Federal Ministry
for Economic Affairs
and Energy

MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

Target Market Analysis - Pakistan

Status: June 2018

Information concerning the potential for
Renewable Energy Technologies

Ralf Bernhard, Intersolar 2018

Facilitator

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Table of Content

Status: 2016

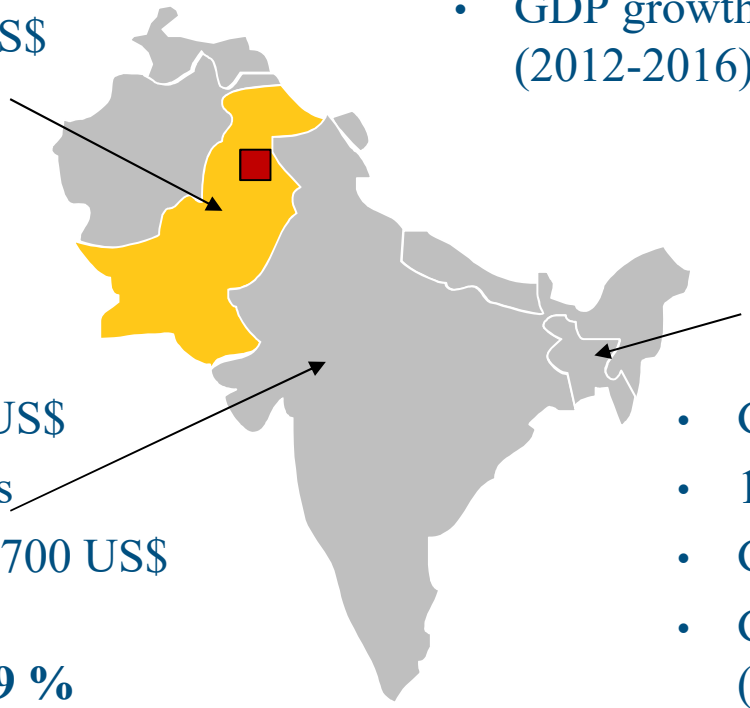
1. Regional Overview

Germany

- GDP =3,467 bn. US$
- 83 Mio. citizens
- GDP per capita: 41,770 US$
- GDP growth rate (2012-2016): **1.3 %**

Pakistan

- GDP = 284 bn. US$
- 208 Mio. citizens
- GDP per capita: 1,629 US$
- GDP growth rate (2016-2017): **5.28 %**



India

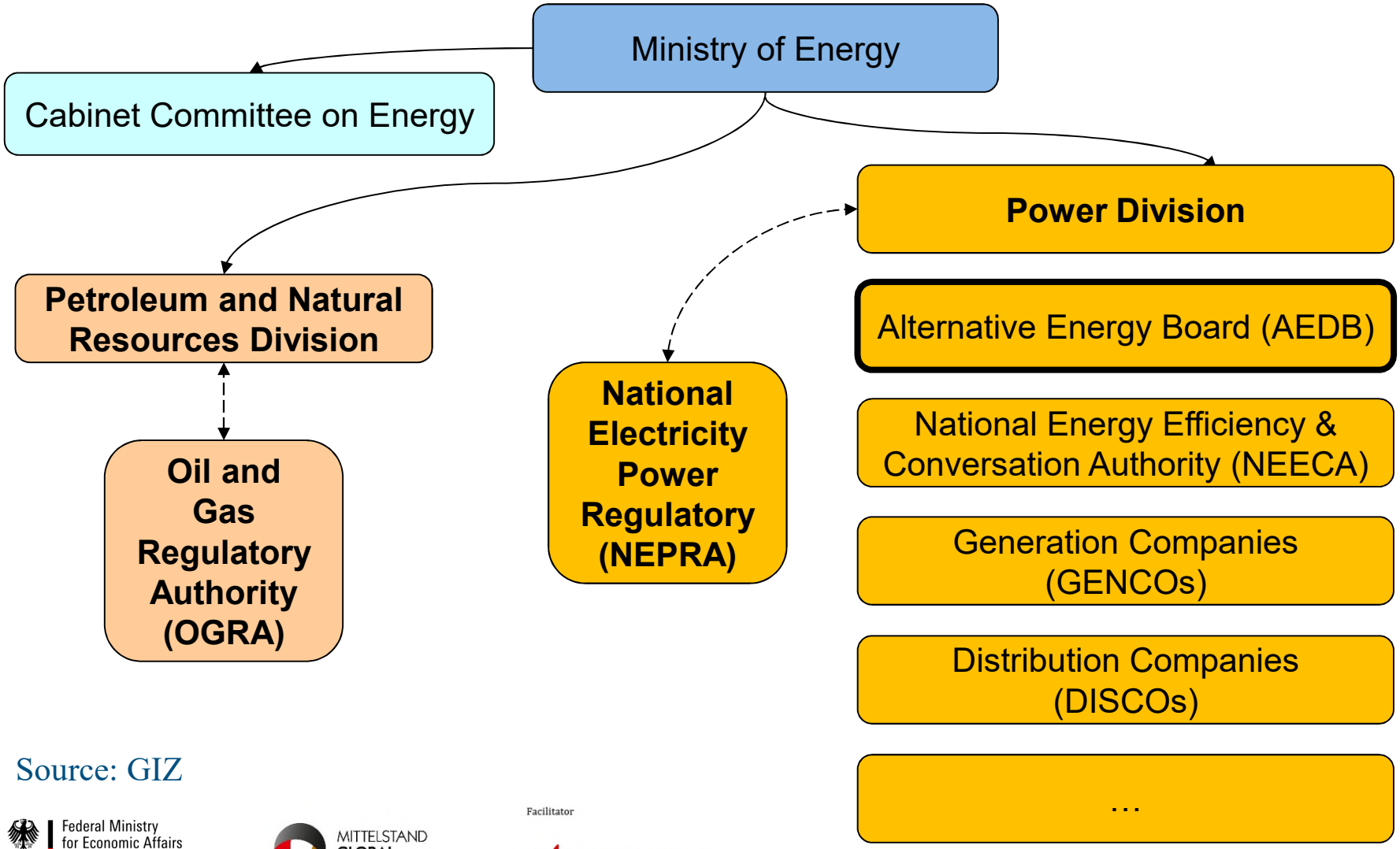
- GDP = 2,256 bn. US$
- 1,324 Mio. citizens
- GDP per capita: 1,700 US$
- GDP growth rate (2012-2016): **6.9 %**

Bangladesh

- GDP = 228 bn. US$
- 163 Mio. citizens
- GDP per capita: 1,400 US$
- GDP growth rate (2012-2016): **6.5 %**

Sources: pbs.gov.pk; finance.gov.pk; global-cliamtescope.org, worldenergy.org; data.worldbank.org

