Islamic Republic of Afghanistan Office of Senior Adviser for Mining & Energy

جمهوری اسلامی افغانستان
دفتر مشاور ارشد درامور معادن وانرژی

دافغانستان اسلامی جمهوریت
دانرژی اومعادن دارشد مشاور دفتر

Energy Sector Afghanistan

Importance of Renewable Energy for Afghanistan

„Renewable Energy for Sustainable Development“

Prof. Dr. Abdul Rahman ASHRAF Dipl. Geol.
Senior Advisor to President Karzai for Mines & Energy

International Conference on „Renewable Energy in Central Asia: Creating Economic Sustainability to Solve Socio-Economic Challenges“
Dushanbe, Tajikistan
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2. Status and Potential of Renewable Energy Utilization
   a. Small Hydro Power
   b. Solar Energy
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3. Economic Development through Renewable Energy

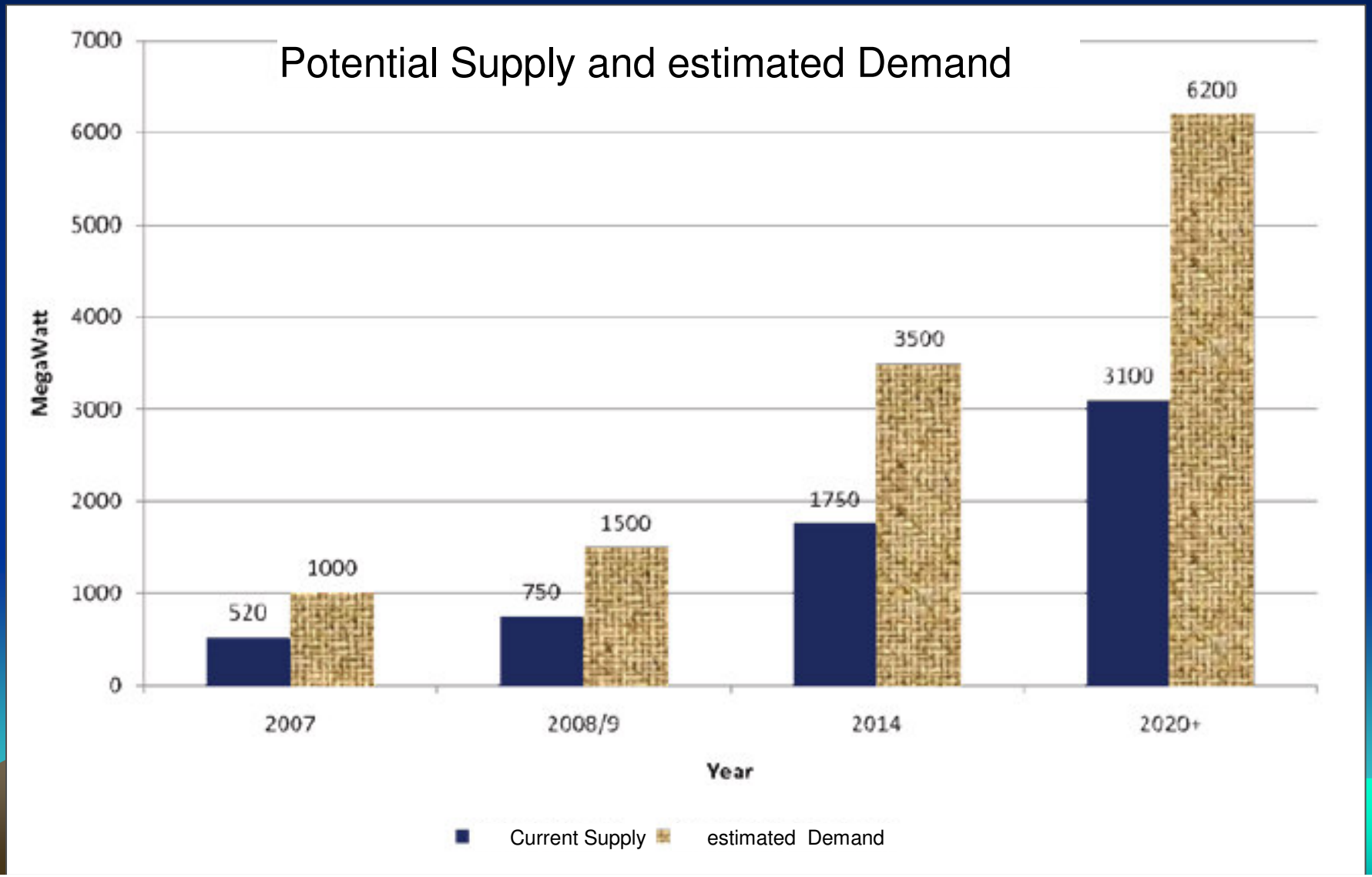
1. Overview of the Energy Sector

- Only 10-15% of the Afghan population have access to electricity, one of the lowest in the world
- About 3 % households are connected to the national grid (About 650.000)- most of them in the large cities: Kabul, Mazar-i-Sharif, Herat, Kandahar, Jalalabad etc.
- 340,000 customers are connected to the public power grid, of which 182,000 are in the Kabul area
- Per head total energy consumption is less than 25 kWh/year (in comparison to: India 520 kWh/year, Germany 6200 kWh/year, world average 3060 kWh/year)
- Continuously rising energy demand, but power station mostly older than 40 years and need to be rehabilitated
- 85% from energy demand are covered by traditional biomass (for example Wood, Dung)





1. Overview of the Energy Sector



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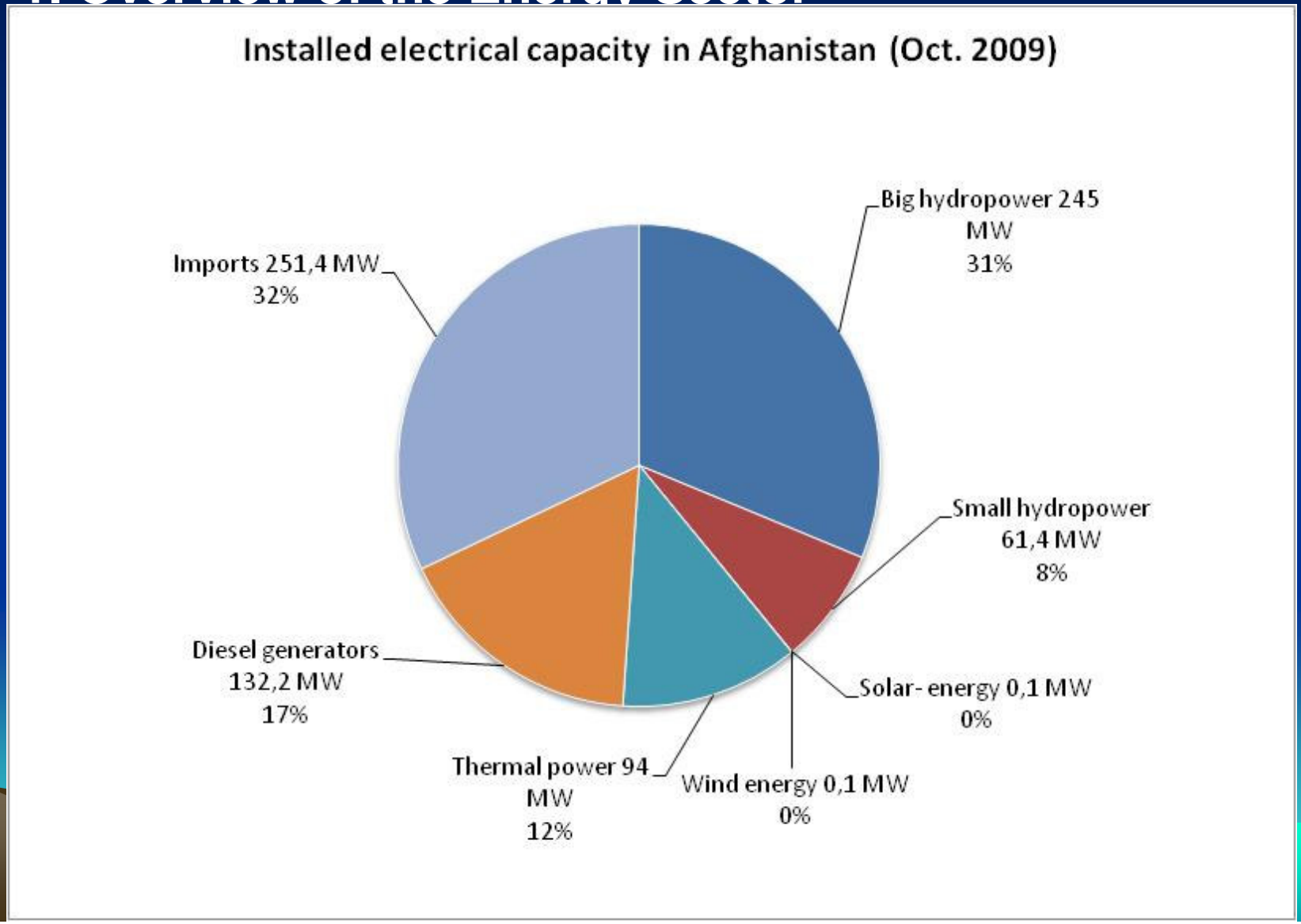

