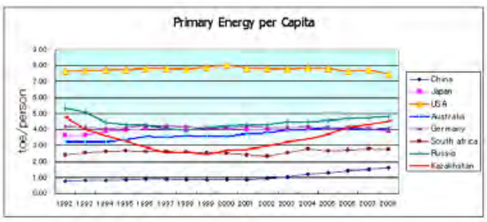
Comparison of Other Countries





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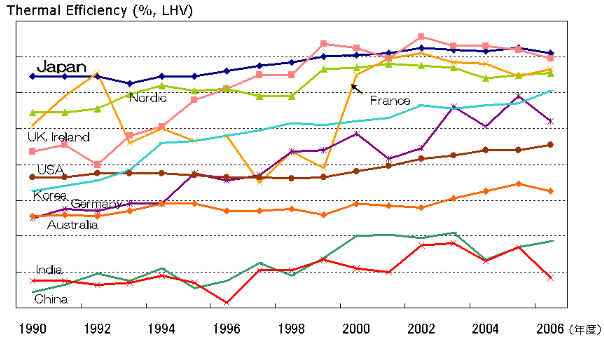
Thermal Efficiency of Coal Power Station

【Comparison in Other Countries】



【出典】 ECOFYS社 (2009年), "INTERNATIONAL COMPARISON OF FOSSIL POWER EFFICIENCY AND CO2 INTENSITY"

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2. Japan's ODA Loan Scheme

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Overview of Energy Efficiency

	Electric Power	Fuel (Oil, Gas, Coal, Uranium)
Supply Side (Utility side)	- Generation - Transmission - Distribution - Renewable energy	-Generation/Cogeneration -Distribution
Demand Side (User side)	(Equipment Installation Approach) - High efficiency heat pump for AC, hot water server, etc. - Ice/water storage system - Solar power - High insulation material for building/house, etc.	(Equipment Installation Approach) - High efficiency absorption chiller - Heat recovery technology - Solar heat - High insulation material for building/house, etc.
	(Institutional Approach) - Labels and standards for home appliances (electric power) - Energy management system (= periodical reporting system) for large consumers - Training program for engineers - Energy education for primary school - Energy assessment scheme - Campaign (EC month, Award system, workshop, etc.) - Database and dissemination - Financial incentive scheme (TOU electricity tariff, subsidy, etc.)	

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Applicable ODA Loan Scheme for Energy Efficiency

Scheme	Donor	Type of Project	Example	Remarks
ODA Loan	JICA	Large scale	Energy supply and relating projects (Power/heat supply, Transportation, Port, etc.) 2 steps loan for subprojects	Oil and gas sector is generally developed by private sector (out of ODA target).
Preparatory Survey for ODA Loan Project	JICA	Project formation survey for the ODA Loan	F/S, Environmental study, etc.	The project expects ODA loan after the survey.

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ODA Loan Scheme by Type of Facilities (1)

For Supply Side

A: ODA Loan, B: Preparatory Survey

	Supply Facilities	Transmission	Relating Facilities
Oil & Gas, Coal, Uranium	Facilities for oil, gas, coal and uranium Master plan study	Pipeline facilities, Network study	Indirect facilities for energy efficiency (port, railways, road, etc.)
			A, B
Power	High efficiency power station (combined cycle), Rehabilitation of existing plants, Master plan study for power development	Ultra high voltage T/L (1,000kV), Smart grid Master plan study for network	Renewable energy - Mega solar - Wind - Biomass power - Geothermal
	A, B	A, B	A, B

・High possibility sector is the supply side projects in the power sector.
・Fuel (Oil & Gas, Coal, Uranium) sector is generally developed by a private sector. However, relating facilities for energy efficiency might be applicable.

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ODA Loan Scheme by Type of Facilities (2)

For Demand Side

A: ODA Loan, B: Preparatory Survey

	Institutional	Industry	Commercial	Residential
Oil & Gas, Coal, Uranium	Master plan study for the whole country, Design for specific program	Support for installation for energy efficiency technology (by 2 steps loan)	Support for installation for energy efficiency technology (by 2 steps loan)	Program for promotion of high efficiency equipment
	-			
Power	Design for Demand Side Management (DSM) scheme	Technology transfer of energy efficiency O&M	Technology transfer of energy efficiency O&M	Program for improvement of consciousness of energy efficiency
	-	A, B	A, B	-

・ODA scheme is difficult to directly support to the private sector such as the industrial and commercial sectors. However, for these sectors, 2 steps loan (through a local development bank) is possible.
・Master plan or design for specific programs is also main fields for assistance.

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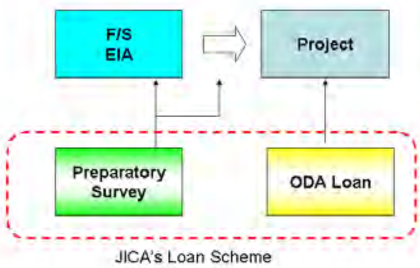
Steps for ODA Loan Project



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3. Samples of JICA's Energy Efficiency Projects in Other Countries

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Case 1: ODA Loan
(High Efficiency Gas Combined Cycle)

1. Shimal Gas Combined Cycle Power Plant (II)
   Loan Amount: 29.3 billion JY (400 MW)
   Recipient Country: Azerbaijan
   Counterpart: Azereneji Joint Stock Company
   Period: 2005-

2. Talimarjan Thermal Power Station Extension Project
   Loan Amount: 27.4 billion Yen
   Recipient Country: Uzbekistan
   Counterpart: Uzbekenergo
   Period: 2010-

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Case 2: ODA Loan
(High Efficiency Coal Power Plant: USC Technology)

That is a proven technology that has 45 % thermal efficiency at LHV. TEPCO also has the USC coal power stations (Hirono #5 : 600MW (2004), Hitachinaka #1: 1,000MW (2003)).

Hitachinaka #1

The following countries considers the adoption of the technology using Japanese ODA loan.

1. Indonesia
2. Vietnam

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Case 3: ODA Loan
(Renewable Energy)

1. Zafarana Wind Power Plant Project
   Loan Amount: 13.5 billion JY (120 MW)
   Recipient Country: Egypt
   Counterpart: New and Renewable Energy Authority
   Period: 2003-
   Other Information:
   Approx 250,000 t of CO_2/year will be reduced.
   Registered as CDM

2. Yguazu Hydropower Station Construction Project
   Loan Amount: 21.4 billion JY (200 MW)
   Recipient Country: Paraguay
   Counterpart: Administración Nacional de Electricidad
   Period: 2006-
   Other Information:
   JICA has assisted to formulate a CDM project

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Case 4: ODA Loan
(2 Steps Loan for Energy Efficiency)

Energy Efficiency and Renewable Energy Promoting Project
Loan Amount: 4.7 billion JY
Recipient Country: Vietnam
Counterpart: Vietnam Development Bank (VDB)
Beneficiary: End Users (through the VDB)
Period: 2009-
Target: Investment for energy efficiency in end users
Other Information:
JICA provides an assistance to VDB for
1) capacity building of evaluating energy-related finance based on Japan's experiences
2) creating and managing energy-saving and renewable energy device lists

17

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Case 5: ODA Loan
(Program Loan for Energy Efficiency)

1. Climate Change Program Loan (I), (II), (III)
   Loan Amount: (I) 30.8 billion JY, (II) 37.4 billion JY, (III) 27.2 billion JY
   Recipient Country: Indonesia
   Counterpart: National Development Planning Agency
   Period: (i) 2008-, (ii) 2009-, (iii) 2010-
   Provision of loans after evaluating the progress of "Policy Actions" related to climate change
2. Support Program to Respond to Climate Change (I)
   Loan Amount: 10 billion JY
   Recipient Country: Vietnam
   Counterpart: Ministry of Natural Resources and Environment
   Period: 2010-

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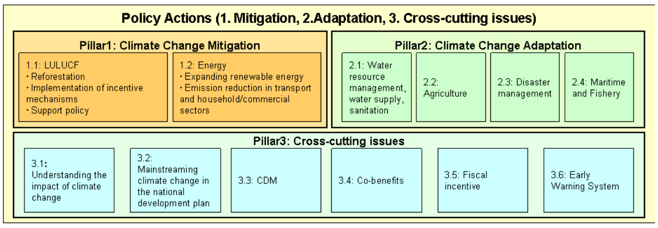
Case 5: ODA Loan
(Program Loan for Energy Efficiency)

Sample of the Policy Actions in the Program Loan (Indonesia)



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4. Formation of JICA Loan Project
(Energy Efficiency)

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Common Conditions

1. Borrower
   Government or State
   Governmental Agency/Company (with Government Guarantee)

2. Status of the Project
   Completion of F/S and EIA
   (In case that these documents have not been prepared yet, JICA can assist such project to formulate JICA Loan Project through technical assistance.)

