INTRODUCTION OF RENEWABLE ENERGY SECTOR IN MONGOLIA AND THEIR POLICY ENVIRONMENT

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Tokyo, Japan
2012

1. Brief information of Mongolia

- **Geography**

Mongolia is situated in northern Asia, bordering China and Russia. The geographical coordinates of the country are 46° North latitude and 105° East longitude.

The total land area of Mongolia is 1,564,116 square kilometers.

- Lowest annual average temperature: -33° C (-50° C)
- Highest annual average temperature: +23° C (+35.8° C)

2. Renewable energy potential in Mongolia

- Wind
- Solar
- Hydro
- Geothermal

Wind power potential

- Mongolia has potential to be a major wind power producer.
- Mongolia has enormous wind power resources;
  - Good-to-excellent wind resources equivalent to **1,113,300 MW** of wind electric potential,

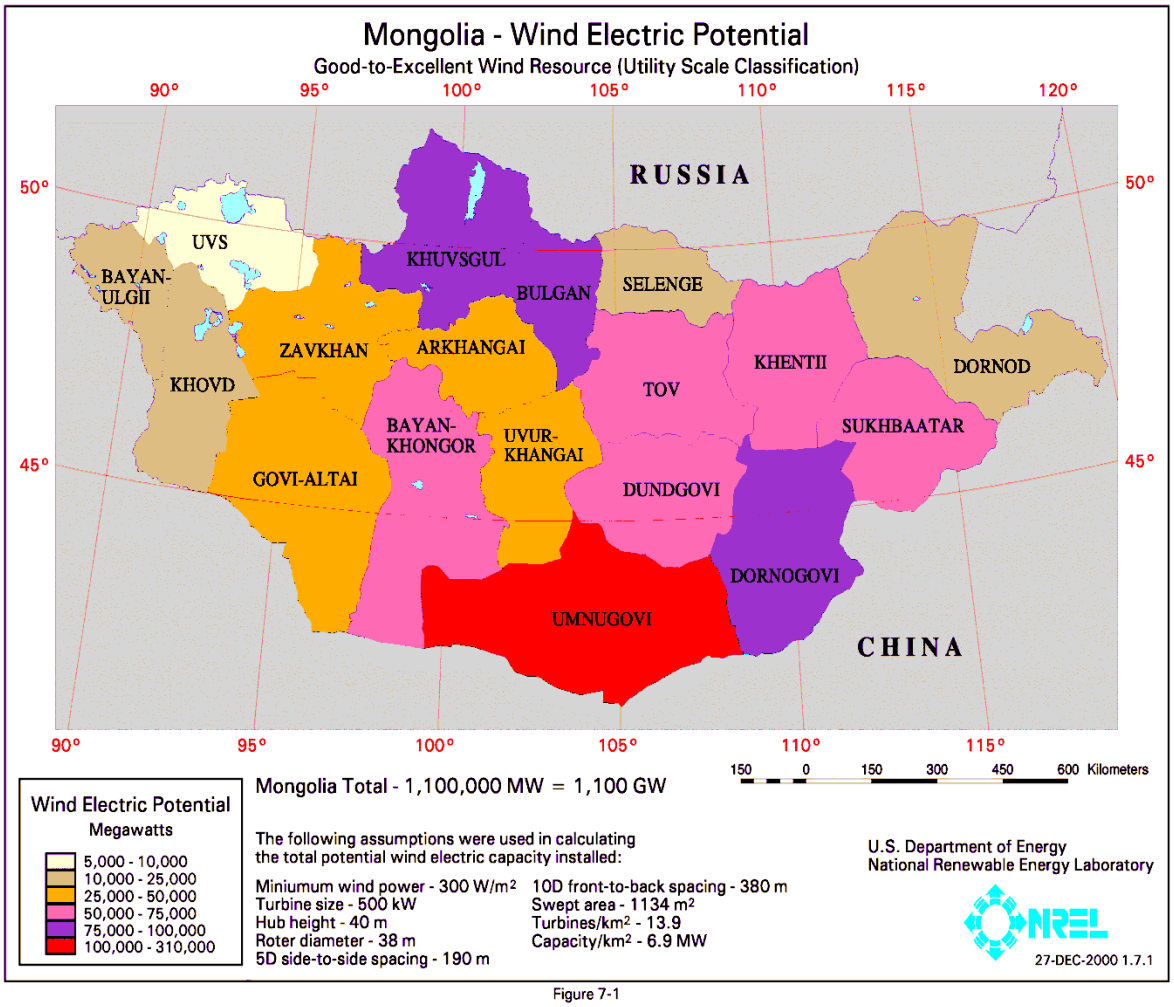


Figure 7-1

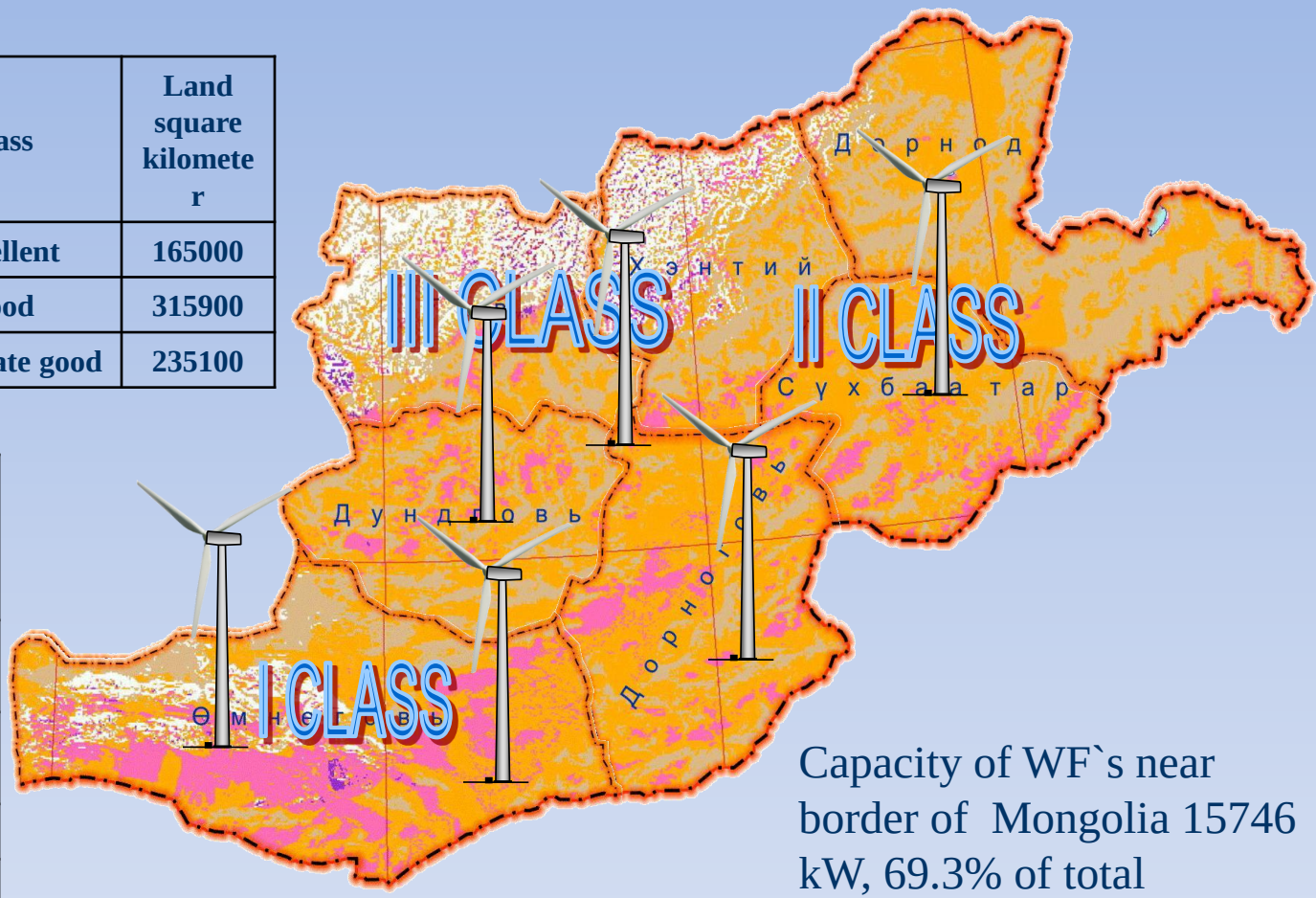
Source: Wind resource Map of Mongolia, NREL, 2001

WIND POWER POTENTIAL

#	Wind power density, W/m2	Wind speed m/s at 30 m	class	Land square kilometer
I	400-600	7.1-8.1	excellent	165000
II	300-400	6.4-7.1	good	315900
III	200-300	5.6-6.4	Moderate good	235100

Perspective of WP

#	Name of WP	Capacity, MW	progress
III	Salkhit	50	Under const
II	Choir	50,4	Under const
II	Sainshand	50	R&D
I	Oyutolgoi WP	250	R&D
I	Khurmen	-	R&D
I	Tsot-tsetsii	-	R&D

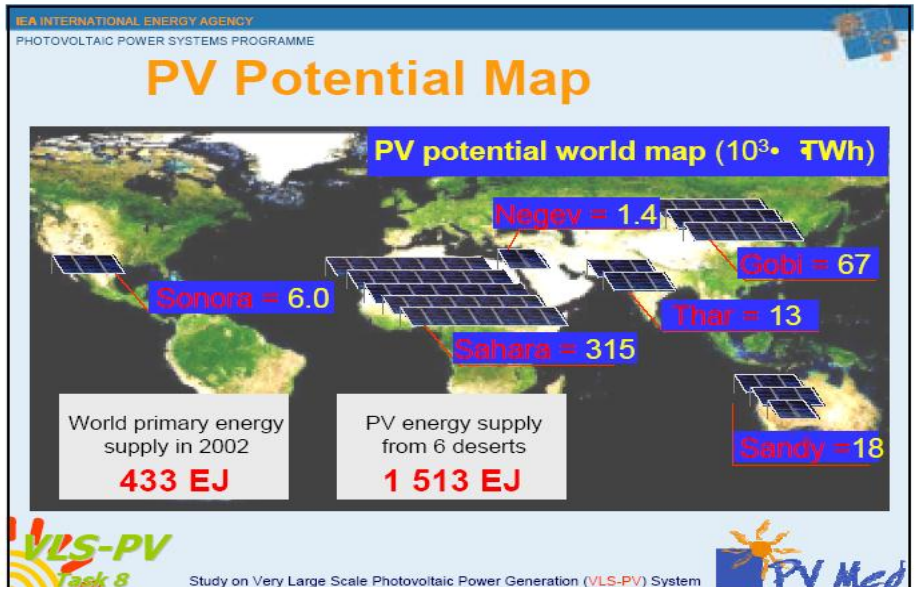


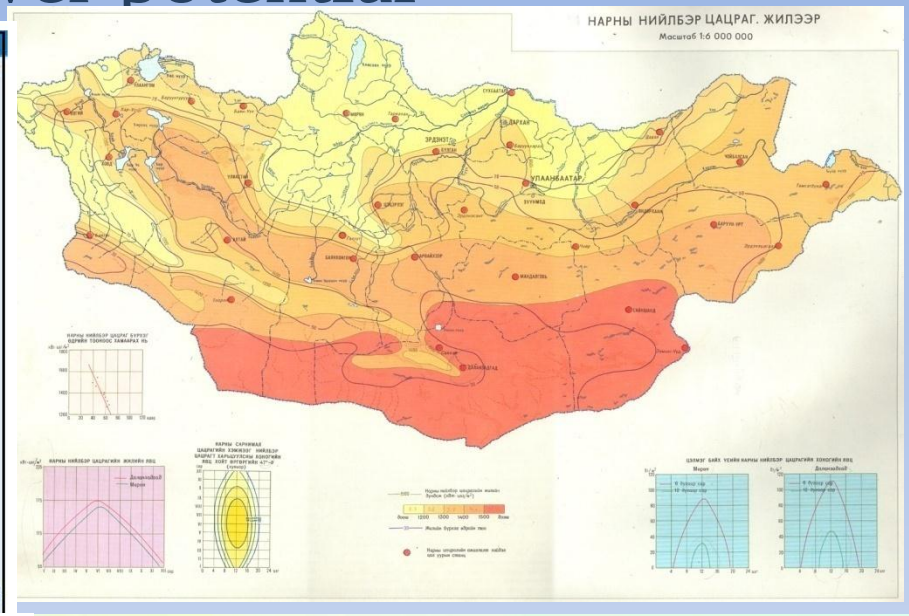
Capacity of WF`s near border of Mongolia 15746 kW, 69.3% of total installed WP in China.

