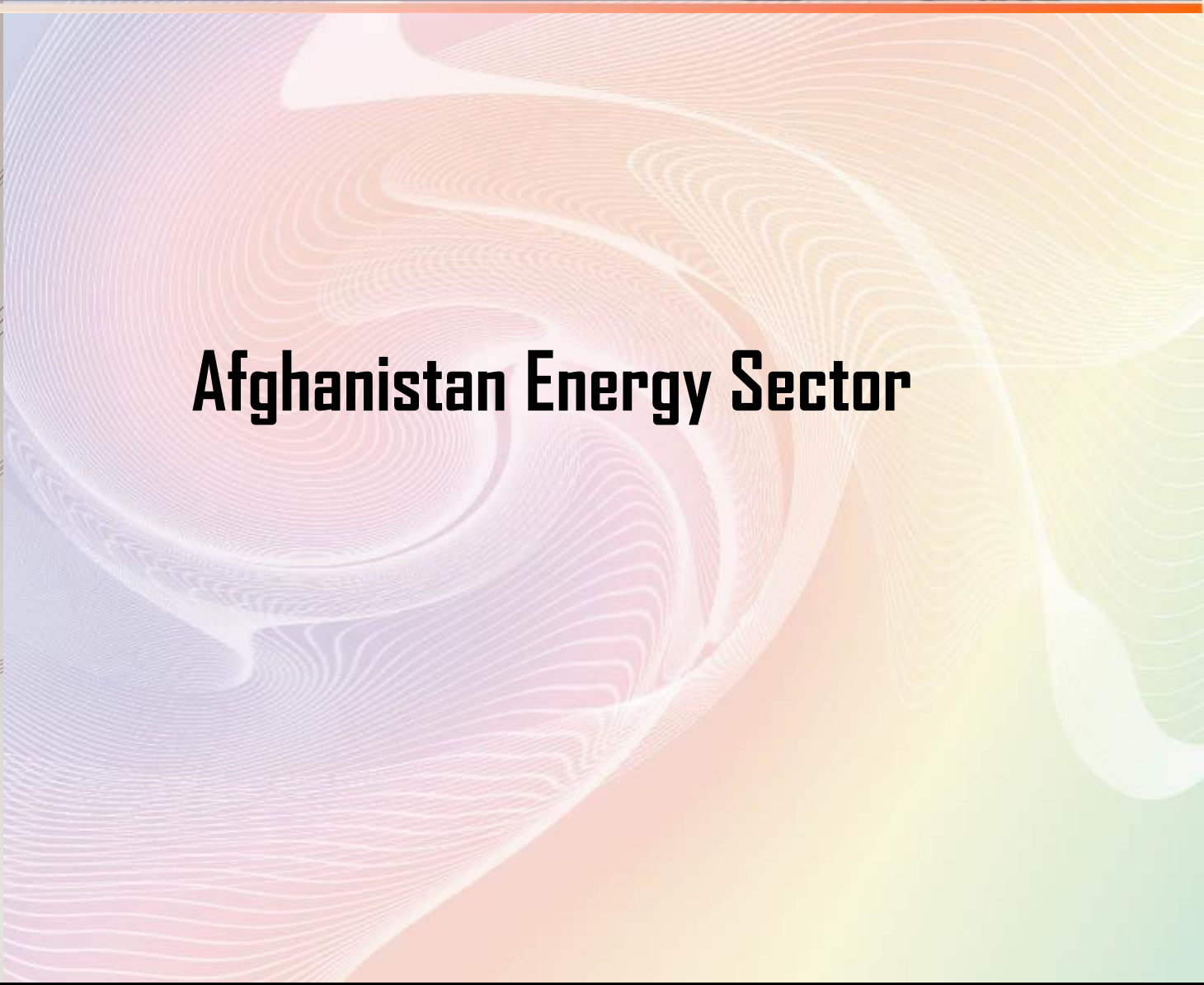


Islamic Republic of Afghanistan

Afghanistan Energy Sector



Afghanistan Energy Sector

Out line of Presentation

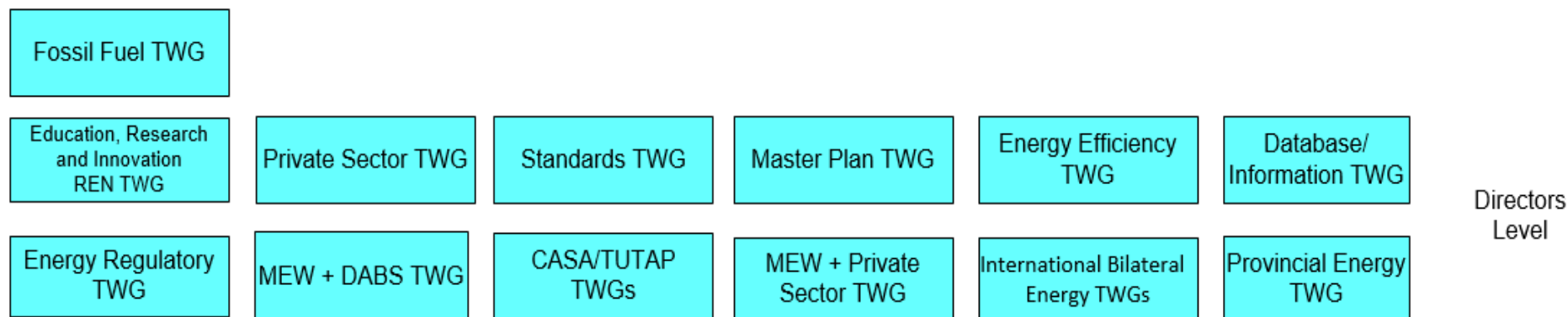
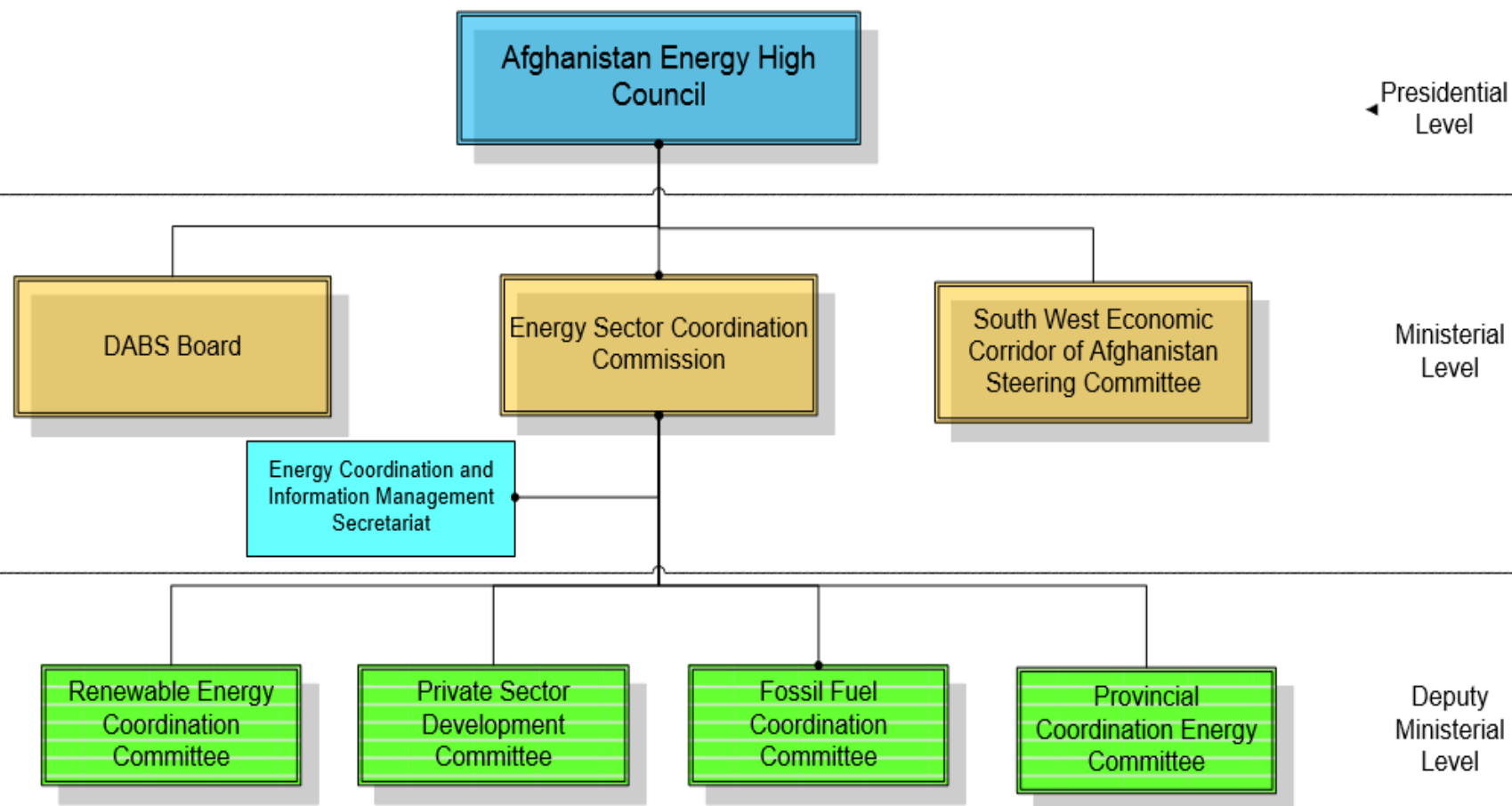
- **Overview of Energy Sector Policy**
- **Energy Sector Structure**
- **Energy Status in Afghanistan**
- **Afghanistan Electricity Demand Forecast**