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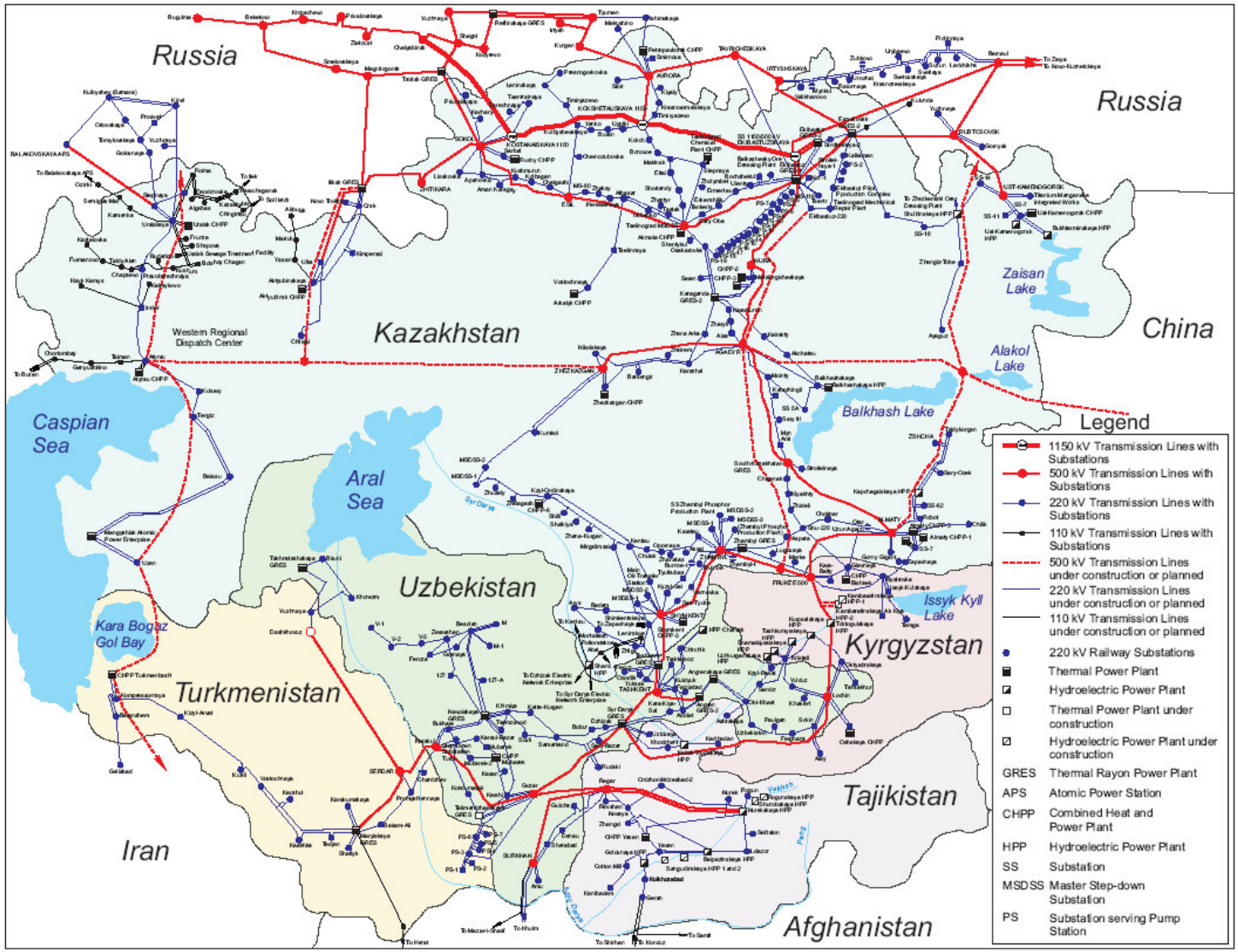
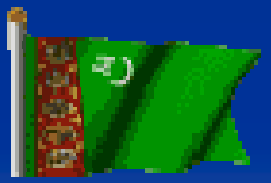


1. Overview of the Energy Sector

Status of Imports in the North - Eastern Power System up to Kabul – NEPS:



- **Uzbekistan :**

Currently: 30 MW for Mazar-i-Sharif, 40 MW for Kabul;
Until end 2009:150 MW;
After 2010: 300 MW;
(Electricity come especially from gas power plants)