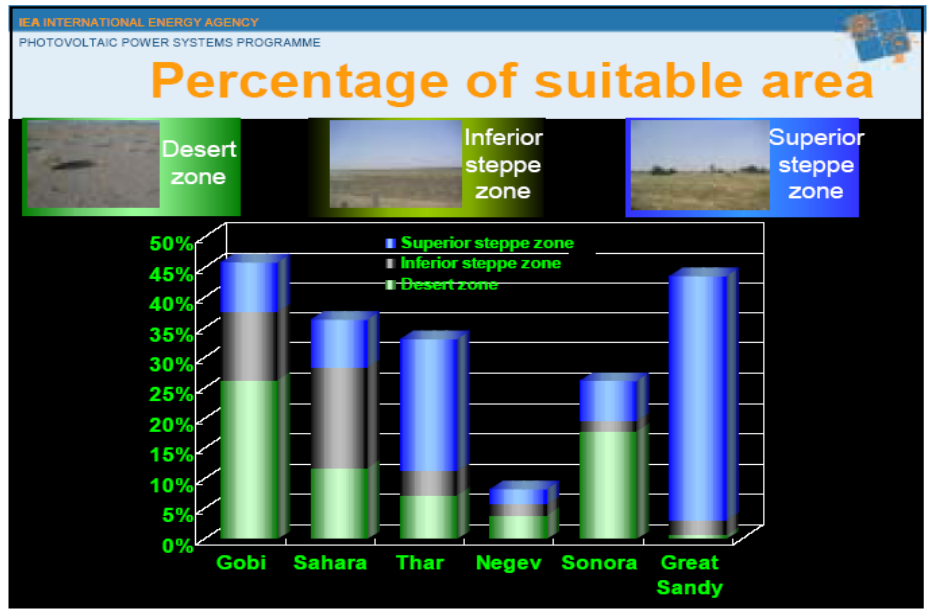
Gobi Desert has largest potential for Wind Power Generation

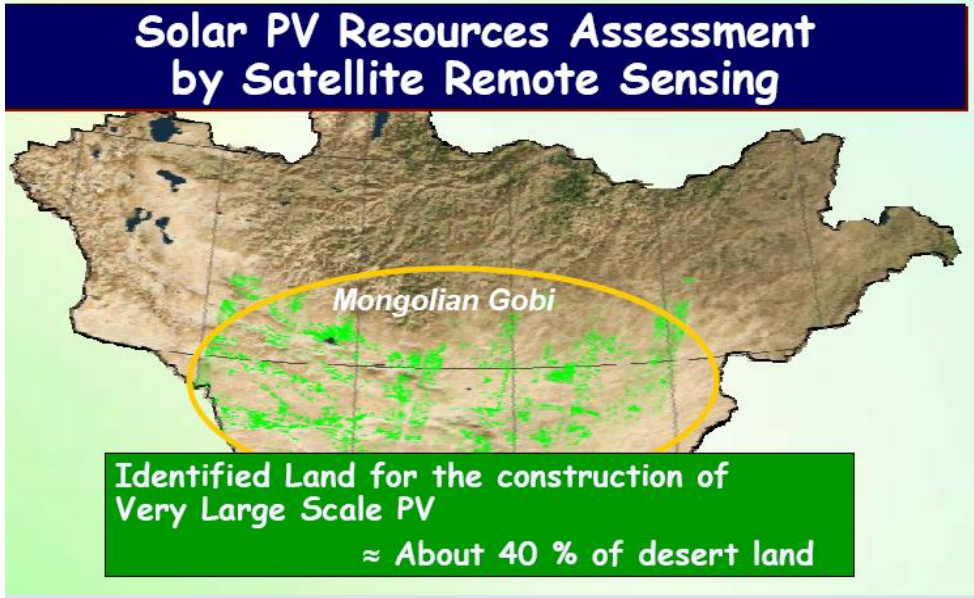
Country	Wind Potential (MW)	2011 Installed (MW)	% Installed (as of 2011)	Target Installed 2020 (MW)
Mongolia	**1,113,300.0**	2.4	0.0002	210 (2015)
PRC	**1,000,000.0**	44,700.0	4.4700	150,000 – 200,000
Kazakhstan	210,650.0	0.5	0.0002	
Afghanistan	158,100.0		-	
Japan	**133,000.0**	2,440.0	1.8346	5% of total installed electric capacity
Vietnam	111,916.0	10.5	0.0094	
Pakistan	50,000.0	6.0	0.0120	
India	48,500.0	14,157.0	29.1897	65,000
Laos	27,104.0	-	-	
Sri Lanka	24,000.0	33.0	0.1375	250
Bangladesh	20,000.0	3.8	0.0190	500
Indonesia	9,300.0	0.5	0.0054	970 (2025)
South Korea	**7,800.0**	379.0	4.8590	23,000 (2030)
Philippines	7,400.0	33.0	0.4459	425
Armenia	4,900.0	2.6	0.0531	
Bhutan	4,825.0	-	-	
Thailand	3,050.0	7.3	0.2393	800
Fiji Island	NA	10.0		