- **Afghanistan Energy Potential**
- **Projects in Pipeline**
- **Renewable Energy in Afghanistan**
- **Challenges and Way forward**

Energy Sector Policy

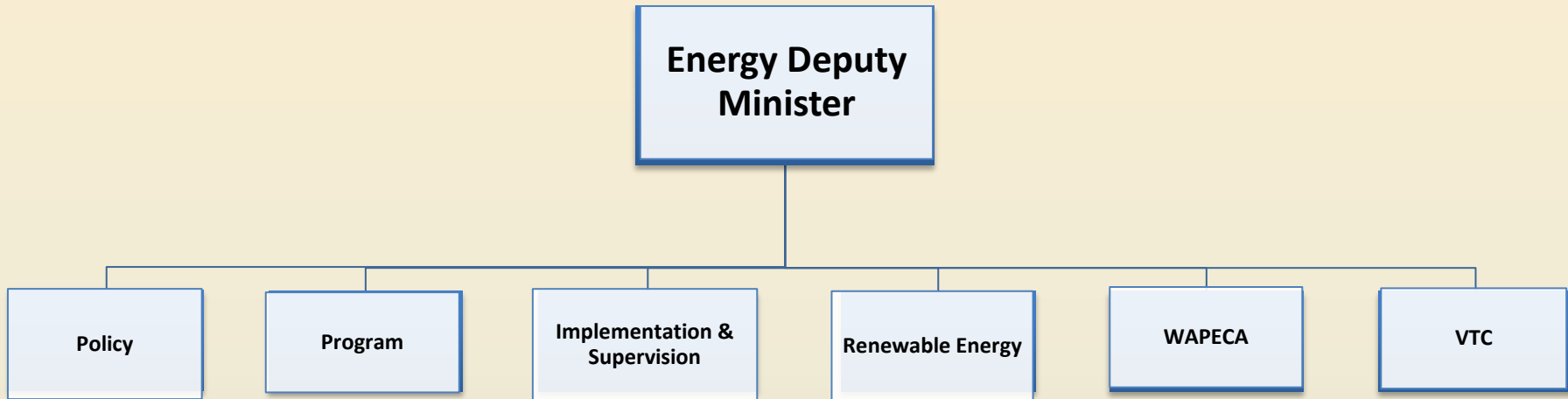


Afghanistan's Energy Sector Strategic goal is to provide sustainable power supply, at affordable prices, and in an environmentally sound manner, for economic growth, and to improve living standards