3. Objectives of the Project
   Energy efficiency, mitigation of global warming, etc.

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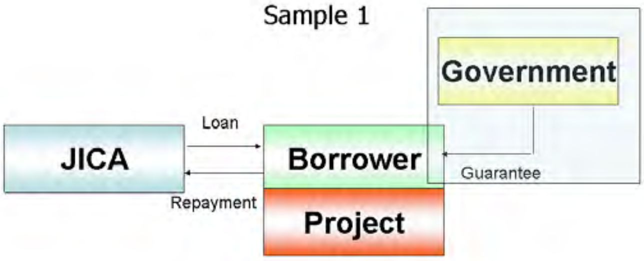
Sample 1



- If Borrower is Government/State , No guarantee is necessary.

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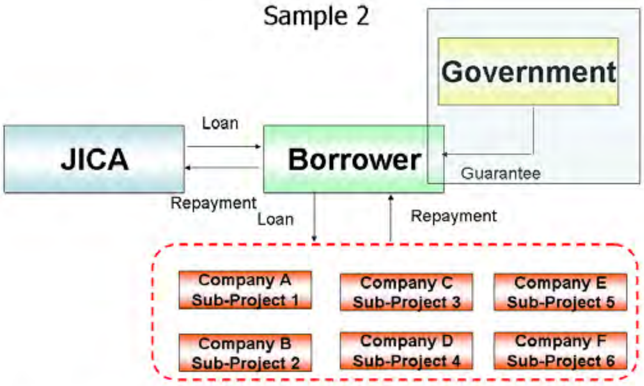
Sample 2



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Thank you for your attention!

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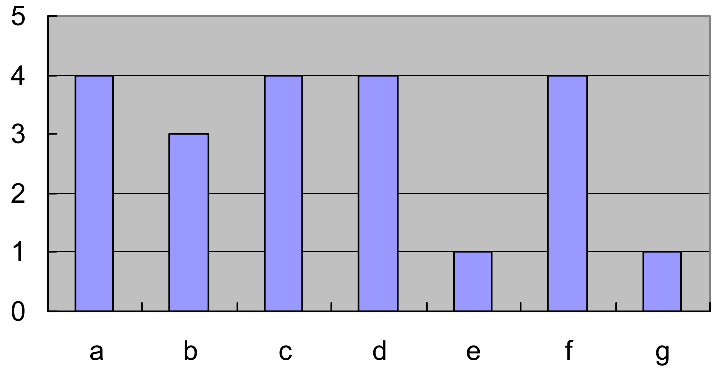
24

付属資料 2

第一回セミナー
アンケート結果

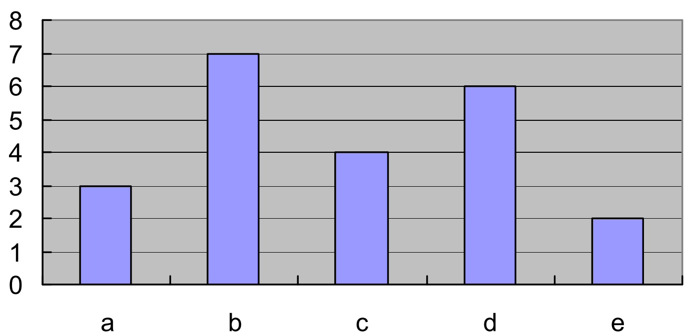
1. What are the likely constraints to promote energy effiiency in Kazakhstan?

a Lack of the adequate laws to regulate energy use
b Lack of the budget/funding
c Absence of the leading organization
d Lack of institutional enhancement for the demand side
e Lack of project development capacity/knowledge
f Limited access to state-of-the-art technologies
g Others



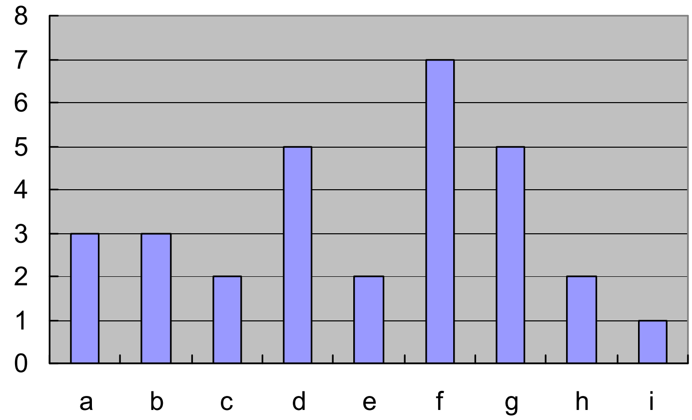
2. What are the priorities to promote energy efficiency in Kazakhstan?

a Supply side of the power sector
b Supply side of the fuel sector (gas 5 / coal 1 / oil 4 / uranium 1)
c Demand side of the power sector
d Demand side of the fuel sector (gas 4 / coal 3 / oil 2 / uranium 1)
e Others



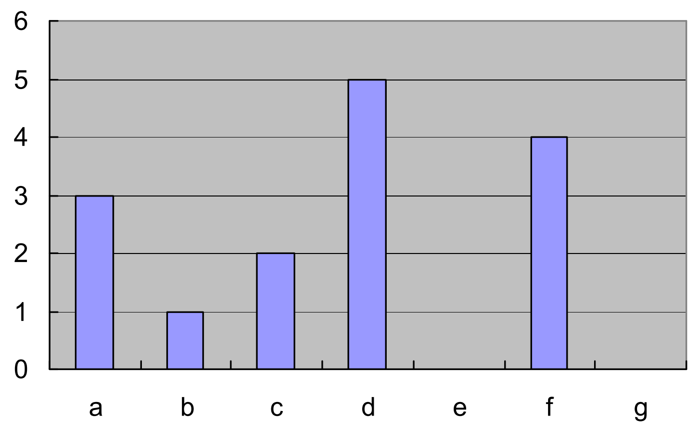
3. In which areas do you expect financial support by the Japanese ODA to promote energy efficiency?

a Highly efficient thermal power plant (gas 1 / coal 3 / oil 0)
b Rehabilitation of the thermal power plant (gas 1 / coal 2 / oil 0)
c Highly efficient transmission line
d Renewable energy (wind 3 / solar1 /hydro 0 / geothermal 0)
e Combined cycle plants
f Installation of gas turbines
g Highly efficient CHP
h Master Plan (electric power development 0 / transmission 1)
i Others



4. What are the likely constraints to develop JI or other emission reduction projects in Kazakhstan?

a Kazakhstan's status under the Kyoto Protocol
b Lack of identified JI projects
c Lack of experience / project development capacity
d Lack of the adequate laws and regulations
e Absence of the leading organization
f Lack of the budget / funding
g Others



5. Which of the project types listed below need most or will benefit most from implementation as JI or other emission reduction projects?

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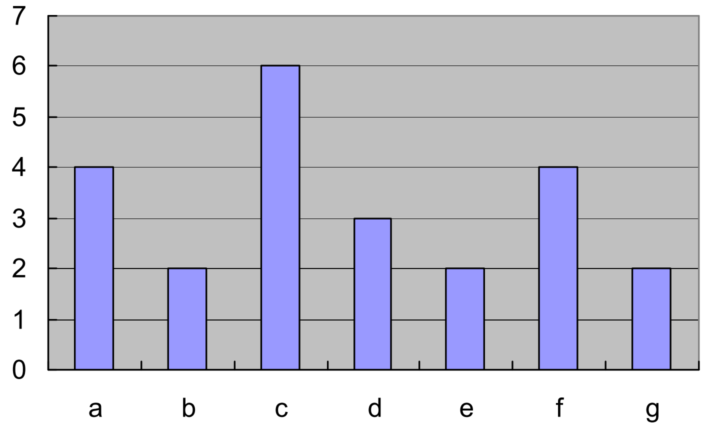

付属資料 3

第二回セミナー資料

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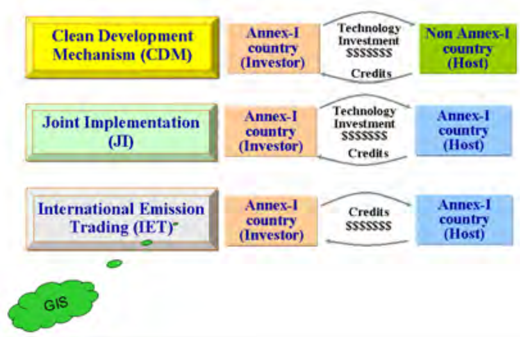

