

Energy Department

JICA
KNOWLEDGE CO-CREATION PROGRAM
(GROUND & REGION FOCUS)

Energy Policy (A)

JFY 2017

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Course Period in Japan: From May 31st 2017 to June 30th 2017

COUNTRY REPORT

“PAKISTAN”

BY:

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

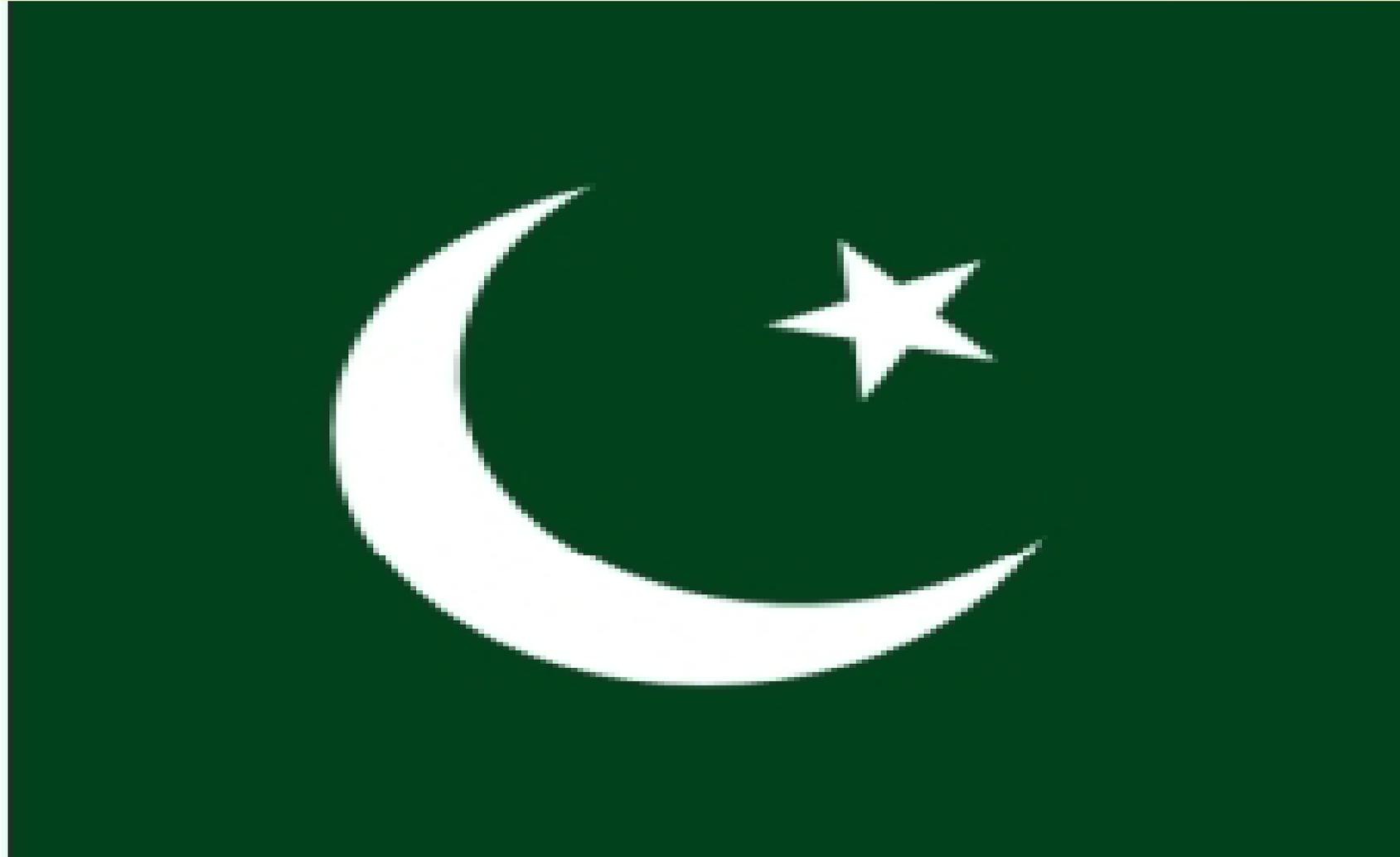
Bismillah al Rahman al Rahim

In the name of Allah, the Most Gracious, the Ever Merciful

Energy Department

1. General Information

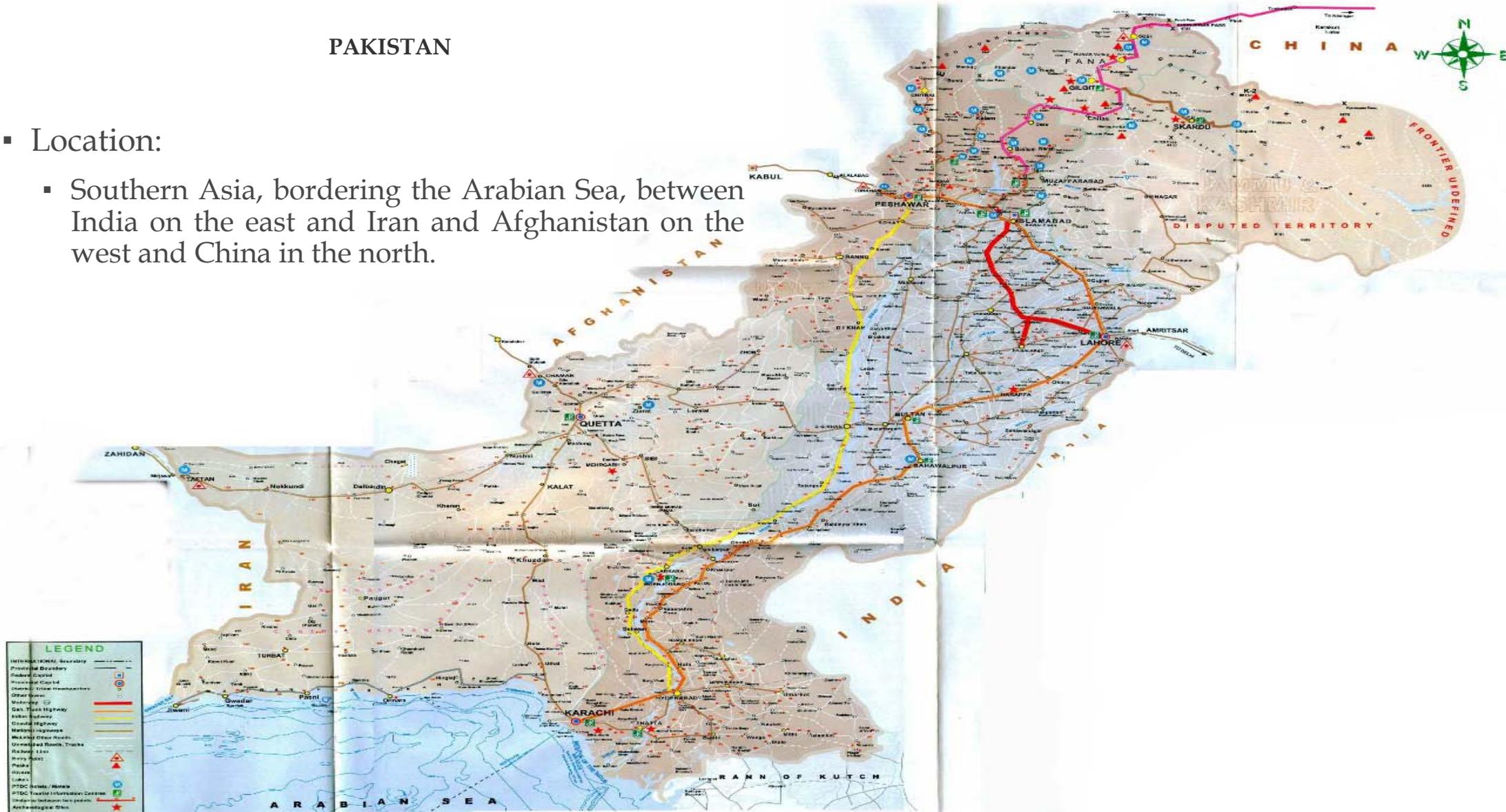
FLAG OF PAKISTAN



PAKISTAN

Location:

- Southern Asia, bordering the Arabian Sea, between India on the east and Iran and Afghanistan on the west and China in the north.



