

**NATIONAL TRANSMISSION & DESPATCH COMPANY LIMITED
(NTDCL), PAKISTAN**

Country Scenario - Pakistan

**SAARC Perspective Workshop on the Past, Present and Future of
High Voltage DC (HVDC) Power Transmission**

30 September – 1 October 2015, Lahore, Pakistan

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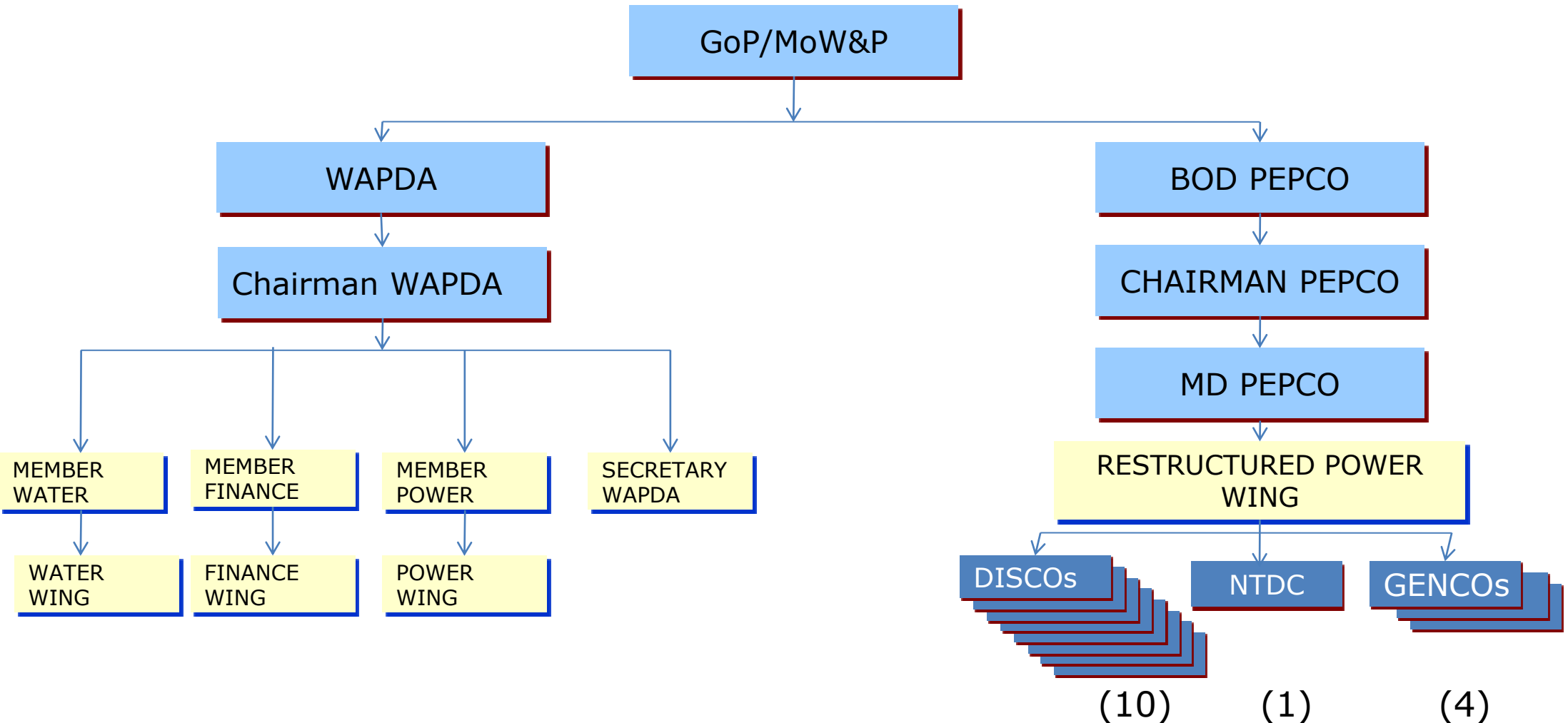
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Overview of Power System of Pakistan

PAKISTAN POWER SECTOR: BACKGROUND

- **Two electric power utility systems operating in Pakistan since 1958:**
 - **Water and Power Development Authority (WAPDA)**
 - **Karachi Electric Supply Corporation (KESC)**
- **Pakistan Power Sector Strategic Plan was approved in 1992 for restructuring the power sector and introducing reforms. In the late 90's, the Power wing of WAPDA was unbundled into:**
 - **1 National Transmission and Despatch Company (NTDC);**
 - **4 Generation Companies (GENCOs); and**
 - **10 Distribution Companies (DISCOs)**

