



Distribution Map of Power Sources for Sun Centers in the Year Stages 2005 and 2010

**LEGEND**

- Diesel + PV
- ▶ Diesel + PV + WG
- ▣ Diesel
- Diesel + Hydro
- ▶ Diesel + PV + Hydro
- ▲ Grid

( PV : Photovoltaic Cell )  
( WG : Wind Generator )

**Master Plan Study for Rural Power Supply by Renewable Energy in Mongolia**  
**The First Stage(2005)Profile of Development Plan**

1. Name of Project	: Rural Power Supply by Renewable Energy
2. Ministry in charge	: Ministry of Infrastructure Development (MOID)
3. Targeted Site	: 167 Sums
4. Objectives of Project	: To improve public services for BHN To change residents' mind for saving of resources
5. Plan of Power Supply System	sums
	: Diesel Individual : 38
	: Diesel+PV : 77
	: Diesel+PV+Wind : 45
	: Diesel+Small Hydro : 2
	: Diesel+Small Hydro+PV : 1
	: Grid extension : 4
6. Renewable Energy Supply System	: Direct power supply to load by isolated renewable energy (Hydro · PV · Wind+Battery)
7. Power Distribution Plan	: Construction of new distribution line for public services (hospitals, schools, etc) Application of meter rated tariff system
8. Capacity of Renewable Energy Supply	: PV 969MWh/year、 Wind 226MWh/year
9. Implementation Schedule	: Sept., 2002~Dec., 2004 (The 1st Stage) 2005 (Commencement)
10. Operation & Maintenance Plan	: Establishment of management organization for electricity supply operation and of work group for maintenance Introduction of basic intelligent management system (IMS)
11. Project Cost	: US\$ 23.814 million
12. Internal Rate of Return	: EIRR -3.3%, FIRR -11.3%
13. Range of Rating per Sum Center	: PV 2 ~ 12 kWp Wind Generation 2.5 ~ 10 kW Battery (for 2 days) 6 ~ 48 kAh
14. Intelligent Management System	: each Sum (computer 2 sets+observation unit) each Aimag (computer 2 sets)
15. Saving on Fuel	: 1,815 kl/year
16. Reduction of CO <sub>2</sub> emission	: 1,336 ton-CO <sub>2</sub> /year

**Master Plan Study for Rural Power Supply by Renewable Energy in Mongolia**  
**The Second Stage(2010)Profile of Development Plan**

1. Name of Project : Rural Power Supply by Renewable Energy
2. Ministry in charge : Ministry of Infrastructure Development (MOID)
3. Targeted Site : 167 Sums
4. Objectives of Project : To improve the power supply to every household  
To stabilize the people's livelihood
5. Plan of Power Supply System : sums
 

: Diesel Individual	: 38
: Diesel+PV	: 77
: Diesel+PV+Wind	: 45
: Diesel+Small Hydro	: 2
: Diesel+Small Hydro+PV	: 1
: Grid extension	: 4
6. Renewable Energy Supply System : Diesel power supply to load by isolated  
renewable energy  
(Hydro · PV · Wind+ Battery)
7. Power Distribution Plan : Construction/reinforcement of distribution  
line for every household
8. Capacity of Renewable Energy Supply : PV 7.1GWh/year、 Wind 2.7GWh/year
9. Implementation Schedule : Mar., 2007~Dec., 2009 (The 2nd Stage)  
2010 (Commencement)
10. Operation & Maintenance Plan : Operation of the system throughout the year  
50% reduction of power distribution loss  
Reserving budget for the renewal of the systems  
Accumulation of know-how for steady power supply
11. Project Cost : US\$ 43.858 million
12. Internal Rate of Return : EIRR 1.0%, FIRR -2.9%
13. Range of Rating per Sum Center : PV 5 ~ 100 kWp  
Wind Generation 10 ~ 130 kW  
Battery (for 1 day) 6 ~ 240 kAh
14. Intelligent Management System : each Sum (computer 2 sets)  
each Aimag (computer 2 sets)  
MOID (computer 2 sets)  
EA (computer 2 sets)
15. Saving on Fuel : 4,965 kl/year
16. Reduction of CO<sub>2</sub> emission : 3,654 ton-CO<sub>2</sub>/year

**Master Plan Study for Rural Power Supply by Renewable Energy in Mongolia**  
**The Third Stage(2015) Profile of Development Plan**