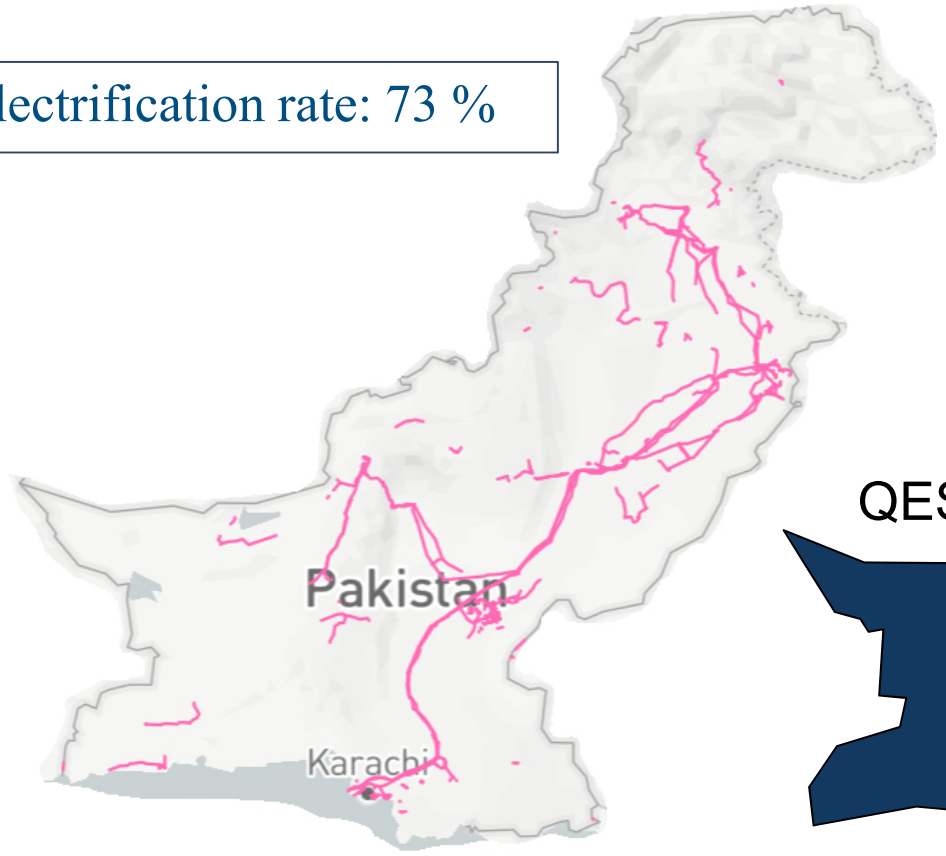
2. Governance structure



Source: GIZ

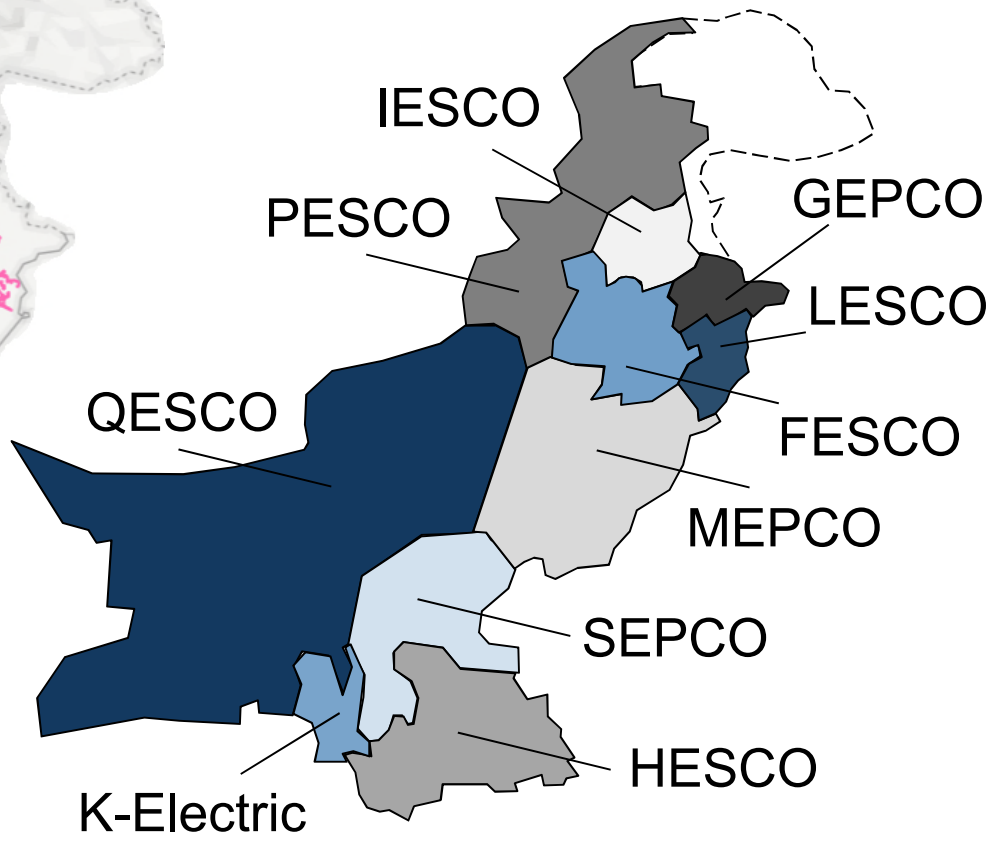
2. Energy Market

Electrification rate: 73 %



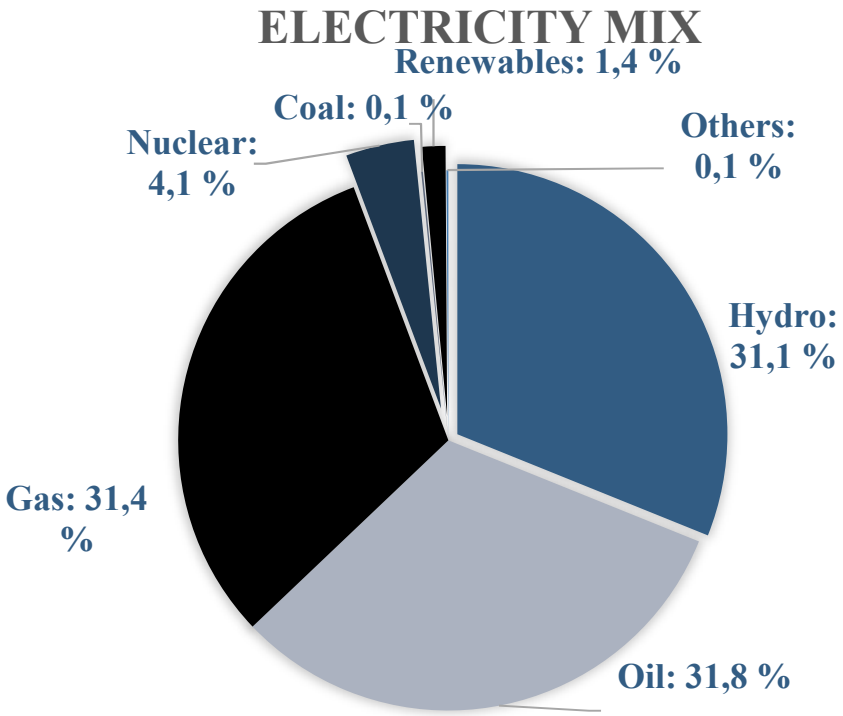
Source: energydata.info

Distribution Companies (DISCOs)