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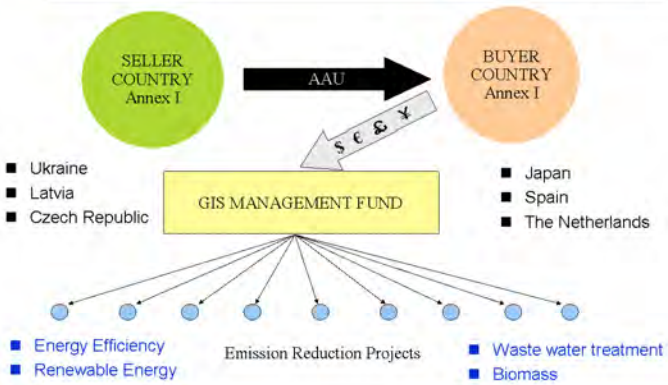
Green Investment Scheme



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  – Energy efficiency improvement (supply and demand side)
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Kazakhstan and the Carbon Market

- Climate change mitigation
  - DFP for JI Projects – Ministry of Environmental Protection of Kazakhstan
  - Kyoto Protocol Road Map 2010
  - Development of a domestic emission trading scheme in Kazakhstan.
- GHG emission reduction potential (examples)
  - Renewable energy
  - Energy efficiency improvement (industry, housing, etc.)
  - Oil and Gas sector
  - CMM and CBM

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The following mechanisms are currently considered in order to overcome some of the issues of the current emission trading framework.

1. NAMA:
   National Appropriate Mitigation Actions by developing country parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a Measurable, Reportable, and Verifiable manner.
2. REDD:
   Reduce Emission from Deforestation and Forest Degradation in developing countries.
3. Bilateral Trading: proposed by Japan. Structurally close to JI Track 1.

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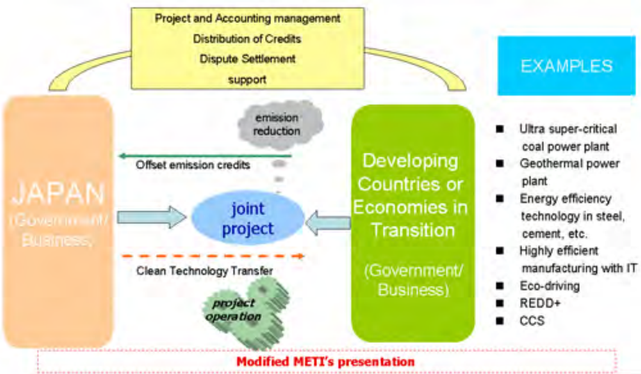
Mitsubishi UFJ Morgan Stanley

Bilateral Trading



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Mitsubishi UFJ Morgan Stanley
Thank you for your attention!
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13

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Comparison of Energy Efficiency and Challenging Agendas of Kazakhstan

JICA Study Team
April 2011

The Japan International Cooperation Agency (JICA)

1

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CONTENTS

1. Energy Briefing of Kazakhstan 3
2. Energy consumption & efficiency in Kazakhstan 6
3. Comparison to Other Counties 9
4. Challenging agendas for energy supply sectors 15
5. Summary of challenging agendas 18

2

3

1. Energy Briefing in Kazakhstan

1.1 Energy reserves of KZH

◆The proven reserves increased in the past 10 years from 1999 to 2009.

◆KZH will be an energy export country in future.

◆World reserve shares of oil, coal and NG are 3.0%, 3.8% and 1.0%.

◆KZH is a rare country to have so many energies including Uranium.

	At end of 2009	R/P	World share
Oil	39.8 billion bbl	65 years	3.0%
Coal	31.3billion ton	308 years	3.8%
Natural gas	1.82 trillion㎥	56 years	1.0%

Note) R/P: Reserves/Production, R/P is one of indicators for measuring size of reserves

Note) bbl: Barrel (bbl＝0.159 kilo liter)

(Source: BP statistics 2010)

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1.2 Energy production of KZH

◆Production shares are crude oil 48%, coal 33% and NG 19% in 2008.

◆Crude oil and NG production shares increased with 8% and 9% respectively, while coal share decreased with 16% in the past 10 years.

◆The increasing of crude oil and NG demand makes coal share decrease.

Production (ktoe)	2000	2001	2002	2003	2004	2005	2006	2007	2008
Coal	34,130	34,859	32,465	37,297	38,198	38,071	42,311	43,014	48,837
Crude oil	35,438	40,272	47,485	51,685	59,759	61,751	65,837	67,413	70,976
Gas	9,680	9,737	11,832	13,919	18,329	21,115	22,125	24,792	27,571
Hydro Power	648	695	765	742	693	676	668	703	642
Renewable	73	87	101	80	44	78	61	94	164
Primary total	79,969	85,650	92,648	103,723	117,023	121,691	131,002	136,016	148,190
Contribution(%)	2000	2001	2002	2003	2004	2005	2006	2007	2008
Coal	42.7	40.7	35.0	36.0	32.6	31.3	32.3	31.6	33.0
Crude oil	44.3	47.0	51.3	49.8	51.1	50.7	50.3	49.6	47.9
Gas	12.1	11.4	12.8	13.4	15.7	17.4	16.9	18.2	18.6
Hydro Power	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4
Renewable	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.1
Primary total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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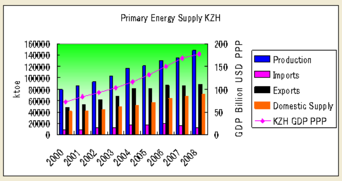
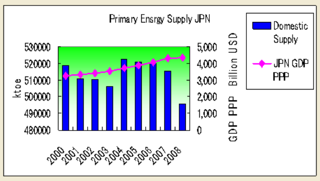
1.3 Primary energy supply (PES) of KZH

◆PES has been increased for the past 10 years from 1998 to 2008 in proportion with GDP growth.
◆Exports of crude oil, coal and NG have not increased due that the increasing productions are consumed in the country.
◆Calculating elasticity between GDP and PES from 2000 to 2008, it is 0.6.
◆KZH takes a policy to produce additional energies and utilize waste energies (associate gas) for promoting the industries.
◆ In JPN, the elasticity between the above two is -0.16.





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2. Energy consumption & efficiency in Kazakhstan

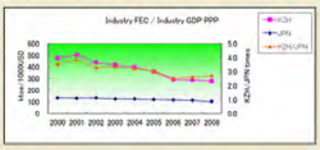
2.1 Energy efficiency in industry sector

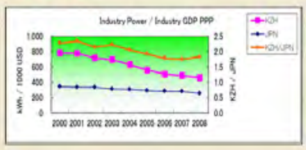
A) Comparison between KZH and JPN in 2008

	KZH	JPN	K/J
Final energy consumption (FEC)	20Mtoe	123 Mtoe	16%
FEC per GDP-PPP in Industry	276 koe/$1000	103koe/$1000	2.7 times
EPC per GDP-PPP in Industry	460 kWh/$1000	252kWh/$1000	1.8 times

B) Comments

◆KZH's energy efficiency is improved by the yearly trend.
◆FEC per GDP is 5.3 times to JPN. EE&C effectiveness are expected, especially heavy and chemical sub-sectors in KZH.





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2.2 Energy efficiency in Commercial & Service sector 7

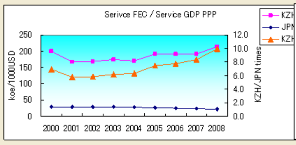
A) Comparison between KZH and JPN in 2008

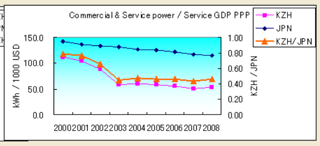
	KZH	JPN	K/J
Final energy consumption (FEC)	21 Mtoe	66 Mtoe	32%
FEC per GDP-PPP in Com-Service	214 koe/$1000	22koe/$1000	9.7 times
EPC per GDP-PPP in Com-Service	53 kWh/$1000	115kWh/$1000	2.1 times

B) Comments

◆The FEC had increased since 23 % in 2000. The FEC will be increased in company with the economic growth in future.

◆As EPC per GDP in the sector increases with the economic growth, KZH is required EE&C policies targeted electric power consumption in the sector.