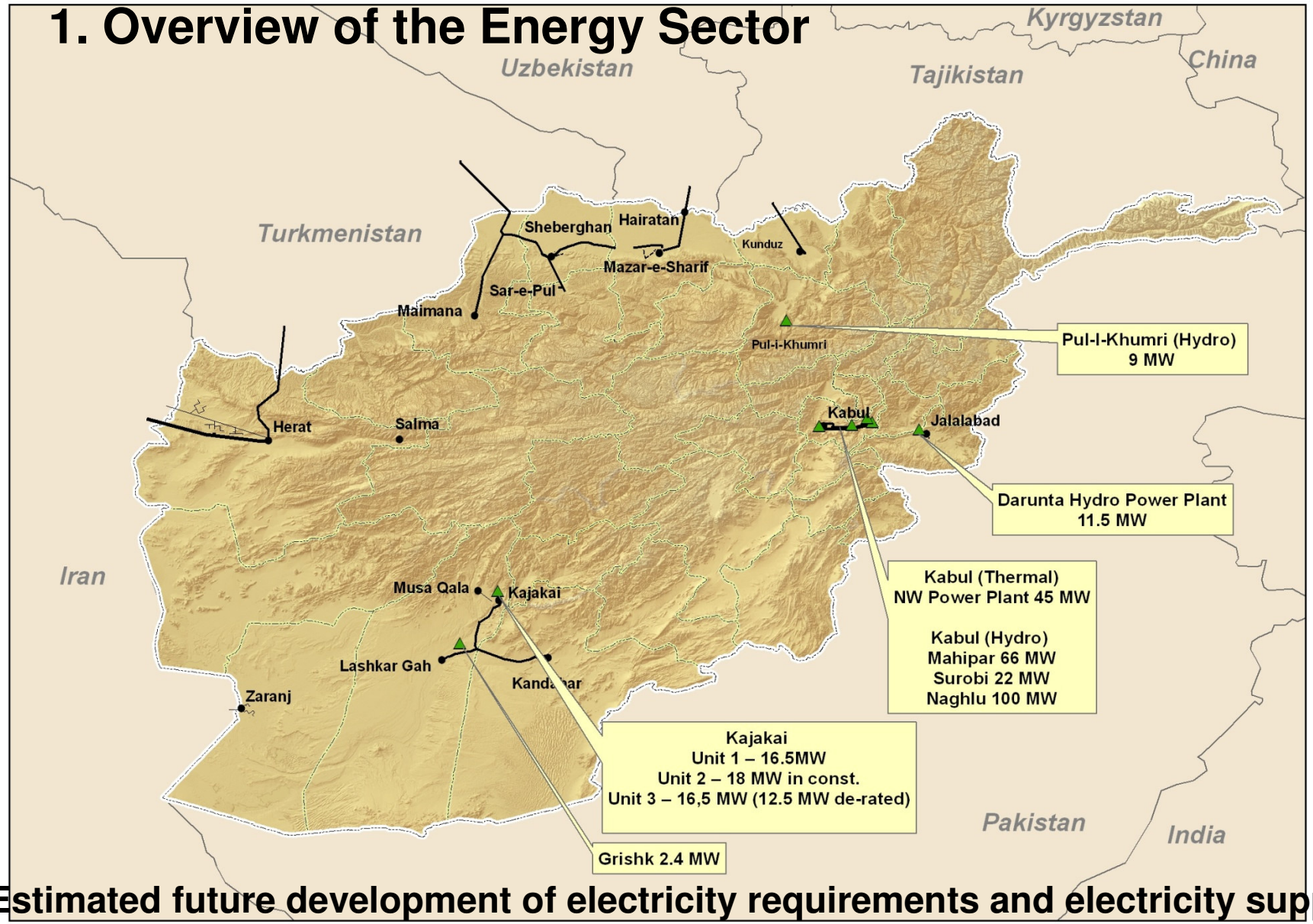
- **Tadjikistan :**

Transmission line expected to be finished end of 2010
(Electricity come from hydro power plants, therefore only some 7 Months in year available)

- **Turkmenistan :**

Up to now no transmission line, end of 2011 shall 300 MW transferred
(Electricity come from gas power plants)

1. Overview of the Energy Sector



Estimated future development of electricity requirements and electricity supply

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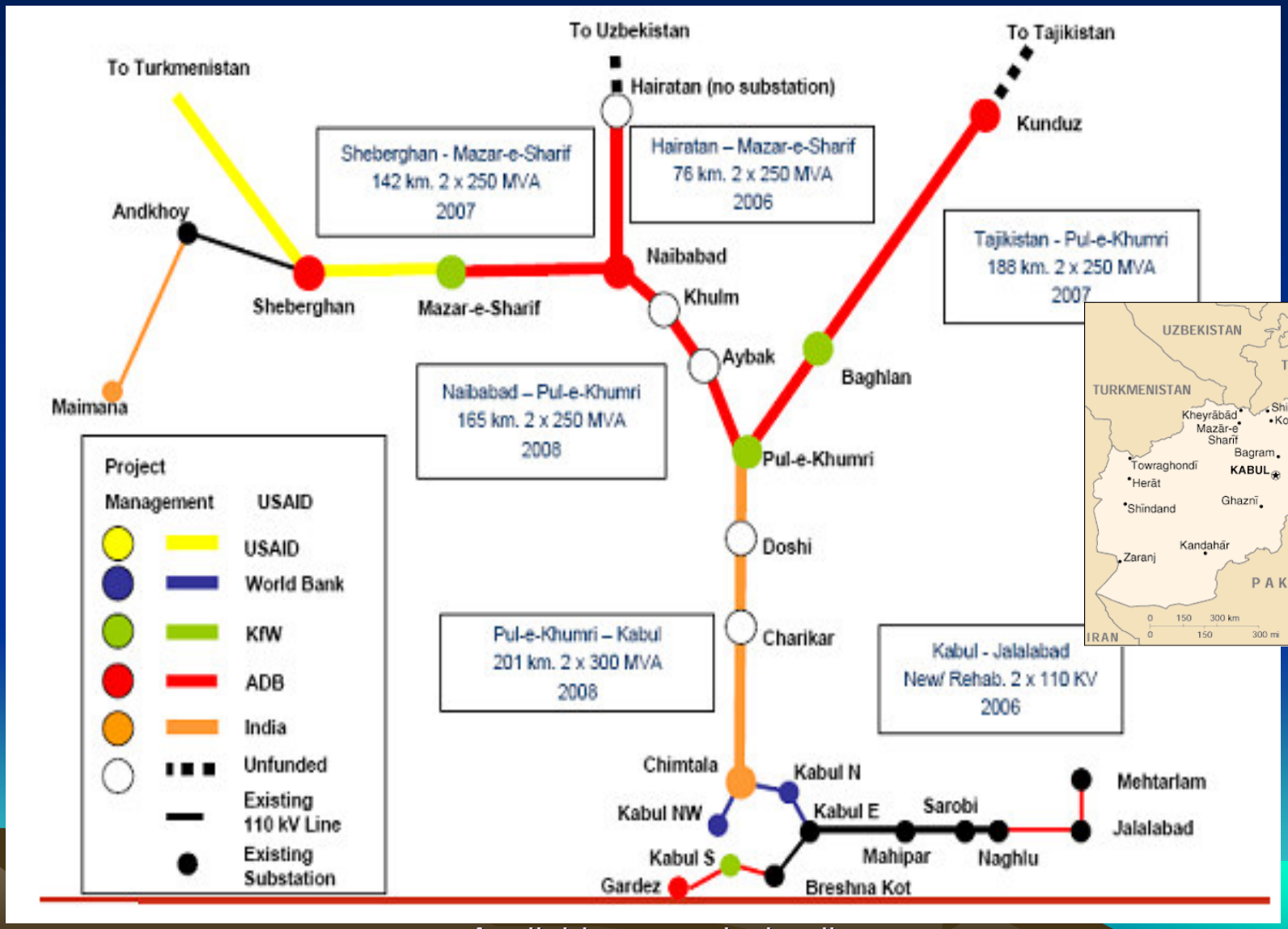

Available transmission lines

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PISU
Program Implementation Support Unit
Planning Department

Hydro Power Plants > 1 MW
Existing and planned

Existing Hydro Power Plants > 1MW

	Plant	River	MW
1	Mahipar	Kabul	62,5
2	Naghlu	Kabul	100,0
3	Sarobi	Kabul	22,0
4	Daronta	Kabul	11,5
5	Chak-i-Wardak	Logar	3,3
6	Jabul-Sarag	Salang	2,4
7	Kajakai	Helmand	33,0
8	Grishk	Helmand	2,4
9	Pul-i-Khumri I	Pul-i-Khumri	4,8
10	Pul-i-Khumri II	Pul-i-Khumri	9,0
11	Khanabad (old)	Canal	1,7
	TOTAL		252,6

Plants recommended in the Master Plan

12	Kajakai Extension	Helmand	100,0
13	Kajakai II	Helmand	18,6
14	Baghdara	Pansjir	280,0
15	Sarobi II	Kabul	180,0
16	Khanabad	Canal	10,5
	TOTAL		589,1