Source: www.dawn.com

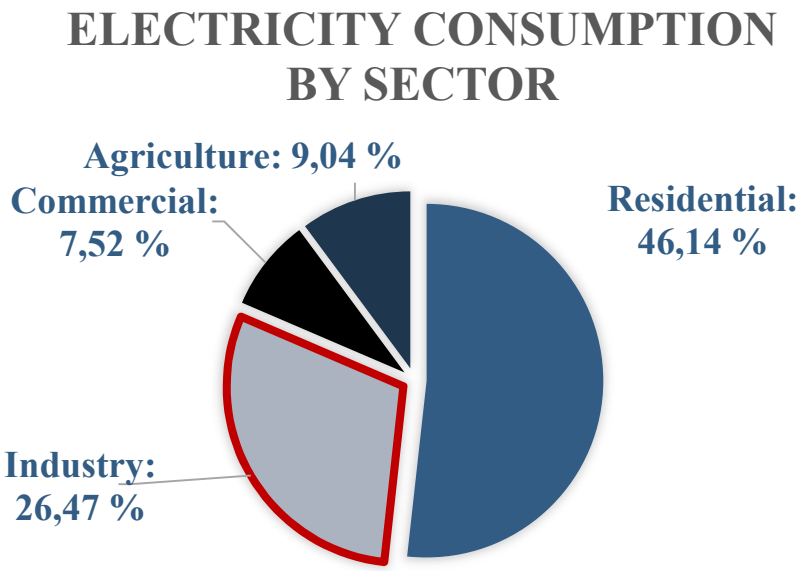
2. Fossil resources still dominate generation mix