Solar power potential

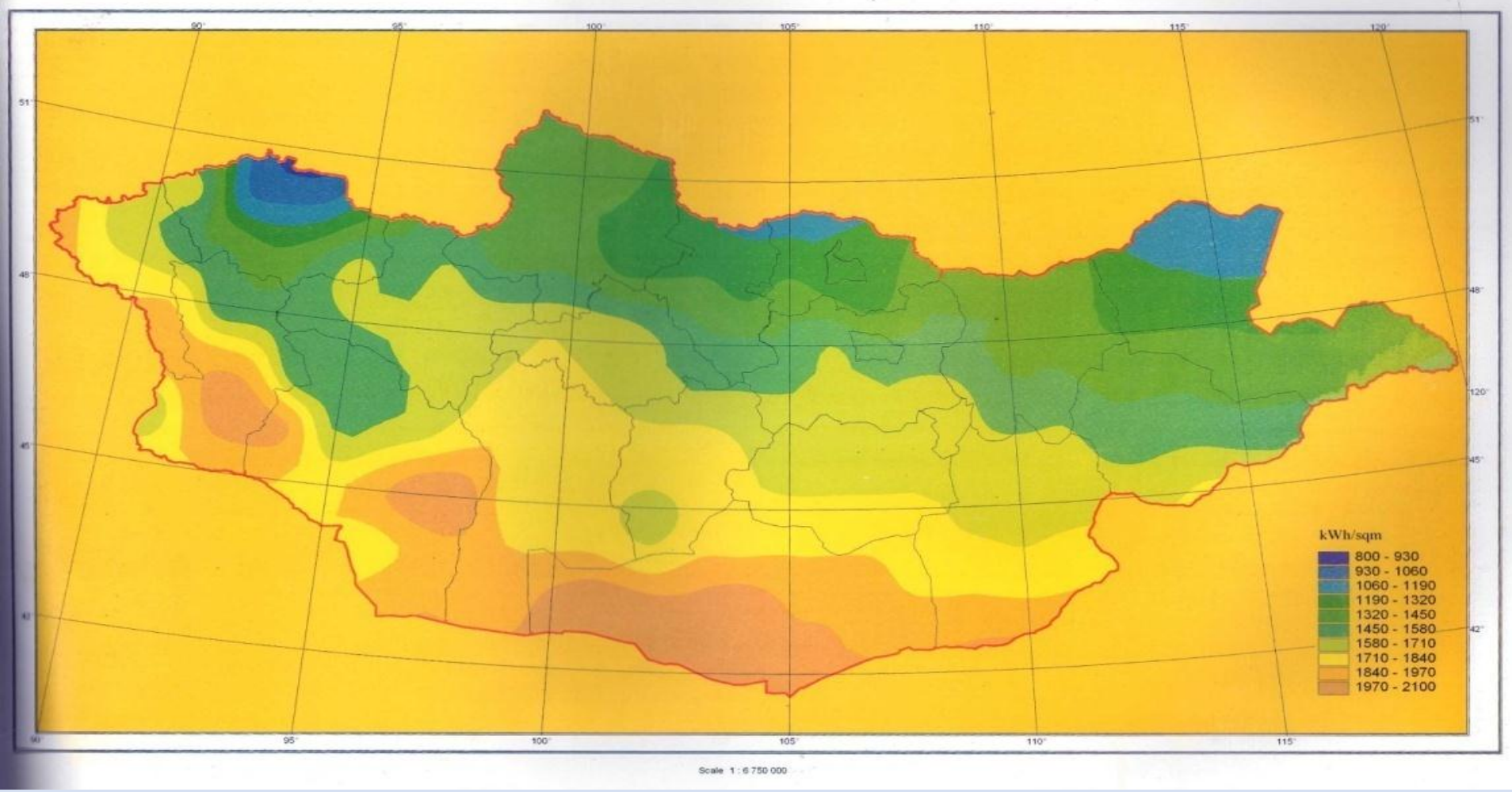








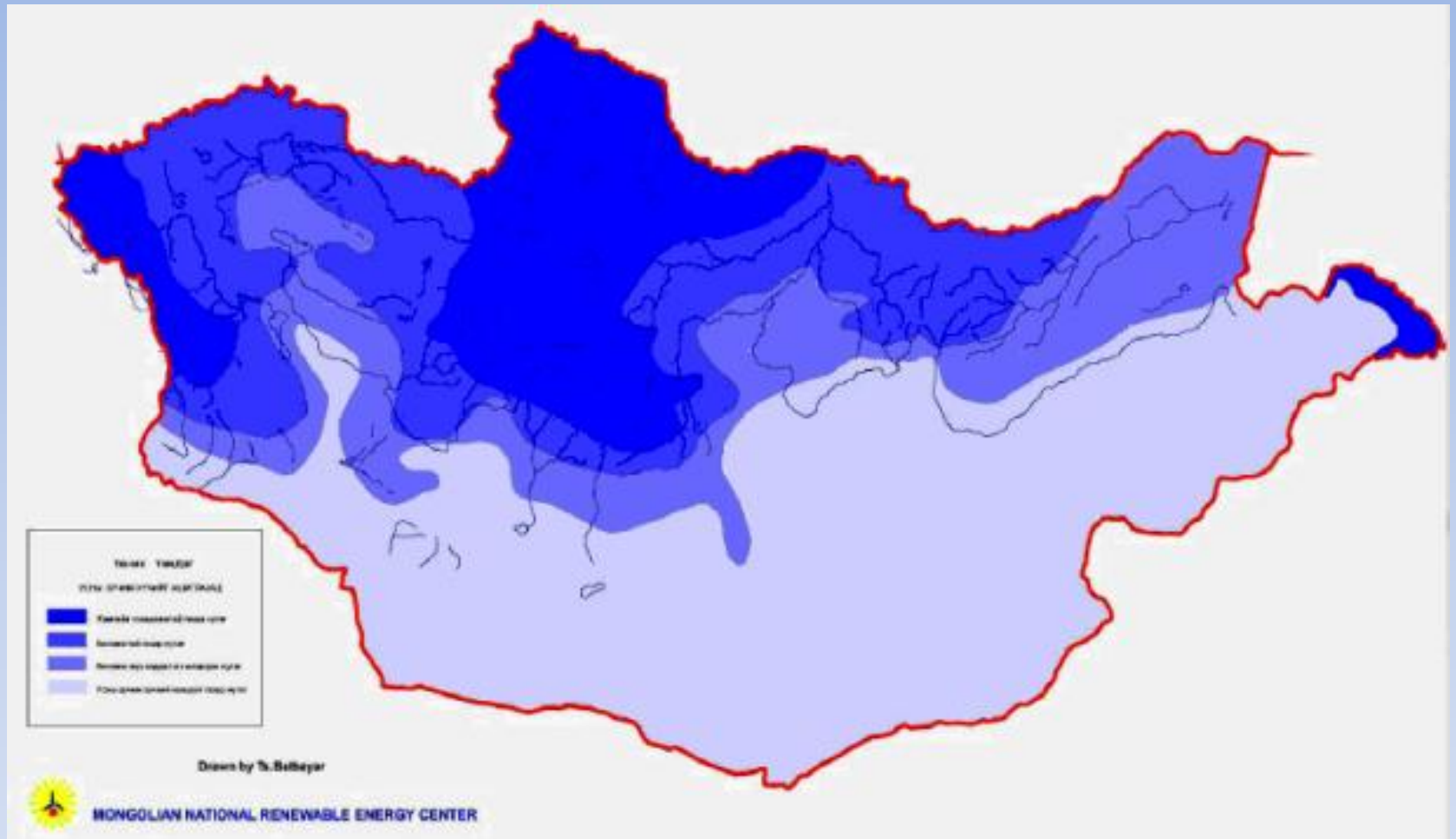
DIRECT NORMAL SOLAR RADIATION. YEAR



Most region of Mongolia, has got solar insolation above 1000 kWh/m2

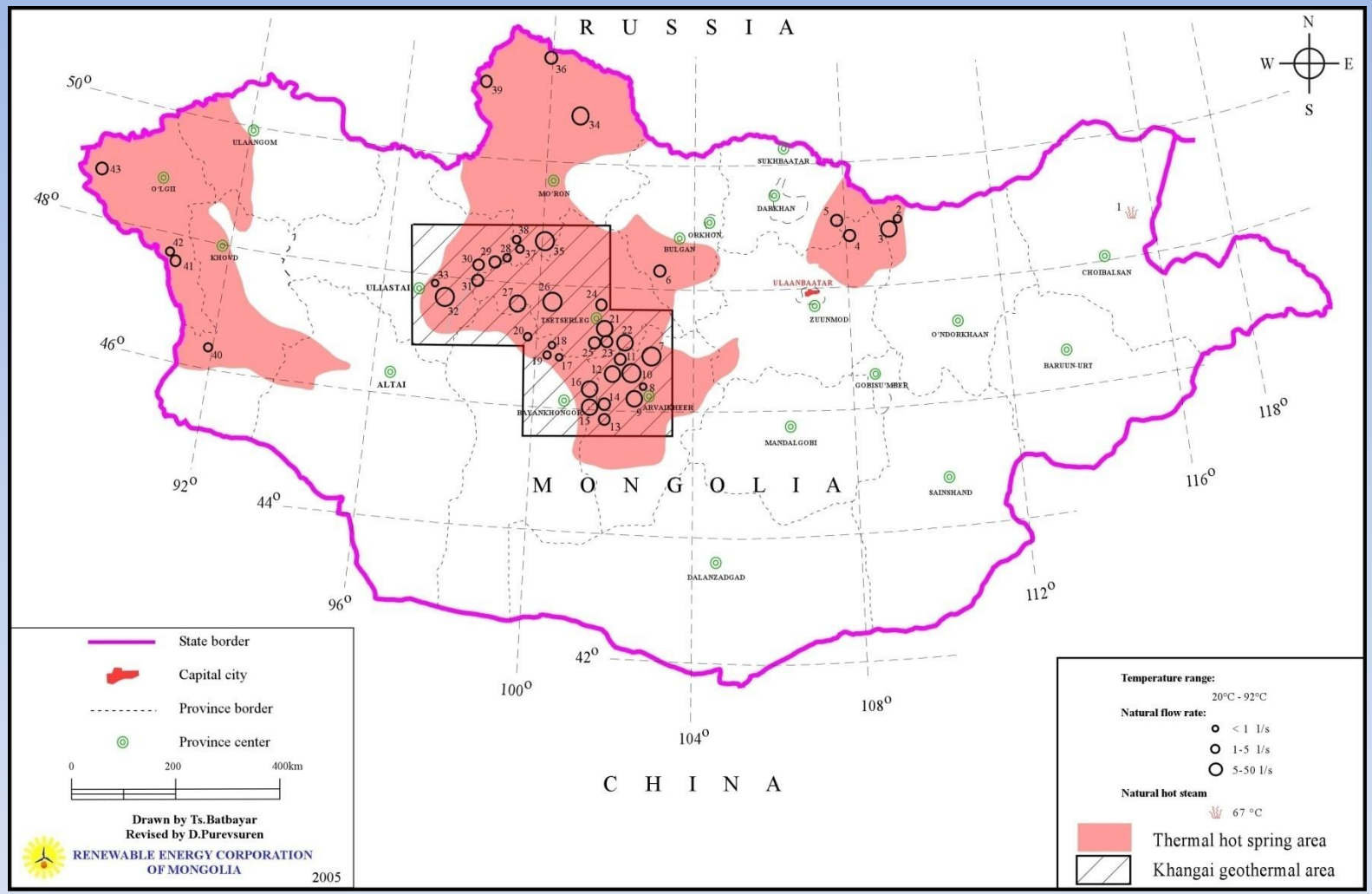
№	Region ¥by color¥	Solar insolation ¥ кWh/m^2¥
1		800-930
2		930-1060
3		1060-1190
4		1190-1320
5		1320-1450
6		1450-1580
7		1580-1710
8		1710-1840
9		1840-1970
10		1970-2100

Hydro power potential



There are 3800 small and big streams and rivers in our country, which could support 6417.7 megawatts of power and deliver 56.2 billion kWh of electric energy in a year.

Geothermal power potential



Totally founded by 43 hot springs, but their application is limited not so great.

3. Policy environment of renewable energy in Mongolia

- Laws, regulations and other related documents
- Renewable energy program

RENEWABLE ENERGY LAW OF MONGOLIA

(approved by the Parliament on 11 January, 2007)

- **Feed-in tariffs for RE power sources**
- **Renewable Energy fund**

Source: *Renewqable energy law*

Renewable Energy tariffs and prices

	Types of energy	Capacity	Tariff /cent/
On Grid	Wind energy		8-9.5
	Hydro energy	till 5 MW	4.5-6
	Solar energy		15-18
Off Grid	Wind energy		10-15
	Hydro energy	till 0.5 MW	8-10
		0.5-2 MW	5-6
		2-5 MW	4.5-5
	Solar energy		20-30

Article 12. Duration of application of prices and tariffs

12.1. Prices and tariffs of renewable energy shall be stabile for a period of minimum 10 (ten) years starting with the date of entry into force of this law.

“National Renewable Energy program” /2005-2020/

- 3-5% share by the year 2010

- 20-25% share by the year 2020

which implies that an increased use of renewable energy systems will be an important contribution

Term Development Tasks: 2011-2020

- Complete construction and launch 200-300 MW Selenge hydro power plant.
- Construct small and medium capacity energy complexes in Ulaanbaatar and other cities and towns to reduce air pollution in these areas using solar, wind, hydrogen and geothermal resources.
- Construct medium capacity (30-50 megawatts) wind parks in sites with proven wind energy potential and connect to the centralized power grid system creating efficient operation condition.
- In the scope of international research activities in very large scale PV power generation system, gradually implement pilot project in Gobi region of the country.