RESTRUCTURING OF POWER SECTOR



Two Power Grid Systems Currently in Operation

1. National Transmission and Despatch Company Limited (NTDCL)

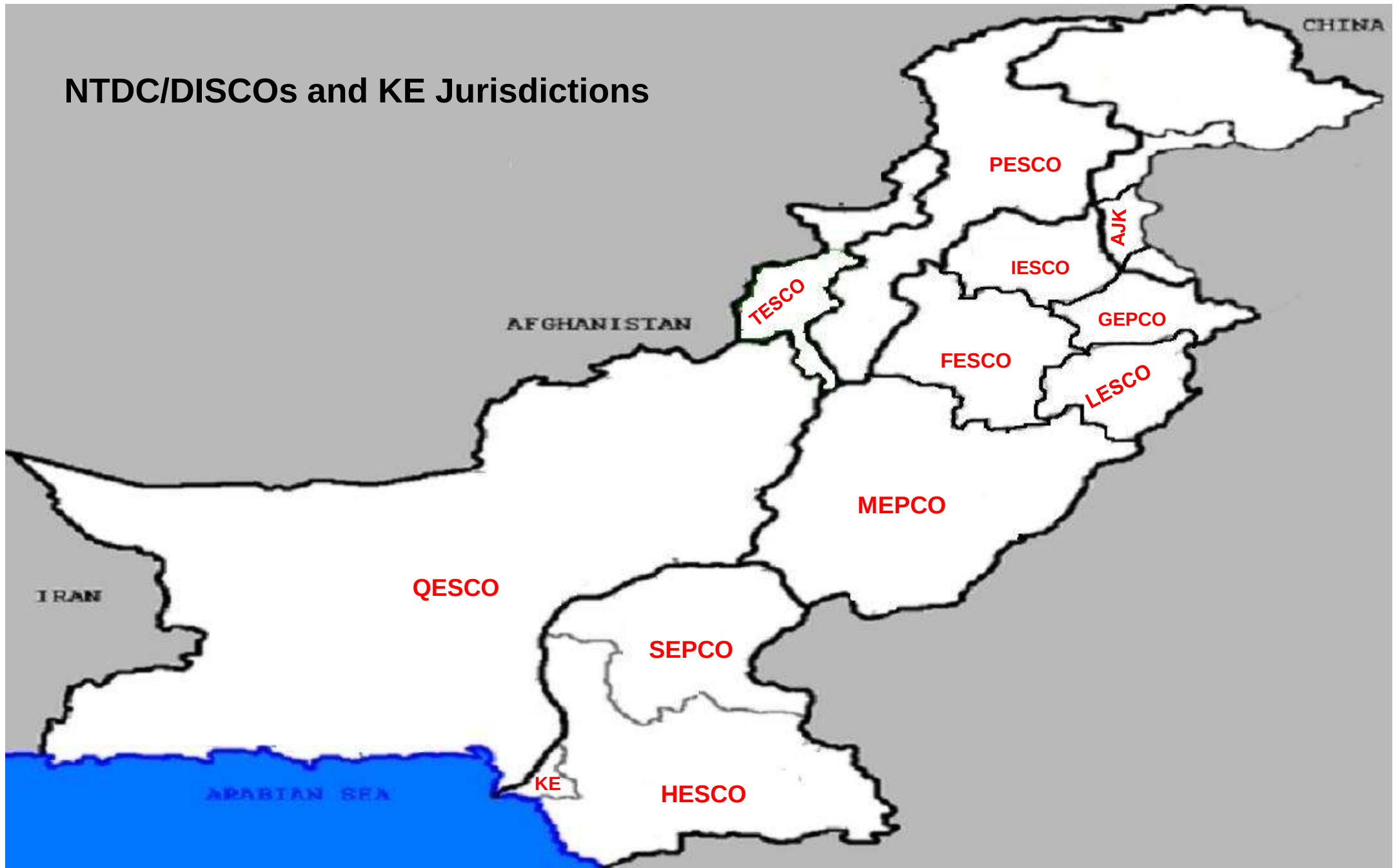
- Public limited Company and incorporated in 1998.
- National Grid Company. Operates all over the country except Karachi.
- Responsible for planning, design, construction, maintenance and operation of 500kV and 220kV network.
- Purchases power from Hydro Power Stations, GENCOs, IPPs etc. and Sells power to Distribution Companies (DISCOs) through its network.
- Exports power to K-Electric.
- Acts as Transmission Network Operator and System Operator.
- Deals with Cross-border Electricity Trade.

2. K-Electric

(formerly known as Karachi Electric Supply Company (KESC))

- Private Limited Company. Operating since 1913.
- Generates, transmits and distributes power in Karachi city & some surrounding areas.
- Purchases power from IPPs located in its territory.
- Imports power from NTDCL.