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2.3 Energy efficiency in Residential sector 8

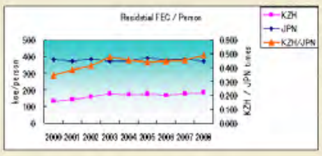
A) Comparison between KZH and JPN in 2008

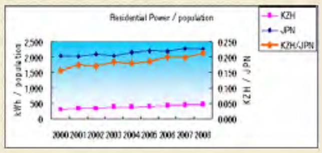
	KZH	JPN	K/J
Final energy consumption (FEC)	2.8 Mtoe	47 Mtoe	6.0 %
FEC per capita in Residential	183 koe/capita	372 koe/capita	49 %
EPC per capita in Residential	479 kWh/capita	2252kWh/capita	21 %

B) Comments

◆Most of the FEC is heat. EE&C to heat supply systems and utilizations are required for improving energy efficiency.

◆The FEC in residential sector is increased in future, introduction of EE&C for heating, air- conditioner and lighting are required.





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3. Comparison to Other Counties 9

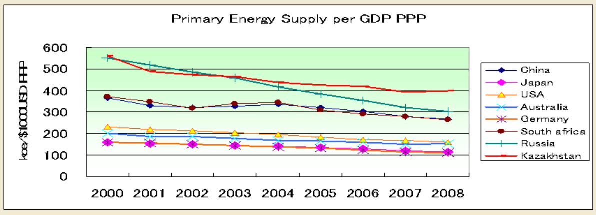
3.1 Primary energy supply

A) Primary energy supply per GDP

◆KZH's intensity is 4 times more than Germany and JPN after 2004.

◆When JPN and Germany using 100 koe (0.7 bbl as crude oil) for producing 1,000 USD of GDP, KZH uses 400 koe (2.8 bbl as crude oil).

◆More energy efficiency policies for more high value added industry policy are required in KZH .



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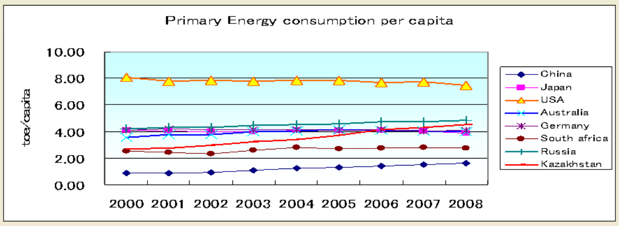
B) Primary energy supply per capita 10

◆USA is the highest in the countries, when considering economic size and land size, it cannot say about USA energy efficiency potentials. While, KZH increases PES per capita in recent years.

◆The increase of PES per capita is evidence of economic growth in KZH. KZH has to make more efficient energy supply and use.



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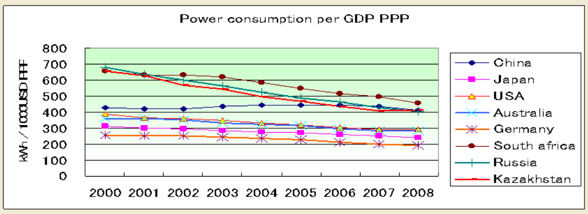
3.2 Electric power consumption 11

A) Electric power consumption per GDP

◆South Africa is 450kWh/1,000USD, it is the highest. Germany is 200 kWh/1,000USD, it is the lowest. German economy is the lowest power dependence.

◆As EE&C on power utilization are the most effective policy for national wide EE&C, it is important agendas for KZH



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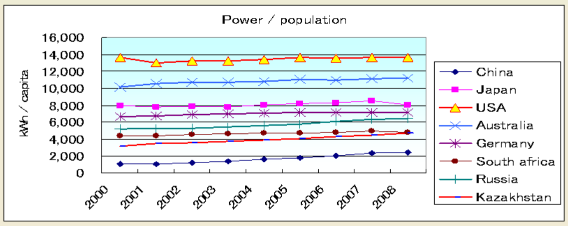
B) Electric power consumption per capita 12

◆Power consumption per capita is higher in USA and Australia, other hand it is lower in KZH and China.

◆As power consumption per capita in KZH will be increased in company with increasing national income, EE&C becomes challenging agenda in commercial & service and residential sectors.



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3.3 GDP per capita and Energy per capita

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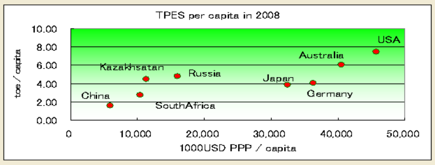
A) GDP per capita and PES per capita

◆ The countries are arranged almost in one line. The order is China, South Africa, KZH, Russia, JPN, Germany, Australia and USA.

◆The gap of GDP/capita between USA and China is 7.6 times, the gap of PES/capita between the two is 4.6 times, the elasticity is "0.5".

◆It means that when GDP/capita becomes 2 times, PES/capita becomes 1.5 times.

◆If KZH's GDP/capita with 11,300USD in 2008 becomes 2 times, the PES/capita is increased to 5.0 toe/capita. However, PES/capita in KZH had reached 4.5toe/capita in 2008, and it is required that KZH introduces EE&C policies in the all sectors.



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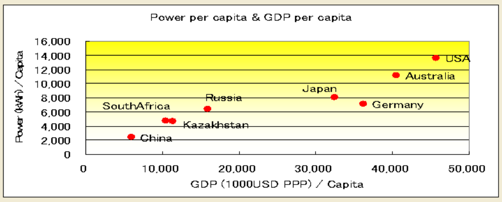
14

B) GDP per capita and EPC per capita

◆The elasticity between GDP/capita and EPC/capita is "0.7".

◆When GDP/capita becoming 2 times, EPC/capita becomes 1.7 times.

◆If KZH's GDP/capita in 2008 becomes 2 times, EPC/capita is increased to 7,000 kWh/capita from 4,600 kWh/ in 2008.



14

4. Challenging agendas for Energy supply sectors

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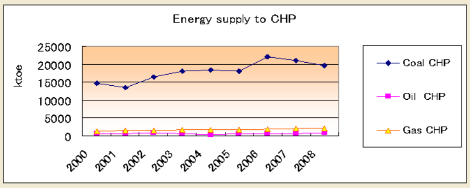
4.1 Electric power sector in KZH

◆The Power with 80Twh was consumed by Industry(41%), self-consumption and losses(32%), Agriculture(9%), Com & Service (9%) and Residential (9%) in 2008.

◆KZH wants to introduce foreign funds for IPPs, it becomes challenging agendas to introduce new power supply and accounting systems.

◆The power supply comes from CHP, and 90% of the CHPs uses coal fired power generations. The countermeasures against smoke dust and SOx and energy efficiency improvement of power plants are required.



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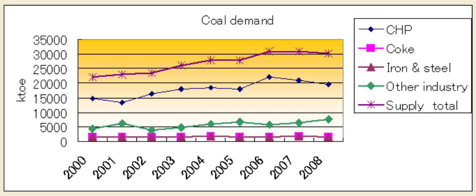
16

4.2 Coal sector in KZH

◆The coal production has been increasing, however the domestic coal consumption has not increased since 2006. The coal is mainly consumed in iron and steel companies and CHP stations.

◆As introduction of natural gas power plants are planned by the Government, the massive coal consumption in the domestic market is not desired in future.

◆If estimating that crude oil prices are going over $80/bbl in future, the high technology for coal utilization becomes challenging agendas in KZH.



16

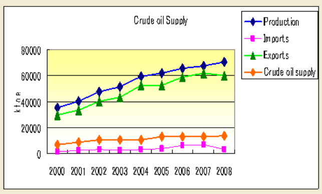
4.3 Oil & gas sector in KZH

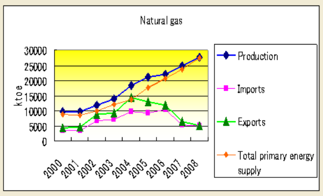
17

◆Oil refinery capacity will be increased in future, the export of oil products from KZH will be increased instead of crude oil. As heavy oil will be surplus, it is used in power plants. It becomes challenging agendas to introduce counter-measures of SOx and high performance oil fired power generation plants for EE&C and environmental protection.

◆In future, more NG will be used in GCC plants by the government policy. And also, NG will be used much more in residential sector.

◆Introduction of the infrastructures is challenging agendas for KZH.