Status: 2016

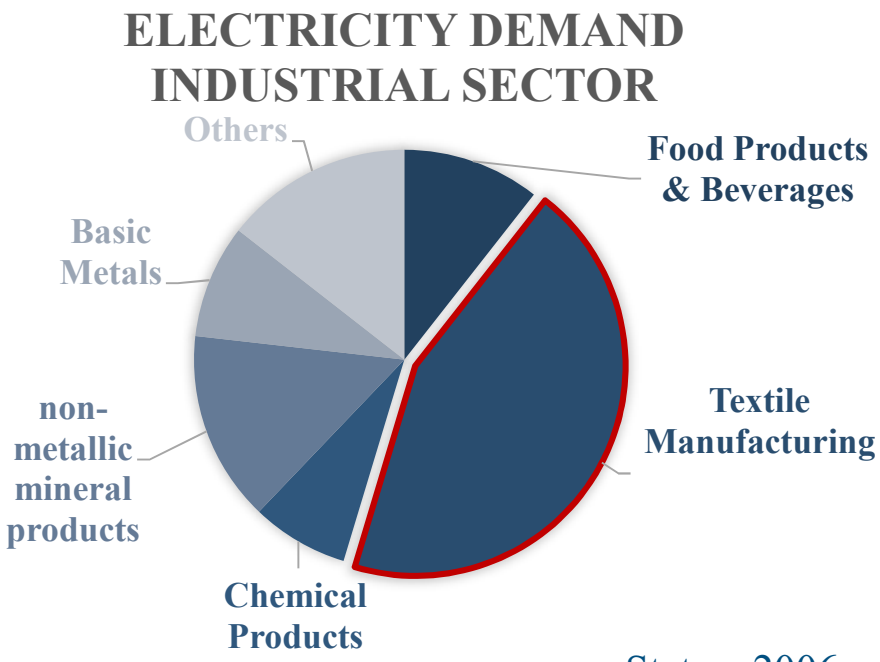
Source: IEA, 2015

2. Residential and industrial segments are key power consumers



Status: 2016

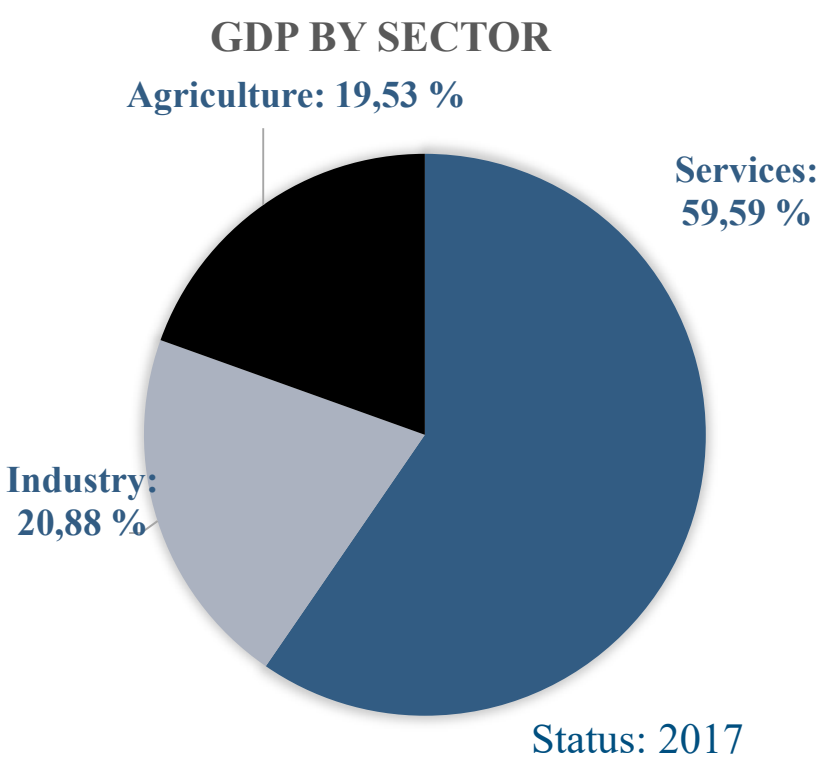
Source: IEA, 2015

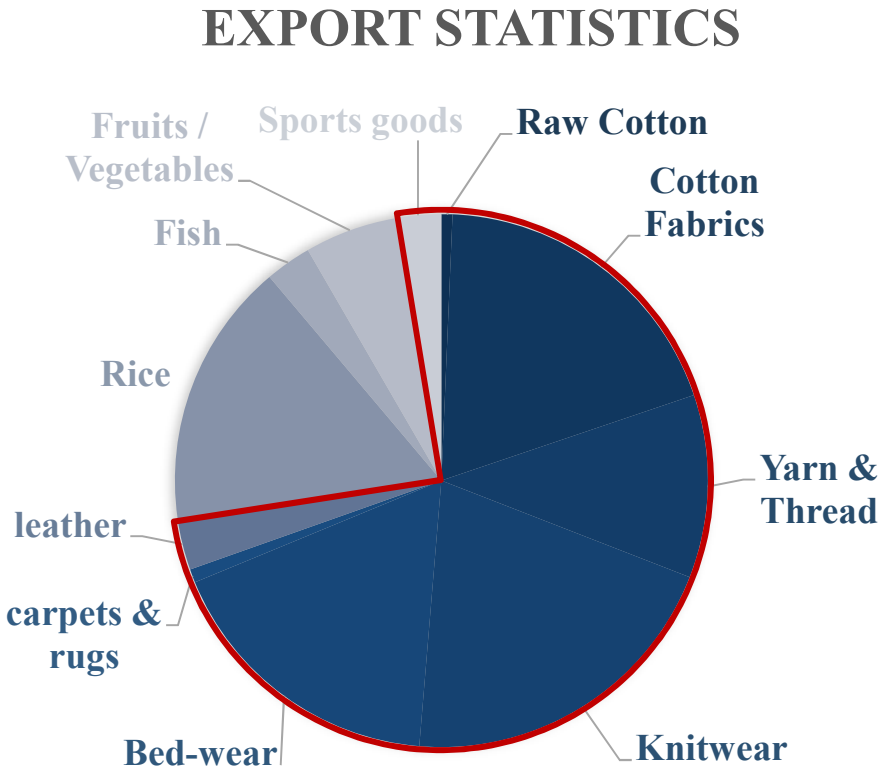


Status: 2006

Source: Pakistan Bureau of Statistics

3. Textile sector dominates exports





Source: Ministry of Finance (finance.gov.pk)

Textile Industry

4. Electricity Tariffs - Industry

Solar Net-Metering only for 3-phase meters, for which "Time-of-Use" Tariff applies"

Peak-Time
6 PM – 10 PM

1 USD = 115,55 PKR
(28/03/2018)

Industry	Fixed Charge [USD ₵ /kWh/month]	Peak [USD ₵/kWh]	Off-Peak [USD ₵/kWh]
a) Normal Rate			
< 25 kW	-	13.1	-
> 25 kW	360	12.6	-
b) By Time of Use			
< 25 kW	-	16.2	11.3
> 25 kW*	343	16.2	11.1

* Average values for categories (< 500 kW, < 5000 kW & > 5000 kW)

Prices are simple average prices from 4 out of 10 Distribution Companies

Applies for:

- Factories in the field of: Manufacturing, value addition, processing of goods (including office buildings)
- Three phase (400 V) Water pumps and tube-wells not meant for irrigation

Source: DISCO Websites

4. Electricity Tariffs – Commercial

Solar Net-Metering only for 3-phase meters, for which "Time-of-Use" Tariff applies"

Peak-Time
6 PM – 10 PM

1 USD = 115,55 PKR
(28/03/2018)

Commercial	Fixed Charge [USD ¢/kW/month]	Peak [USD ¢/kWh]	Off-Peak [USD ¢/kWh]
a) Normal Rate			
< 5 kW	-	15.8	-
> 5 kW	360	14.3	-
b) By Time of Use			
> 5 kW	360	16.3	11.3

Prices are simple average prices from 4 out of 10 Distribution Companies

Applies for:

- Shops
- Hotels/Guest Houses
- Restaurants
- Petrol Pumps & Service Stations
- Private Hospitals
- Cinemas/Theaters/Clubs
- Offices of Lawyers, Consultants etc.

Source: DISCO Websites

4. Electricity Tariffs - Agriculture

Solar Net-Metering only for 3-phase meters, for which "Time-of-Use" Tariff applies"

Agriculture*	Fixed Charge [USD ¢/kW/month]	Peak [USD ¢/kWh]	Off-Peak [USD ¢/kWh]
a) SCARP**			
< 5 kW	-	10.8	-
> 5 kW	180	13.5	8.0
b) Tube-Wells			
Normal	180	10.4	
by Time (> 5 kW)	-	10.1	8.0

Peak-Time

6 PM – 10 PM

1 USD = 115,55 PKR
(28/03/2018)

* Applies only for irrigation purpose

** Salinity Control and Reclamation Projects

Prices are simple average prices from 4 out of 10 Distribution Companies

Applies for:

- Pumps & tube-wells for agricultural irrigation purpose only

Source: DISCO Websites

4. Electricity Tariffs - Residential

Solar Net-Metering only for 3-phase meters, for which "Time-of-Use" Tariff applies

Residential / Public Buildings*	Peak [USD ¢/kWh]	Off-Peak [USD ¢/kWh]
a) < 5 kW		
< 50 kWh/m	1.8	
< 100 kWh/m	6.2	
< 200 kWh/m	7.9	
< 300 kWh/m	9.2	
< 700 kWh/m	14.5	
> 700 kWh/m	16.3	
b) > 5 kW		
by Time	16.1	11.2

Prices are simple average prices from 4 out of 10 Distribution Companies

Peak-Time
6 PM – 10 PM

1 USD = 115,55 PKR
(28/03/2018)

Applies for:	• Residences • Public buildings (religious & charitable institutions, hospitals, educational institutions)