NTDC/DISCOs and KE Jurisdictions



Existing Generation Capacity of NTDCL System

(as of August 2015)

1. Hydro

• WAPDA	6902 MW
• IPPs	195 MW
• Sub-Total	7097 MW (31.1%)

2. Thermal

• GENCOs	6001 MW
• IPPs	8866 MW
Sub-Total	14867 MW (64.9%)

3. Nuclear	665 MW (2.9%)
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4. Wind	256 MW (1.1%)
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TOTAL	22, 885 MW
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NTDCL SYSTEM HISTORICAL SURPLUS / DEFICIT

Years	Available Capability (MW)	Computed Peak Demand (MW)	Surplus/ Shortfall (MW)
2003-04	11834	11598	236
2004-05	12792	12595	197
2005-06	12600	13847	-1247
2006-07	13292	15838	-2546
2007-08	12442	17398	-4956
2008-09	13637	17852	-4215
2009-10	13445	18467	-5022
2010-11	13193	18521	-5328
2011-12	12320	18940	-6620
2012-13	13577	18827	-5250
2013-14	14584	20576	-5992
2014-15	15489	20966	-5477

Existing Generation Capacity & Load Demand of K-Electric

as of June 2014

- **Generation Capacity**

- 1. Thermal

• Own Plants	2422 MW
• IPPs & Others	290 MW
Sub-total	2712 MW (95.1%)

- 2. Nuclear

	137 MW (4.9%)
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Total Installed Capacity	2849 MW
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- Load Demand: 2929 MW
- K-Electric imports 650 MW from NTDCL

Government Priorities for Future Generation to Improve Power Supply Position

- **Addition of hydropower generation in North.**
- **Addition of imported-coal based generation in South near coast**
- **Development of Indigenous coal based power generation in South at Thar.**
- **Addition of imported coal based generation at/near mid-country load centers.**
- **Addition of Renewable Energy:**
 - *Wind Power Projects near coast*
 - *Solar power projects near load centers*
 - *Cogeneration power projects near load centers*
- ***Import of Power through Cross-border Interconnections.***

Summary of Generation Additions up to Year 2019-20

Sponsors	Generation Addition (MW)
WAPDA Hydel	4023
IPP Hydel	247
Sub-total Hydel	4270
GENCOs	1320
IPP Thermal	12713
Sub-total Thermal	14033
Nuclear	680
Wind	1500
Solar	900
CASA (Import)	1000
Total	22383

NTDCL System Surplus / Deficit in Future

Years	Available Capability	Computed Peak Demand	Surplus/ Shortfall
2015-16	17820	23107	-5287
2016-17	21285	24466	-3181
2017-18	27932	26409	1523
2018-19	29039	28511	528
2019-20	31756	30785	971

Transmission Voltage and Technology in Power Grid System of Pakistan

The voltage levels and technologies used in the existing power grid and proposed for the future grid expansion are as under:

AC Voltage:

- *500 kV & 220 kV: Used in the existing and future expansion of NTDCL system. 220 kV is used in the existing and future expansion of K-Electric system.*
- *132 kV & 66 kV : Used in existing system and future expansion of Distribution Companies and K-Electric. 66 kV system will be gradually upgraded to 132 kV.*

HVDC Voltage for Future Grid Expansion:

± 600 kV: Proposed for South to mid-country bulk power transfer.

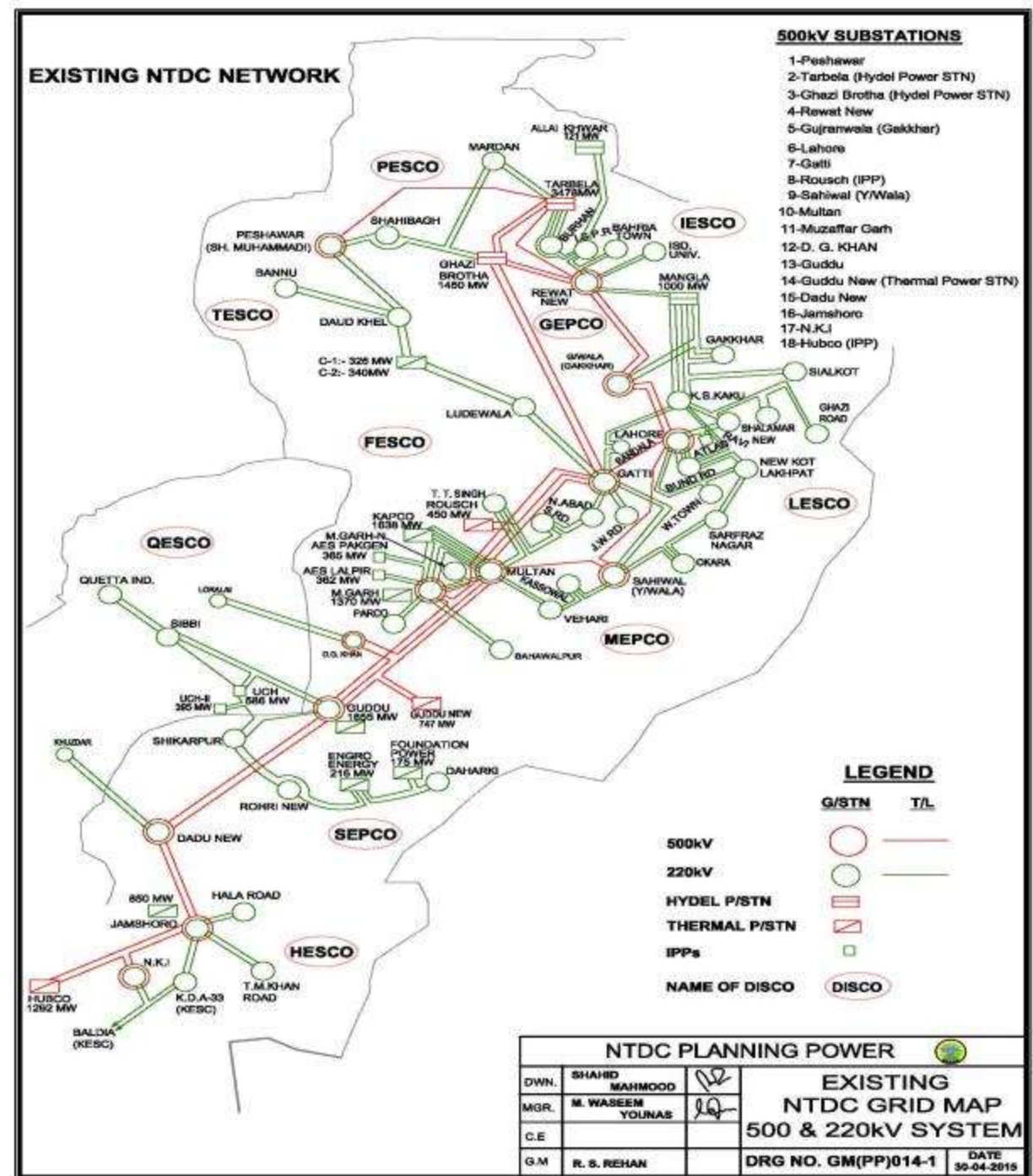
± 500 kV: Proposed for Cross-border Interconnections.