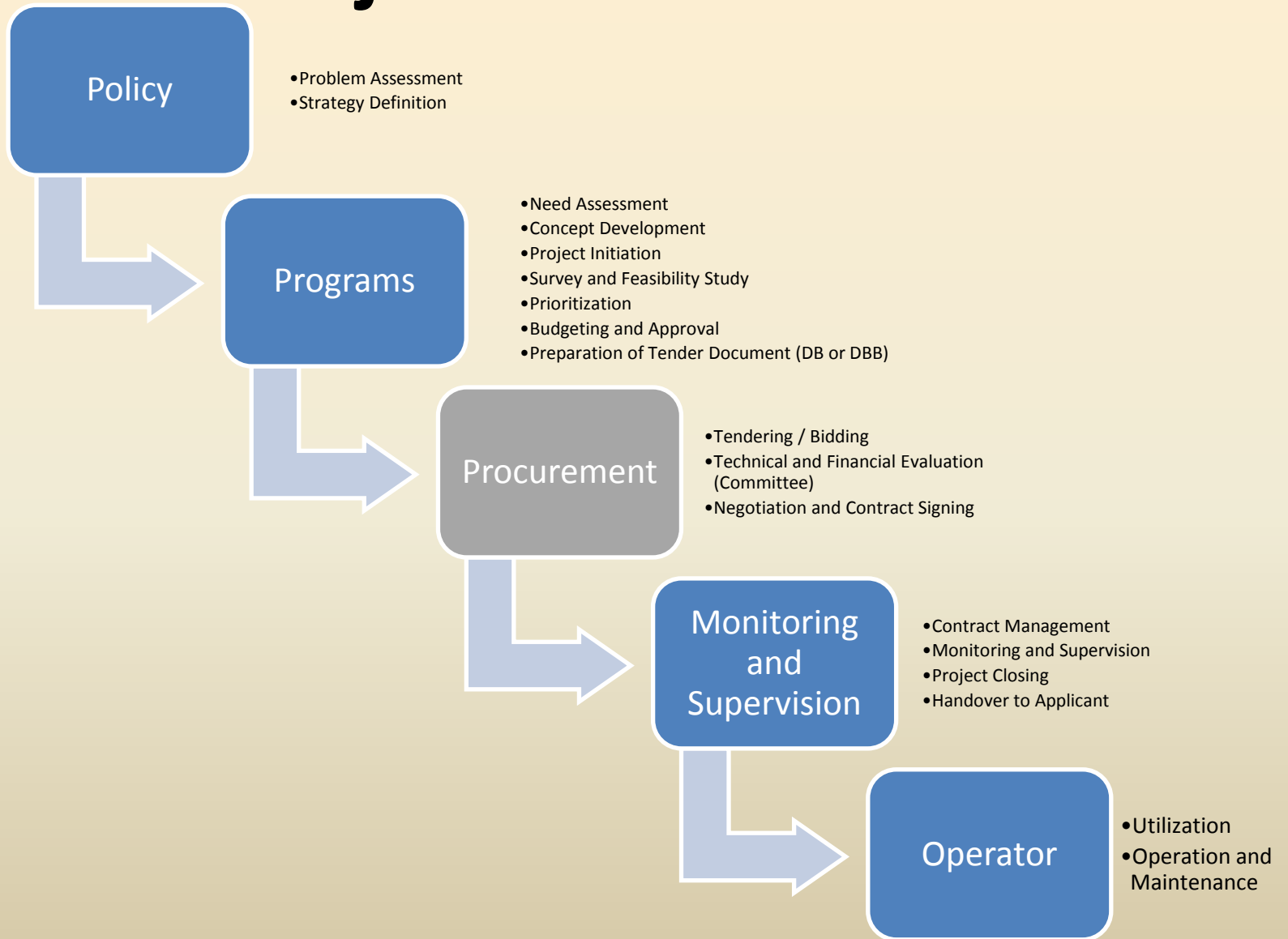
- Direct policies and regulations
- Make maximum use of domestic resources
- Initiate sector regulation
- Promote private sector participation and investment in the electricity sector
- Encourage the expansion of access to underserved and rural communities
- Stimulate the rational use of Renewable sources of energy



Current Structure



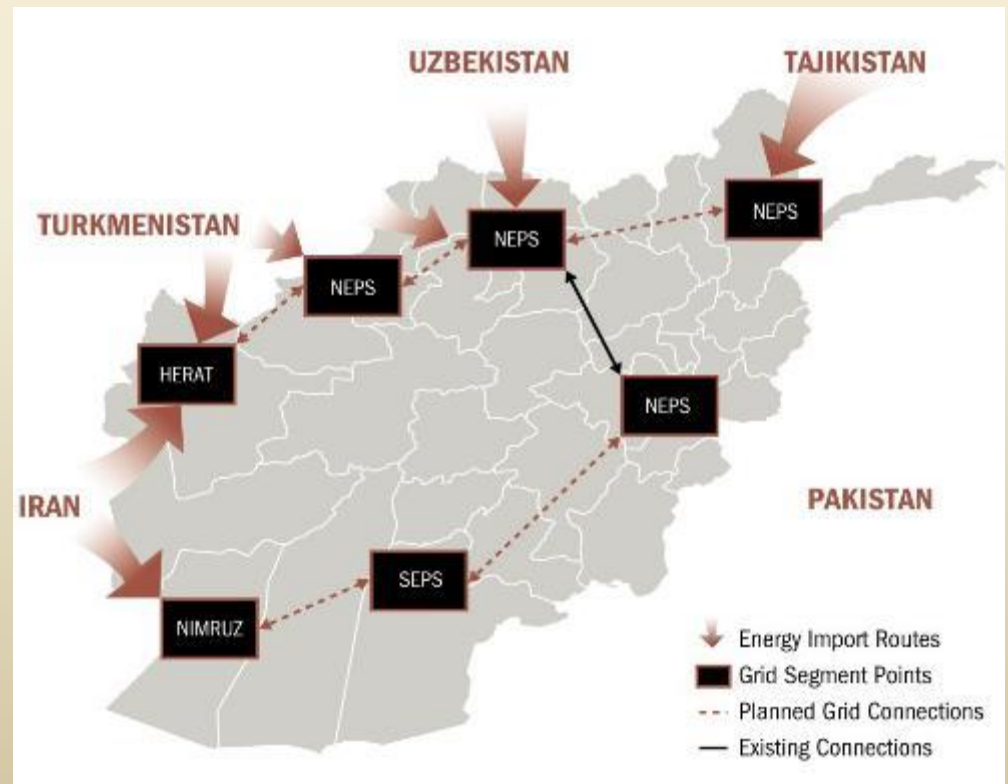
Project Work Flow



Industry structure and institutional arrangements

- Currently, the power sector is governed by Ministry of Energy and Water (MEW) and operated by Da Afghanistan Breshna Sherkat (DABS), which controls & operates all the activities of power sector throughout the country.
- The Afghanistan power system is categorized into four different networks namely, North East Power System, South East Power System, Herat Zone System and Turkmenistan system which facilitates both internal and cross border interconnections with neighboring countries like Uzbekistan, Tajikistan, Iran and Turkmenistan.