Federal Ministry for Economic Affairs and Energy

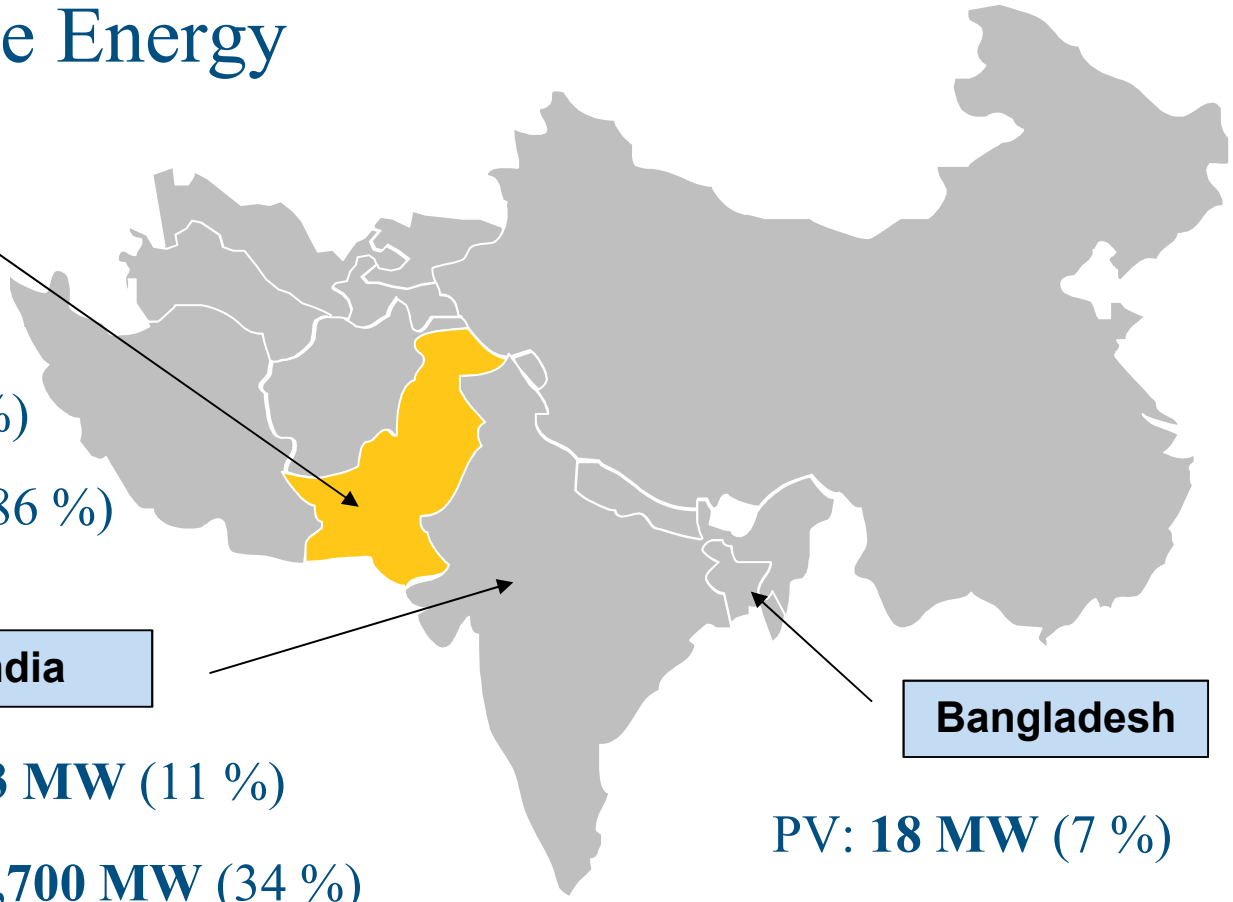
MITTELSTAND GLOBAL ENERGY SOLUTIONS MADE IN GERMANY

Facilitator

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Source: DISCO Websites

5. Renewable Energy



Pakistan

PV: **430 MW** (5 %)

Wind: **789 MW** (9 %)

Hydro: **7,270 MW** (86 %)

India

PV: **9,013 MW** (11 %)

Wind: **28,700 MW** (34 %)

Hydro: **47,228 MW** (55 %)

Bangladesh

PV: **18 MW** (7 %)

Wind: **3 MW** (1 %)

Hydro: **230 MW** (92 %)

Source: www.global-climatescope.org, www.worldenergy.org

5. Renewable Energy Law

Total PV in Operation 2017:
738 MW

2006

Policy for Development of Renewable Energy for Power Generation

- Target: **9,700 MW RE by 2030**
- RE defined as “Wind”, “Solar “ & “Hydro < 50 MW”

2015

Distributed Generation and Net Metering Regulations (Updated: 2017)

- Net Metering for Wind & Solar (1 – 1000 kW)
- PPA for 7 years
- guaranteed electricity tariff for 7 years
- Feed-in Tariff may be adjusted

2016

Wheeling of Electric Power

- Wheeling grid charges to be defined by authority

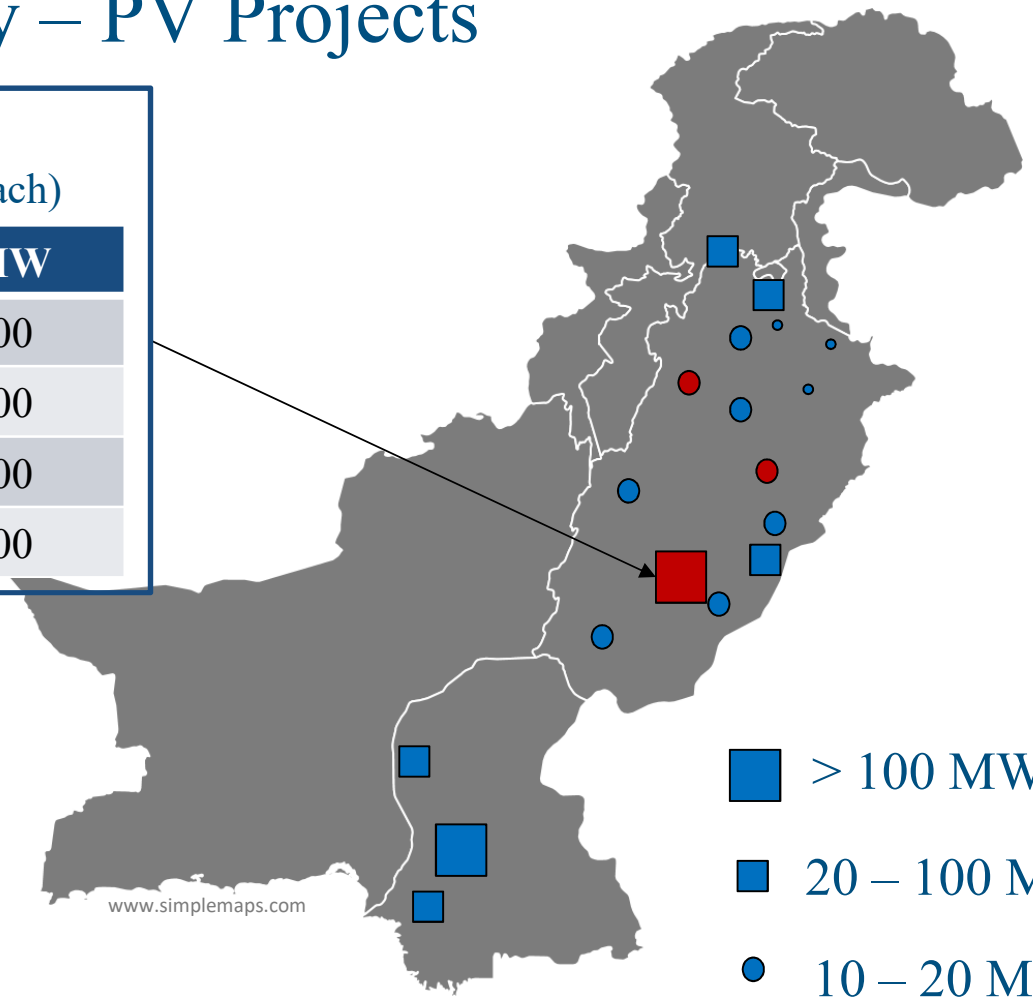
Source: GIZ

5. Renewable Energy – PV Projects

Quaid-e-Azam Solar Park

(in operation: 4 projects with 100 MW each)