1. Name of Project : Rural Power Supply by Renewable Energy
2. Ministry in charge : Ministry of Infrastructure Development (MOID)
3. Targeted Site : 167 Sums
4. Objectives of Project : Steady power supply to every household  
Saving resources, Protection of the environment,  
Community development
5. Plan of Power Supply System sums
  - : Fuel Cell+Hydrogen Production/Storage+PV : 93
  - : Fuel Cell+Hydrogen Production/Storage+PV+Wind : 53
  - : Fuel Cell+Hydrogen Production/Storage+PV+Small Hydro : 1
  - : Fuel Cell+Hydrogen Storage : 14
  - : Small Hydro : 1
  - : Small Hydro+PV : 1
  - : Grid extension : 4
6. Renewable Energy Supply System : Direct power supply to load by isolated  
renewable energy  
(Hydro · PV · Wind+ Fuel Cell)
7. Power Distribution Plan : Construction of distribution line for  
new household
8. Capacity of Renewable Energy Supply : PV 19.8GWh/year、 Wind 14.9GWh/year
9. Implementation Schedule : Sept., 2011~Dec., 2014 (The 3rd Stage)  
2015 (Commencement)
10. Operation & Maintenance Plan : Improvement of service quality  
Reduction of power generating cost  
Attainment of perfect self-operation
11. Project Cost : US\$ 80.490 million
12. Internal Rate of Return : EIRR 6.5%, FIRR 2.9%
13. Range of Rating per Sum Center : PV 10 ~ 200 kWp  
Wind Generation 30 ~ 300 kW  
Fuel Cell 50 ~ 300 kAh
14. Intelligent Management System : version up of software for each Sum,  
each Aimag, MOID and EA
15. Saving on Fuel : 6,850 kℓ/year
16. Reduction of CO<sub>2</sub> emission : 5,042 ton-CO<sub>2</sub>/year

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## Abbreviations and Acronyms

### (1) Domestic Organization

EA	: Energy Authority of Mongolia
MOID	: Ministry of Infrastructure Development
PTA	: Post and Telecommunication Authority
UCS	: State owned Hydropower Company

### (2) International or Foreign Organization

ADB	: Asian Development Bank
GTZ	: Deutsche Gesellschaft für Technische Zusammenarbeit GmbH, Germany
JBIC	: Japan Bank for International Cooperation, Japan
JICA	: Japan International Cooperation Agency, Japan
KFW	: Kreditanstalt für Wiederaufbau, Germany
NEDO	: New Energy and Industrial Technology Development Organization, Japan
OECF	: Overseas Economic Cooperation Fund, Japan
TACIS	: Technical Assistance for Common-welfare Independent State, EU
UNDP	: United Nations Development Program
USAID	: The US Agency for International Development, USA
WB	: World Bank
WHO	: World Health Organization
ISO	: International Organization for Standardization

### (3) Others

BHN	: Basic Human Needs
BOD	: Biochemical Oxygen Demand
BOO	: Build Own Operate
BOT	: Build Operate Transfer
COD	: Chemical Oxygen Demand
DSM	: Demand Side Management
F/S	: Feasibility Study
GDP	: Gross Domestic Product
NGO	: Non Government Organization
O&M,O/M	: Operation and Maintenance
VAT	: Value Added Tax

**(4) Technical Term**

AC	: Alternative Current
DC	: Direct Current
CO	: Carbon Monoxide
CO <sub>2</sub>	: Carbon Dioxide
NO <sub>2</sub>	: Nitrogen Dioxide
NO <sub>x</sub>	: Nitrogen Oxides
SO <sub>2</sub>	: Sulfur Dioxide
SO <sub>4</sub>	: Sulfur Tetroxide
SO <sub>x</sub>	: Sulfur Oxides
ACSR	: Aluminum Conductor Steel Reinforced
SCADA	: Supervisory Control and Data Acquisition
TV	: Television
NewDG	: New Diesel Generator
ExDG	: Existing Diesel Generator
PV	: Photovoltaic Cell
WG	: Wind Generator
FC	: Fuel Cell
Hyd	: Hydraulic Generator
Grid	: Transmission Line
CES	: Central Energy System
EES	: East Energy System
WES	: West Energy System
LDC	: Load Dispatching Center
Indepen.	: Independent (Electric System)

**(5) Unit**

Length	mm	: millimeter
	m	: meter
	km	: kilometer
Area	mm <sup>2</sup>	: square millimeter
	km <sup>2</sup>	: square kilometer
Weight	mg	: milligram
	ton, t	: metric ton
Pressure	hPa	: hecto Pascal
Time	mo	: month
	yr	: year
Electrical Measurement	V	: Volt
	Hz	: Hertz (cycle)
	kW	: kilowatt
	MW	: Megawatt
	Wp	: Watt
	kWp	: kilowatt
Other Measures	%	: percent
	cal	: calorie
	°C	: degrees centigrade
Derived Measures	kWh	: kilowatt hour
	GWh	: Gigawatt hour
	MVA	: Megavolt ampere
	Ah	: ampere hour
Currency	Tg, tg	: Tugrik, Mongolian Currency
	US\$	: US Dollar
	M.US\$	: Million US Dollar
	US ¢	: US cent