- ✓ North East Power System; (**NEPS**) consisting of a grid linking 17 load centers (Kabul, Mazar-i-Shariff, Jalalabad, etc) with Uzbekistan and Tajikistan (HVTL 220kv, 110kv, 35kv)
- ✓ South East Power System (**SEPS**) consisting of Khandar, etc linking Kajaki (HVTL 110kv)
- ✓ Herat system linking the Herat Zone with Islamic Republic of Iran and Republic of Turkmenistan (HVTL 132kv, 110kv)
- ✓ Turkmenistan system linking Herat, Faryab, JawzJan, Sar-e-Pul and Andkhoy district. (HVTL 110kv)



پژواک
فصلنامه علمی پژوهشی

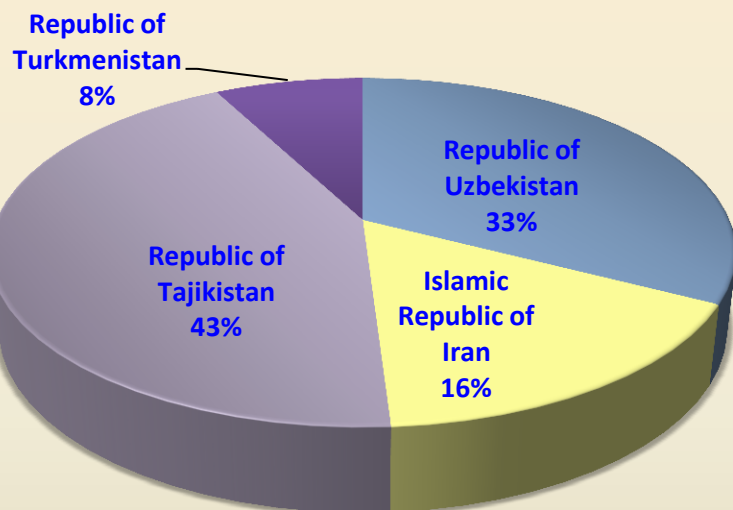


Energy access is a key focus of national development programs

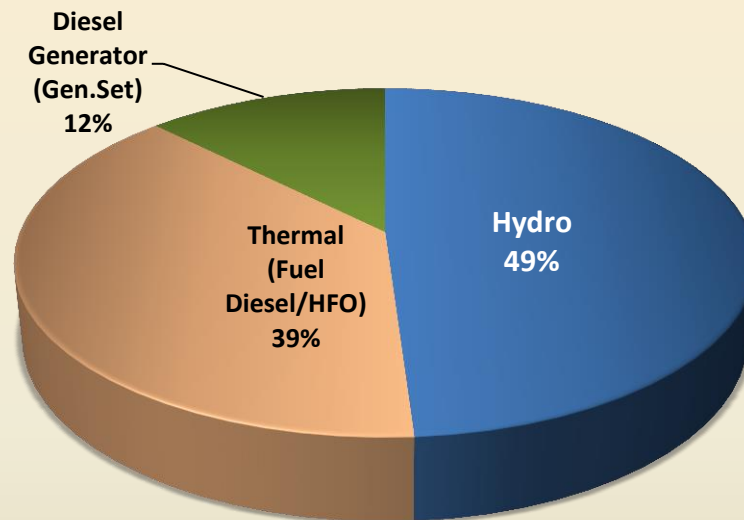
- National Priority Programs (NPP)
 - National Energy Supply Program (NESP) on Infrastructure Cluster
 - National Water and Natural Resources Development Program : where Energy for Rural Development in Afghanistan is one component : ARD Cluster.
- Power Sector Master Plan prepared
 - 20 year grid expansion planning
- Gas sector plan is under formulation stage
 - Options to efficiently utilize country's significant natural gas resources for electricity, transport, and heating/cooking
- Development of coordination bodies
 - Renewable Energy Coordination Committee
 - Inter-ministerial Commission for Energy

Afghanistan on Grid Generation / Transmission Profile

**Transmission Lines Installed Capacity, Max
in MW**



**Afghanistan Core Generation, Installed Capacity
in MW**



Republic of Uzbekistan	326
Islamic Republic of Iran	164
Republic of Tajikistan	433
Republic of Turkmenistan	77
<u>Total</u>	<u>1,000</u>

Hydro	254
Thermal (Fuel Diesel/HFO)	200
Diesel Generator (Gen.Set)	65
<u>Total</u>	<u>519</u>

Afghanistan Electricity Demand Forecast Within 20 Years

- A demand forecast for 20 year horizon has been prepared based on commonly applied methodology. Inputs are key socio-economic variables, such as GDP growth, as well as standardization of the average tariff level for all category of consumers, as critical deciding factors. Starting with the forecasts for the various provinces, the anticipated total demand forecast for Afghanistan has been estimated.

(Afghanistan Power Sector Master Plan)

- For the whole of Afghanistan, gross demand, i.e. dispatched electrical energy, will increase in the base case scenario by 5.7% or 8.7% per annum on average from its current level to 18,400 GWh in 2032. Total peak demand in 2032 is expected to stand at around 3500 MW. In addition, high and low scenarios were developed which show a total gross demand of about 22,500 GWh and a peak of 4300 MW in 2032 in the high scenario and around 13,700 GWh gross demand and 2600 MW peak in the low scenario. (Afghanistan Power Sector Master Plan)

Afghanistan Energy Potential

No	Type	Potential
1	Hydro Power	<ul style="list-style-type: none"> • 23,000MW of Energy • 125 sites been identified for MHP, with potential of over 600MW of electricity
2	Wind Energy	<ul style="list-style-type: none"> • 158,500 MW installed capacity i.e. 5MW/km² • 31,600km² windy land area i.e. 5% of Afg. total land area
3	Solar Energy	<ul style="list-style-type: none"> • 300 Sunny day in one year, i.e. 3,000 Hours of Sun • 6.5 kWh/m² per day solar radiation average
4	Bio-Mass	<ul style="list-style-type: none"> • More than 85% of Afghanistan's energy needs are met by traditional biomass, mainly wood and dung
5	Geo-Thermal Energy	<ul style="list-style-type: none"> • Prospects of low to medium temperature geothermal resources are widespread all over Afghanistan. • Power plants to be built in Afghanistan could range from 5 to 20MW each
6	Gas and Coal	<ul style="list-style-type: none"> • 3000 MW*– 4000 MW* • Prefeasibility Studies, Sites Identification of coal power plants • 8 out of 12 gas wells been surveyed