17

5. Summary of Challenging agendas

18

Fields	Challenging agenda
Primary energy supply	As PES / GDP of KZH is higher than Russia, EE&C for Industry, Transformation, Commercial & service sectors are required.
Final energy consumption	The FEC in Industry and Commercial & Service sectors per GDP are so higher than JPN. Energy Management System for the sectors are required.
Electric power supply and consumption	Power sector requires challenging agendas to introduce new power supply and accounting systems and EE&C for electric appliances.
Coal supply sector	Introduce clean coal technologies such as coal gasification and liquefaction.
Oil and gas supply sector	NG will be used much more in residential sector, the introduction of the infrastructures is challenging agendas for the government.

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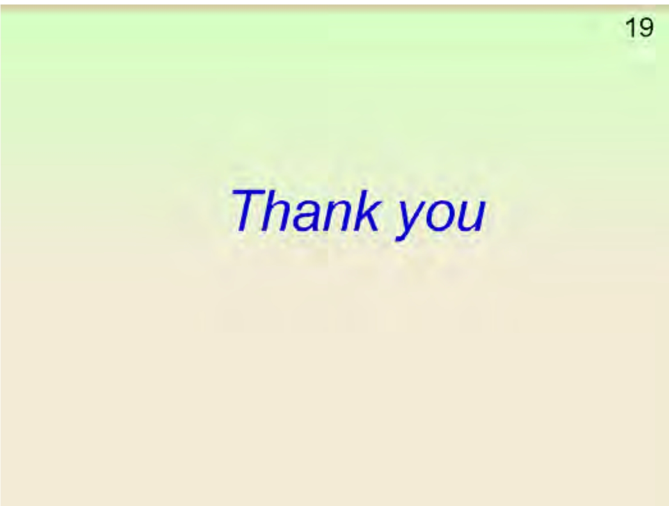

19

- Energy-Efficient Technologies in Japan -

JICA Study Team
April 2011

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Technologies for the Supply Side

2

More Advanced Combined Cycle (1,500°C-class Combined Cycle Power Generation)

Effects
- Improvement of thermal efficiency (47%LHV* >> 59%LHV) *Conventional CC
- Reduction of CO² emission

● **Gas turbine**

Model	Open cycle single-shaft type
Output	Approx. 330 thousand kW (air temperature of 5°C)
Inlet gas temperature	Approx. 1,500°C
Pressure ratio	Approx. 21
Combustor	Premixed combustion type
Fuel used	Re-gasified LNG

● **Steam turbine**

Model	Three-pressure reheated double-flow exhaust condensation type
Output	Approx. 170 thousand kW (air temperature of 5°C)
Steam pressure	High pressure ... Approx. 13 MPa Medium pressure ... Approx. 3 MPa Low pressure ... Approx. 0.4 MPa
Steam temperature	High pressure ... Approx. 560°C Medium pressure ... Approx. 570°C Low pressure ... Approx. 270°C

Kawasaki Power Station

Barriers
- Quality management of construction and maintenance

2

3

Ultra Super Critical Coal Power Generation

Effect
- Improvement of thermal efficiency (38%HHV >> 43%HHV)
- Reduction of CO² emission

Location	Boiler Contractor	Turbine/ Generator Contractor	Capacity (MW x unit)	Construction	First operation
Hitachinaka #1	BHK	HTC	1000 x 1	12/1998 - 12/2003	12/2003
Hirono #5	MHI	MHI/ME	600 x 1	7/2000 - 7/2004	7/2004

Specification	Main steam Press.(MPa)	Main steam Temp.(℃)	Reheater Temp.(℃)	Efficiency (%, HHV)	Fuel
Hitachinaka #1	24.5	600	600	43.1	Coal
Hirono #5	24.5	600	600	43.0	Coal

(Under construction)

Location	Boiler Contractor	Turbine/ Generator Contractor	Capacity (MW x unit)	Construction Schedule	Expected first operation
Hitachinaka #2	BHK	HTC	1000 x 1	10/2009 - 12/2013	12/2013
Hirono #6	MHI	MHI/ME	600 x 1	12/2008 - 12/2013	12/2013

Hitachinaka Power Station

BHK: Babcock-Hitachi K.K.
HTC: Hitachi, ltd.
MHI:Mitsubishi Heavy Industries, ltd.
ME: Mitsubishi Electric

Barriers
- Materials resistant to corrosion under high temperature and steam oxidation need to be utilized.

3

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IGCC (Integrated Coal Gasification Combined Cycle)

Effects
- Improvement of thermal efficiency of coal fired thermal power plant (42%LHV >> 48-50%LHV)
- Reduction of CO² emission

Capacity	Gross	•250 MW class (coal consumption : 1700ton/day)
Targets of thermal efficiency	Gross efficiency	•48%(LHV), 46%(HHV)
	Net efficiency	•42%(LHV), 40.5%(HHV)
Plant System	Gasifier	•air-blown, entrained-flow gasifier •dry coal feed
	Gas clean-up	•MDEA chemical absorption •limestone-gypsum method for sulfur recovery
	Gas turbine	•1200℃- class gas turbine(50Hz)

*Now under R&D

Source: Clean Coal Power R&D

Barriers
- Quality management of construction and maintenance

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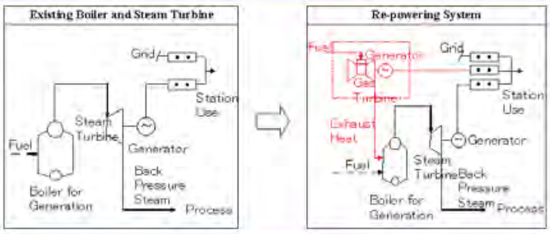
Combined Cycle Re – powering System

Effect
- Improvement of the thermal efficiency without scraping the conventional power station



Barriers
- The additional gas turbine needs the same capacity as that of the conventional boiler.

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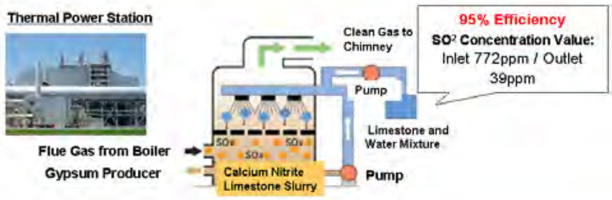
Flue Gas Desulfurization

Effects
- Reduction of SO2 emitted from thermal power plants (oil/gas)
- Mitigation of air pollution and acid rain



Barriers
- Facility cost
- Lack of regulations (disincentives)

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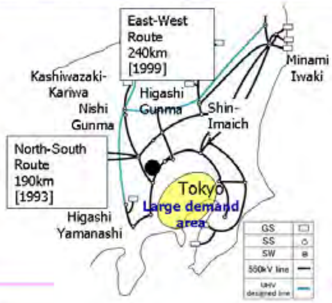
Ultra High Voltage (UHV) Technology - 1,000 kV Transmission Facilities -

Effect
- Reduction in transmission loss (550kV : 1 UHV (1100kV) : ¼)



Barriers
- Construction cost (Incl. pylons)

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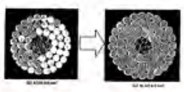
Other Measures to Reduce the Distribution System Losses

Effects
- Lossless power line: reduction of CO2, expansion of distribution capacity, and reduction of voltage drops
- Power Capacitor: Reduction of transmission losses

Lossless Power Line



Power Capacitor

Nissin Electric Co., Ltd.

Barriers
- Lossless power line: Facility cost
- Power Capacitor: Facility cost, Systematic Installment

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Technologies for the Demand Side

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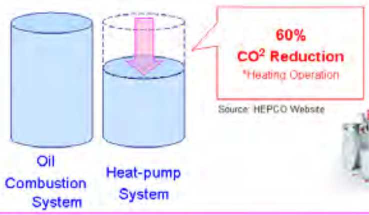
Highly Efficient Heat-Pump Air Conditioner

Effect
- The latest highly-efficient heat pumps have 6.0 or more COP.
- Lowers the electricity cost



Source: HEPCO Website

Turbo-Freezer

Barriers
- Heating capacity decreases due to the low outside temperature. (Applicable over -25°C)
- Facility cost (Tariff Incentive is desirable.)

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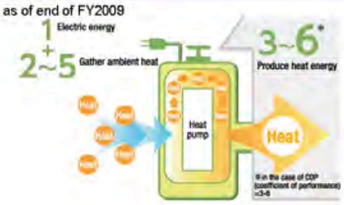
Eco Cute (Heat-Pump Water Heater)

Effect
- Saves the primary energy by 30% and reduce CO2 by 50% compared with conventional combustion-type water heaters
- Lowers the electricity cost

Dissemination Status: 2.25 million units as of end of FY2009



Barriers
- Heating capacity decreases due to the low outside temperature. (Applicable over -25°C)
- Facility cost (Tariff Incentive is desirable.)