Other previously planned Hydro Power Plants

17	Olambagh	Helmand	90,0
18	Kamal Khan	Helmand	10,0
19	Gulbahar	Panjshir	120,0
20	Kapar	Panjshir	116,0
21	Kama	Kunar	45,0
22	Kunar A	Kunar	366,0
23	Kunar H	Kunar	165,0
24	Kila Gai	Pul-i-Khumri	60,0
25	Salma	Hari Rud	40,0
26	Bakshabad	Farah Rud	20,0
	TOTAL		1032,0

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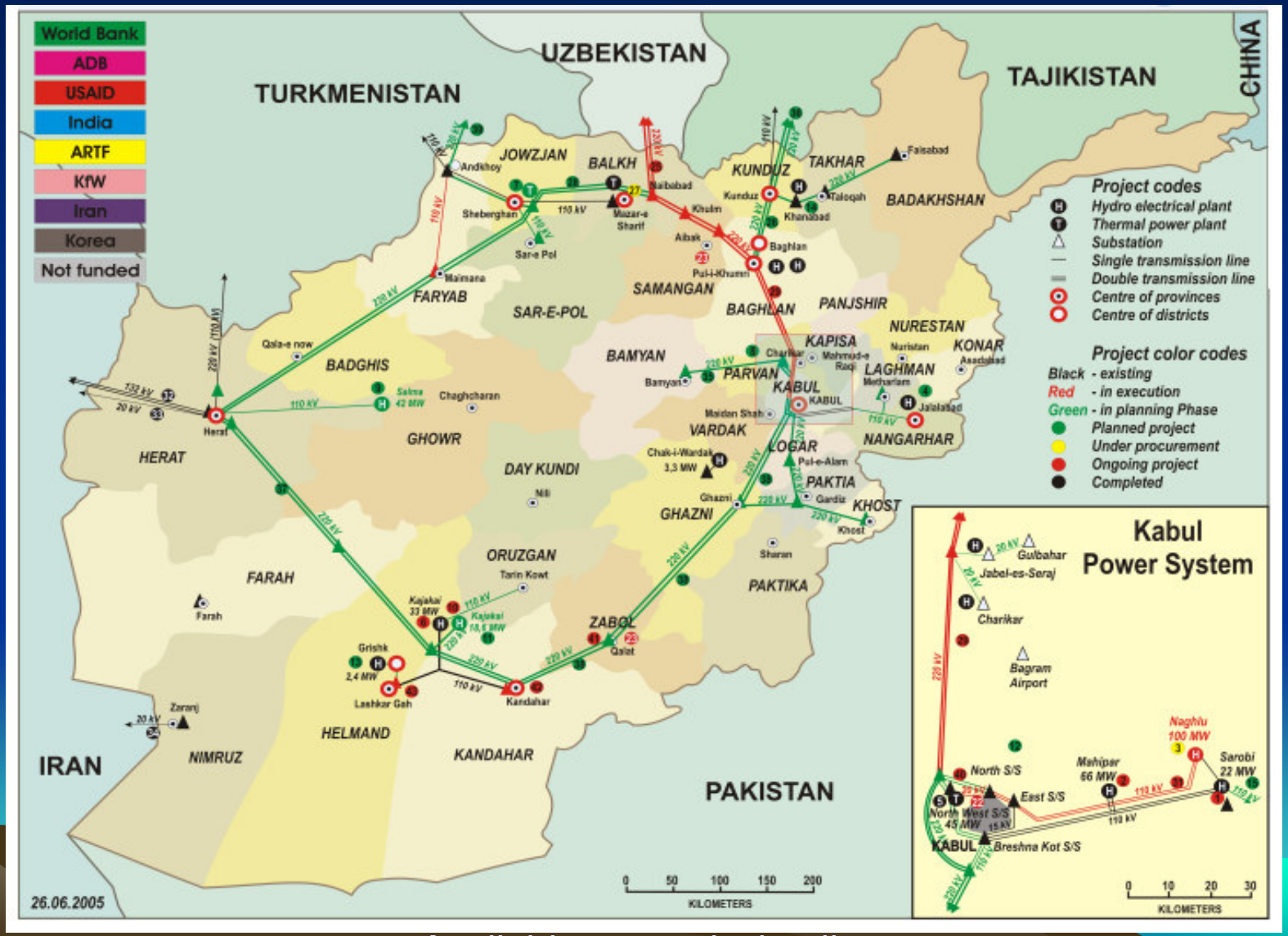

Available transmission lines

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پروژه های عمده موسسات تمویل کننده درافغانتسان

Major energy projects in Afghanistan by Donor Organizations

1. Overview of the Energy Sector

Long term development projects include:

- CASA 1000: 1000 MW from the Northern neighbours to Pakistan through Afghanistan; 300 MW will be used in the country
- Aynak copper mine: Chinese company (MCC) will exploit the coal mine in North Hindukush and build coal power plant; projected capacity is 400 MW
- Shibirghan: 100 MW gas power plant supported by USAID