Investment Required to Meet demand Supply Gap

- ❖ To achieve the goal for providing power supply towards whole Afghanistan, a large investment plan is required for all the sub-areas like, Generation expansion, Transmission Network development and strengthen Distribution System. This will need a total investment of \$10,096m, out of which, \$7,330m for Generation sector development and network integration, \$1,727m for major Transmission Projects and \$1,040m for Transmission Network development within the provinces up to the year 2032. (Afghanistan Power Sector Master Plan)
- ❖ The total investment for stage A is estimated at \$1,214m. Stage B will require \$1,464m while stage C and stage D will require about \$1,409m and \$6,010m. The high investment in Stage D is related to the hydropower plants. (Afghanistan Power Sector Master Plan)

Overview on Investment type	Subtotal by project	Stage A	Stage B	Stage C	Stage D
Generation development	\$ 7,329.50	\$ 327.60	\$ 348.50	\$ 981.50	\$ 5,671.90
Major transmission projects	\$ 1,725.90	\$ 595.00	\$ 676.00	\$ 212.90	\$ 242.00
Transmission development within the provinces	\$ 1,041.00	\$ 291.10	\$ 439.80	\$ 215.10	\$ 95.00
Total in Million USD	\$ 10,096.40	\$ 1,213.70	\$ 1,464.30	\$ 1,409.50	\$ 6,008.90

Energy Projects in pipeline Status

- CASA 1000: 1000 MW from the Northern neighbors 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
- Mazaar Gas Plant: 50 MW gas power plant supported by IFC/WB
- TAPI : Turkmenistan, Afghanistan, Pakistan and India Gas pipe line
- TUTAP : Turkmenistan, Uzbekistan, Tajikistan, Afghanistan and Pakistan – Interconnection
- TAP 500: Turkmenistan, Afghanistan and Pakistan 500 KV TL project

Legislation

General Works done and in Progress

Regulatory + Policy + Strategy

- Electricity Services Law
- Renewable Energy Policy
- Rural Renewable Energy Policy -draft
- REN Strategy
- Energy Efficiency Standards for Buildings
- Wind & Solar Atlas and Investment Plan
- RED ToR and Five Year Action Plan
- REN Industry Study – Under process to be developed
- INDC

Coordination

- Inter Ministerial Commissioning of Energy
- Renewable Energy Coordination of Energy
- REN Potential Maps
- REN Online Database
- REN Magazine
- REN Union of Private Companies
- Energy Working Groups – 5 Provinces
- Technical REN Working Groups

Demonstration

- 50 MW REN projects – off grid
- Provincial Electrical Concepts
- REN Workshop and Exhibition or Road shows
- Regional REN workshops and seminars
- REN Park – To be constructed
- Solar and MHP Guidelines
- 100 MW REN Package for private investors

Electricity Regulator

- Historically electricity tariffs were fixed by Government.
- Constrained by political and administrative compulsions, over the years resulted in acute distortion of tariffs on a large scale.
- Thus arose the need for removing this responsibilities from Government and vesting them in independent electricity regulatory body.
- Independent regulatory mechanism for the Power sector is somewhat new to our country but it has been working successfully in many developed countries.
- In Afghanistan, the institution of electricity regulators has been introduced under USAID/GIZ assistance. Thereafter, this became an important item in the reform agenda for the Power sector and was ultimately included in the Afghanistan Electricity Law, 2015.

Renewable Energy Development Roadmap

Regulatory Framework

- ◆ Electricity Act
- ◆ REN Policy
- ◆ REN Strategy
- ◆ Tariff Act
- INDC

Institutional Framework

- ♣ Constituted Regulatory Body
- ♣ Constituted REN directorate in Ministry and Utility
- ♣ Established independent FI to finance REN projects

Capacity Development

- ♠ Establish REN Institute
- ♠ Arranging training at home and abroad
- ♠ Arranging seminar, symposium and workshop

Project Development

- ♥ Implementing REN Projects
- ♥ Identify REN Potentials
- ♥ Implementing REN project
- ♥ O&M – Sustainability of the projects

Renewable Energy Development

A renewable energy industry with private sector participation will require



Underpinned By

Political Will

Regulatory Environment

Investment

Coordination (Govt / Devpt Partners / Private Sector)

Renewable Energy Proposed 100 MW Projects						
No	Project Name	Province	Type of Energy	Capacity (kW)	Power Plant Est. Cost (Million USD)	No. of People Supplied
1	Kandahar Solar - DG Hybrid Project	Kandahar	Solar	30000	90	
2	Kabul Solar - Hydro Hybrid Project	Kabul	Solar	10000	25	
3	Roof Top Solar Project	Kabul	Solar	5000	15	
4	Kabul Waste to Energy Project	Kabul	Biomass	6000	23	
5	Kabul Waste Water Treatment Project	Kabul	Biomass	1000	2	
6	Bini Hisar Biogas Digester Project	Kabul	Biomass	500	1	
7	Pul Charkhi Biogas Project	Kabul	Biomass	500	0.5	
8	Ghor Solar Project + Backup + Distribution Network	Ghor	Solar	5000	25	
9	Helmand Solar Project	Helmand	Solar	3000	20	
10	Herat Wind project	Herat	Wind	14000	36	
11	Spogmee MHP Project	Badakhshan	MHP	2500	10	
12	Kuran Wa Munjan MHGP Project	Badakhshan	MHP	1500	9	
13	Yangi Qala MHP Project	Takhar	MHP	1000	6.5	
14	Farkhar MHP Project	Takhar	MHP	500	2.5	
15	Namak Ab MHP Project	Takhar	MHP	500	2.5	
16	Mazar Waste to Energy Project	Balkh	Biomass	6000	16	
17	Zari MHP Project	Balkh	MHP	500	2	
18	Sholgara MHP Project	Balkh	MHP	500	1.5	
19	Kishindeh MHP Project	Balkh	MHP	500	2	
20	Urozgan Solar Project	Urozgan	Solar	1500	4.5	
21	Noristan Solar Project + Distribution Network	Noristan	Solar+MHP	1000	4	
22	Daikundi Solar Project	Daikundi	Solar	1000	3	
23	Badghis Solar Project	Badghis	Solar	1000	3	
24	Zabul Solar Project	Zabul	Solar	1000	3	
25	Paktia Solar Project	Paktia	Solar	1000	3	
26	Logar Solar Project	Logar	Solar	1000	3	
27	Khost Solar Project	Khost	Solar	1000	3	
28	Ghazni Solar Project	Ghazni	Solar	1000	3	
29	Paktika Solr Project + Distribution Network	Paktika	Solar	1000	4	
30	Farah Solar Project	Farah	Solar	1000	3	
Total				100000	326	1000000