Proposed projects

ELECTRIFICATION

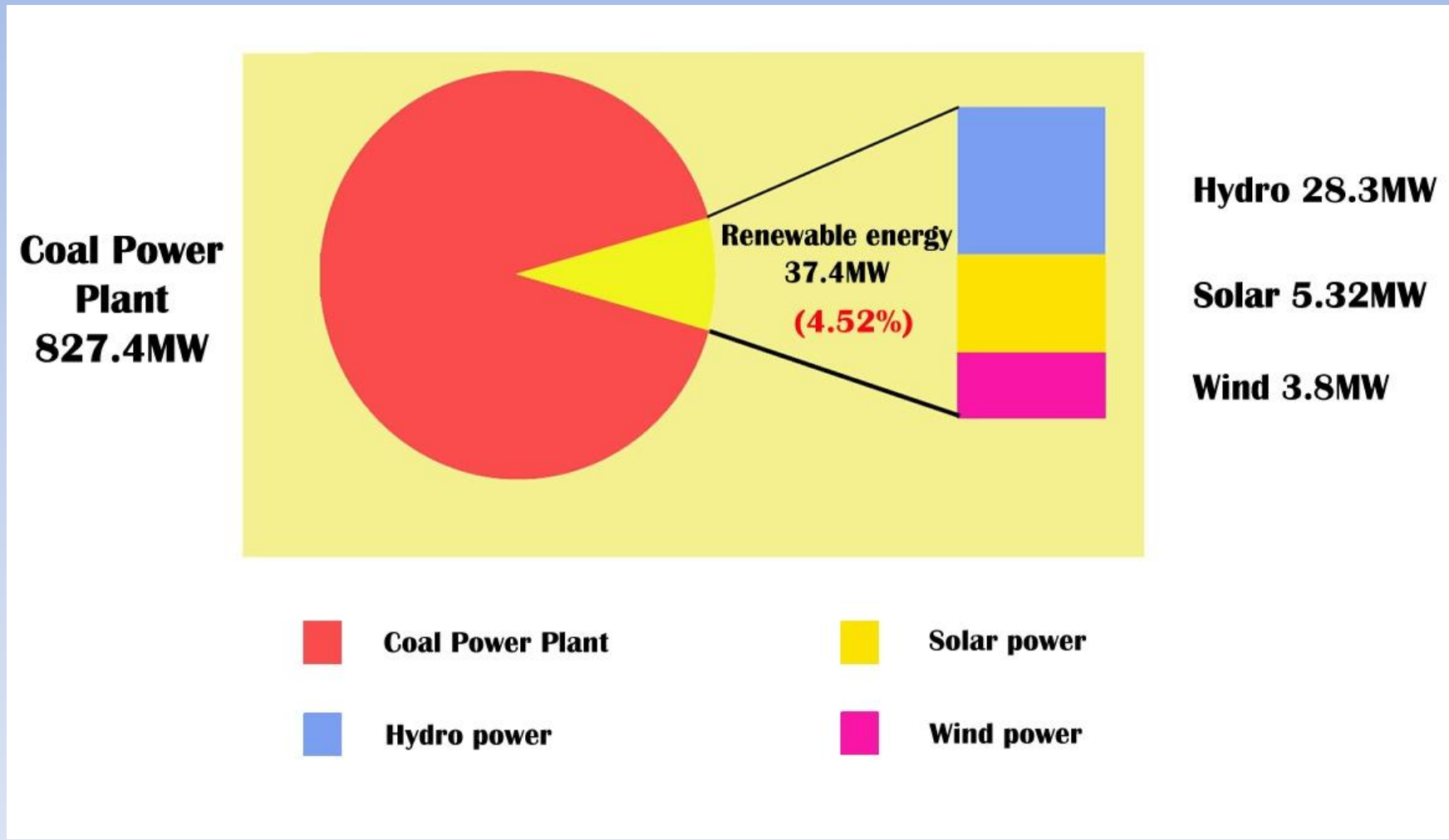
1. Oyu-tolgoi wind park, 250 MW, /Feasibility study was completed/
2. Sainshand solar power plant, 30 MW, /Pre-feasibility study was completed/
3. Taishir solar power plant, 7.8 MW, /Pre-feasibility study was completed/
4. Industrial complex in Sainshand city, 300MW electrical demand
5. Tavantolgoi mining complex, 300-500MW electrical demand
6. East coal fired thermo-electrical power plant /increase capacity up to 100MW/
7. Electric railways in southern region, 200 MW
8. Delger Hydro Power Plant, 250 MW; /Feasibility study was completed/
9. Egiin Hydro Power Plant, 220 MW; /Feasibility study was completed/
10. Erdeneburen Hydro Power Plant, 60 MW; /Feasibility study was completed/
11. Chargait Hydro Power Plant, 24.6MW; /Feasibility study was completed/
12. Orkhon Hydro Power Plant, 100MW; /Feasibility study was completed/

Proposed projects

Heating

1. Thermal power plant, 5MW x 3 aimag`s /renewable energy source/
2. Heating households using renewables, /capital city and remote areas/
3. Thermal power plant in capital city, /coal-fired power plant/

ELECTRIFICATION UTILIZATION



Wind - solar – diesel hybrid power plants

No	Location	Capacity	Start year of operation	Investment
1	Manlai	150 kW	2008	Gov.budget - 910,0 mln.₮
2	Tseel	150 kW	2008	Gov.budget - 960,0 mln.₮
3	Shinejist	150 kW	2008	Gov.budget - 920,0 mln.₮
4	Bayan-Undur	150 kW	2008	Gov.budget - 920,0 mln.₮
5	Nalaikh	110 kW	2009	Korea gov.budget – 2,5 mln.$
6	Mandakh	200 kW	2010	Gov.budget - 484,0 mln.₮ Kor.gov.bud – 3,6 mln.$

Wind - diesel power plants

No	Location	Capacity	Start year of operation	Investment
1	Erdenetsagaan	100 kW	2004	Gov.budget - 348,0 mln.₮
2	Bogd	80 kW	2008	Gov.budget - 395,0 mln.₮
3	Sevrei	80 kW	2008	Gov.budget - 395,0 mln.₮
4	Khatanbulag	150 kW	2008	Gov.budget - 890,0 mln.₮

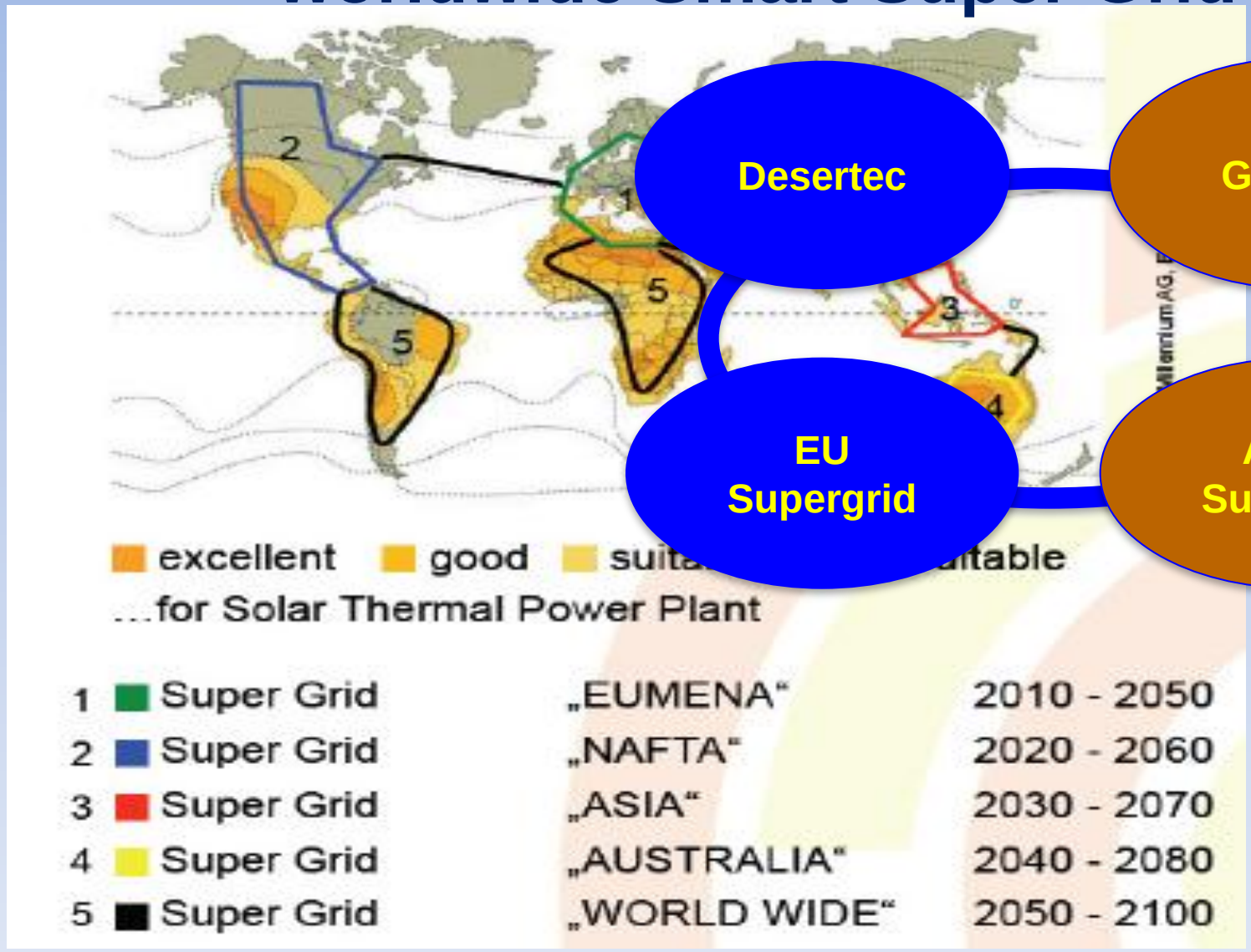
Source: *Energy Authority*

Solar power plants

No	Location	Capacity	Start year of operation	investment
1	Hatanbulag	185 kW	2012	NREC
2	Tsetseg	100 kW	2008	Gov.budget - 1195 mln.₮
3	Bugat	140 kW	2009	Gov.budget - 1220 mln.₮
4	Urgamal	150 kW	2010	WB project –1350.0mln$
5	Durvuljin	150 kW	2010	WB project –1350.0mln$
5	Bayantooroi	100 kW	2010	WB project –900.0mln$
6	Altai	200 kW	2010	WB project –1800.0mln$
7	Matad	52.4 kW	2010	Gov.budget – 890. mln.₮
8	Bayantsagaan	60 kW	2011	Gov.budget - 920 mln.₮

4. Asian Super grid initiative and interconnection

The image of future concept for worldwide Smart Super Grid



Desertec

Gobitec

EU Supergrid

Asian Supergrid

WHY GOBITEC & ASIA SUPERGRID?

Share the risk & benefit for “regional energy community”

Renewable energy flow

High technology & Money flow

Gobi Desert

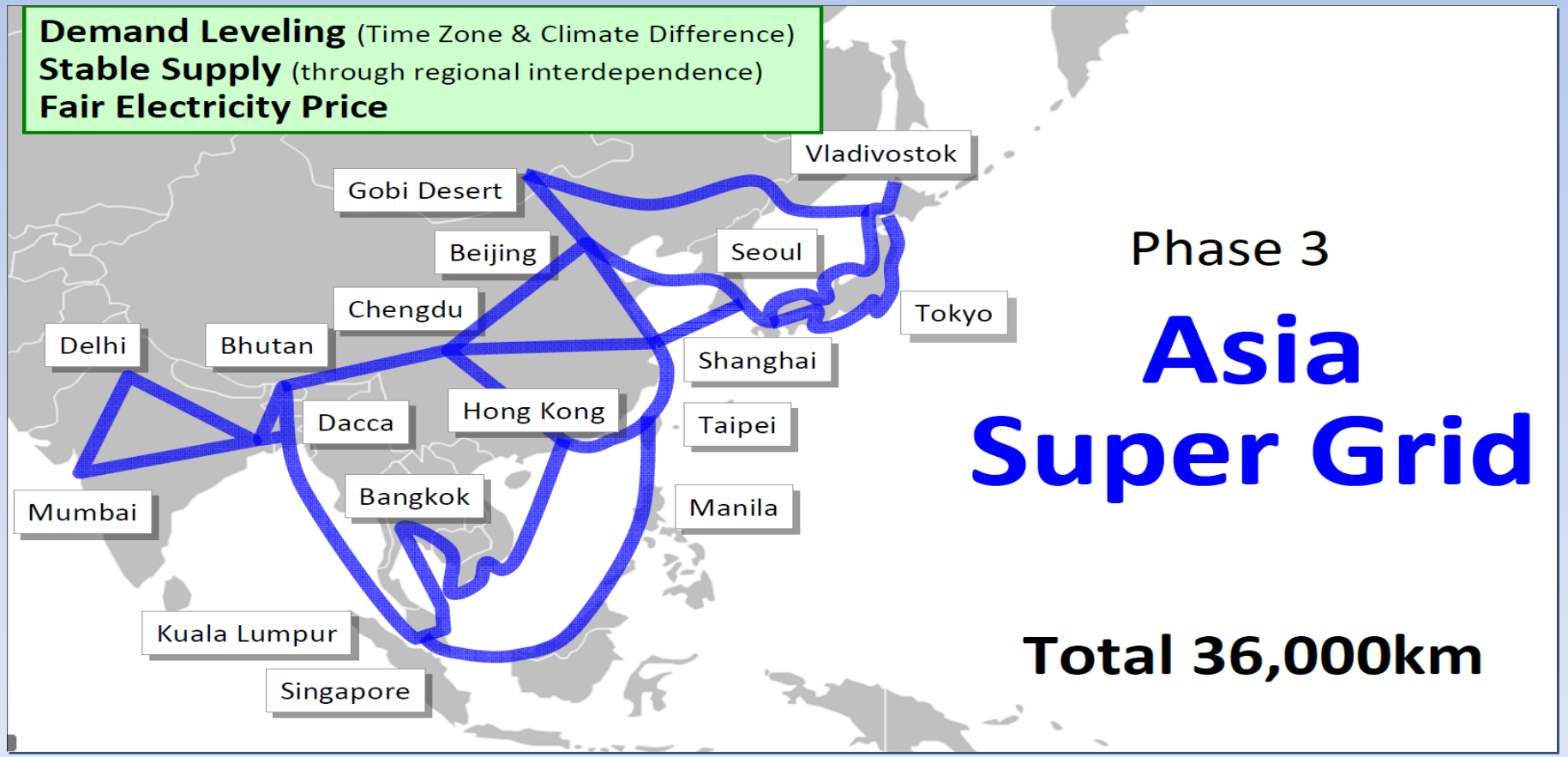
P. R. China

DPRK

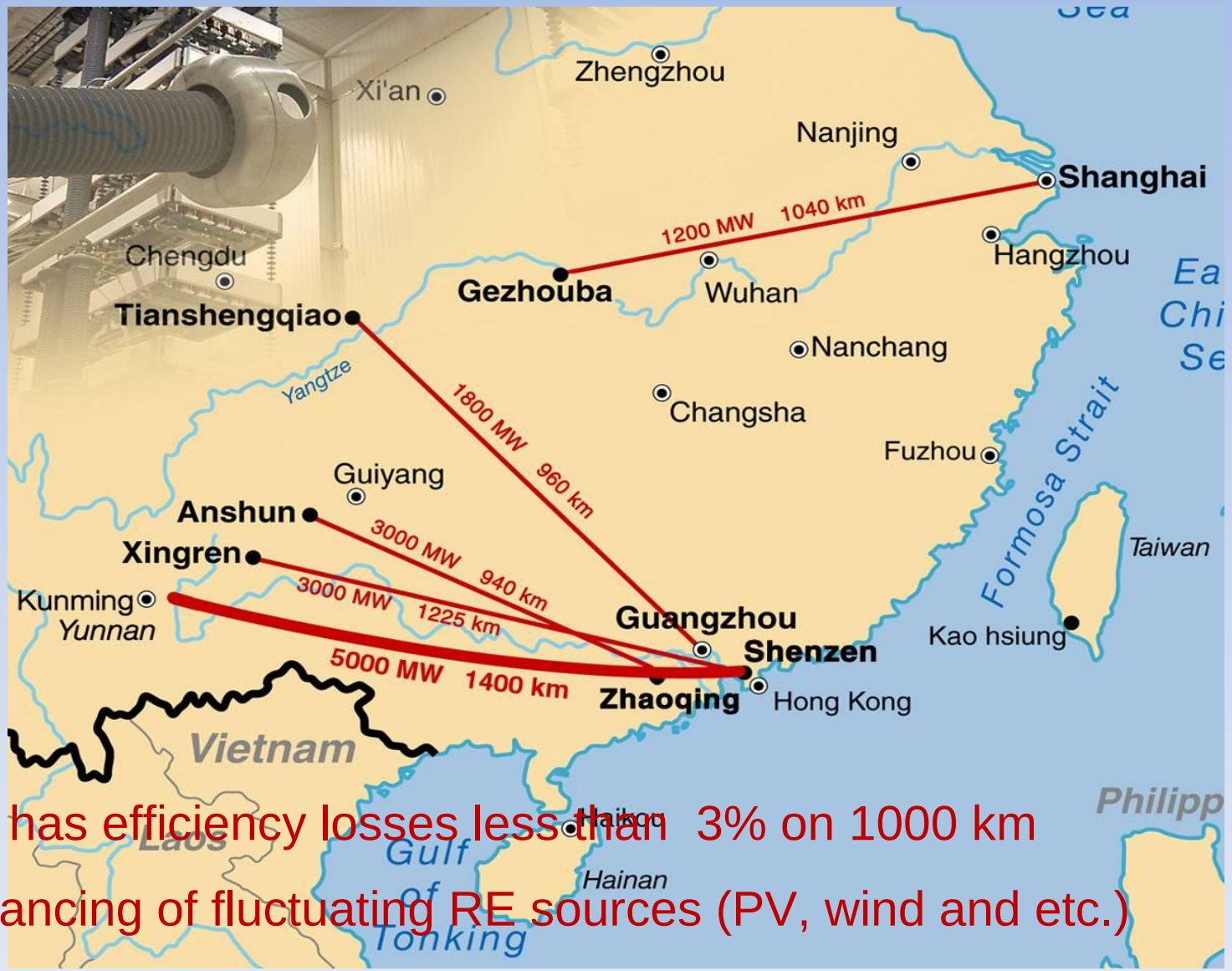
Japan

“from war over the oil, to peace by renewable energy”

JREF (Japan Renewable Energy Foundation) promotes the ASG initiative to facilitate an electricity system based fully on renewable energy in Asia. The ASG initiative envisions the interconnection of the national grids of Japan, Korea, China, Mongolia, and Russia with low-loss High-Voltage Direct Current (HVDC) transmission lines. These transmission lines would enable the delivery of electricity from the region's most abundant renewable energy sources (such as Gobi desert) to its centers of demand.



Several HVDC for long distances already in operation in China (E.g.Yunnan-Guangdong): 1400 km, 800kV, 5000 MW



- HVDC lines has efficiency losses less than 3% on 1000 km
- Enables balancing of fluctuating RE sources (PV, wind and etc.)

THANK YOU FOR YOUR ATTENTION