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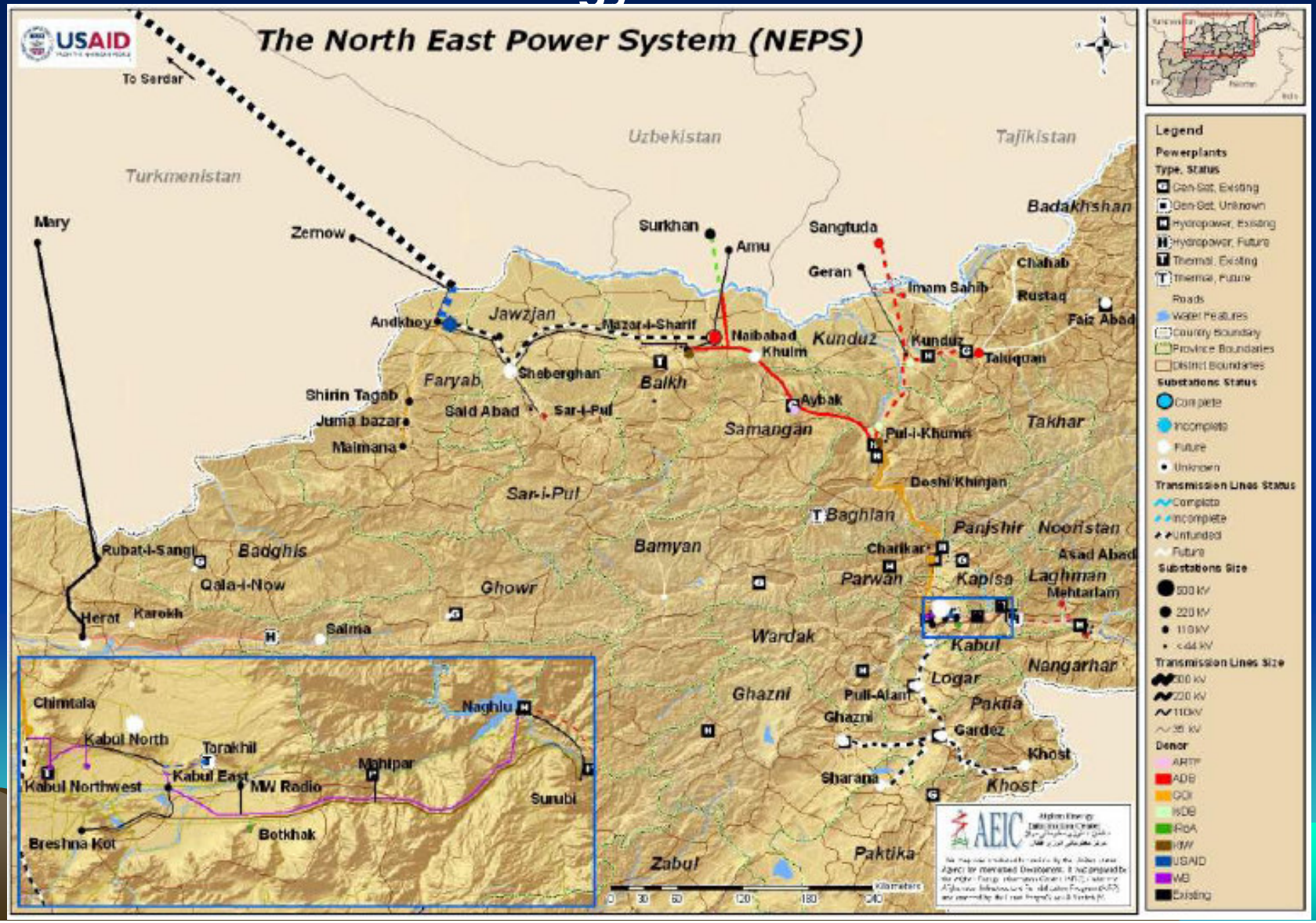
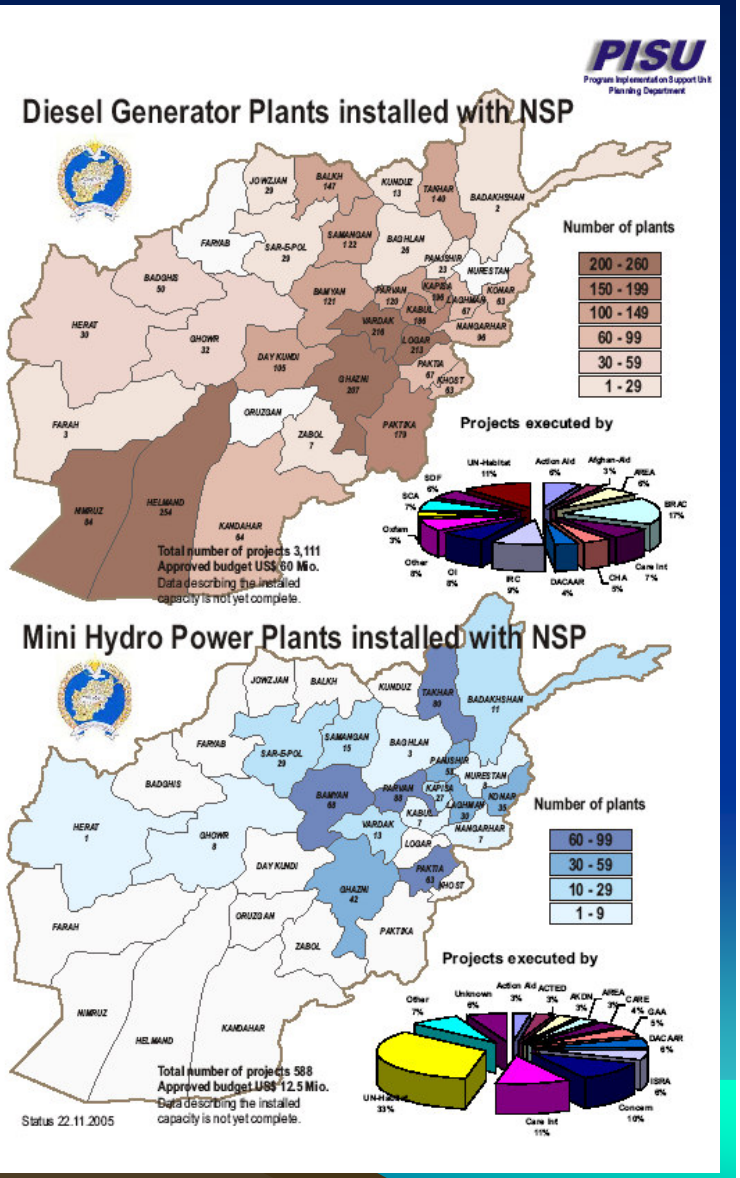


2. Status and Potential of Renewable Energy Utilization

Diesel units:

- Most of the diesel units supplied to the rural communities through the National Solidarity Program to provide limited service to rural areas, require overhaul or replacement
- In addition, dependence upon diesel generation results in high economic losses for Afghanistan due to the prohibitively high cost and unreliability of fuel supplies
- Many of the diesel generators in rural communities are not in operation due to the lack of funding for fuel and other operation and maintenance costs.



2. Status and Potential of Renewable Energy Utilization

Hydro Power :

- Currently about 304 MW installed capacity; about 183 MW are operating
  - -From this small hydro power : about 45 MW operating capacity
- Theoretical potential estimated at 25 GW estimated (big and small hydro power)
- High economic potential for small, mini and micro hydro power especially in the mountainous regions in Northern and South-eastern like Badakshan, Takhar, Kunar, Paktia, etc
  - -There alone at least 20 MW additional capacity until 2013 expected
- Many donors are engaged in hydro power: USA, Germany, ADB, Japan, etc

2. Status and Potential of the Renewable Energy Utilization

Small, Mini and Micro Hydro power- Programmes :

A number of micro-hydro systems have been installed in villages in central, north and northeast Afghanistan over the last ten years, with at least 30 Afghan manufacturers located throughout Afghanistan manufacturing inexpensive cross-flow turbines and associated components sufficient to produce between 3 and 50 kW of power. Since 2003, Provincial Reconstruction Teams (PRTs) activities funded by USAID and implemented by local NGOs have installed over 125 micro-hydro power units in Afghan villages at an average total cost of equipment and materials of about $3,500 per village, not including the costs for design, technical assistance, community development and Training. Untapped water resources provide new opportunities for exploring mini- and micro-hydro power (MHP), a comparatively low cost and readily available technology, as a major renewable energy source for rural Afghanistan.