What we Offer for Investors

- Long Term Land Lease – Energy Farms
- 25% Subsidy
- Tax Incentives
- Security Assistance
- Long term PPA
- Right to Buy
- Attractive Tariff

Renewable Energy Maps



Islamic Republic of Afghanistan
Ministry of Energy & Water
Renewable Energy Department

Afghanistan Biomass Resource Potential Map



Districts Suitable for Installing Domestic Biogas
Cylinders Using Cattle Manure



Crop Residues by Province



Municipal Solid Waste Generation
in Major Urban Areas in Afghanistan

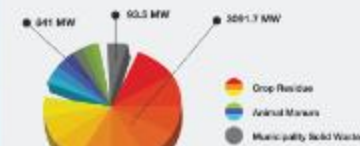


This informational map is provided by the Renewable Energy Department of the Ministry of Energy and Water. The dataset and charts provide information on Biomass Energy Potential in Afghanistan.

The data is obtained from the National Renewable Energy Laboratory (NREL) of the U.S. Department of Energy and the Renewable Energy Department (RED) of the Ministry of Energy and Water.

Plant Size (Cows/mini)	Average Daily Manure Required (kg)	Approximate No. of Cattle	Avg. of Family members that use a latrine
1	25	3-3	3-4
2	50	6-6	6-8
3	75	9-9	9-12
4	100	12-12	12-15
5	125	15-15	15-20
6	150	18-18	18-25

Potential of Biomass Resources in Afghanistan



No.	Province	Animal Manure (Tons/Year)	Electrical Energy Production Potential (MWh/Year)	Animal Manure Conversion (Tons/Year)	Electrical Energy Production Potential from Animal Manure (MWh/Year)	Crop Residues Conversion (Tons/Year)	Electrical Energy Production Potential from Crop Residues (MWh/Year)
1	Badekshah	12008	25003	2437796	452598	140550	598004
2	Badkhis	68667	15152	700218	519216	138670	273627
3	Bugdix	126700	27742	1257441	208343	348880	1442708
4	Capix	331750	38860	1046006	186478	420330	1731006
5	Barix	42123	13867	207478	531548	86701	288602
6	Dalix	64021	14000	1114880	300588	48820	194405
7	Fayix	73000	15488	888814	160217	86000	315409
8	Fayix	136408	30460	371824	182700	325640	1308830
9	Ghazix	170819	20343	1570519	327386	322931	1342574
10	Chix	66801	21108	3236302	232387	37471	408485
11	Herat	224802	27174	2320040	401513	415470	1732510
12	Hilix	136407	28360	2038277	382718	480000	2073708
13	Jalix	74767	15440	430328	15000	27440	300725
14	Kabul	317152	3284036	341488	440884	371888	168172
15	Kandix	190061	58773	2194770	439588	286440	1111000
16	Kapix	61081	13488	811880	171608	106680	383103
17	Kapix	73003	17003	1000216	307208	90200	378930
18	Kapix	68605	13773	1888746	313313	127880	498054
19	Kapix	190008	22808	1000008	308207	448780	1600114
20	Lagix	61999	13600	1431800	208207	156870	207430
21	Lagix	84173	11984	346770	137103	250700	810403
22	Nangix	200000	48124	3330444	829507	470610	1740774
23	Nurix	22861	4000	242884	47184	17128	288714
24	Nurix	22861	4000	242884	47184	17128	288714
25	Nurix	190008	22808	1000008	308207	448780	1600114
26	Paktix	60413	13005	208802	534888	154880	425763
27	Papix	21001	4000	107213	37070	4450	108111
28	Papix	10714	17007	818880	188800	138880	588880
29	Samarix	53043	11040	200007	21134	90000	410041
30	Samarix	73003	17003	1000216	307208	90200	378930
31	Talix	190008	22808	1000008	308207	448780	1600114
32	Uzix	18661	10713	818880	188800	138880	588880
33	Warak	62870	18000	451880	84017	127000	528714
34	Zabix	42000	4000	218400	74000	30700	301400
Total		2728610	878800	31876881	7881277	8084800	27088889

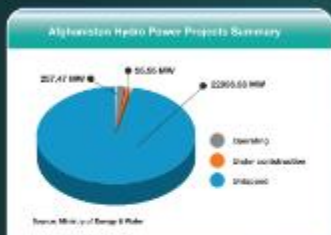
Source: "Assessment of Biomass Resources in Afghanistan" by NREL - January 2011

Renewable Energy Maps



Islamic Republic of Afghanistan
Ministry of Energy & Water
Renewable Energy Department

Afghanistan's Hydro Resource Potential Map (Including Mini & Micro Hydro Power Plants)



Legend

- Water Features
- Sub-Basins/River Basins
- The Panj-Amu River Basin
- The Harirod-Murghab River Basin
- The Helmand River Basin
- The Kabul River Basin
- The Northern River Basin

Afghanistan's hydro potential resources information is provided by the Renewable Energy Department of the Ministry of Energy and Water. The dataset provides information on hydro power potential, installed hydro power plants capacity and under construction hydro power projects capacity (including Mini & Micro Hydro Power Projects) in Afghanistan. The data is obtained from the National Renewable Energy Laboratory (NREL) of the U.S. Department of Energy, Kabul Polytechnic University, Ministry of Energy and Water (Planning Department) and Renewable Energy Database.