1) Country Profile

- Full name: Islamic Republic of Pakistan
- Population: 188.9 million (2015)
(Source: World Bank, US Census Bureau)
- Number of Households: 34.7 million (2016)
(Source: National Statistics Office)
- Capital: Islamabad
- National Language: Urdu
- Major Religion: Islam (95%)
- Life expectancy: 67 years
- Monetary unit: Pakistani Rupee

Pakistan

- Main exports: Textile Products, Rice, Cotton and Leather goods
- GDP estimate 2017
\$ 313.6381 Billion(Nominal-2017)
\$ 1.061 trillion(PPP,2017)
- Per capita
\$1,584 (Nominal, 140th 2017)
\$5,340 (PPP,133rd 2017)
- President: Mamnon Hussain
- Prime Minister: Mian Mohammad Nawaz Sharif

GEOGRAPHY

- Location:
 - Southern Asia, bordering the Arabian Sea, between India on the east and Iran and Afghanistan on the west and China in the north.
- Geographic coordinates: 30 00 N, 70 00 E
- Area: 796,095 Sq.Km, (Land 96.86% Water 3.14%)
- Land boundaries: Total 7,257 Km
 - border countries: Afghanistan, 2,670 Km, China 438 Km
India 3,190 Km, Iran 959 Km
 - Coastline: 1,046 Km
- Climate:
 - Mostly hot, dry desert; temperate in northwest; arctic in north.

GEOGRAPHY

- Elevation extremes:
 - Lowest point: Indian Ocean 0 m
 - Highest Point K2 (Mt. Godwin-Austen) 8,611 m
- Natural resources:
 - Land, extensive natural gas reserves, limited petroleum, coal, iron ore, copper, salt, limestone.
- Irrigated land:
 - About 25% of Pakistan's total land area with the largest irrigated network in the world.
- Environment – current issues:
 - Water pollution from raw sewage, industrial wastes, and agricultural runoff; limited natural fresh water resource; a majority of the population does not have access to potable water; deforestation; soil erosion; desertification

People

- Age structure:
 - 0-14 years: 41%, 15-64 Years: 55%, 65 years and over: 4%
- Population growth rate: 1.45% (2016 est.)
- Birth rate: 22.3 births/1,000 population (2016 est)
- Death rate: 6.4 deaths/ 1,000 population (2016 est.)
- No of Households: 34.7 million (2016)
- Nationality: Pakistani
- Ethnic groups:
 - Punjabi 48%, Sindhi 12%, Siraiki (a Punjabi bariant) 10%, Pashtu 8%, Urdu (Official) 8%, Balochi 3%, Hindko 2%, Brahvi 1% English (Official language of most government ministries), and other 8%
- Literacy: Total population: 57.9% (Male 69.5% Female 45.8% (2015 est)).

Basic Facts

- Parliament consists of 02 Houses i.e.
 - The Senate (Upper House) having 104 members &
 - The National Assembly (Lower House) having 342 members.
- National Flag: It is dark green with a white vertical bar, a white crescent & a five pointed star in the middle. It symbolizes Pakistan profound commitment to Islam & religious minorities.
- National Anthem approved in Aug 1954, verses composed by Hafeez Jallundhri, its duration is 80 seconds.
- National Flower: Jasmine
- National Tree: Deodar (Cedrus Deodara)

Basic Facts

- National Animal: Markhor
- National Bird: Chakor (Red-legged partridge)
- National Game: Hockey
- Major Cities: Islamabad, Lahore, Karachi, Peshawar, Quetta, Rawalpindi, Hyderabad, Multan, Abbottabad.
- Tourist Resorts: Murree, Swat, Kalam, Kaghan, Chitral, Gilgit, Ziarat,
- Major Sports: Hockey, Cricket, Squash.

CULTURAL HERITAGE

- The land where Pakistan is situated today had been a seat of world's leading Civilizations. Some of the archaeological findings suggest presence of civilization as old as 14 M years.
- The Cultural Heritage of Pakistan is spread over the centuries & may be summarized in the periods.
- Indus Civilization About 8000 years B.C.
- Gandhara Civilization 2nd Century B.C till 10th Century A.D.
- Islamic Period 712 – 1762 A.D.
- Sikh Period 1762-1849 A.D
- British Period 1857 to 1947 A.D

2) Economic Indicators

- GDP – Real growth rate: 4.2% (2015)
- GDP – composition by sector: Agriculture: 25.5%, Industry: 19%
Services 55.5% (2015 est).
- Population below Poverty line: 11% (FY 2016-17)
- Imports: \$ 45.83 Billion (2015 est.)
- Exports: \$ 23.34 Billion (2015 est.)
- Inflation rate (consumer prices): 3.7% (Feb: 2017)
- Unemployment rate: 6.5% (2015 est.)

ECONOMY

- Industries: Textiles, Food Processing, Beverages, Construction Materials, Clothing, Paper Products, Shrimp.
- Industrial production growth rate: 6.99% (Jan 2017 est.)
- Electricity – Production: 109.26 trillion Wh (2015-16)
- Electricity – production by source:

Fossil Fuel:	64%
Hydro:	30%
Nuclear:	5%
- Electricity – Consumption: 90.36 trillion Wh (2015-16)
- Electricity – Consumption per capita: 970 kwh/ per capita (2015-16)

ECONOMY

- Agriculture: Cotton, Wheat, Rice, Sugarcane, Fruits, Vegetables; Milk, Beef, Mutton, Eggs.
- Exports – Commodities: Cotton, Fabrics, Yarn, Rice and other Agricultural Products.
- Exports – Partners: US 13.6%, European Union 18.2%, China 11.7%, Afghanistan 7.6%,(FY 2011-12)
- Imports – Commodities: Machinery, Petroleum, Petroleum Products, Chemicals, Transportation Equipment, Edible Oils, Grains, Pulses, Flour.
- Imports – Partners: European Union 10.4%, China 17%, UAE 15%, Kuwait 8.8%, Saudi Arabia 8.5%, Malaysia 4.8% (FY 2014-15)

ECONOMY

- Currency: 1 Pakistani Rupee (PKR) = 100 paisa
- Exchange rates: US\$1 = PKR 104.80 (May 2017)
- Fiscal Years: 1st July – 30th June
- Population: 188.9 million (2015)
(Source: World Bank, US Census Bureau)
- Number of Households: 34.7 million (2016)
(Source: National Statistics Office)

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2. ENERGY RESERVES

COAL RESERVES

Region	Coal (Billion Tonnes)
Province Sindh: Lakhra, SondaThatta, Jherruck, Thar, Haji Coal others	184.623
Province Punjab: Eastern Salt Range, Central Salt Range, Makerwal	0.235
Province Balochistan: host-Sharig-Harnai,Sor Range/Degari, Duki, Mach- Kingri, Musakhel Abegun, Pir Ismail Ziarat,Chamalong	0.217
Province Khayber Pakhtoon Khawan:	0.091
Azaad Jamoo Kashmir:	0.009
Grand Total	185.175

Natural Gas Reserves

- The recoverable reserves of natural gas have been estimated at 29.671 trillion cubic feet (January 1st 2009).
- During July-March 2008-09 the production was 3986.5 million cubic feet per day as compared to 3965.9 mmcf/d during the corresponding period last year showing an increase of 0.52%.