2. Status and Potential of Renewable Energy Utilization

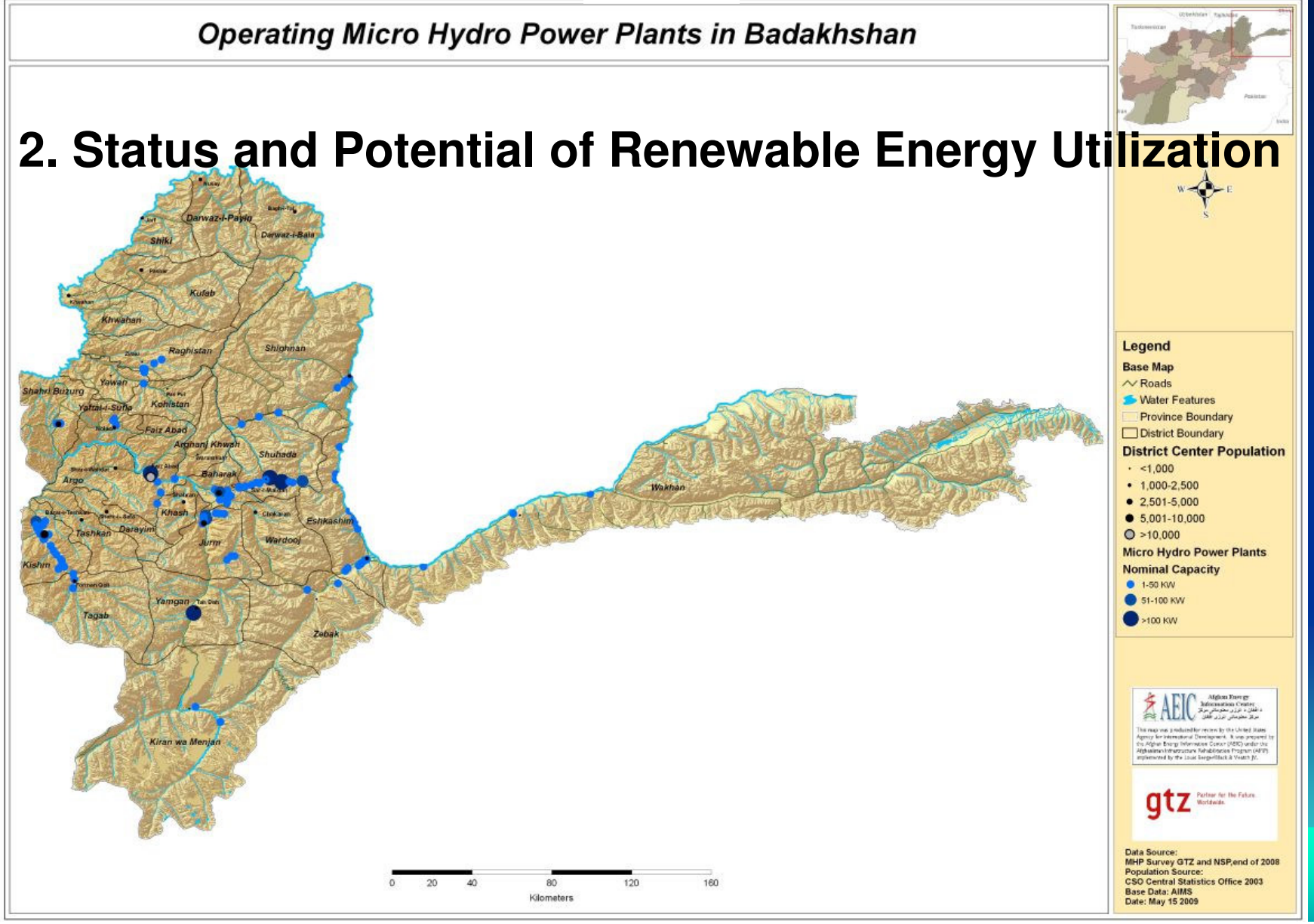
Small, Mini and Micro hydro power - Programmes :

- **Germany:** in total about 9MW new installed capacity for provision of electricity for about 500,000 people until 2013 in Northeast-provinces Badakhshan and Takhar

- **ADB/ Japan:** one small power plant in Badakhshan (about 2,1 MW), four mini plants in Badakhshan, Bamian (total about 2 MW); in total about 360,000 people with access to electricity until 2014

- **USAID:** about 1MW in micro power until 2012 for about 90,000 people in all Afghanistan (regional focus on South-Southeast)

2. Status and Potential of Renewable Energy Utilization



2. Status and Potencial of Renewable Energy Utilization

Solar Energy :

- Afghanistan also has significant solar resources, averaging 300 days of sunshine per year.This solar radiation is estimated to average 6.5 kWh per square meter per day
- solar heaters and solar photovoltaic cells could be important sources of energy for Afghanistan, both for off grid and potentially large solar plants connected to the grid
- Current biggest program is the National Solidarity Program : more than 2000 individual projects
- for the dissemination of Solar Home Systems in the range 20 till 40 W implemented; in total about 103 kW electricity for lighting supplied
- Some small single projects (per example Schools, Hospitals, Police buildings, Mosques, etc.)
- Very high technical potential but economically feasible only in absence of hydro resources/ main grid

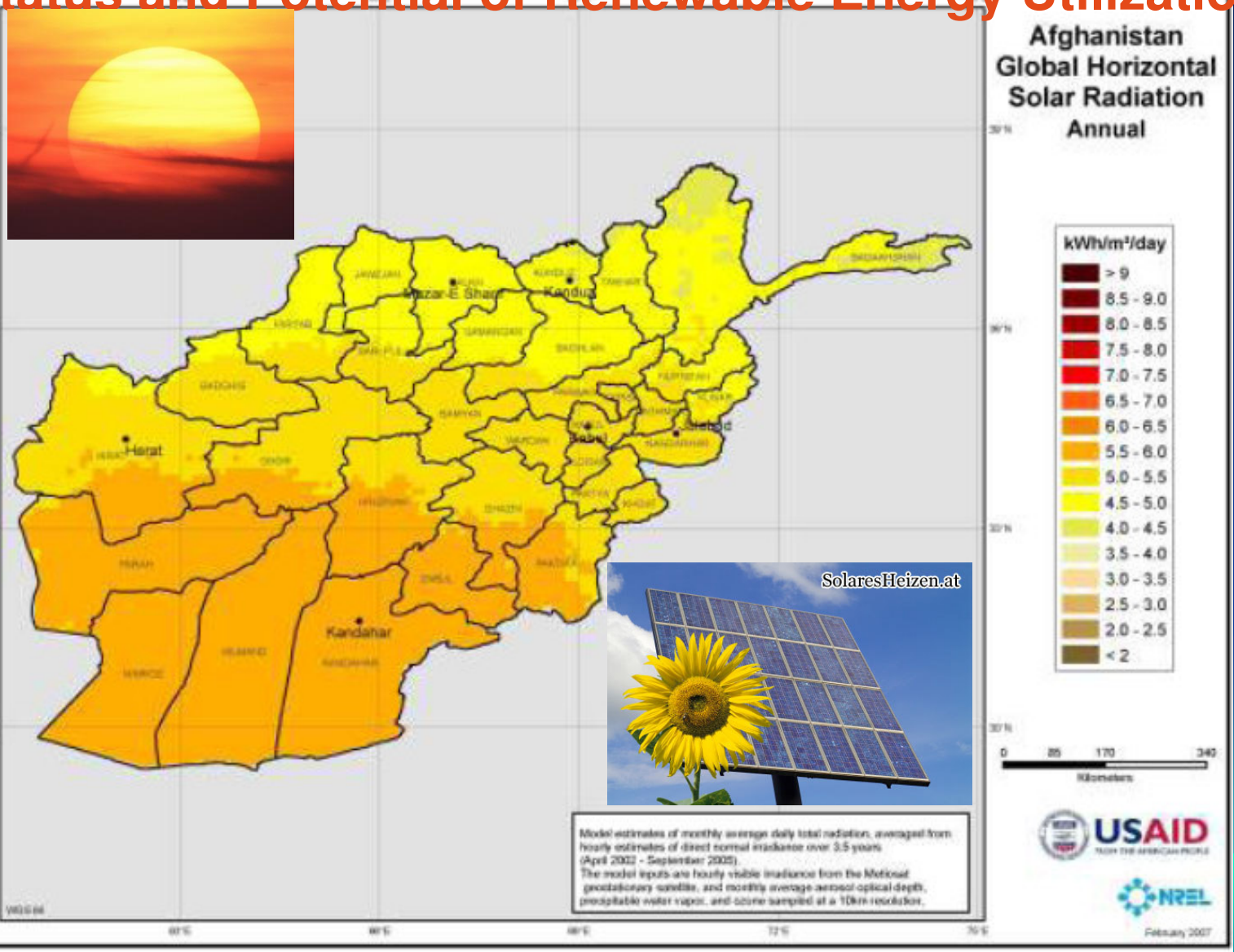
2. Status and Potential of Renewable Energy Utilization

Solar Energy :

In December 2006, Ministry of Rural Rehabilitation and Development (MRRD) of Afghanistan and Ministry of External Affairs (MEA) of India awarded a project to Central Electronics Limited (CEL) for Solar Electrification of 100 villages in Afghanistan. All houses in 100 villages were provided with Solar Home Lighting Systems 40 Wp Solar Panel (3 Lamps in the house). In addition, Solar Lighting Public Address System was installed in the Mosques in each of the 100 villages 80 Wp Solar Panel . At the end of the project 2007, some of the Solar Home Lighting Systems' Hardware was left over (after the electrification of 100 villages), and it was installed in a village near Kabul.