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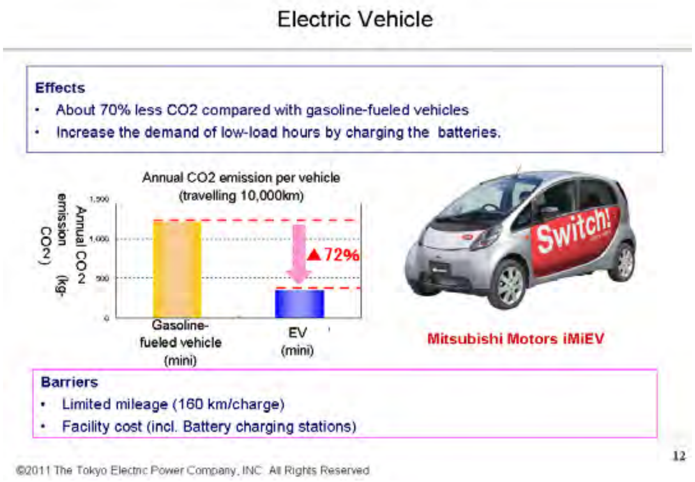

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Thank you for listening !

14

For Seminar at the Japan Center

Renewable Energy Technology in Japan (Solar, Wind and Mini Hydro)

JICA Study Team
April 2011

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1. General

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2

Law on Renewable Portfolio Standards

1. **Enforcement:** April 2003
2. **Objective:** To promote Renewable Energy, an obligation is placed on power utilities to utilize/purchase RE in accordance with allocation portfolio.
3. **Definition of RE in RPS:** Wind, Solar, Geothermal, Run-off River Hydro under 1,000kW, Biomass (incl. Solid waste generation)
4. **Unit:** kWh
5. **Method:** (1) Generation by power utilities, (2) Purchase from RE owners, (3) Purchase of certificate from other utilities
6. **Target of Renewable Energy Usages of Japanese Power Utilities** (Including purchase)

	2007	2008	2009	2010	2011	2012	2013	2014
Billion kWh	8.67	9.27	10.38	12.43	12.82	14.21	15.73	17.33

*RPS (Renewable Portfolio Standard)

Equivalent to 1.3 % of total generation in Japan

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3

Feed In Tariff for Renewable Energy

1. Before November2010 : Power Utilities purchased surplus power of solar generation at the same price of retail of the power utility. This is one of voluntary programs prepared by power utilities to meet the law an RPS.
2. From November 2010: Government started "Feed in Tariff" for solar power (less than 10 kW) and surplus power. 48 JY/kWh for 10 years is paid to the application. The high price is recovered from the collection of tariff from all the customers.
3. As of Today: Other RE technology (Wind, Mini Hydro, Geothermal, Biomass) is now discussed in the Japanese Parliament.

Feed in Tariff

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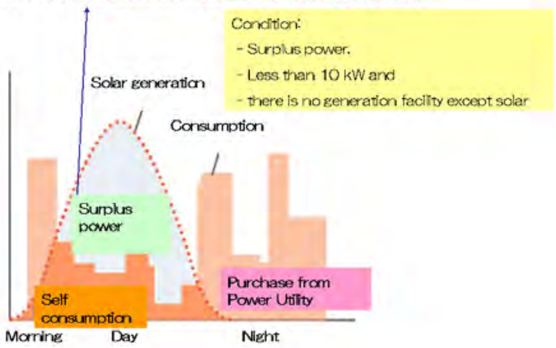
Feed in Tariff (2010/11/1-)

Purchase at 48 (JY/kWh) = 82 tenge/kWh



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5

Support Schemes by Government

	Solar	Wind	Hydro
Study Stage		- 1/2 Subsidy for Wind Data Collection	- 1/2 Subsidy for Design - New or Rehabilitation under 50 MW
Construction Stage	- 20,000 JY for 1 kW (already closed by 2005)	- 1/3 x 0.8 Subsidy for the Project Cost - Not less than 1.5 MW	(1 MW-30MW) - 10% to 20 % Subsidy for Construction or 50% of New Technology (Under 1 MW) - 1/3 of the Project Cost

6

6

Issues about Wind Power and Solar Power

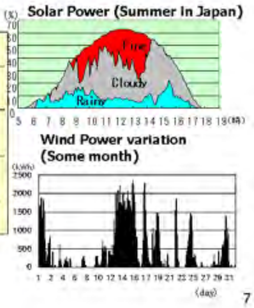
- Power output variation due to weather conditions
- High cost
- Large area

Cost and required areas Solar power and wind power in Japan

	Solar Power	Wind Power
Cost	Around 46 JPY/kWh	Around 11-14 JPY/kWh (Large) Around 18-24 JPY/kWh
Required Area	Equivalent to 1,000 MW Power Unit	
	Around 67 km2	Around 246 km2
Plant Factor	12%	20%

<Reference> LNG Thermal: 6.2JPY/kWh

1 JY=1.7 Tenge



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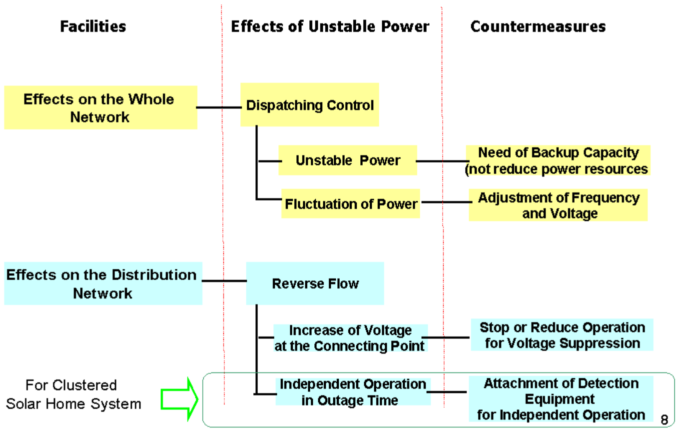
Technical Issues of Unstable Power in the Power Grid



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Needs of Technical Analysis to Confirm Grid Stability

- In order to check the stability of grid, a power utility have to conduct the following analysis.
  - Power Flow Analysis
  - Short-Circuit Current Analysis
  - Fluctuation of Voltage Analysis
  - Check of Frequency Stability against the Fluctuation of Output
  - Study for Proper Protection System (Relay System)

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9

2. Solar Power

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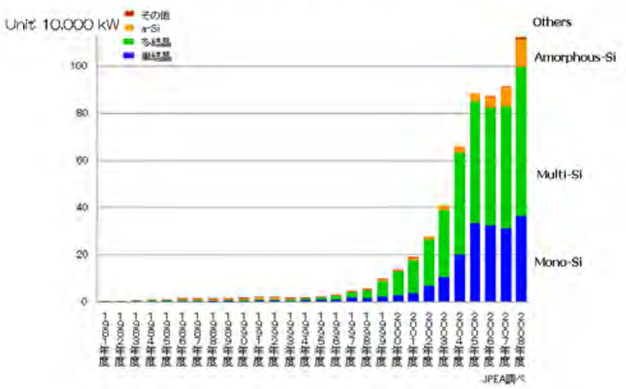
10

PV Production in Japanese Manufacturers (By type of PV)



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11

PV Manufacturers in the World (By production volume: 2008)

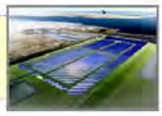
Country	Company	Share
German	Q-Cells	8%
USA/German/Malaysia	First Solar	7%
China	Suntech	7%
Japan	Sharp	7%
Taiwan	Motech	6%
Japan	Kyocera	4%
China	Yingli	4%
China	Ja Solar	4%
Phillipine	SunPower	4%
German/USA	Deutsche Solar/SolarWorld CA	4%

12

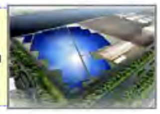
12

Examples of Mega Solar Power Projects

- **Ukisima Solar Power Station (in Kawasaki City)**
  - Solar cell output: around 7 MW · 2009 starting construction
  - Energy output: 7.4GWh · Commissioning year: 2011
  - Reduction in CO_2 emission (Estimation): around 3,100 ton/year



- **Ohgishima Solar Power Station (in Kawasaki City)**
  - Solar cell output: around 13 MW · 2009 Starting construction
  - Energy output: 13.7GWh · Commissioning year: 2011
  - Reduction in CO_2 emission (Estimation): around 5,800 ton/year



- **Yonekurayama Solar power station (in Yamanshi prefecture)**
  - Solar cell output: around 10 MW · 2010 Starting construction
  - Energy output: 12GWh · Commissioning year: 2011
  - Reduction in CO_2 emission (Estimation): around 5,100 ton/year

13

13

Features of Solar Power

	Advantage	Disadvantage
Owners	-It is easy to select its scale and install it anywhere. -Maintenance free (except power conditioner change: every 10 years)	-It is still high cost (5,000 US$/kW). -Large space is necessary. (1kW=10m2).
Power Utility	- It might contribute to reduce peak power load in daytime.	-Voltage increase at the connecting point -Fluctuation of output (affects the frequency) -Protection of independent operation by each site

14

14

Results of Price Analysis Survey (2005)

Actual prices of SHS were surveyed by questionnaire.