Energy Reserves

- Oil 68,670 bbl/d
- Coal 185.175 Billion Tonnes
- Natural Gas 29.671 trillion cubic feet

3. CURRENT ENERGY POLICY AND MEASURES

Current Energy Policies

- Federal Power Generation Policy 2002
- Federal Renewable Energy Policy 2006
- Federal Bagasse Based Co-Generation Policy 2008
- Federal Energy Policy 2013
- Power Generation Policy 2015

Measures

- The **energy policy of Pakistan** is formulated and determined by the federal, provincial, and local institutional entities in Pakistan, which address the issues of energy production, distribution, and consumption of energy, such as gas and petroleum standards. Energy Policy requires the proper legislation, international treaties, subsidies and incentives to investment, guidelines for energy conservation, taxation and other public policy techniques.
- To provide sufficient Power Generation Capacity at the least cost.
- To encourage and ensure exploitation of indigenous resources.
- To ensure that all stakeholders are looked after in the process; a win-win situation.
- To be attuned to safeguarding the environment.

Scope of the Power Policy

- Private Sector Power Projects.
- Public Sector Power Projects, where required by the Project Sponsor.
- Public – Private Partnership (PPP) Power Projects.
- Power projects developed by the Public sector and subsequently divested.

POWER POLICIES

Power Policy 2002 (Federal)

- This Policy deals with all type of fuels vis-à-vis Thermal, Hydel Coal etc. at Federal Level for Projects above 50 MW Capacity.
- Private Power and Infrastructure Board (PPIB) at Federal level administers this Policy.

Renewable Energy Policy 2006 (Federal)

- This Policy deals with renewable energy projects vis-à-vis Wind, Biomass, Geothermal Solar, Hydropower (<50 MW), Biodiesel, etc. at Federal Level
- Alternative Energy Development Board (AEDB) administers this Policy.

POLICY FOR POWER GENERATION 2002

SALIENT FEATURES

- Project on BOOT basis and Term could be up to 50 years.
- Exemption from corporate income tax, turnover tax and withholding tax, no sales tax, only 5% concessionary Import Duty on plant & equipment not manufactured locally.
- GOP Guarantees obligations of power purchaser and provinces.
- GOP provides protection against Political Force Majeure, change in law and Change in duties & taxes
- Power purchaser to bear hydrological / Geological risks for hydropower projects.

POLICY FOR POWER GENERATION 2002

SALIENT FEATURES

- Payment of compensation in case of termination due to GOP default
- Tariff adjustments for variation in currency exchange rates and Cost Escalation.
- Government ensures conversion of Pak Rupee & remittance of foreign exchange for project-related payments.

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RENEWABLE ENERGY POLICY 2006

SALIENT FEATURES

- Wind Risk / Hydro Risk borne by purchaser
- Guaranteed Electricity purchase
- Grid provision is the responsibility of the purchaser
- No Import Duties on Equipment Zero Sales Tax
- Net Metering
- Banking and Wheeling Provisions

4. Past Energy Demand and Supply (at least past 10 years)

1) Energy Demand by Sector

Oil / Petroleum (Tonnes)							
Fiscal Year	Households	Industry	Agriculture	Transport	Power	Others Govt:	Total
2002-03	282,521	1,604,068	196,747	8,082,273	6,019,958	266,387	16,451,954
2003-04	231,459	1,493,080	183,506	8,464,042	2,739,763	309,263	13,421,113
2004-05	192,750	1,542,398	142,062	9,024,783	3,452,581	316,686	14,671,260
2005-06	128,651	1,681,517	81,896	8,156,831	4,218,982	358,807	14,626,684
2006-07	106,148	1,595,981	97,232	7,981,893	6,740,559	325,318	16,847,131
2007-08	120,961	1,071,191	109,351	9,384,482	7,083,933	310,501	18,080,419
2008-09	97,332	969,193	69,793	8,837,197	7,570,418	367,266	17,911,199
2009-10	90,312	984,690	58,072	8,860,880	8,814,274	323,472	19,131,700
2010-11	85,449	1,355,443	40,597	8,892,268	8,138,956	373,794	18,886,507
2011-12	61,884	1,141,397	21,215	6,832,937	5,608,785	213,127	13,879,345

1) Energy Demand by Sector

Gas (mm cft)							
Fiscal Year	Households	Commercial	Cement	Fertilizer	Power	CNG (Transport)	Total
2002-03	153,508	22,776	3,445	180,611	335,636	164,968	872,264
2003-04	155,174	24,192	7,711	185,350	469,738	193,395	1,035,560
2004-05	172,103	27,191	13,383	190,409	507,398	226,116	1,136,600
2005-06	171,109	29,269	15,335	198,175	491,766	278,846	1,184,500
2006-07	185,533	31,375	14,686	193,682	433,672	306,600	1,165,548
2007-08	204,035	33,905	12,736	200,063	429,892	322,563	1,203,194
2008-09	214,113	35,536	7,305	201,100	404,140	319,003	1,181,197
2009-10	219,382	36,955	1,944	220,124	366,906	333,508	1,178,819
2010-11	232,244	36,466	1,378	228,460	337,401	291,667	1,127,616
2011-12	261,915	39,627	1,266	211,828	358,381	119,000	992,017

1) Energy Demand by Sector

Electricity (Gwh)								
Fiscal Year	Traction	Household	Commercial	Industrial	Agriculture	Street Light	Other	Total
2002-03	10	23,624	3,218	16,181	6,016	244	3,363	52,656
2003-04	9	25,846	3,689	17,366	6,669	262	3,650	57,491
2004-05	12	27,601	4,080	18,591	6,988	305	3,750	61,327
2005-06	13	30,720	4,730	19,803	7,949	353	4,035	67,603
2006-07	12	33,335	5,363	21,066	8,176	387	4,373	72,712
2007-08	8	33,704	5,572	20,729	8,472	415	4,500	73,400
2008-09	5	32,282	5,252	19,330	8,795	430	4,277	70,371
2009-10	2	34,272	5,605	19,823	9,689	458	4,499	74,348
2010-11	1	35,885	5,782	21,207	8,971	456	4,797	77,099
2011-12	1	35,589	5,754	21,801	8,548	478	4,590	76,760