EPC	MW
Tebian Electric Apparatus	100
Zonergy	100
Best Green Solar	100
Crest Energy Solar	100



- in operation
- in project pipeline (letter of interest issued)

- > 100 MW
- 20 – 100 MW
- 10 – 20 MW
- < 10 MW

Source: AEDB

5. Renewable Energy – Wind Energy Projects

Location / Status	Jhimpir	Gharo	Nooriabad	Gajju	Total
In Operation	589.5	199			**789**
Under Construction *	396.7	48.3			**445**
In project pipeline **	150			14	**164**

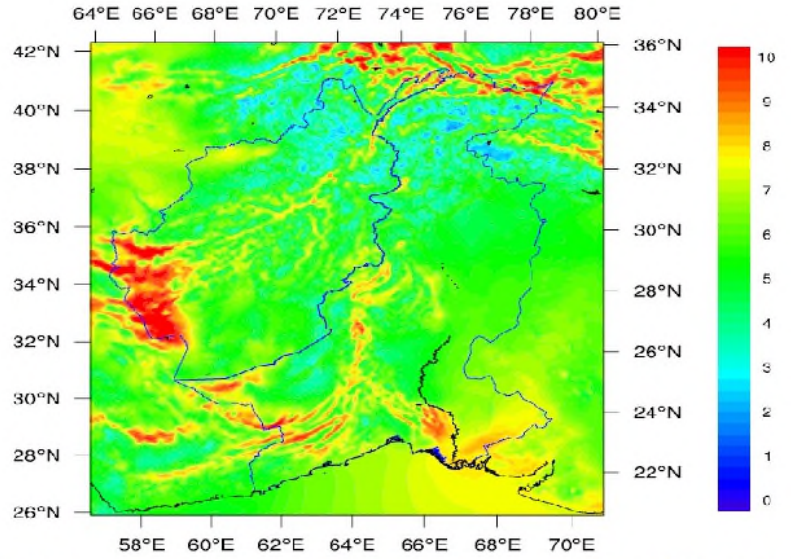
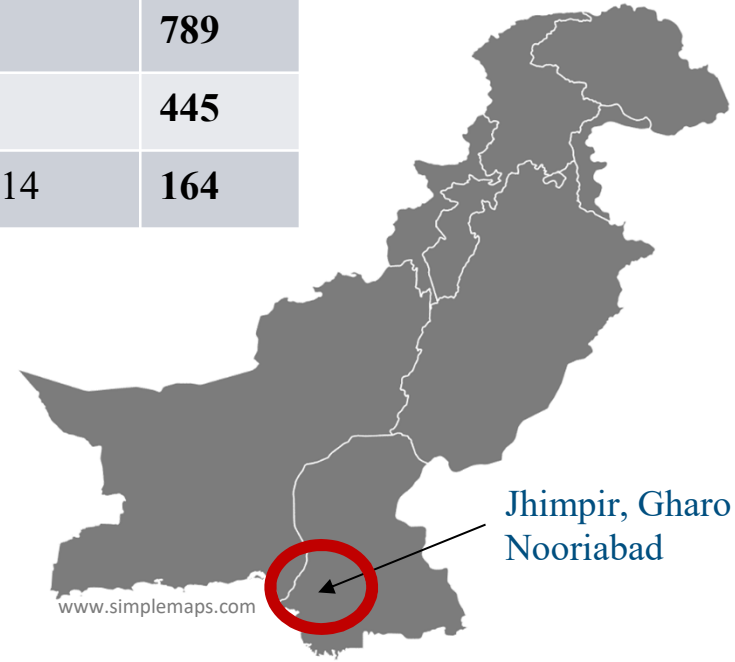


Figure: Mean annual simulated wind speed at 100 m above ground level from WRF simulation at 5 km x 5 km grid spacing for the period 2001 to 2010 inclusive. The colour scale indicates wind speed in m/sec.



* Energy Purchase Agreement (EPA) and Implementation Agreement (IA) signed

** EPA & IA negotiations or ongoing feasibility study

Source: AEDB

Status: 16/03/2018

Federal Ministry for Economic Affairs and Energy

MITTELSTAND GLOBAL ENERGY SOLUTIONS MADE IN GERMANY

Facilitator

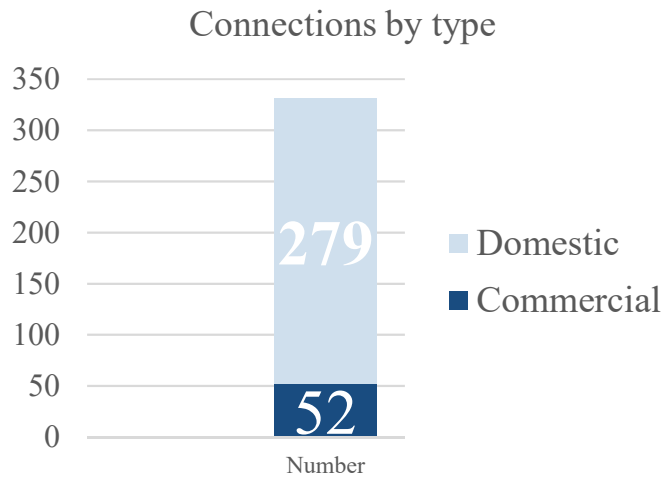
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