Unit Price (1,000 JY/kW)

	All Data	By Type of PV: Mono-Si	Multi-Si	Amorphous
Total Price	**684**	**829**	**644**	**643**
(a) Module Price	441	550	411	430
(b) PCS and others	165	195	157	143
(c) Installation	78	84	76	70

Number of Samples: 11,638 cases (mono: 2,731cases, Multi: 8,860 cases: AP: 37 cases)

1 JY=1.7 Tenge (Source: NEF)

15

15

Features of Various Type of PV

Type	Current Status
Crystalline Si (mono and multi)	● Mono and multi crystal has been technically matured (module efficiency: 16%). ● Annual production capacity is 700MW in Japan ● Mono type is higher efficiency than multi, but it is costly due to large use of silicon. ● Multi type is the most popular technology in the world.
Thin-Film Si	● This is hybrid of amorphous and thin silicon. This has been technically matured. ● Efficiency improvement is a current issue (module: 11%).
CIS	● This technology has been developed. ● Instead of use of silicon, Cu, In and Se are used for material. ● Efficiency improvement is a current issue (module: 11%).

(Source: NEDO)


Mono-Si


Multi-Si


Thin-Film Si


CIS

16

16

Conversion Efficiency

Current situation and future target in Japan

2008 / **Future Target**

Type	current status Module (%)	current status Cell (%)	2017 Module (%)	2017 Cell (%)	2025 Module (%)	2025 Cell (%)	2050 Module (%)
Crystalline Si	~18	25	20	25	25	(30)	Ultra-high 40 % efficiency solar cells (additional development)
Thin-film Si	~11	15	14	18	18	20	
CIS	~11	20	18	25	25	30	
Compound	~25	41	35	45	40	50	
Dye-sensitized		11	10	15	15	18	
Organic		5	10	12	15	15	

(Source: NEDO)

17

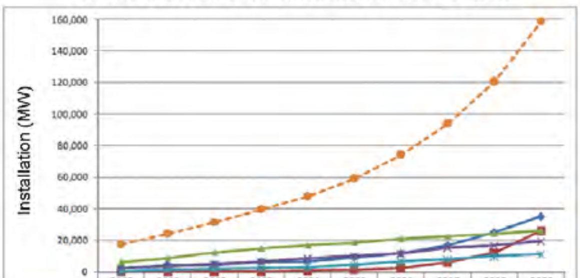
17

3. Wind Power

18

18

Wind Power Installation in the World



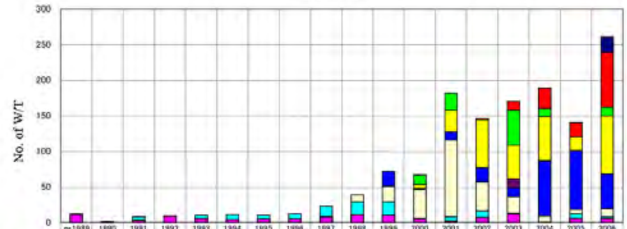
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
USA	米国	2,578	4,275	4,685	6,372	6,725	9,149	11,575	16,824	25,068	35,064
China	中国	346	402	469	567	764	1,260	2,599	5,910	12,020	25,805
German	独	6,104	8,754	11,994	14,609	16,629	18,415	20,622	22,247	23,903	25,777
Spain	スペイン	2,235	3,337	4,825	6,203	8,263	10,027	11,623	15,145	16,689	19,149
India	インド	220	1456	1702	2125	3000	4430	6270	7,845	9,655	10,926
World	世界	17,400	23,900	31,100	39,431	47,620	59,091	74,052	93,835	120,297	158,505

Source: Global Wind 2009 Report

19

19

Annual Number of Wind Power Installation in Japan

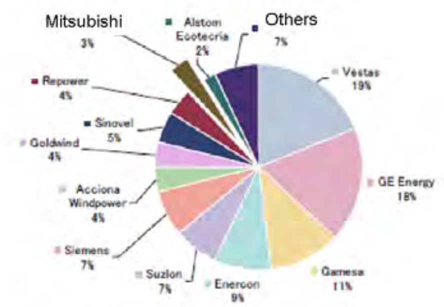


	~1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
>2000kW																	1	22
~2000kW														2	12	29	20	77
~1750kW												14	24		49	11		12
~1500kW												5	31	67	48	62	19	82
~1250kW												1			12	1		
~1000kW											21	1	11	20	13	77	83	49
~750kW										10	22	40	106	41	23	9	8	11
~500kW	1		5		4	7	5	7	15	18	19	1	8	9	1		6	2
~250kW	11	1	3	9	8	4	5	8	8	11	10	5	2	7	12		6	8

20

20

Market Share of Manufacturers in the World (2008)



Source: Emerging Energy Research

21

21

Estimate Cost of Wind Power System

Sources	Location		Unit Price *
1. World Energy Outlook 2009 (IEA)	Onshore		1,770-1,960 US$/kW
	Offshore		2,890-3,200 US$/kW
2. Technology Roadmaps Wind Energy 2009 (IEA)	Onshore	Europe	1,450-2,600 US$/kW
		USA	1,400-1,900 US$/kW
		Japan	2,600-3,200 US$/kW
		China	About 1,000 US$/kW
		India	About 1,000 US$/kW
	Offshore	UK	3,100 US$/kW
		German/Holland	4,700 US$/kW

* Unit price includes wind power system, installation and connection.

22

22

Generation Cost of Wind Power System

Sources	Location		Unit Price *
1. World Energy Outlook 2009 (IEA)	Onshore		9 - 10.5 US cent/kWh
	Offshore		10.0 – 12.0 US cent/kWh
2. Technology Roadmaps Wind Energy 2009 (IEA)	Onshore		7.0 – 13.0 US cent/kWh
	Offshore		11.0 – 13.1 US cent/kWh
3. Energy Technology Perspectives 2008 (IEA)	Onshore	High Wind Area*1	6.5 – 9.4 US cent/kWh
		Middle Wind Area*2	8.5 US cent/kWh
		Low Wind Area	8.9 – 13.5 US cent/kWh

*1: UK, Ireland, France, Denmark, Norway
*2: German, France, Spain, Portugal, Holland, Italia, Sweden, Finland, Denmark

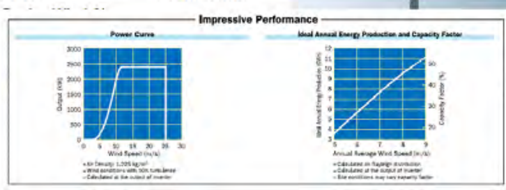
23

23

Samples of Wind Turbine (Mitsubishi Heavy Industry)

MWT100/2.4 : Model For European Market

- **Rated output** : 2400 kW
- **Number of Blade** : 3 (48.7m)
- **Rotor diameter** : 100m
- **Swept Area** : 7854m²
- **Operational interval** : 9.0～16.9 rpm
- **Hub height** : 80m
- **Pitch control** : Individual
- **Yaw control** : Active
- **Blade** : GFRP 48.7m



24

24

Features of Wind Power (Grid Connection)

	Advantage	Disadvantage
Owners	-Wind power is more economic feasible than other technology of renewable energy.	-Environmental issues such as bird strike and loudness. -Power utility sometimes limits the purchase of generation due to limitation of system capacity. -Large space should be secured.
Power Utility		-Fluctuation of power is the most critical issues for grid connection.

25

25

4. Hydro Power

26

26

Features of Small/Mini Hydro Power (Grid Connection)

	Advantage	Disadvantage
Owners	-Environmental impact is not so large.	-Coordination with stakeholders (water users, existing facility owners, land owners) might be necessary. -Sometimes generation schedule is limited due to other purpose of water use.
Power Utility	- It is relatively stable in terms of power output.	-In case of remote area, it is difficult to connect to the existing grid.