1) Energy Demand by Sector

Coal (metric tonne)					
Fiscal Year	Household	Power	Brick Kilns	Cement	Total
2002-03	1.1	203.6	2,607.0	2,078.2	4,889.9
2003-04	1.0	184.9	2,589.4	3,289.2	6,064.5
2004-05	..	180.0	3,906.7	3,807.2	7,893.8
2005-06	..	149.3	4,221.8	3,342.8	7,714.0
2006-07	1.0	164.4	3,277.5	4,451.2	7,894.1
2007-08	1.0	162.0	3,760.7	6,186.9	10,110.6
2008-09	0.8	112.5	3,274.8	5,001.8	8,389.9
2009-10	..	125.5	3,005.2	5,007.8	8,138.5
2010-11	..	96.5	3,003.6	4,617.1	7,717.1
2011-12	..	104.6	3,108.2	4,456.9	7,669.7

3 Energy Prices

	Ave Cost of Generation (Rs/kwh)		Total Generation (in 000 Gwh)		%age Share in Generation	
	FY14	FY15	FY14	FY15	FY14	FY15
Hydel			32.2	32.6	32.9	32.5
RFO	16.0	12.4	36.0	31.7	38.5	33.2
Gas	4.8	4.7	19.0	22.5	20.1	23.3
HSD	22.2	17.4	1.6	2.9	1.7	3.1
Coal	4.0	4.5	0.1	0.1	0.1	0.1
Nuclear	1.3	1.2	4.4	5.0	4.8	5.4
Import Iran	10.2	10.1	0.4	0.5	0.4	0.5
Mixed	9.3	8.2	1.1	1.3	1.2	1.5
Wind			0.3	0.5	0.3	0.5
(Avg/Total)	7.7	5.9	95.2	96.7	100	100
Transmission Losses	0.2	0.1	-2.3	-2.1		
Net Delivered	8.0	6.1	92.8	94.9		
FPA Variation (Rs/Kwh)	2.8	-1.8				

FPA=Average Fuel Price Adjustment; RFO=Residual Fuel Oil or Furnace Oil; HSD=High Speed Diesel
(Source: NEPRA)

5. Outlook of energy demand and supply (2020, 2030, and 2050 if possible)

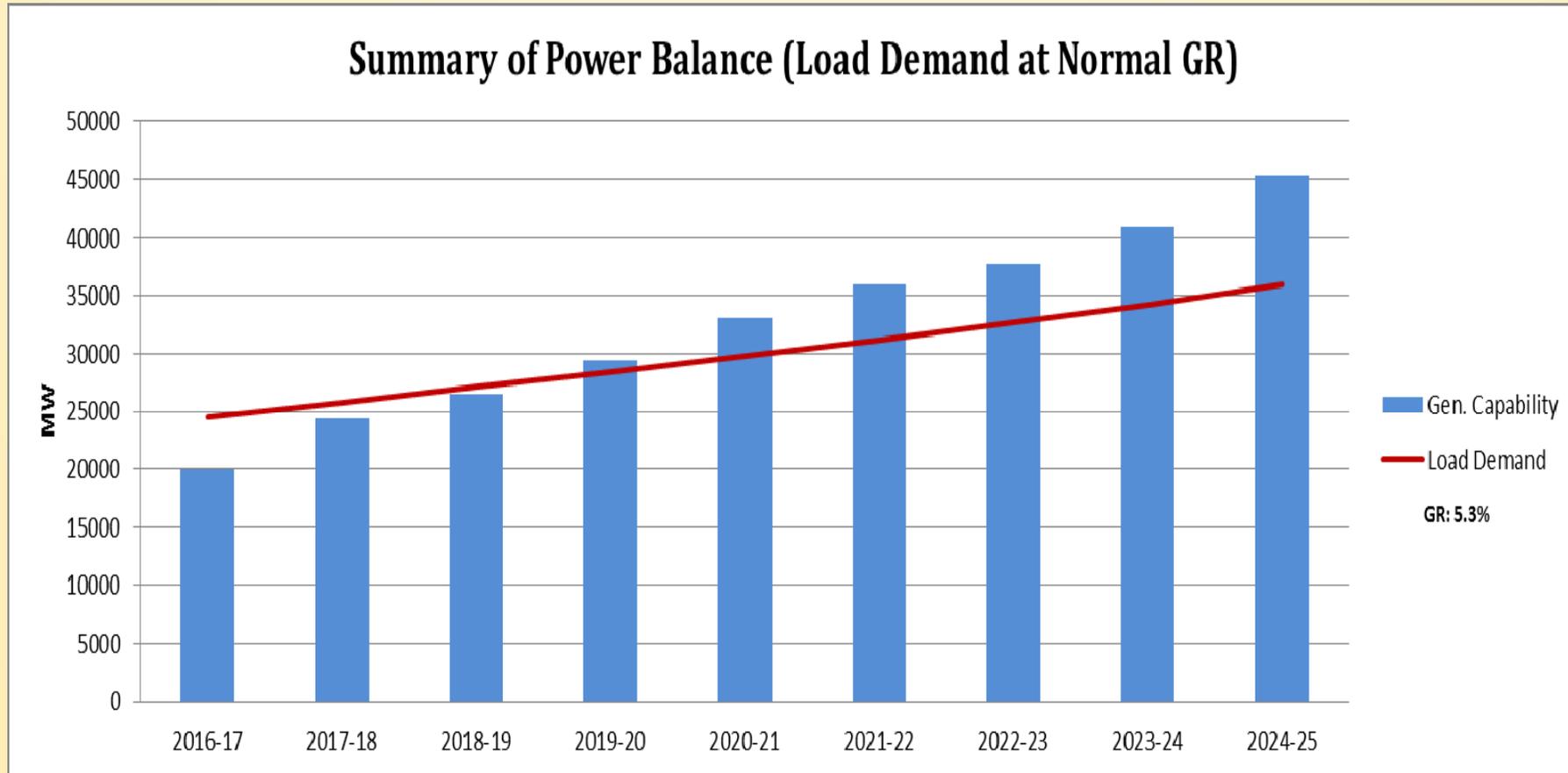
Outlook of energy demand and supply

Financial Year ending 30th June	NTDC Peak Demand (MW)	Capacity Addition per year in NTDC System (MW)	Total Installed Capacity per year (MW)
2015	21,701	1,504	22,928
2016	23,711	689	23,617
2017	24,871	6,643	30,260
2018	26,105	9,961	40,221
2019	27,408	1,279	41,500
2020	28,773	4,580	46,080
2021	30,156	2,200	48,280