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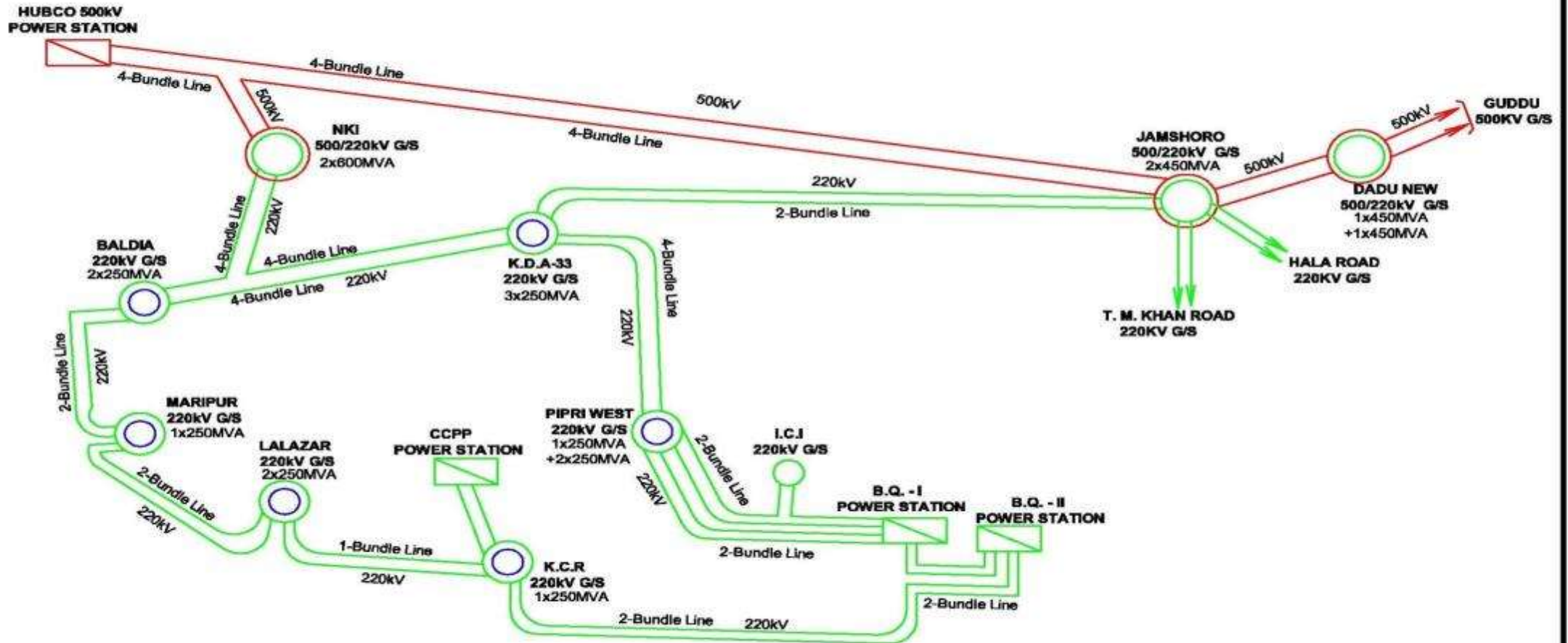
Existing Transmission Networks of NTDCL and K-Electric