No.	Zone	River	Potential (MW)
1	Kabul	Kabul	409
2		Panjshir	403
3		Laghman	54
4	Panj-Amu	Amu	9110
5		Kokcha	1027
6		Kandahar	50
7	Northern	Jirgatal	483
8		Balkh	203
9		Harat	102
10	Helmand	Helmand	102
11		Urgench	193
12		Farah	80
Total			22,218

Source: Ministry of Energy & Water, Kabul Polytechnic University

Mini & Micro Hydro Power projects in Afghanistan								
No.	River Basin	Province	Area (km ²)	Project Completed		Project Underway		Total Zones
				Capacity (MW)	Number	Capacity (MW)	Number	
1	Kabul	Kabul	4,234	565	25	0	0	20,427
2		Kapisa	1,558	947	141	0	0	
3		Parwan	5,715	3310	228	0	0	
4		Wardak	10,548	621	65	0	1	
5		Logar	4,258	423	42	500	1	
6		Uruzgan	22,400	873	63	0	0	
7		Paktia	18,576	0	0	0	0	
8		Paktika	3,772	2808	100	0	0	
9		Pandjshir	5,883	604	78	1,000	3	
10		Kunar	4,235	70	8	0	0	
11		Nangarhar	7,641	1864	171	0	0	
12		Kunar	4,503	2141	127	3,200	3	
13		Laghman	3,678	561	65	0	0	
14		Nooristan	8,257	1038	78	0	0	
15	Panj-Amu	Badkhan	44,530	12477	366	2,500	19	35,472
16		Samangan	18,020	2304	105	1,750	5	
17		Takhar	12,408	4879	214	3,395	11	
18		Badkhan	15,706	2799	172	0	0	
19		Kunduz	8,187	36	4	0	0	
20		Sar-e-Pol	10,038	1116	63	800	2	
21		Ghazni	16,166	554	53	0	0	
22		Farjahan	11,500	0	0	0	0	
23		Ghazni	10,506	347	28	0	0	
24		Faryab	20,796	345	25	0	0	
25		Sadqia	20,794	37	3	0	0	
26		Herat	35,300	324	23	0	0	
27		Farah	49,339	0	0	0	0	
28		Other	36,897	1870	83	0	0	
29	Helmand	Herat	47,410	0	1	0	0	3,825
30		Helmand	90,808	75	5	0	0	
31		Kandahar	56,805	1000	2	0	0	
32		Zabul	17,479	0	0	0	0	
33		Urgench	11,474	0	0	0	0	
34	Total	Daykundi	17,501	58	16	2,537	11	68,686
				682,894	44,371	2,841	21,816	

Source: Renewable Energy Department, Ministry of Energy & Water

Supported by
Afghanistan Renewable Energy for Rural Areas (ESRA)