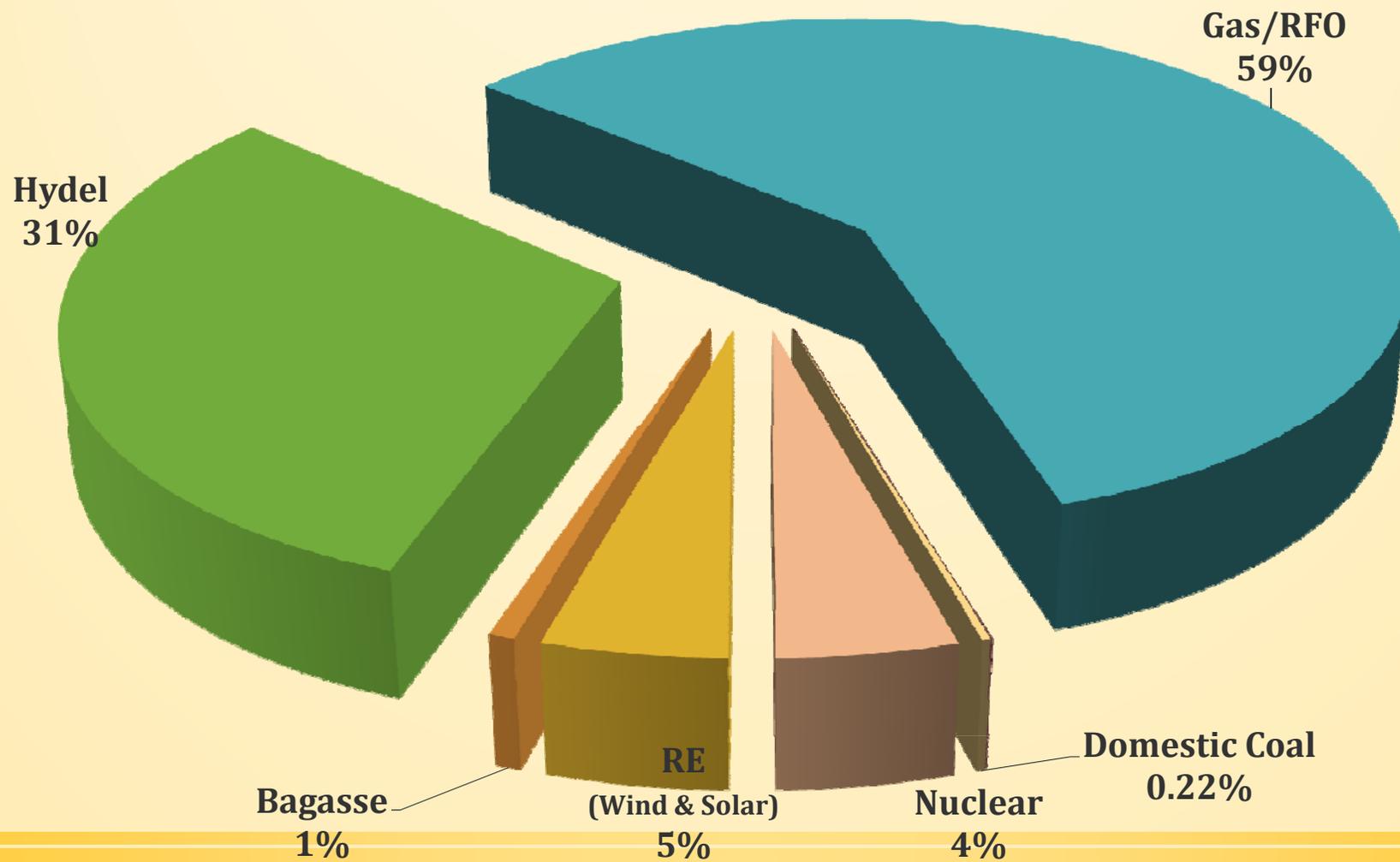
Future Generation Mix

S. No.	Description	Total Installed Capacity (MW)			
		Existing	2018-19	2021-22	2024-25
1	Hydel	7,097	12,089	12,089	27,196
2	Thermal	13,370	13,370	13,370	13,370
3	Dom. Coal	150	810	4,440	8,400
4	Imp. Coal	-	3,300	6,103	6,103
5	Imp. LNG	-	3,600	3,600	3,600
6	Nuclear	1,005	2,445	3,545	4,645
7	Import	-	-	1,000	1,000
8	Baggase	146	850	919	919
9	Wind & Solar	1,034	2,231	4,732	6,582
Total		22,802	38,695	49,798	71,815

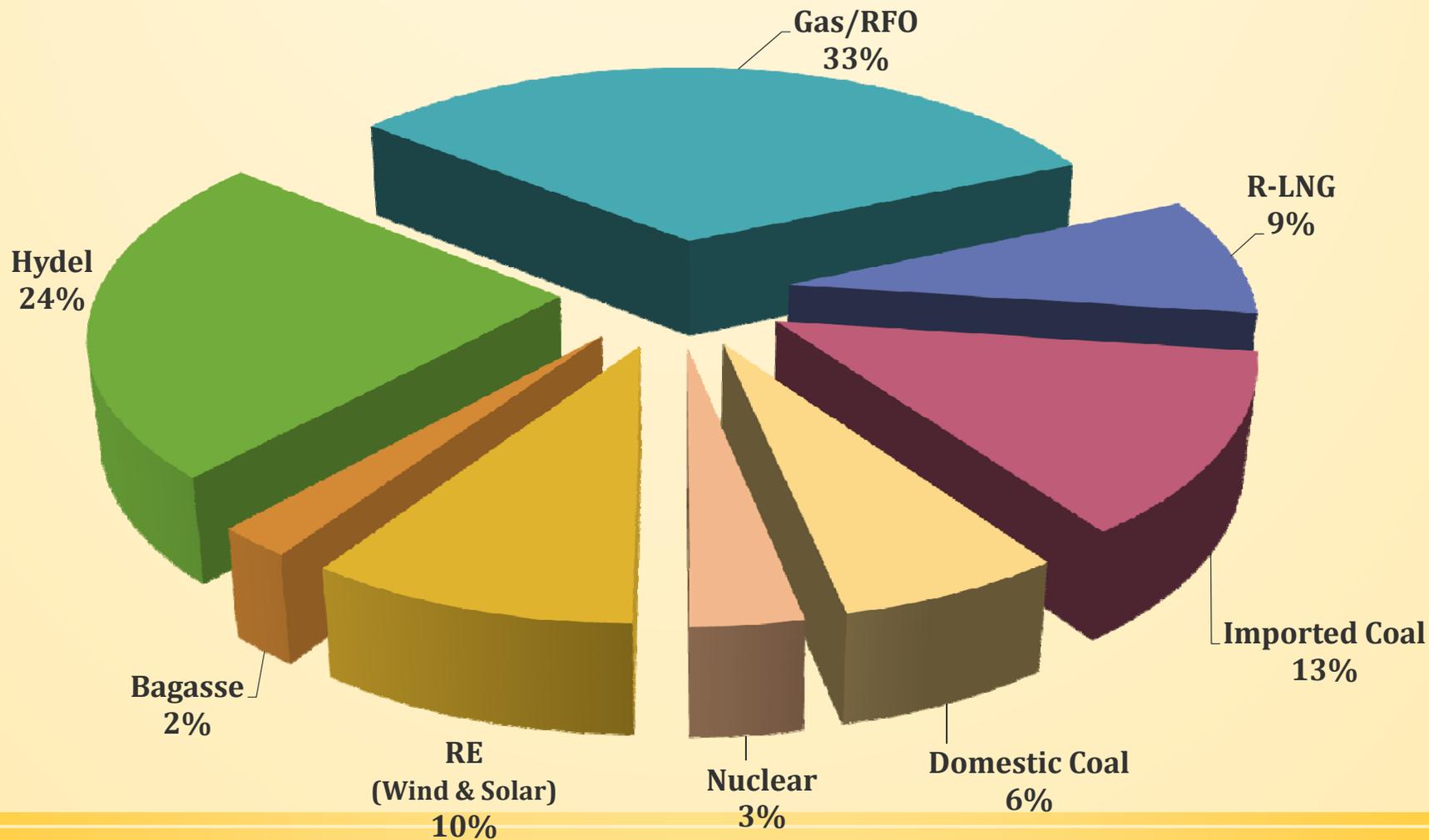
Power Balance at Normal Demand Growth Rate