Salient Features of NTDCL Network

- North to South longitudinal network.
- Hydro generation in North and major thermal generation in South & in lower middle part of network
- Large load centers are remote from major generation sources.
- Seasonal variation in generation dispatch and in power flows



EXISTING INTERCONNECTION ARRANGEMENT BETWEEN NTDC AND KESC



Planned Transmission Network of NTDCL (Year 2019-20)

NTDCL TRANSMISSION SYSTEM - EXISTING AND FUTURE PLAN

Sr. No.	Description	Existing as of 2015		Additions up to 2019-20	
		Quantity	Capacity	Quantity	Capacity
		(No.)	(MVA)	(No.)	(MVA)
1	No. of 500 kV Grid Stations	18	18,624	07	11,000
2	No. of 220 kV Grid Stations	48	24,063	21	15,220
3	Length of 500 kV Transmission lines	5,197 km	-	3,306 km	-
4	Length of 220 kV Transmission lines	9,184 km	-	1,576 km	-
5	± 500kV HVDC Convertor Station at Peshawar New	-		1000 MW	
6	±500 kV HVDC Bipole Transmission line from Pak-Afghan Border to Peshawar New	-		100 km	
7	± 600 kV HVDC Bipole Converters (Matiari & Lahore)	-		4000 MW	
8	±600kV HVDC Bipole Transmission line (Matiari - Lahore)	-		878 km	
9	± 600 kV HVDC Bipole Converters (Port Qasim & Faisalabad West)	-		4000 MW	
10	±600kV HVDC Bipole Transmission line (Port Qasim – Faisalabad West)	-		1050 km	

Note: In the existing system, the IPPs, Privately Owned, Hydel & GENCO owned generating substations have also been included.

Planned and Under Consideration HVDC Projects

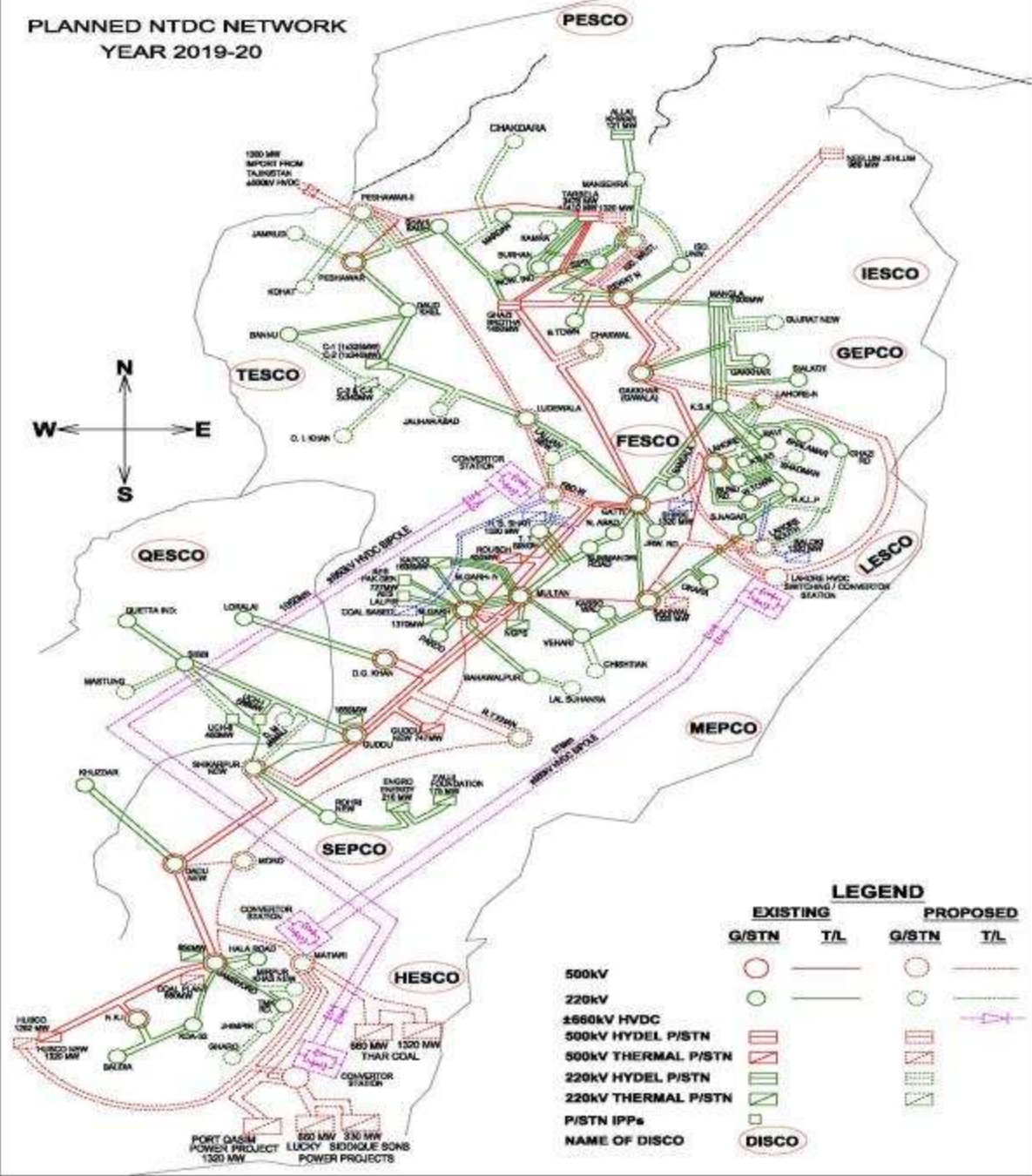
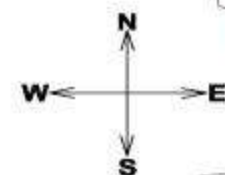
Domestic Projects