Sl. No.	Name of Province	No. of Villages	Type of SPV System	
			Nos. of Home Lighting System	Nos. of SPV System for Mosque
1.	Kapisa	20	913	20
2.	Bulkh	20	671	20
3.	Badakhshan	20	1157	20
4.	Badghis	20	1068	20
5.	Kandahar	20	1043	20
6.	Kabul	01	348	Nil
Total		**101**	**5200**	**100**

2. Status and Potential of Renewable Energy Utilization



2. Status and Potencial of Renewable Energy Utilization

Wind Energy :

- Wind resources in Afghanistan show promise on the basis of satellite data. The lowland areas in the south and west have around 120 windy days per year, with average velocities of four meters per second. Seasonal dusty winds may be as high as 6.5-9 meters per second around western, northern and central provinces of Afghanistan, but with averages still around four meters per second: 158 GW Electricity production theoretical possible

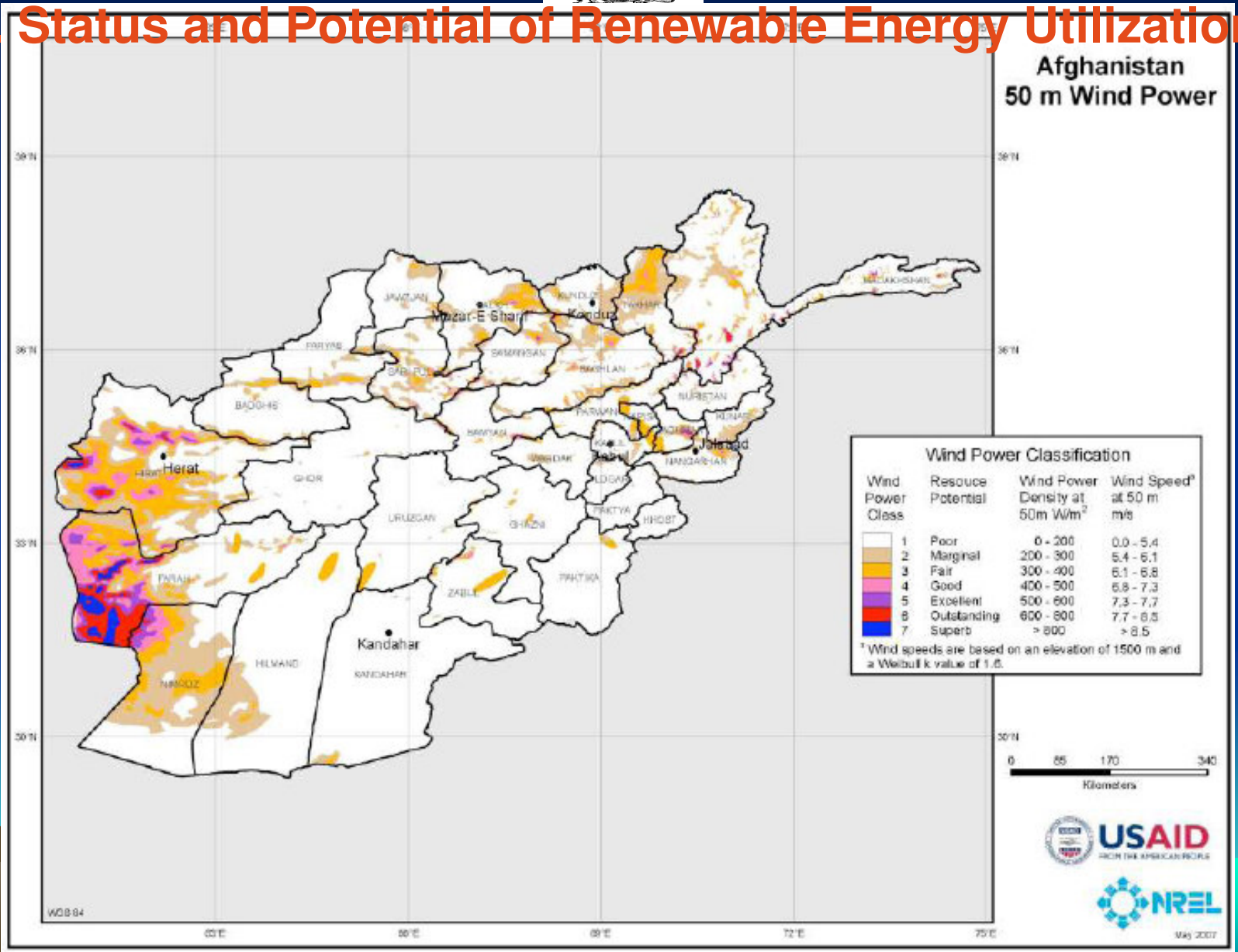
- High theoretical potential particularly in the West like Herat, Farah (at the border to Iran with its 120 days- Winds): 158 GW electricity generation theoretically possible (at wind speeds above 7 m/s in 50 m height)

- Very dependent on micro climate; projects need long lead time for measurements

- Household systems (e.g. up to 500W) are more complicated in maintenance (sand, dust) than solar-photovoltaic systems; solar- wind-hybrid systems most feasible

- Big wind power needs a power grid to feed in the electricity

2. Status and Potential of Renewable Energy Utilization



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2. Status and Potential of Renewable Energy Utilization

- **Other non- Fossil Energy**
- **Biomass:**

  - Huge energy saving potential lies in cooking and heating stoves
  - Most climate in Afghanistan is not suitable for biogas production for electricity: very cold winters do not permit constant temperature in the ground- additional heating would be needed
  - Biofuels raise competition with agricultural land use and water resources for irrigation