giz German Renewable Energy Research Alliance



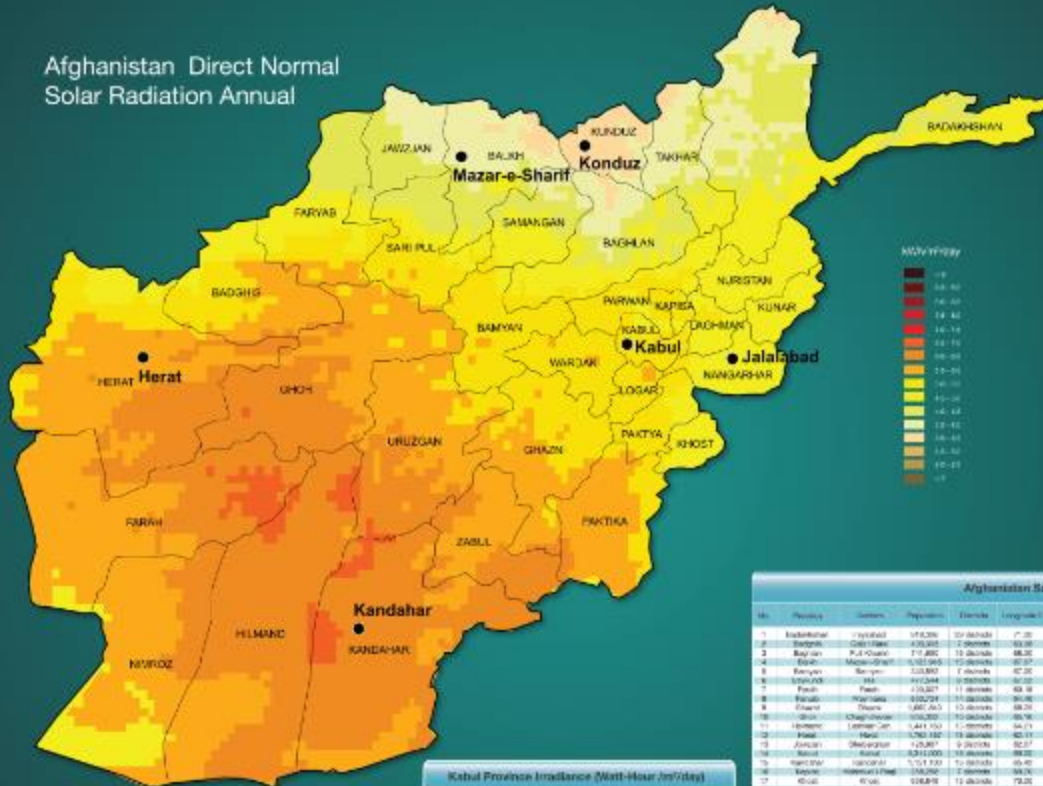
Maps



Afghanistan Solar Resource Potential Map



Afghanistan Direct Normal Solar Radiation Annual



Agglomeration index: resources per province					
No.	Province	Province Pop.	Province GDP/capita	Province GDP/capita	Province GDP/capita
1	Andalusia	4,518,000	5,379,120	1,190	1,190
2	Aragon	2,040,000	2,140,000	1,049	1,049
3	Asturias	1,040,000	1,040,000	1,040	1,040
4	Balearic Islands	1,040,000	1,040,000	1,040	1,040
5	Basque Country	2,040,000	2,140,000	1,049	1,049
6	Catalonia	5,379,120	5,379,120	1,190	1,190
7	Castile and León	2,040,000	2,140,000	1,049	1,049
8	Castile-La Mancha	2,040,000	2,140,000	1,049	1,049
9	Cantabria	1,040,000	1,040,000	1,040	1,040
10	Galicia	2,040,000	2,140,000	1,049	1,049
11	Madrid	5,379,120	5,379,120	1,190	1,190
12	Murcia	1,040,000	1,040,000	1,040	1,040
13	Navarre	1,040,000	1,040,000	1,040	1,040
14	Rioja	1,040,000	1,040,000	1,040	1,040
15	Valencia	4,518,000	5,379,120	1,190	1,190
16	Zamora	1,040,000	1,040,000	1,040	1,040
17	Segovia	1,040,000	1,040,000	1,040	1,040
18	Valladolid	2,040,000	2,140,000	1,049	1,049
19	León	2,040,000	2,140,000	1,049	1,049
20	Asturias	1,040,000	1,040,000	1,040	1,040
21	Cantabria	1,040,000	1,040,000	1,040	1,040
22	Basque Country	2,040,000	2,140,000	1,049	1,049
23	Navarre	1,040,000	1,040,000	1,040	1,040
24	Rioja	1,040,000	1,040,000	1,040	1,040
25	Aragón	2,040,000	2,140,000	1,049	1,049
26	Catalonia	5,379,120	5,379,120	1,190	1,190
27	Balearic Islands	1,040,000	1,040,000	1,040	1,040
28	Valencia	4,518,000	5,379,120	1,190	1,190
29	Murcia	1,040,000	1,040,000	1,040	1,040
30	Andalusia	4,518,000	5,379,120	1,190	1,190
31	Castile and León	2,040,000	2,140,000	1,049	1,049
32	Castile-La Mancha	2,040,000	2,140,000	1,049	1,049
33	Galicia	2,040,000	2,140,000	1,049	1,049
34	Madrid	5,379,120	5,379,120	1,190	1,190
35	Murcia	1,040,000	1,040,000	1,040	1,040
36	Navarre	1,040,000	1,040,000	1,040	1,040
37	Rioja	1,040,000	1,040,000	1,040	1,040
38	Aragón	2,040,000	2,140,000	1,049	1,049
39	Catalonia	5,379,120	5,379,120	1,190	1,190
40	Balearic Islands	1,040,000	1,040,000	1,040	1,040
41	Valencia	4,518,000	5,379,120	1,190	1,190
42	Murcia	1,040,000	1,040,000	1,040	1,040
43	Andalusia	4,518,000	5,379,120	1,190	1,190
44	Castile and León	2,040,000	2,140,000	1,049	1,049

Afghanistan War Incidents (Wall-Hours)														
Id	Province	Location	Frequency	Distance	Longitude	Latitude	City	Area	Time	Alt	Aug	Aug	Aug	Aug
1	Kandahar	Yakabad	17,200	10 days	7.20	33.50	Talab	1000	1000	44.5	18	100	100	100
2	Herat	Chah Zang	13,500	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
3	Badkhan	P. J. Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
4	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
5	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
6	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
7	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
8	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
9	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
10	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
11	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
12	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
13	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
14	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
15	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
16	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
17	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
18	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
19	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
20	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
21	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
22	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
23	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
24	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
25	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
26	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
27	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
28	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
29	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	
30	Herat	Chah Zang	12,000	12 days	63.00	34.50	1000	1000	1000	1000	1000	1000	1000	

This informational map is provided by the Renewable Energy Department of the Ministry of Energy and Water. The dataset and charts provide information on solar energy potential in Afghanistan.

The data is obtained from the National Renewable Energy Laboratory (NREL) of the U.S. Department of Energy and the Renewable Energy Department (RED) of the Ministry of Energy and Water.



Supported by
Afghanistan Renewable Energy for Rural Areas (ERRA)

Renewable Energy Maps



Islamic Republic of Afghanistan
Ministry of Energy & Water
Renewable Energy Department

Afghanistan Wind Resource Potential Map



Wind resource (synthesized data)

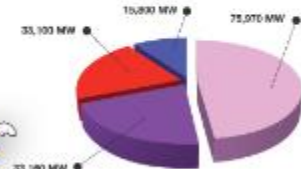
Wind resource and power potential
Wind resource is the wind speed in m/s
Wind power is the power in MW



Legend:
1. Badkhashan
2. Balkh
3. Bamiyan
4. Baglan
5. Bamyan
6. Badkhashan
7. Faryab
8. Ghor
9. Herat
10. Kabul
11. Kandahar
12. Kapisa
13. Khost
14. Kunar
15. Lagman
16. Logar
17. Nangarhar
18. Nuristan
19. Paktia
20. Paktiya
21. Paktiya
22. Paktiya
23. Paktiya
24. Paktiya
25. Paktiya
26. Paktiya
27. Paktiya
28. Paktiya
29. Paktiya
30. Paktiya

Afghanistan's first ever power-generating wind farm was built in Faryab in April 2008. It consists of 10 turbines, with a total installed capacity of 100 MW. The wind farm generates enough electricity to power the provincial government complex.

Afghanistan Wind Power Potential
(Prior to Republic Wind Resource at 0.05 m/s)



Wind Speed Class	Resource Potential	Wind Power (MW)	Wind Speed (m/s)	Land Area (km²)	Wind Power Potential (MW)
1	Poor	0 - 200	0 - 5.4	-	-
2	Marginal	200 - 300	5.4 - 6.1	-	-
3	Marginal	300 - 400	6.1 - 6.8	-	-
4	Good	400 - 500	6.8 - 7.5	15183	2.4
5	Excellent	500 - 600	7.5 - 8.2	16821	1
6	Excellent	600 - 800	8.2 - 8.9	16821	1
7	Excellent	800 - 1000	8.9 - 9.5	16821	1
			Total	31604	4.5
					150000

Development of RE Sector

No	What	How
----	------	-----

- | | | |
|---|--|--|
| 1 | Resource Assessments | <ul style="list-style-type: none">• Site-specific resource assessments• Evaluation of grid-connectivity options• Grid-tied / mini-grid / stand-alone balance assessment• Market (+tariff) assessments |
| 2 | Technology Development and Demonstration | <ul style="list-style-type: none">• Pilot/demonstration programs (stand-alone / mini-grid / grid-tied)• Standards development• International technology transfer• REN Parks |
| 3 | Commercials | <ul style="list-style-type: none">• Business model innovation + demonstration• Demonstrate cost-recovery by private sector• Financial risk mitigation for PPPs• Mechanisms to access capital |
| 4 | People | <ul style="list-style-type: none">• Awareness programs• Developing Curricula / certifications• Advertisements |

What Needs to be Done

No	What	How
5	Political Will	<ul style="list-style-type: none">• Awareness of RE benefits• Coordination with government at different levels• Demonstration of benefit to constituents• Demonstration of economic benefit
6	Regulatory Environment	<ul style="list-style-type: none">• Develop legal basis for private sector• Transparent guidelines• Technical standards• Oversight/monitoring (especially O&M)
7	Coordination	<ul style="list-style-type: none">• ICE / RECC• IRENA• ECO• SAARC

Thank You

تشکر