- 1. $\pm 600\text{kV}$ HVDC Bipole Transmission line (Matiari - Lahore)**
- 2. $\pm 600\text{kV}$ HVDC Bipole Transmission line (Port Qasim – Faisalabad West)**

Cross-border Interconnections

- 1. Import of Power from Tajikistan/Kyrgystan through Afghanistan
(CASA-1000 Project)**
- 2. Import of Power from Iran**
- 3. Import of Power from India**

PLANNED NTDC NETWORK
YEAR 2019-20



**Import of 1000-1300 MW Power
through CASA-1000 Project
(Pakistan – Afghanistan – Tajikistan –
Kyrgystan Interconnection)**

CASA-1000 Project

- **Transport of surplus power (1300 MW) during 5 summer months from Kyrgyz Republic and Tajikistan to Afghanistan (300 MW) & Pakistan (1000 MW)**
- **Scope of Work:**
 - 750 km $\pm$ 500 kV HVDC Bipole between Tajikistan and Pakistan via Afghanistan; and Converter Stations at Sangtuda, Kabul & Peshawar
 - 477 km 500 V AC link between the Kyrgyz Republic (Datka) and Tajikistan (Khoujand)
 - AC system upgrades on existing lines



Pakistan - Iran Interconnections

Pakistan – Iran Interconnection Projects

1. Existing Interconnection Projects:

Import of 74 MW Power by Pakistan in border areas of Pakistan (in Baluchistan Province):

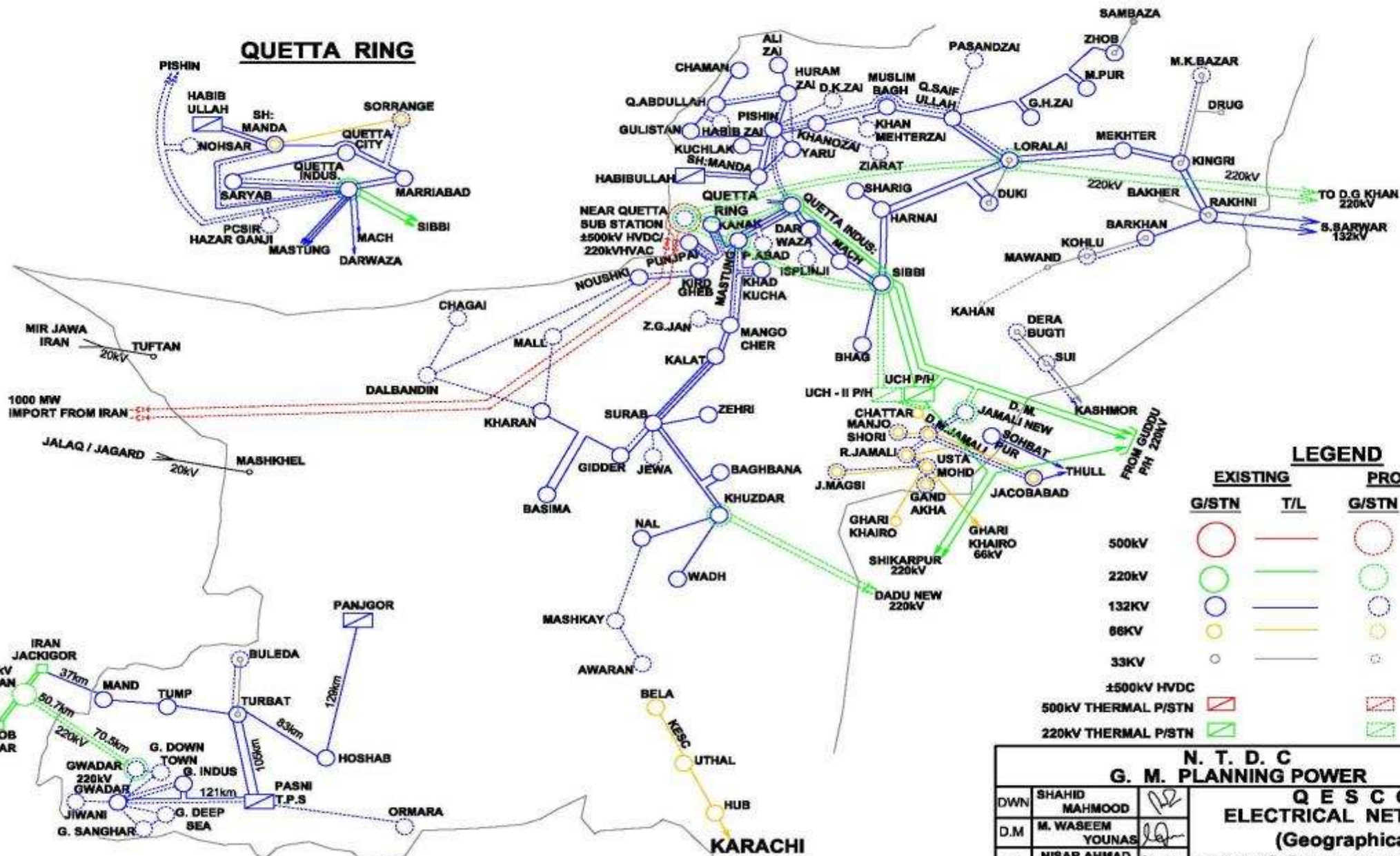
- i. 70 MW at 132 kV (continued since 2003. Initially, it was 35 MW)
- ii. 4 MW at 20 kV (continued since 2002)
- iii. (Tariff: US cents 7-10. Contracts is renewed after every 3-years)