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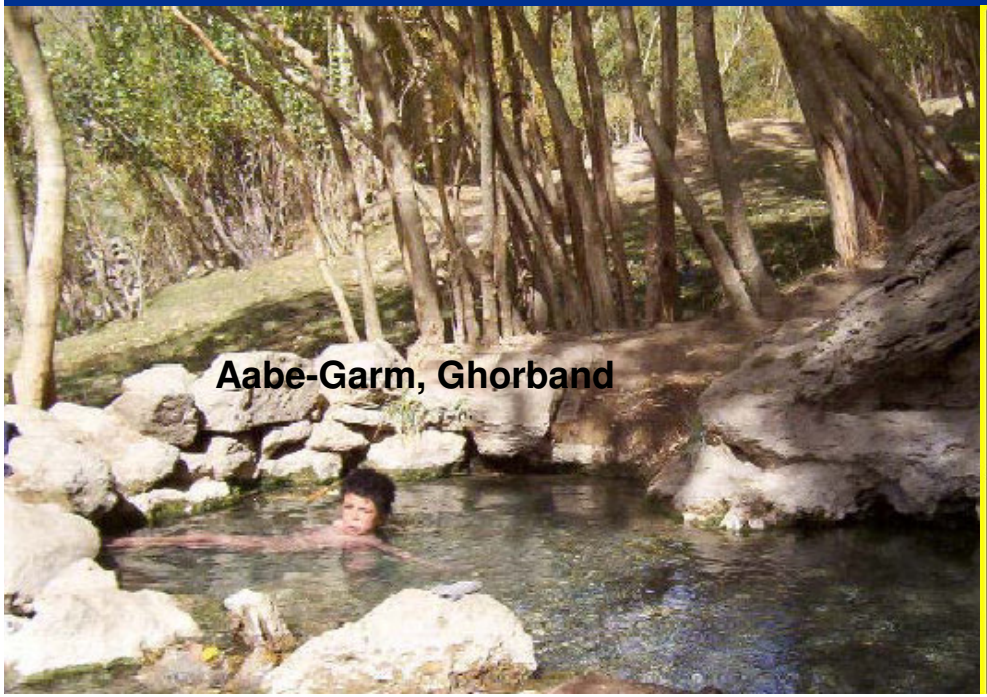
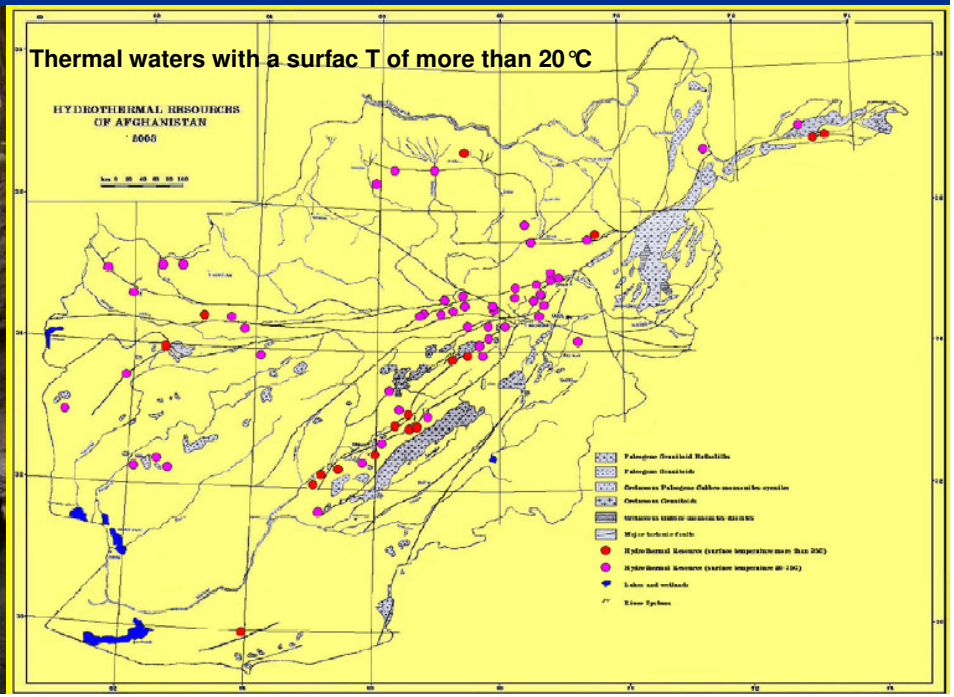
2. Status and Potential of Renewable Energy Utilization

Other non- Fossil Energy

- **Geo-thermal:**
  - Huge potential expected particularly along the Hindukush- mountain range
  - Several small power plants (5 to 20 MW) might be build
  - Only geo- physical study made; study for exploitation and electricity generation needed





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3. Economic Development through Renewable Energy

Productive use of electricity stimulates the economic development in rural areas!

Access to sufficient Electricity

(Implementation of Power Stations)

Access to Small Business development - knowledge

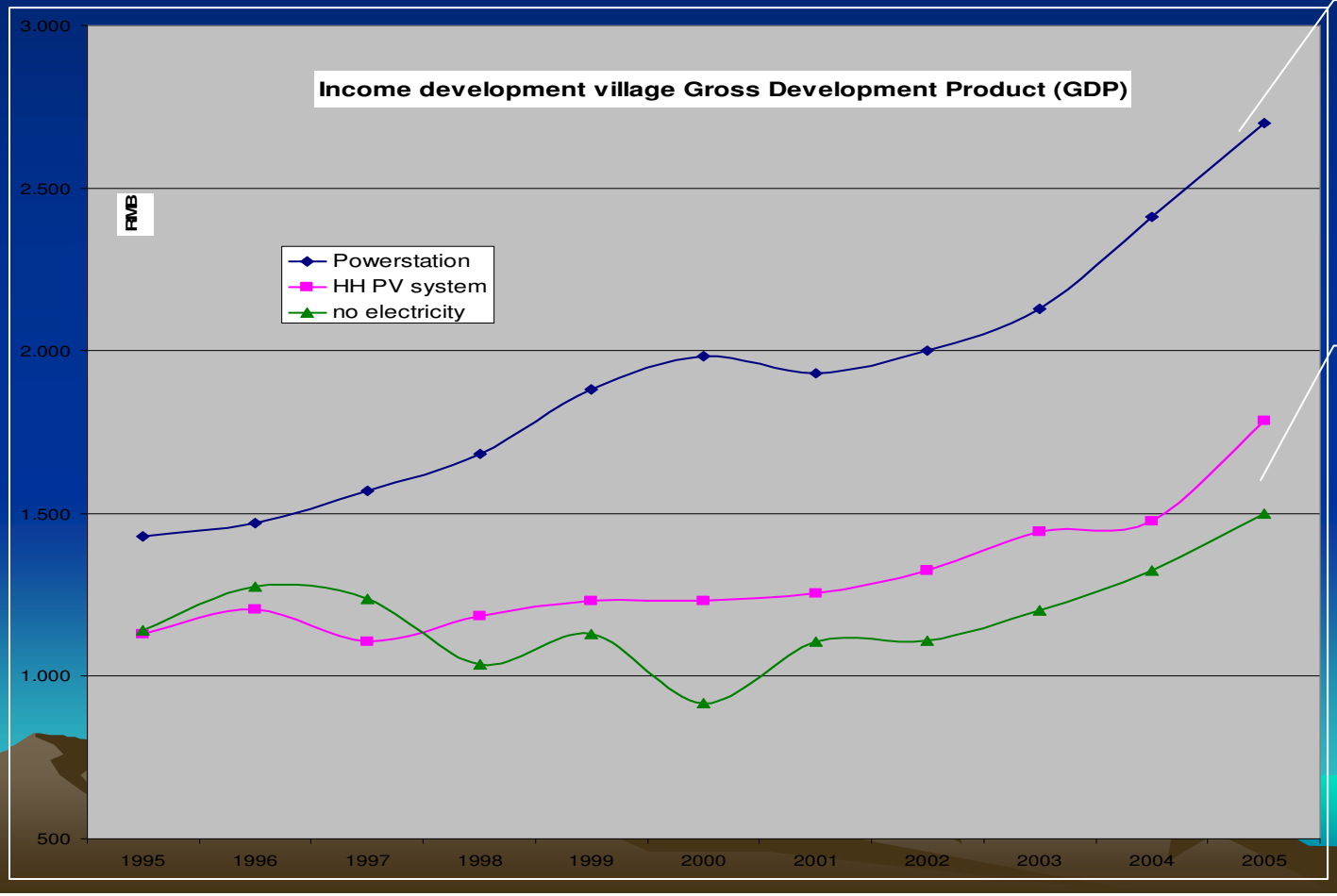
(Business- Trainings for men and women)

Access to financing

(for material, Machines, Marketing)

3. Economic Development through Renewable Energy

1 kWh of productively used electricity generates 1,5 US $ in Gross Domestic Product in a rural village !



GDP-increase with productive use (blue)

GDP-increase with lighting (red)/ no access to electricity (green)

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3. Economic Development through Renewable Energy

Afghanistan has a huge potential for economic development in the rural areas!

- Electricity supply to rural areas stimulates economic development, particularly through the use of electricity for production in mini and small businesses
- Economic development, labour and increased income foster a stable security environment in the medium to long term

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