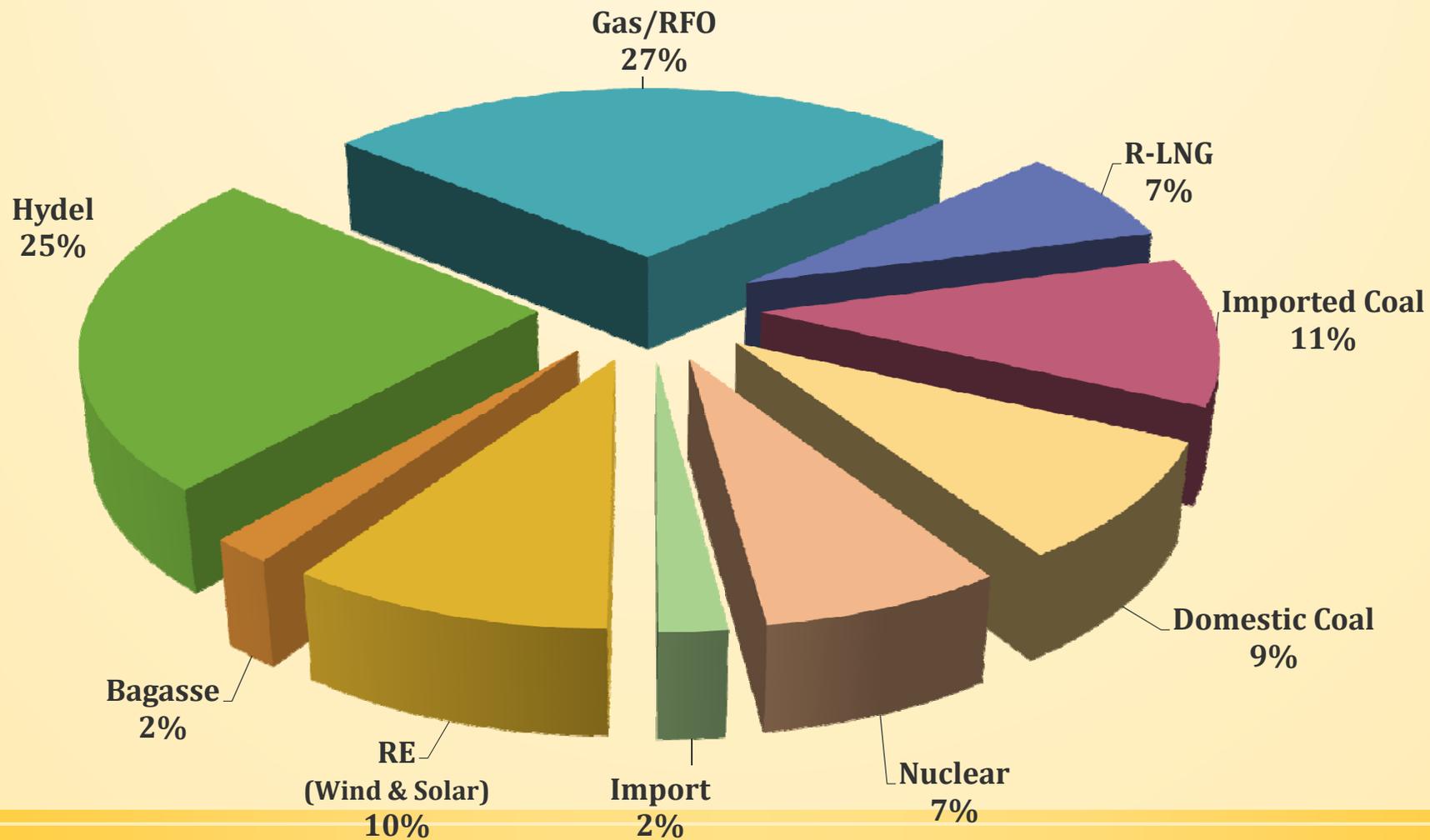
Generation Mix - Existing (21222 MW)



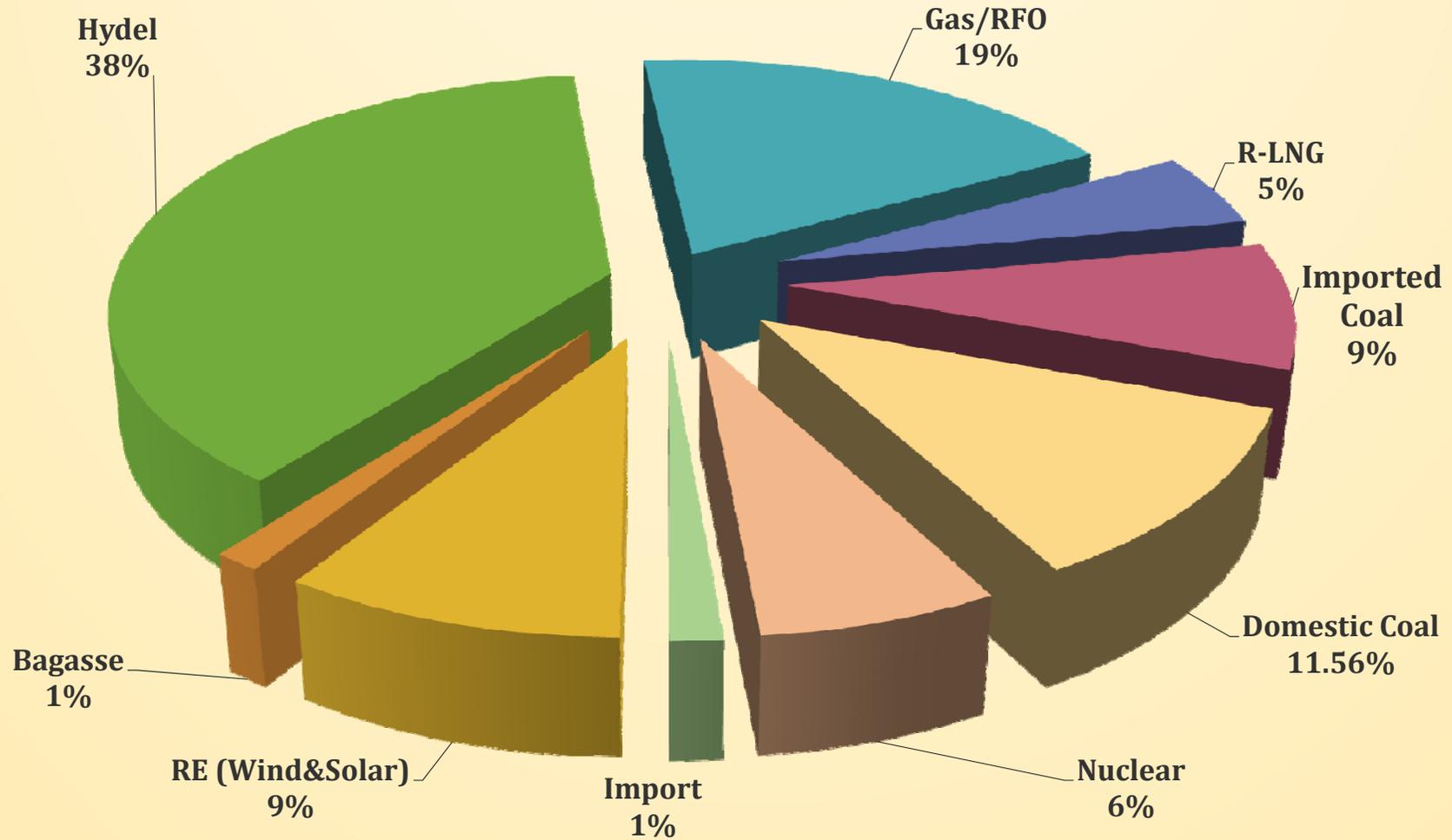
Generation Mix 2019-20 (41358 MW)