2. Planned Interconnection Projects:

- i. Import of 100 MW at Gwadar through 220 kV D/C T/Line (contract signed)
- ii. Import of 1000 MW at Quetta through ± 500 kV HVDC Bipole (MoU signed)**

For import of power from Iran, Tariff is linked with International Oil prices.

QUETTA RING



LEGEND

EXISTING PROPOSED

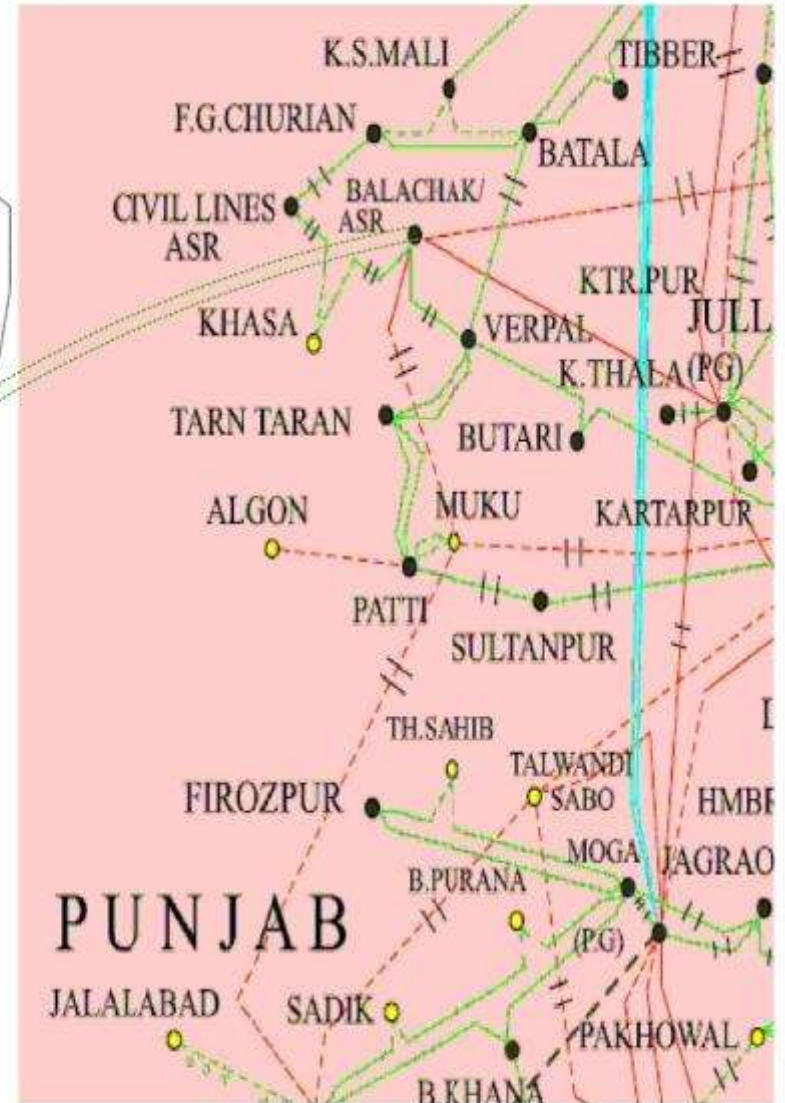
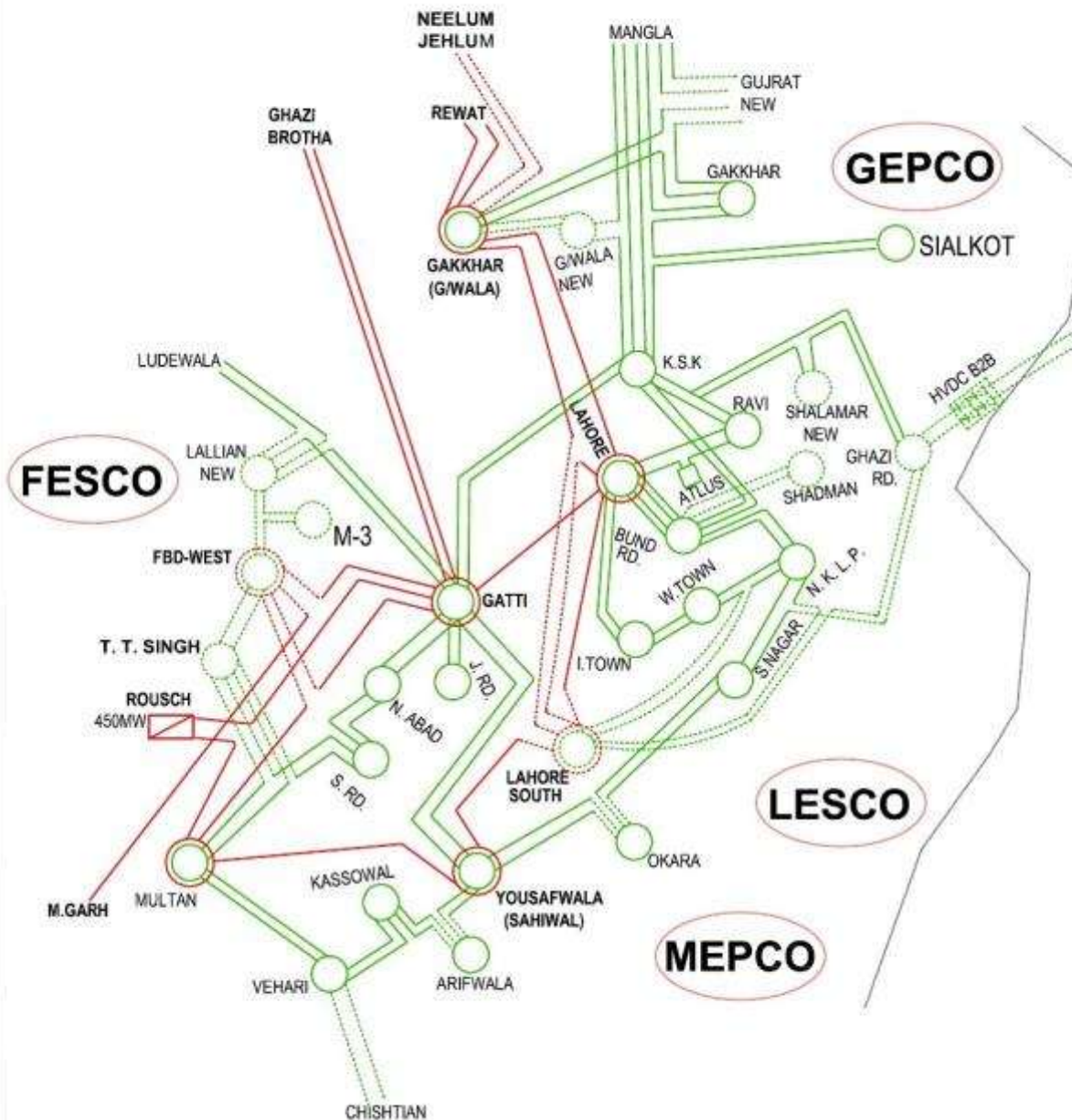
G/STN	T/L	G/STN	T/L
500kV			
220kV			
132KV			
66KV			
33KV			
±500kV HVDC			
500kV THERMAL P/STN			
220kV THERMAL P/STN			

N. T. D. C
G. M. PLANNING POWER

DWN	SHAHID MAHMOOD		QESCO ELECTRICAL NETWORK (Geographical) EXPANSION PLAN UPTO 2020
D.M	M. WASEEM YOUNAS		
C.E	NISAR AHMAD BAZMI		
G.M	MUHAMMAD DAUD		
DRG# GMPP/Geog/Q/010			DATE 31-05-11

Pakistan - India Interconnection

**ARRANGMENT FOR 500 MW TRANSFER THROUGH HVDC B2B
(PAKISTAN-INDIA INTERCONNECTION)**



Pakistan – India Interconnection

Scope of Work:

A pre-feasibility study for import of 500 MW power by Pakistan from India was conducted by consultants (M/s Tetra Tech, USA and M/s Hagler Bailly, Pakistan in 2012-13. The study was funded by World Bank.

In the study report, the following scope of transmission interconnection was proposed:

- 400/220 kV HVDC Back-to-Back Converter Station in Pakistan
- 400 kV D/C T/Line (approx. 26 km) from Balachak to Pak-India Border.
- 400 kV D/C T/Line (approx. 10 km) from Converter Station to Pak-India Border
- 220 kV D/C T/Line from Ghazi Road to Converter Station

Cost Estimates: US\$ 119.4 million

Thank You



PLANNED NTDC NETWORK
YEAR 2019-20