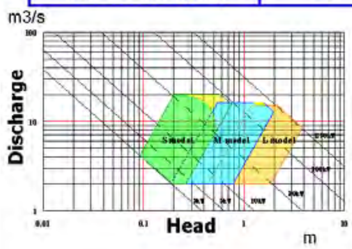
27

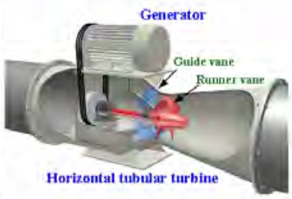
27

Micro Tubular Turbine System

■ **Application range of three standard models**

	S model	M model	L model
Max. output [kW]	90	200	250
Applicable head [m]	2 - 20	2 – 16.5	2 – 15
Applicable discharge [m³/s]	0.09 – 0.6	0.3 – 2.0	0.8 – 4.0
Runner diameter [mm]	290	500	760





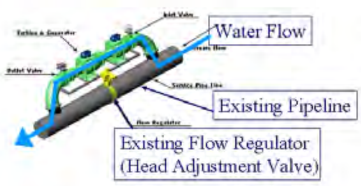
28

28

Case of Micro Hydro 1: Attachment to Drinking Water Pipeline

Egasaki Power Station (TEPCO)

No of Turbine	2 units
Max. Output	Total 170 [kW]
Effective Head	36.1 [m]
Max. Discharge	0.6 [m³/s]
Annual Generation	1.0 GWh (LF=67%)



(Construction)
- Bypass Line Installation to Water Pipeline at the Head Adjustment Point
- Install Turbine and Generator and connecting to Distribution Line Grid

29

29

Case of Micro Hydro 2: Attachment to Existing Pond

Image

Nurukawa Power Station (TEPCO)

No of Turbine	1 unit
Max. Output	37 [kW]
Effective Head	5.0 [m]
Max. Discharge	1.1 [m³/s]
Type of Waterway	Siphon

(Construction)
- Utilization of Existing Pond and Low Head
- Install Turbine and Generator

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Reference

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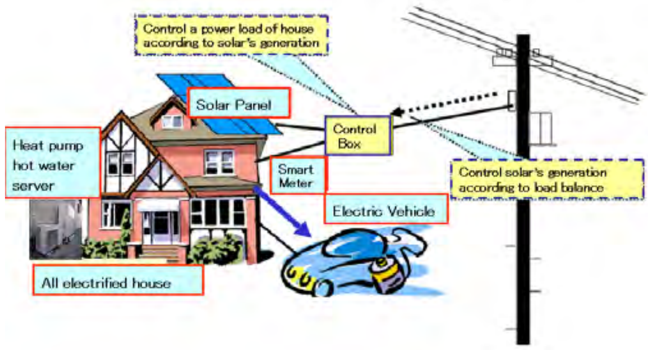
31

Smart Use of Solar in the Future



32

32

PV Utilization in the Grid System in the Future

■Enhancing utilization of nuclear power, solar power will be installed with minimum social cost and efficient harmony together with existing generation, transmission and distribution system.

33

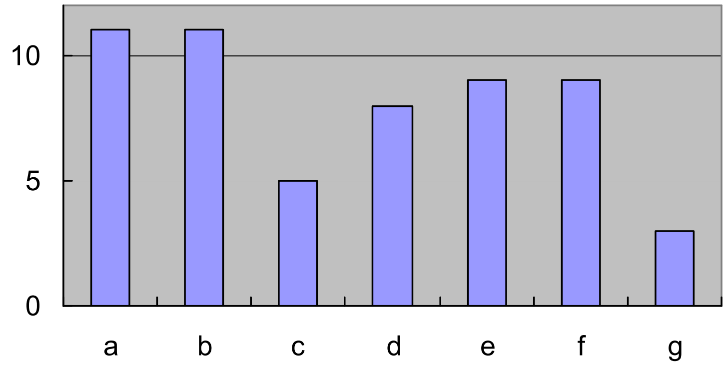
33

付属資料 4

第二回セミナー
アンケート結果

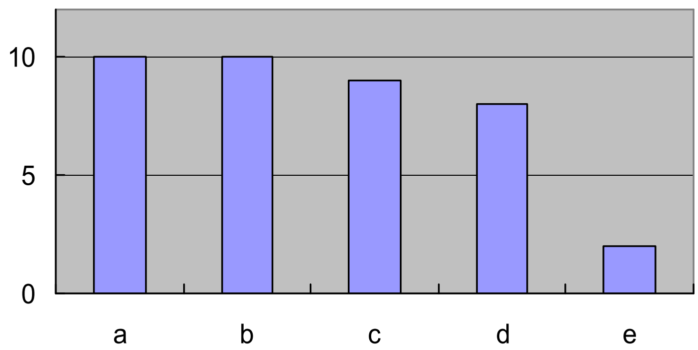
1. What are the likely constraints to promote energy effiiency in Kazakhstan?

a Lack of the adequate laws to regulate energy use
b Lack of the budget/funding
c Absence of the leading organization
d Lack of institutional enhancement for the demand side
e Lack of project development capacity/knowledge
f Limited access to state-of-the-art technologies
g Others



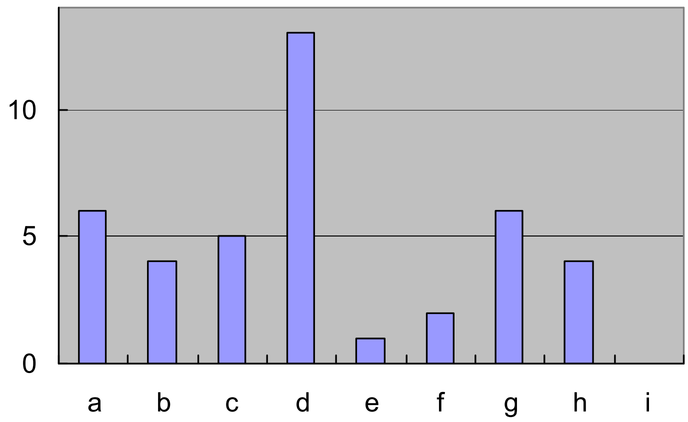
2. What are the priorities to promote energy efficiency in Kazakhstan?

a Supply side of the power sector
b Supply side of the fuel sector (gas 7 / coal 3 / oil 3 / uranium 0)
c Demand side of the power sector
d Demand side of the fuel sector (gas 4 / coal 3 / oil 1 / uranium 1)
e Others



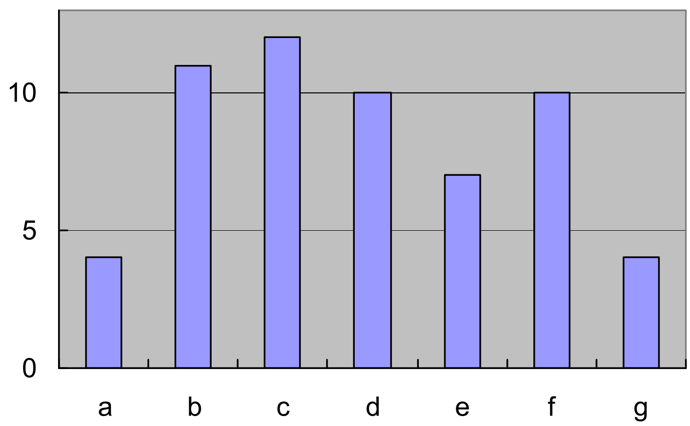
3. In which areas do you expect financial support by the Japanese ODA to promote energy efficiency?

a Highly efficient thermal power plant (gas 1 / coal 2 / oil 0)
b Rehabilitation of the thermal power plant (gas 1 / coal 2 / oil 0)
c Highly efficient transmission line
d Renewable energy (wind 9 / solar9 /hydro 4 / geothermal 3)
e Combined cycle plants
f Installation of gas turbines
g Highly efficient CHP
h Master Plan (electric power development 3 / transmission 5)
i Others



4. What are the likely constraints to develop JI or other emission reduction projects in Kazakhstan?

a Kazakhstan's status under the Kyoto Protocol
b Lack of identified JI projects
c Lack of experience / project development capacity
d Lack of the adequate laws and regulations
e Absence of the leading organization
f Lack of the budget / funding
g Others



5. Which of the project types listed below need most or will benefit most from implementation as JI or other emission reduction projects?

a Highly efficient thermal power plant (gas 4 / coal 1 / oil 0)
b Highly efficient transmission line
c Renewable energy (wind 7 / solar 6 /hydro 4 / geothermal 2)
d Combined cycle plants
e Installation of gas turbines
f Highly efficient CHP
g Others