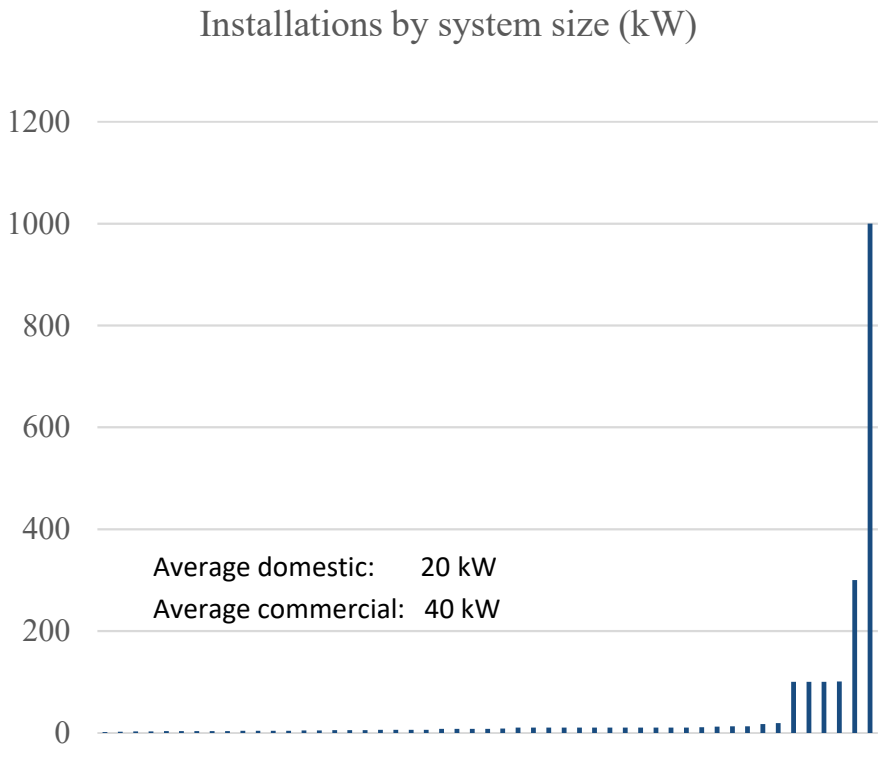
5. Distributed Renewable Energy Legal Instruments

PPA	Lease	Net-Metering
• NEPRA gets involved • Lengthy approval process • No limit for system size • Captive production only	• No involvement of NEPRA • Approvals not needed • No limit for system size • Captive production only	• NEPRA issues license • Easy approvals - 30 days • System size limit: 1MWp • Can be fed into the grid

VS. VS.

5. Renewable Energy: Net Metering Status update (04/18)

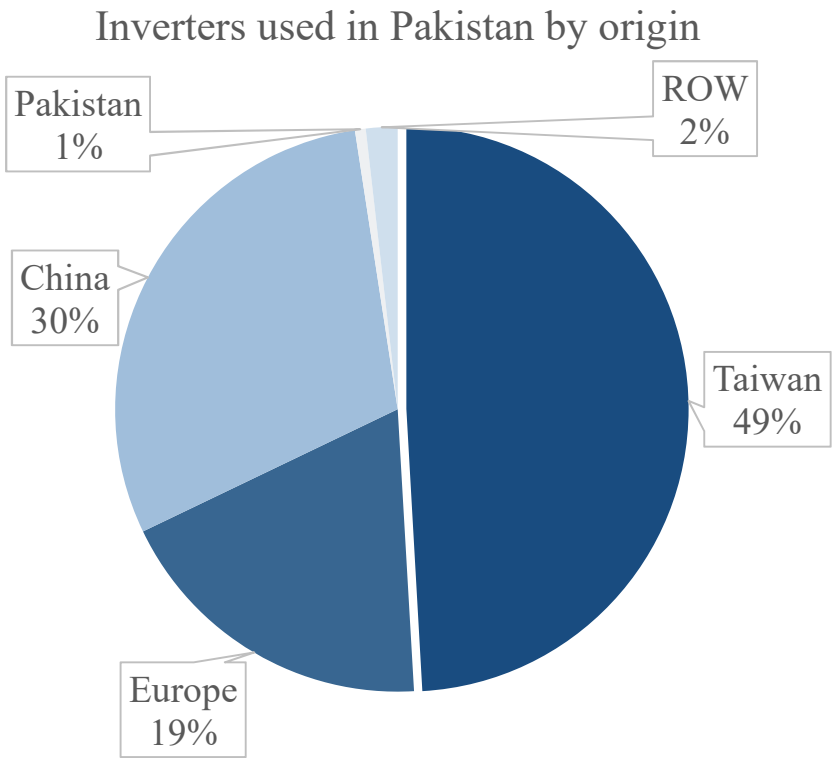


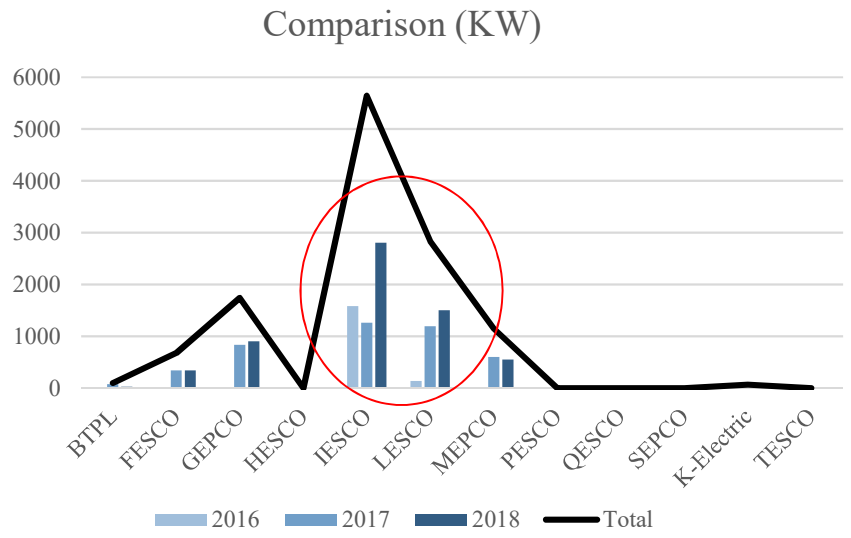


Source: Own illustration based on AEDB data

→ About 7.5 MW of Net Metering systems installed

5. Renewable Energy: Net Metering Status update (04/18)





Source: Own illustration based on AEDB data

6. Embedded Generation

… may be suitable in case of:

- Off-Grid Systems due to low electrification rate → Electrification rate: 73 %
- frequent Power Cuts ?
- LCOE Solar PV less than Grid Tariff ?

6. Project opportunities exist for embedded generation

Electricity demand: 22,559 MW
Electricity supply: 17,261 MW

5298 MW capacity shortage!
(Status: 2016)

Indicator	
Percentage of firms experiencing electrical outages [%]	81.1
Number of electrical outages per month	75.2
Duration of a typical electrical outage [h]	16.9
Average losses due to electrical outages [% of annual sales]	33.8
Percentage of firms owning of sharing a generator [%]	65.4
If generator is used, average proportion of electricity from a generator [%]	41.4

Enterprise Surveys (http://www.enterprisesurveys.org), The World Bank.