Generation Mix 2021-22 (49138 MW)



Generation Mix 2024-25 (71815 MW)



6. Energy – Related investment for domestic and overseas

ENABLING POLICIES & INCENTIVES

REGULATORY STRUCTURE

REGULATORY FRAMEWORK

- National Power Regularity Authority (NEPRA)
- Generating Licenses
- Independent Power Producers (IPPs)
- Central Power Purchase Agency (CPPs)
- Co-Generation

CONTRACTUAL MECHANISM

- Guaranteed power purchase from IPPs
- Upfront tariffs
- Sovereign Guarantees
- Standardized Implementing Authorities
- Power Purchase Agreements

ENABLING POLICIES & INCENTIVES FINANCIAL & FISCAL INCENTIVES

ATTRACTIVE RETURNS

- Ave. 17% RoE on Renewable Energy projects

CUSTOMS DUTY EXPEMTION

- 5% on import of Plant & Equipment not manufactured locally
- No Duties on Renewable Energy Plants & Equipment

ENABLING POLICIES & INCENTIVES FINANCIAL & FISCAL INCENTIVES

Tax Exemptions;

- Exemption from Income Tax
- Exemption from Turnover tax and
- Exemption from Withholding tax on imports

INVESTMENT INITIATIVES (Coal based Power Projects)

- At present, various local and imported coal based IPPs are under process with Private Power and Infrastructure Board (PPIB), most of which are being developed under the China Pakistan Economic Corridor (CPEC)
- PPIB, after consultation with the stakeholders, has finalized and shared Security Package Documents with the Sponsors (Implementation and Power Purchase Agreements)
- Moreover, the total potential of Thar is estimated at 175 billion tons of lignite coal which may be sufficient to produce 100,000 MW electricity for 200 years
- NPERA has already announced Upfront Tariff for Indigenous Coal based Projects
- Investors are encouraged to participate in development of power projects based on Coal and also propose new projects based on Coal

AREAS OF INVESTMENT / COOPERATION

- *Direct Foreign Investment (DFI):*

Investors may invest in RE power projects such as wind, solar, biomass, waste-to-energy and small hydel power projects as an IPP on unsolicited mode / raw sites. Government of Pakistan would provide full facilitation to the companies through AEDB under the Renewable Energy Policy 2006.

Geothermal Energy

Pakistan has prospective geothermal sites with possible potential of power generation. However, detailed resource assessment of the sites needs to be carried out. Preliminary information of the sites is available with Geological Survey of Pakistan.

AREAS OF INVESTMENT / COOPERATION

- *Financing/Lending for Renewable Energy Based Power Projects:*

Banks and financing institutions may finance the commercial renewable energy projects in Pakistan through debt financing or equity sharing or both.

- *Collaboration in Manufacturing:*

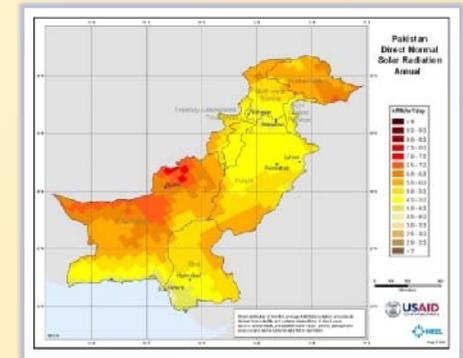
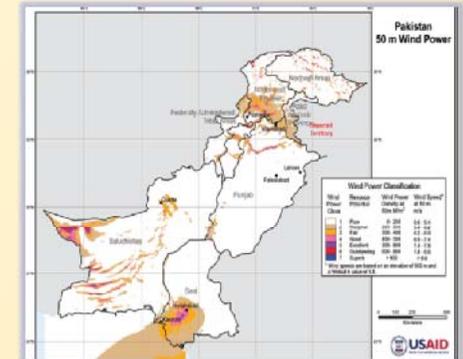
OEMs can establish manufacturing facilities or collaborate with Pakistani engineering industries for manufacturing of Alternative Energy (AE) / Renewable Energy (RE) products such as wind turbines and its components, solar panels, hybrid inverters, control boxes, solar thermal equipment, solar water pump/motors etc.

- *Distributed Generation*

Installation of renewable energy based distributed generation for direct sale to consumers or as Energy Service Companies (ESCO) by setting up mini private grids.

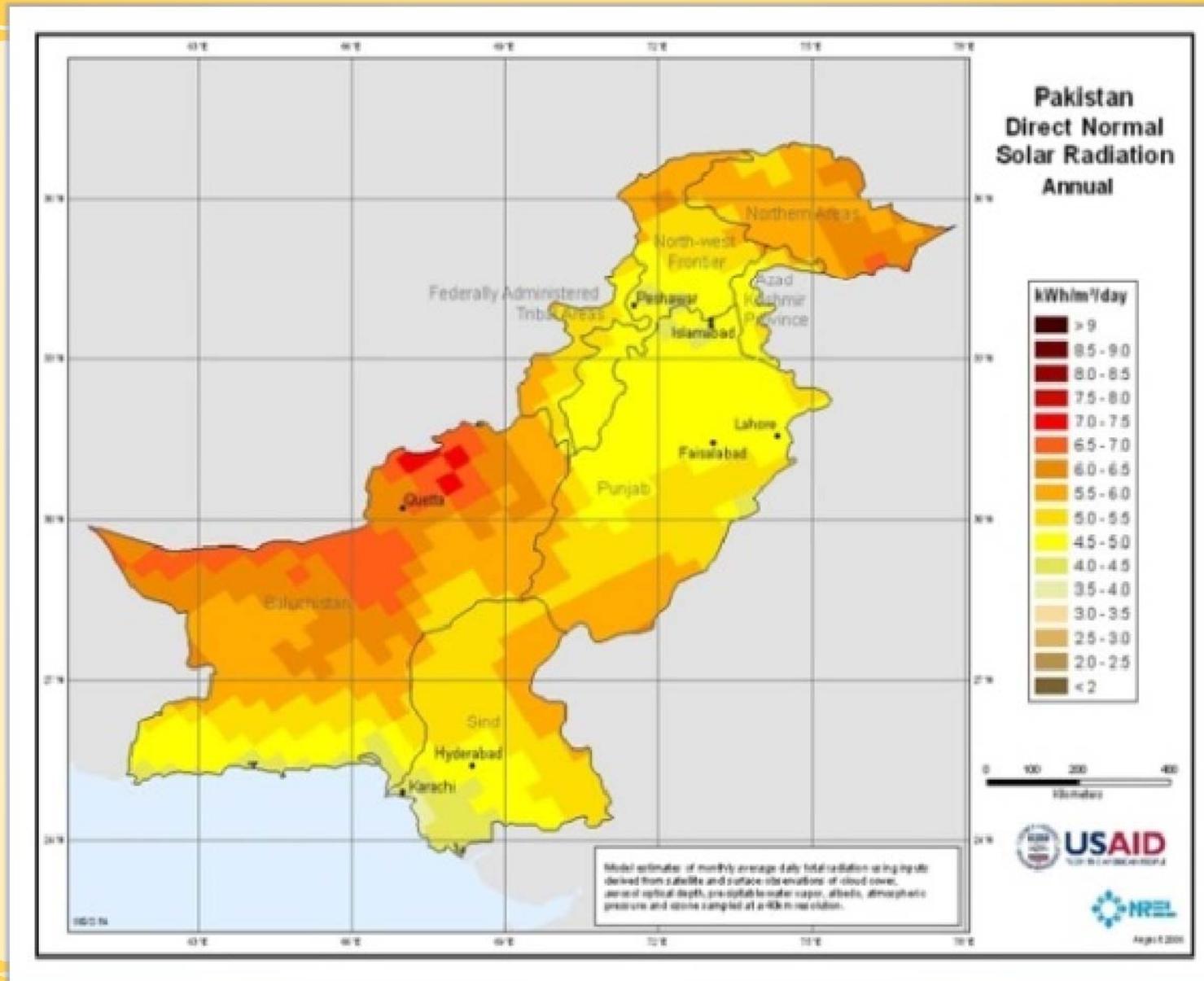
ALTERNATIVE & RENEWABLE ENERGY POTENTIAL

- Immense Potential of
 - Wind
 - Solar
 - Biomass
 - Waste-to-Energy
 - Small hydro (less than 50 MW)
 - Geothermal
 - Biofuels



- Initial macro level resource maps for wind and solar developed by NREL (USA).
- Resource mapping and spatial planning of solar , wind and biomass energy resources has been initiated with the support of the World Bank Resource Mapping Initiative.

* Based on NREL study conducted in 2006.

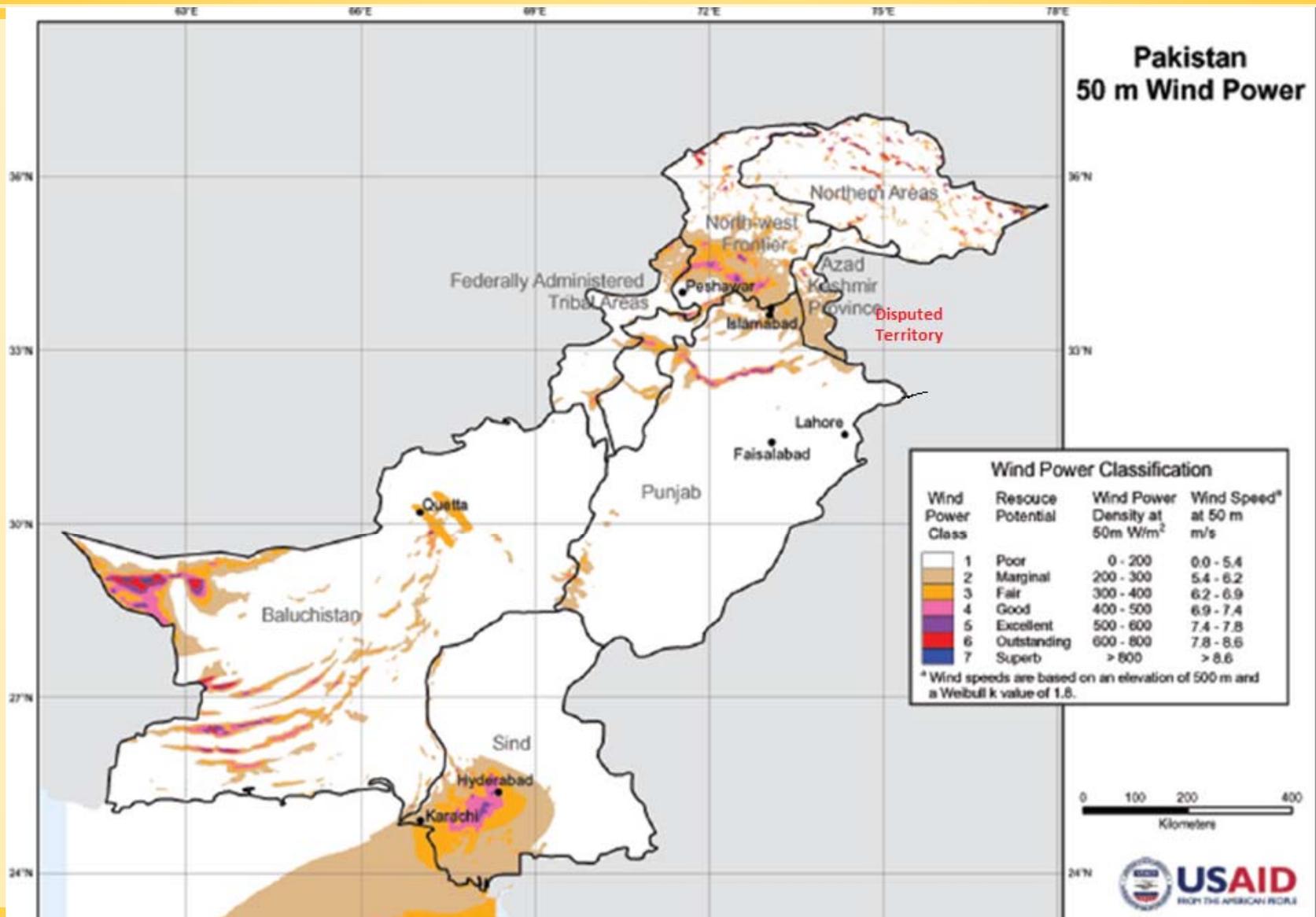


FUTURE PROSPECTS OF SOLAR ENERGY IN PAKISTAN

On-Grid Large Scale Solar Power Projects

- Development of solar on-grid power projects
- Plans to add 2500-3000 MW solar power generation in next 5-6 years.





INCENTIVES OFFERED (By Government of Pakistan)

- ❖ No custom's duty or sales tax on import of equipment
- ❖ No Income Tax / withholding tax / turnover tax
- ❖ Repatriation of Equity along with dividends freely allowed
- ❖ Mandatory purchase of electricity by power purchaser
- ❖ Government's Sovereign Guarantee
- ❖ Mandatory purchase of electricity from RE projects

7. Major difficulties and bottlenecks currently faced in formulating energy policies

Major difficulties and bottlenecks currently faced in formulating energy policies

- The **energy policy of Pakistan** is formulated and determined by the federal, provincial, and local institutional entities in Pakistan.
- Energy Policy requires the proper legislation, international treaties, subsidies and incentives to investment, guidelines for energy conservation, taxation and other public policy techniques.
- Policy implementation recommended by AEDB, Water & Power Ministry (as policy enforcer), the NEPRA regulates the energy sources network as well as determining the financial prices of the usage of energy.

8. Subjects you would like to study in the order of priority and the reason

Subjects you would like to study in the order of priority and the reason

- I would like to discuss and amend our Power Policy w.r.t our needs
- Proposed amendments in the Power Policy as of current situation
- Energy Demand and Forecasting
- Energy Supply forecasting