Status: 2013

75 % of Pakistan's firms mention electricity as the major constraint for their business

6. Embedded Generation – Business Case

Industrial generation coupled with Diesel powered generation

Financial Assumptions (500 kWp system)	
Specific cost solar (PKR/Wp)	120
Inflation / CPI increase (% p.a.)	5%
Debt case:	
Debt (% of total)	75%
Interest rate (%)	10%
Tenor (years)	10

Financial Results	
Investment (PKR)	60.2 million
Payback (years)	6.0
NPV (PKR)	67 million
IRR (unleveraged)	21%
IRR (leveraged)	32%

Other Assumptions:

- There is no battery storage
- All of the electricity being generated is either being consumed by the industry or net-metered to the grid

Source: Business Case for Implementation of Net-Metering Regulations 2015; GIZ Pakistan – April 2016

6. Embedded Generation – Business Case

Sample Project – Textile Factory in Faisalabad, Pakistan

Potential System Design (Base case)

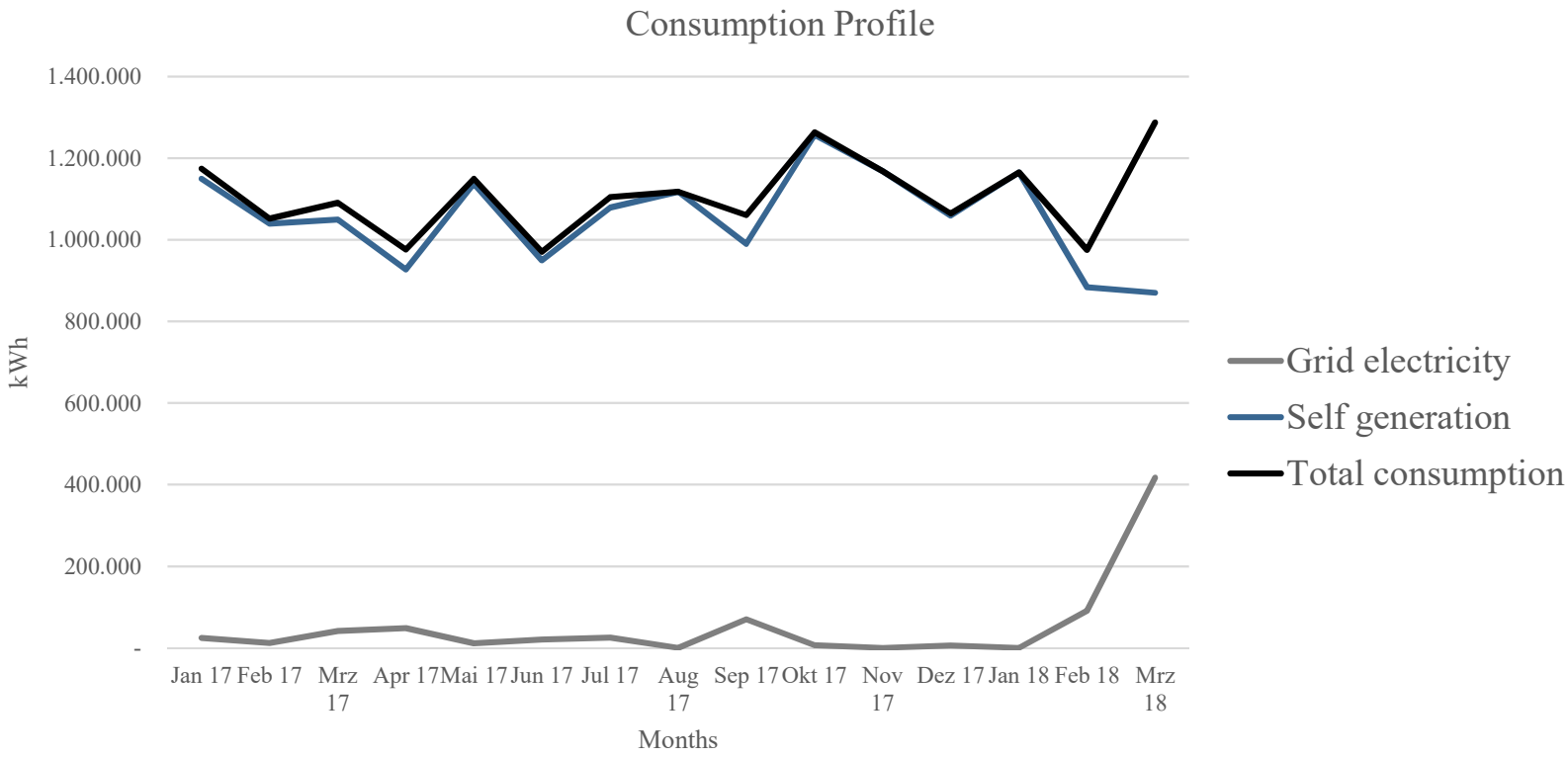
- Available roof area: **10,900 sq. m.**
- Potential system size*: **200-350 kWp**
- Solar PV Yield: 1,457 kWh / kWp / year
- Operation 24/7
- Exporting textile to Europe & US; three large clients in Germany

***Note:** Initial system required to cater to the needs of the administrative building primarily, and to pilot the performance of solar to graduate to a larger system subsequently, subject to satisfactory performance.

Source: Client visit

6. Embedded Generation – Business Case

Sample Project – Textile Factory in Faisalabad, Pakistan



Source: Client visit

6. Embedded Generation – Business Case

Sample Project – Textile Factory in Faisalabad, Pakistan

Key project data:

- Available roof area: **10,900 sq. m.**
- Annual power demand: **13,194 MWh**
- Daily peak demand: **~2.5 MW**
- Average daily demand: **~2 MW**
- Consumption pattern: variable on a monthly basis – monthly consumption between **970 MWh to 1,287 MWh**
- Electricity price of current electrical supply (grid and gen-set): **10 $ ¢ and 8.6¢ - 20 $ ¢ per kWh respectively**

→ Simple Payback ~ 5 years

Source: Client visit

7. Solar PV Generation – Financing Options

Regular Financing

- Available through commercial banks
- Normally at KIBOR + ~3.5%
- So far only available for large scale projects (IPPs)
- Retail financing products not developed

VS.

RE Refinancing Scheme by SBP

- Available through commercial banks
- Fixed at 2% + up to 4%
- Has two categories: 4kW - 1MW and 1MW - 50MW
- Small scale financing available to large corporate groups only

The RE Refinancing scheme of the State Bank of Pakistan will expire on June 30, 2019. However, the bank may decide to extend the scheme with or without revisions.

Federal Ministry
for Economic Affairs
and Energy

MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

Thank you for your attention!

Ralf Bernhard
Project Development Programme
GIZ GmbH
ralf.bernhard@giz.de
+49 (0)30 338424-640

Facilitator

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH