Grid Interconnection Studies of Bagasse Based Co-generation Power Plants in Pakistan

Case Study

Presented by Hassan Jafar Zaidi

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at

SAARC Workshop on Application of on-grid Biogas Technologies

16-17 May, 2016

Intercontinental Hotel Kabul, Afghanistan

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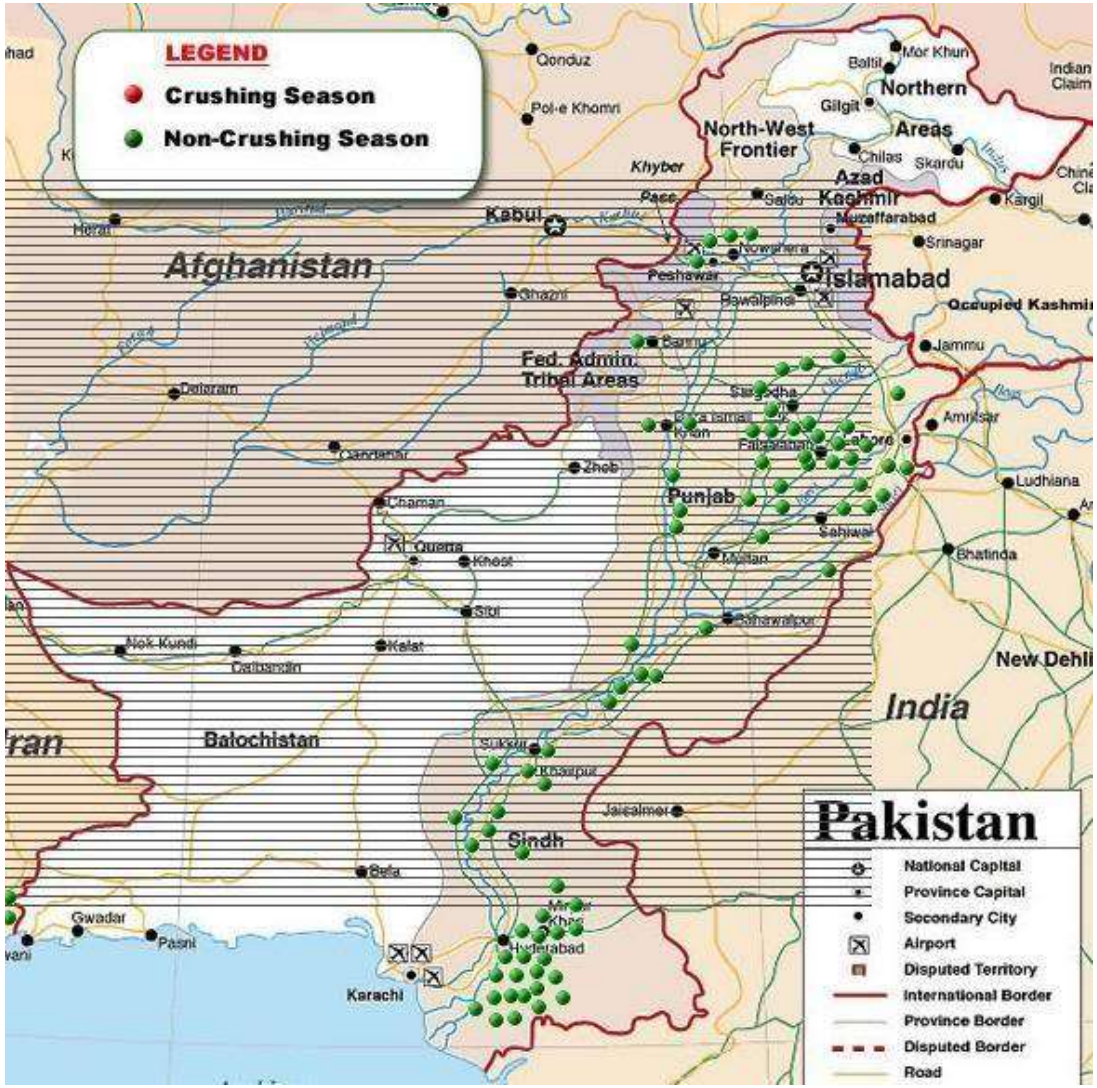
Bagasse Potential in Pakistan

- Bagasse is a fibrous Captive Biomass
- An excellent Raw Material for power generation
- Existing 81 sugar mills with an annual capacity of about six million tons sugar
- The industry crushes about 30 - 40 million tons of sugar cane that yields about 12 million tons of bagasse as an industrial waste
- It has a potential of generating 2000 MW electricity

Bagasse Potential in Pakistan



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Interconnection Studies Completed or Ongoing by PPI

- Bagasse Based

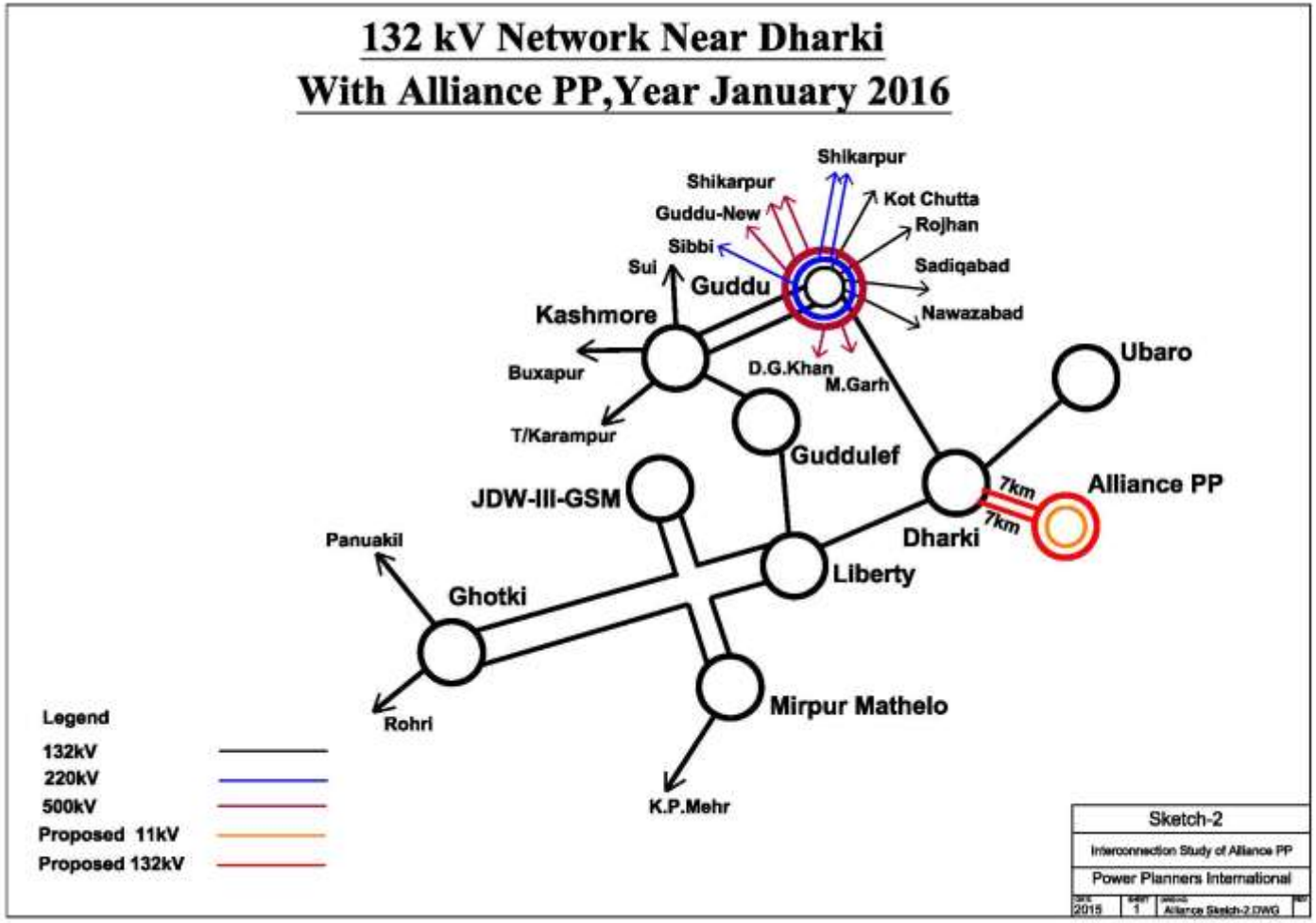
Sr. No.	Name of Sugar Mill	Installed Capacity (MW)		Spillover to National Grid (MW)	
		Summer	Winter	Summer	Winter
1	Fatimah Sugar Mills	120		107	88
2	Alliance Sugar Mill	30		19	
3	Al-Moiz (Layyah Sugar Mill)	25	20	16	12
4	Al-Moiz (Mianwali Sugar Mill)	20	15	16	10
5	Chanar Sugar Mill	22		19.3	
6	Chiniot Suagr Mill	60		54	
7	Etihad Sugar Mill	74		67	
8	Jamal-din-Wali (JDW-II-USM)	26		26	
9	Jamal-din-Wali (JDW-III-GSM)	26		26	
10	Kamalia Sugar Mill	17		12	
11	RYK Sugar Mill - Unit I	30		19	
12	RYK Sugar Mill - Unit II	36		33	
13	Shahtaj Sugar Mill	32		15	
14	Hamza Sugar Mills	32		15	
15	Shiekhoo Sugar Mill, Muzaffargarh	6		6	
16	Indus Sugar Mills	25		25	
17	Mirpur Khas Sugar Mills	20		20	
18	Tandlianwala Sugar Mills	74		74	
Total		**675**		**649.3**	

Interconnection Studies Completed or Ongoing by PPI

- **Agricultural Biomass**

Sr. No.	Name of Biomass Mill	Installed Capacity (MW)
1	Lumen Energia near Jhang	12
2	Masood Textile Mills Limited Faisalabad	12
3	Shakarganj Energy near Bhone, Jhang	20
4	SSJD, Gorchanni, Mirpurkhas	12
Total		**56**

30 MW Power Plant by Alliance Sugar Mills
Interconnection Scheme



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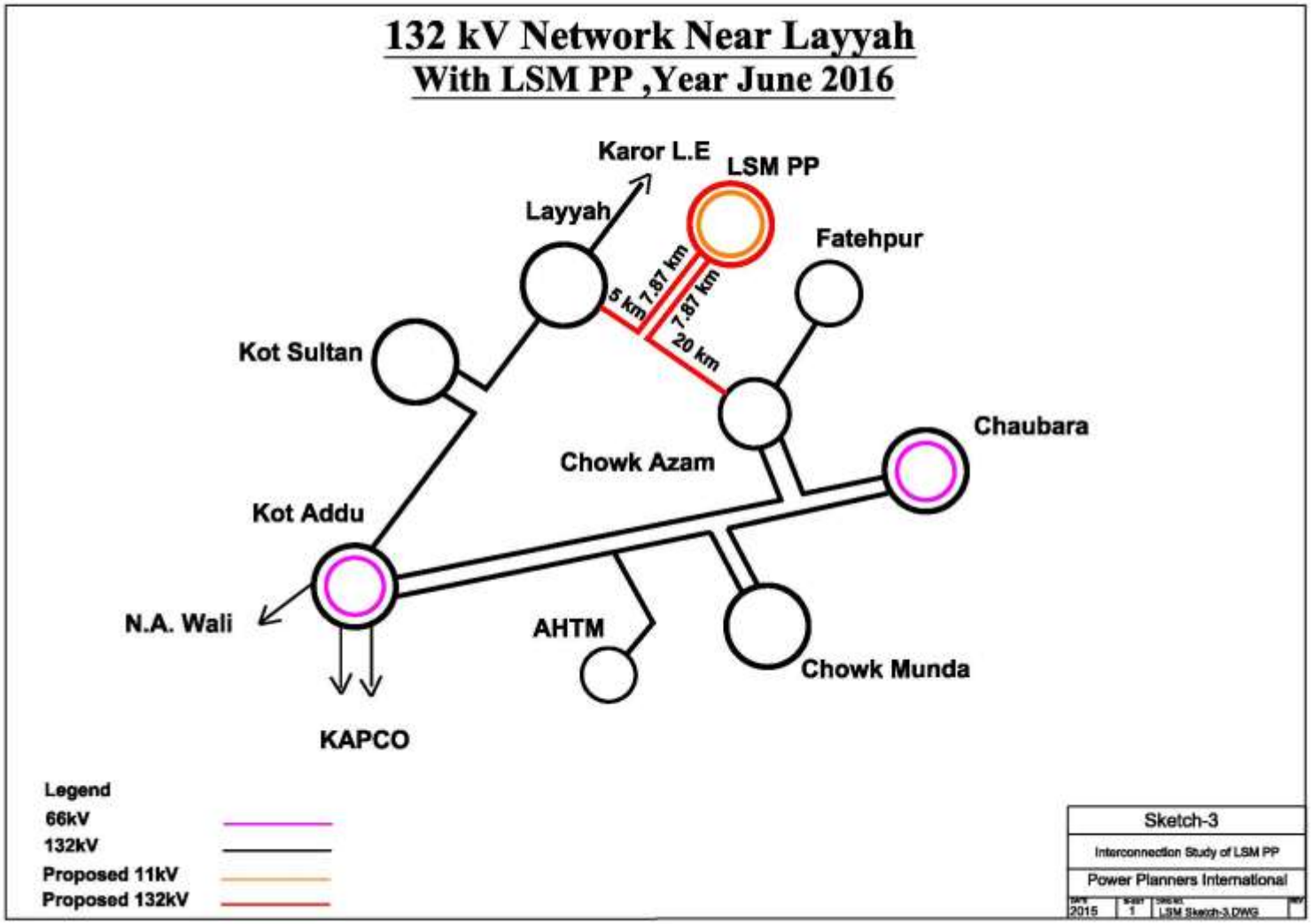
25 MW Power Plant by Layyah Sugar Mills Interconnection Scheme



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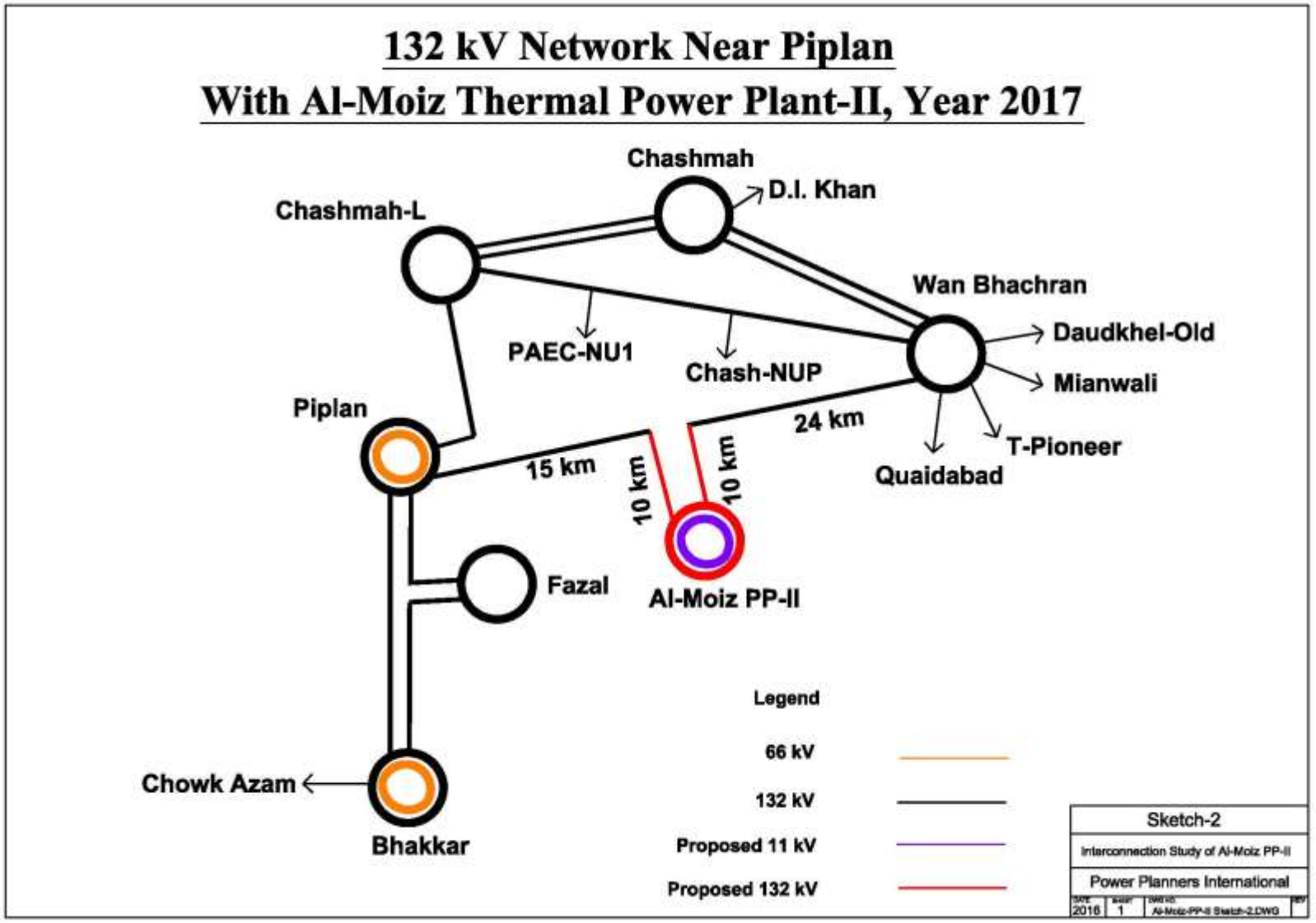
20 MW Power Plant by Almoiz Sugar Mills
Interconnection Scheme



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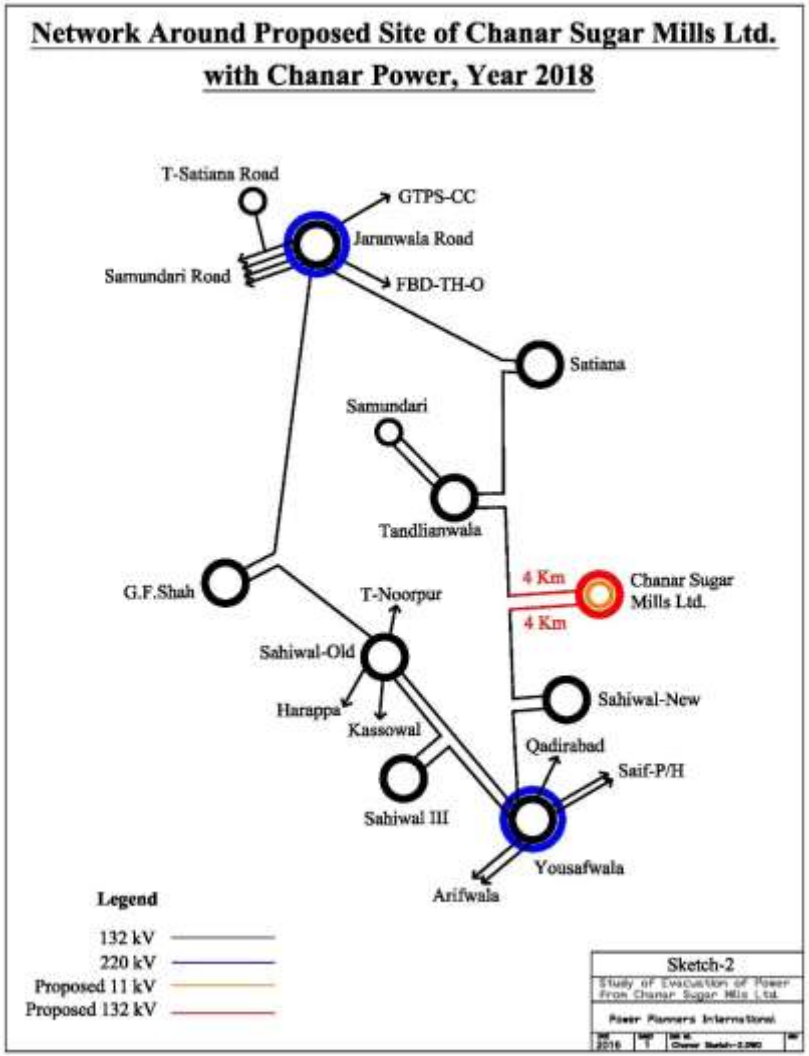
22 MW Power Plant by Chanar Sugar Mills
Interconnection Scheme



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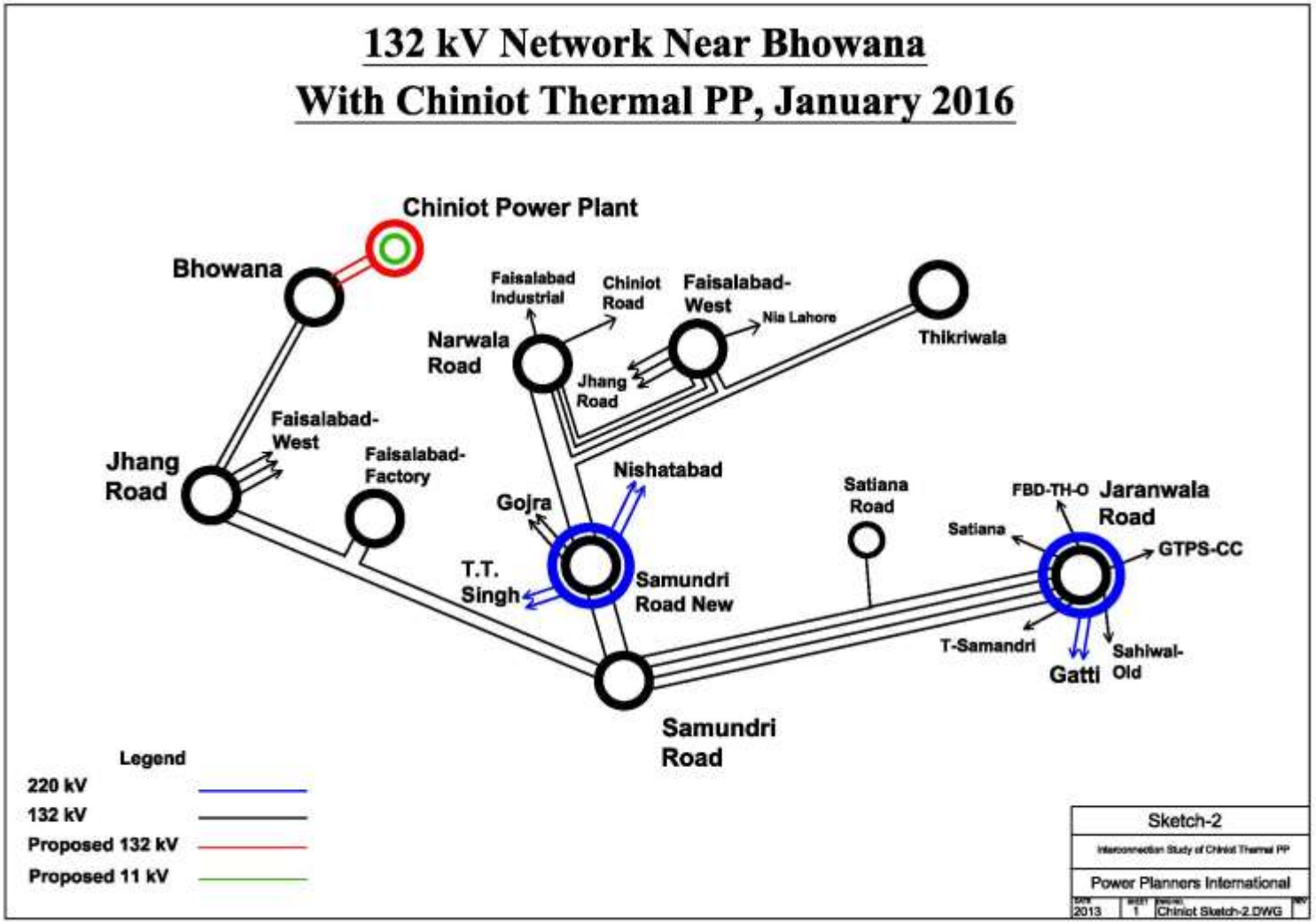
60 MW Power Plant by Chiniot Sugar Mills Interconnection Scheme



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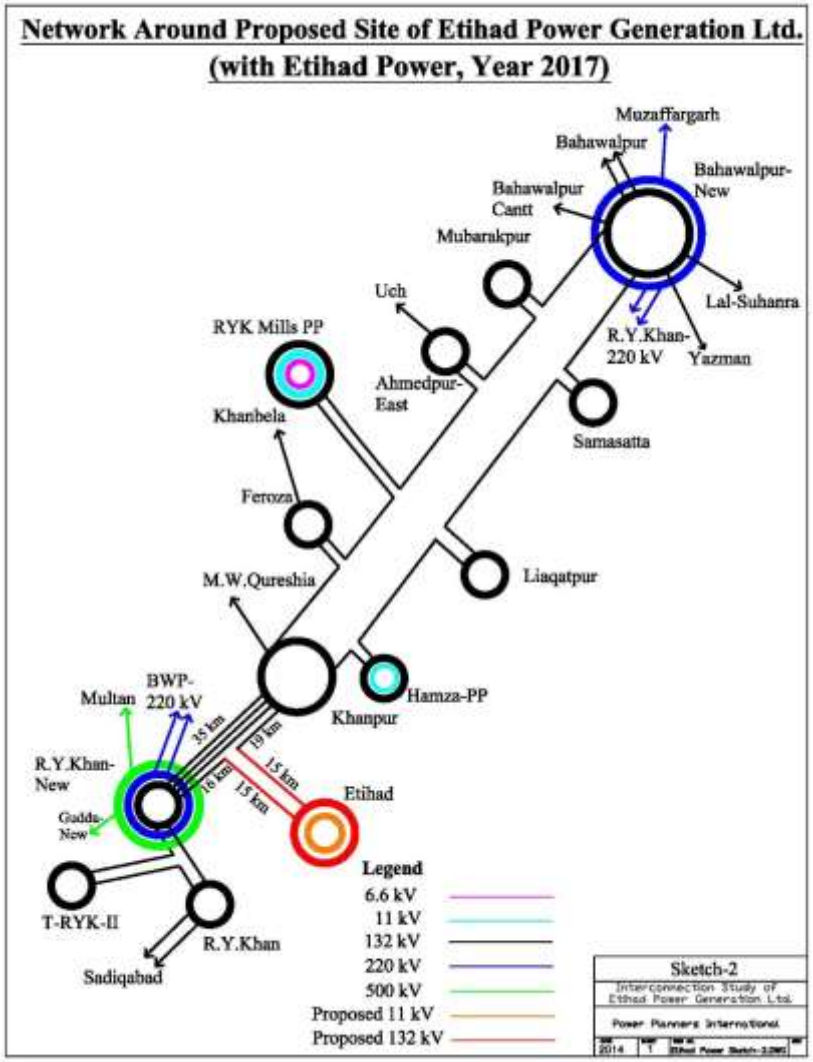
74 MW Power Plant by Etihad Sugar Mills Interconnection Scheme



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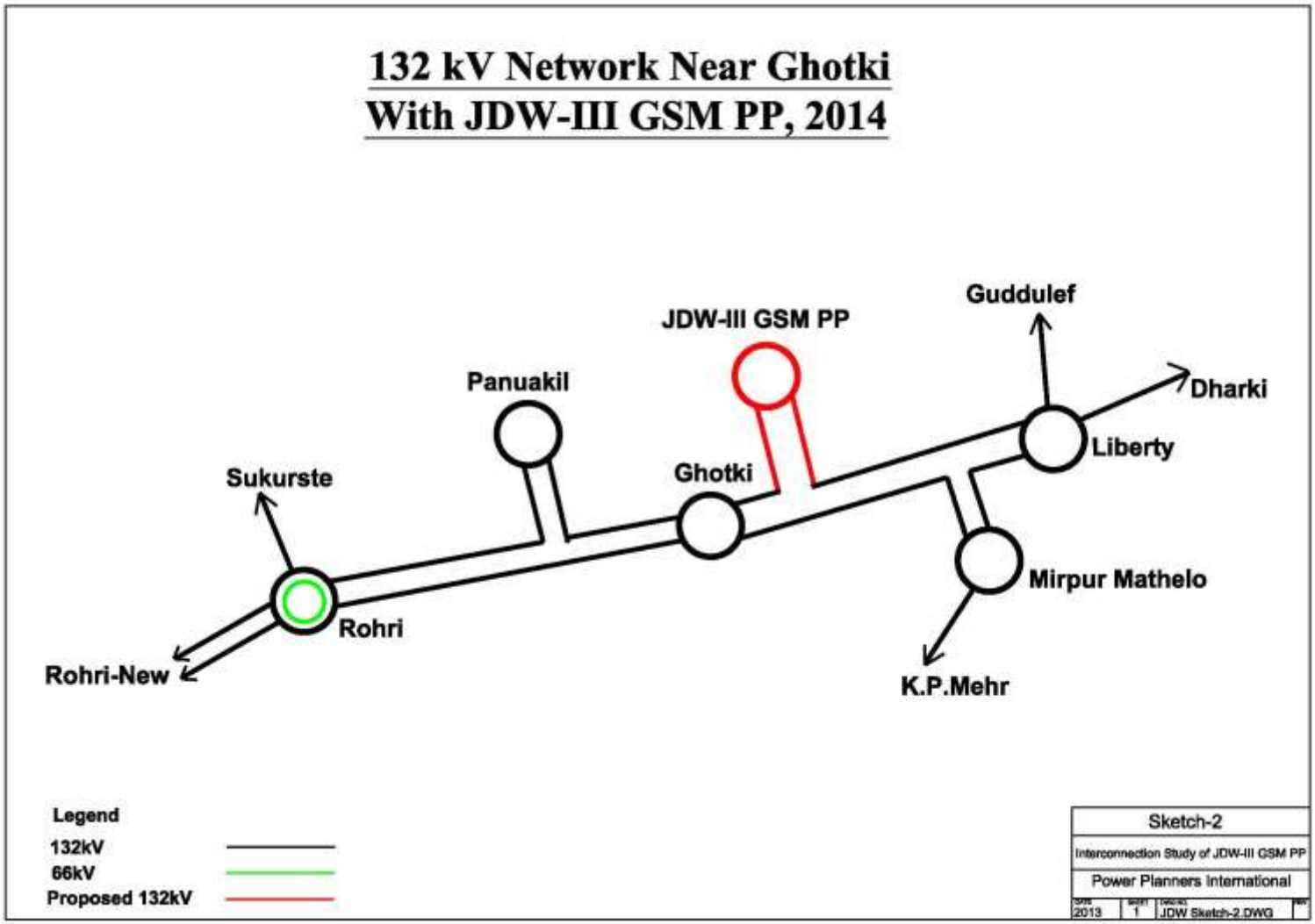
26 MW Power Plant by Jamaldin Wali (JDW) Sugar Mills Interconnection Scheme



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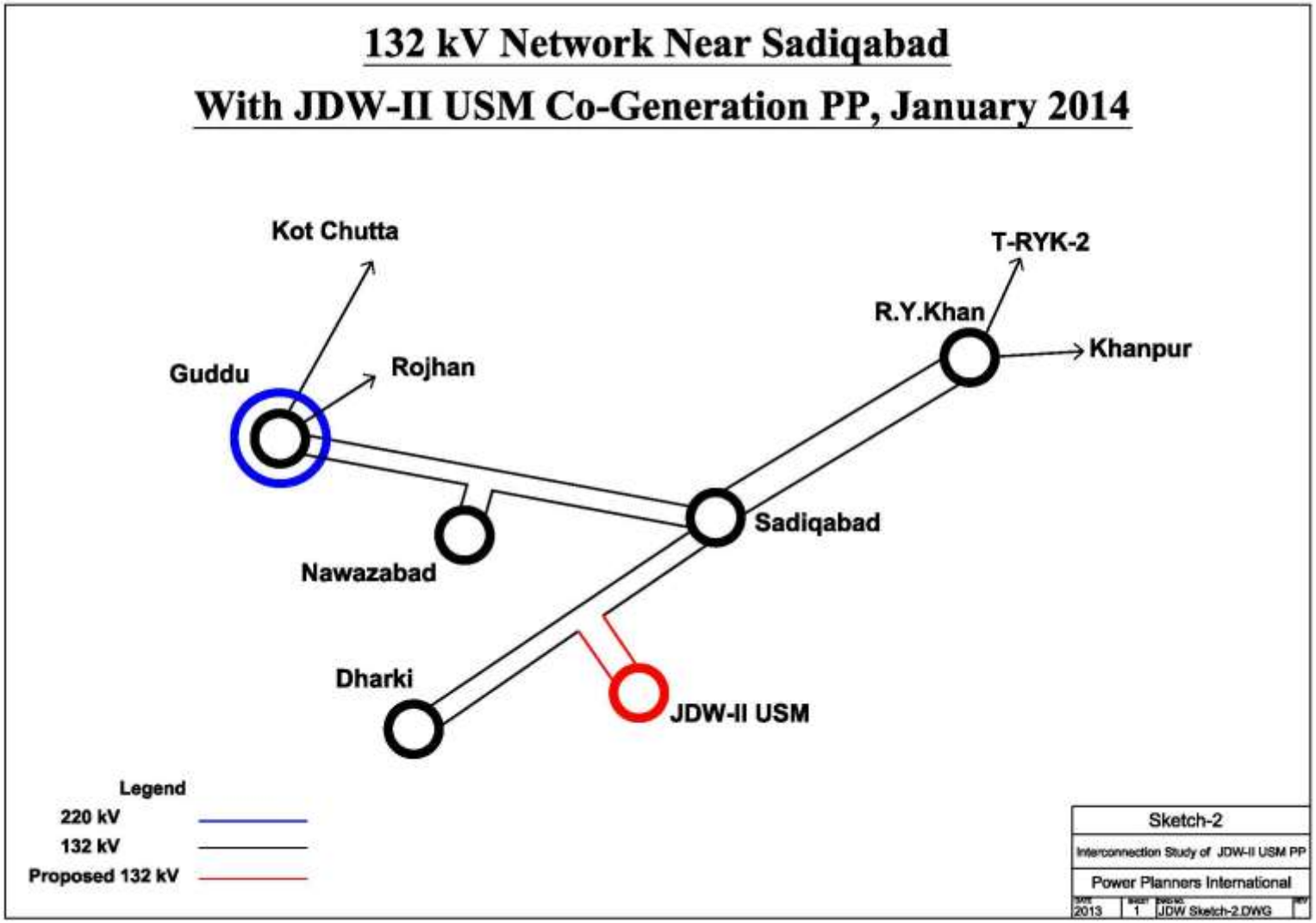

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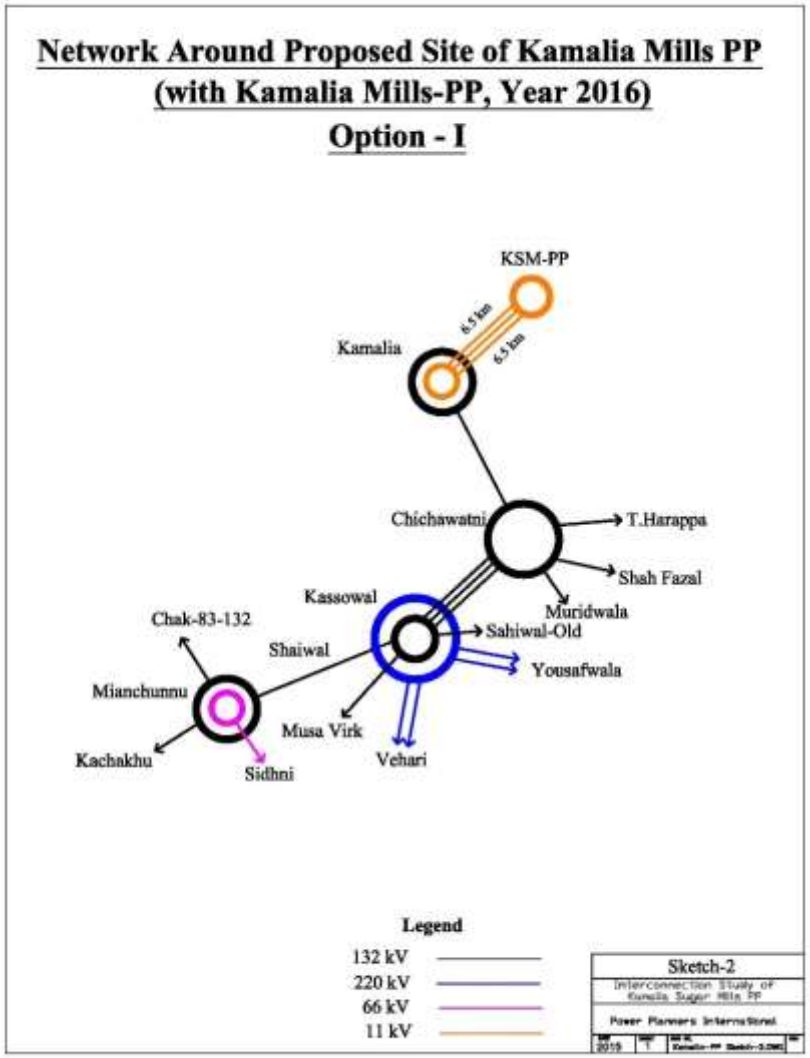
17 MW Power Plant by Kamalia Sugar Mills Interconnection Scheme



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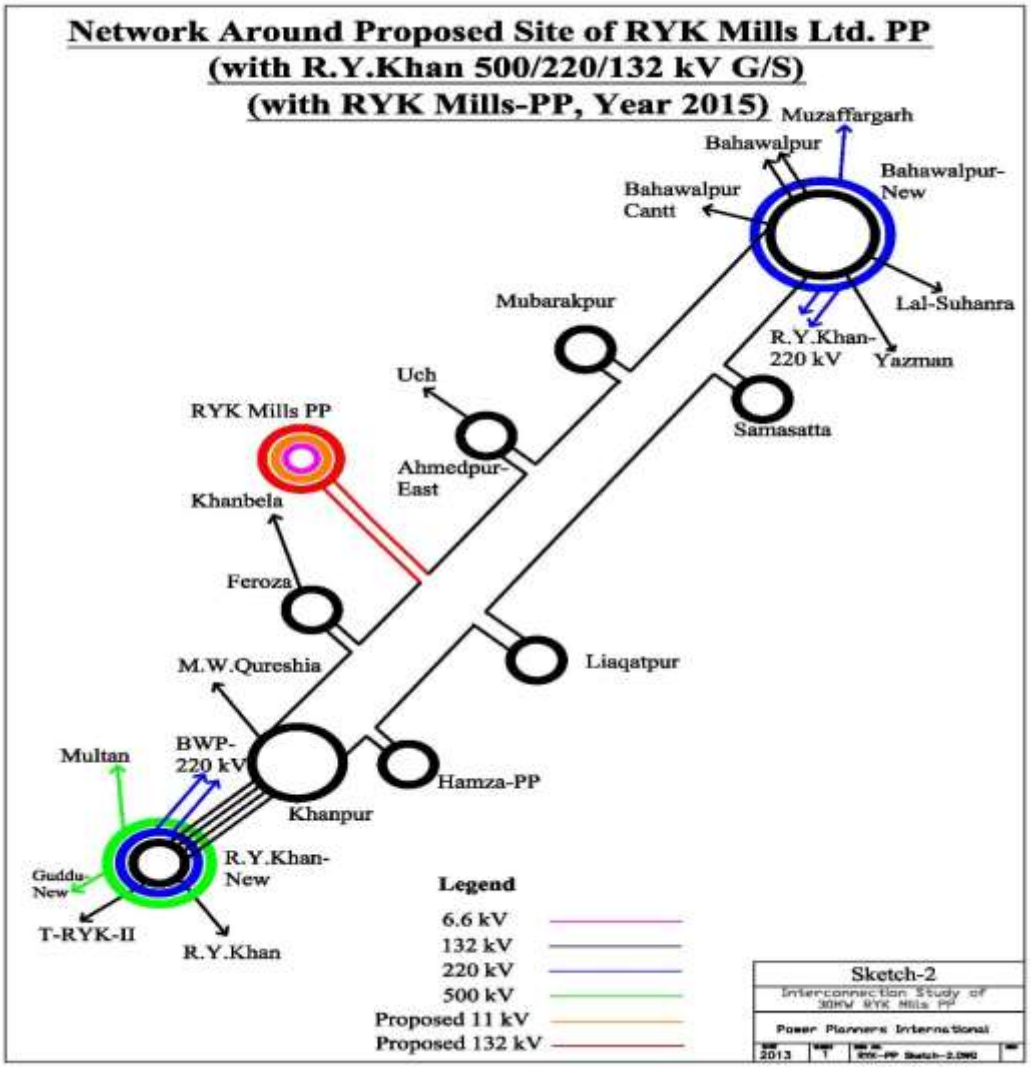
RYK Sugar Mills 30 MW (Unit-1) and 36 MW (Unit-2) Interconnection Scheme



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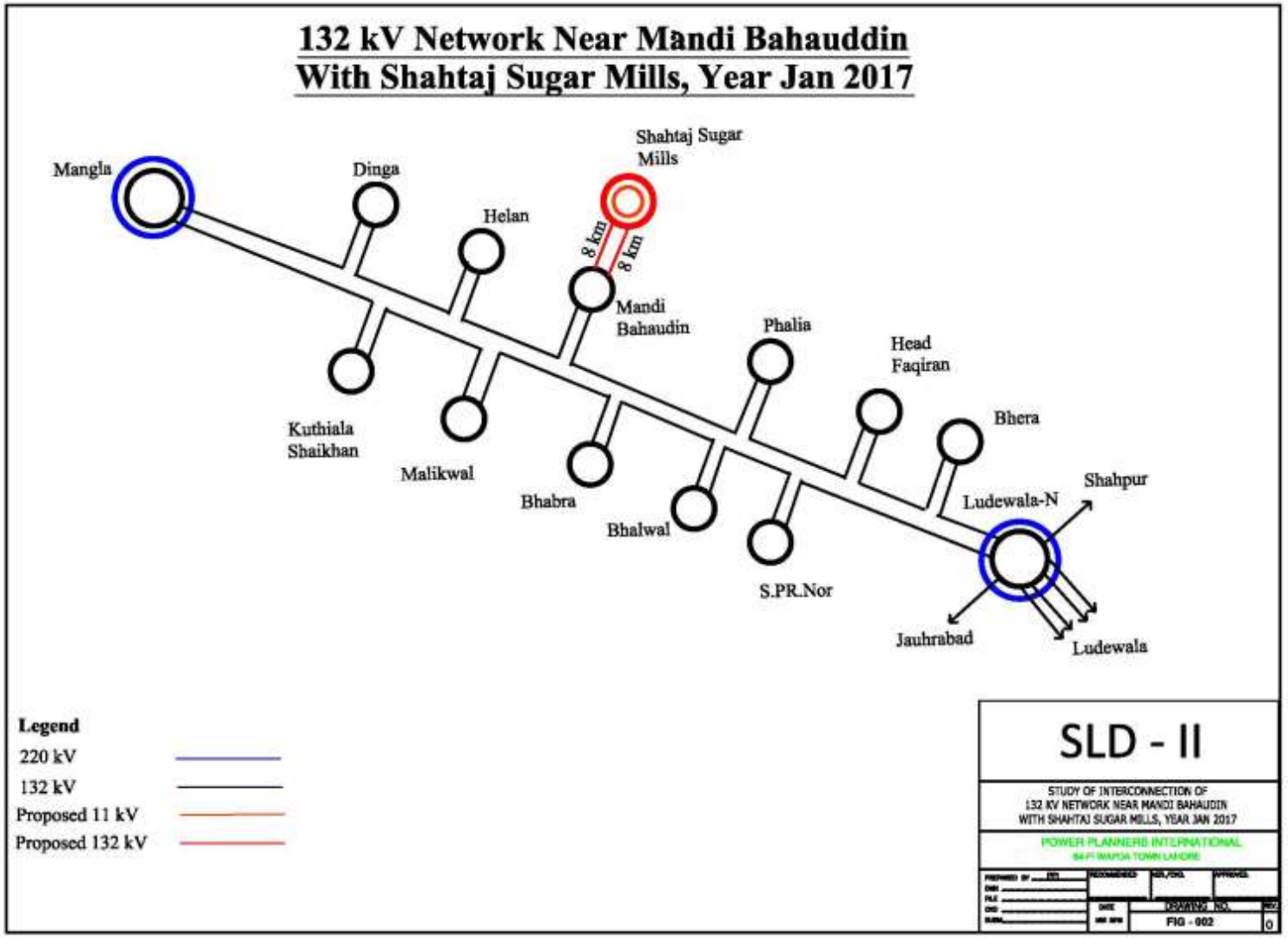
32 MW Power Plant by Shahtaj Sugar Mills Interconnection Scheme



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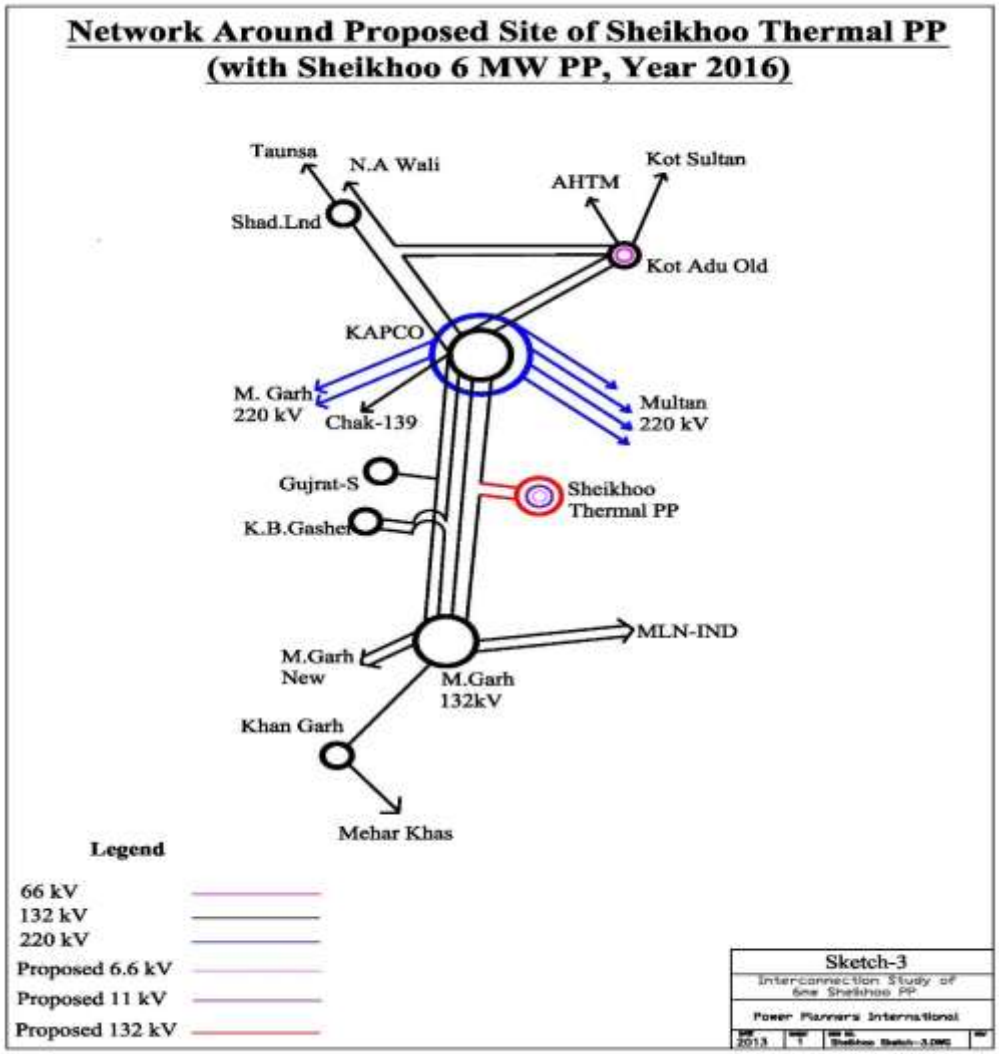
6 MW Power Plant by Sheikhoo Sugar Mills
Interconnection Scheme



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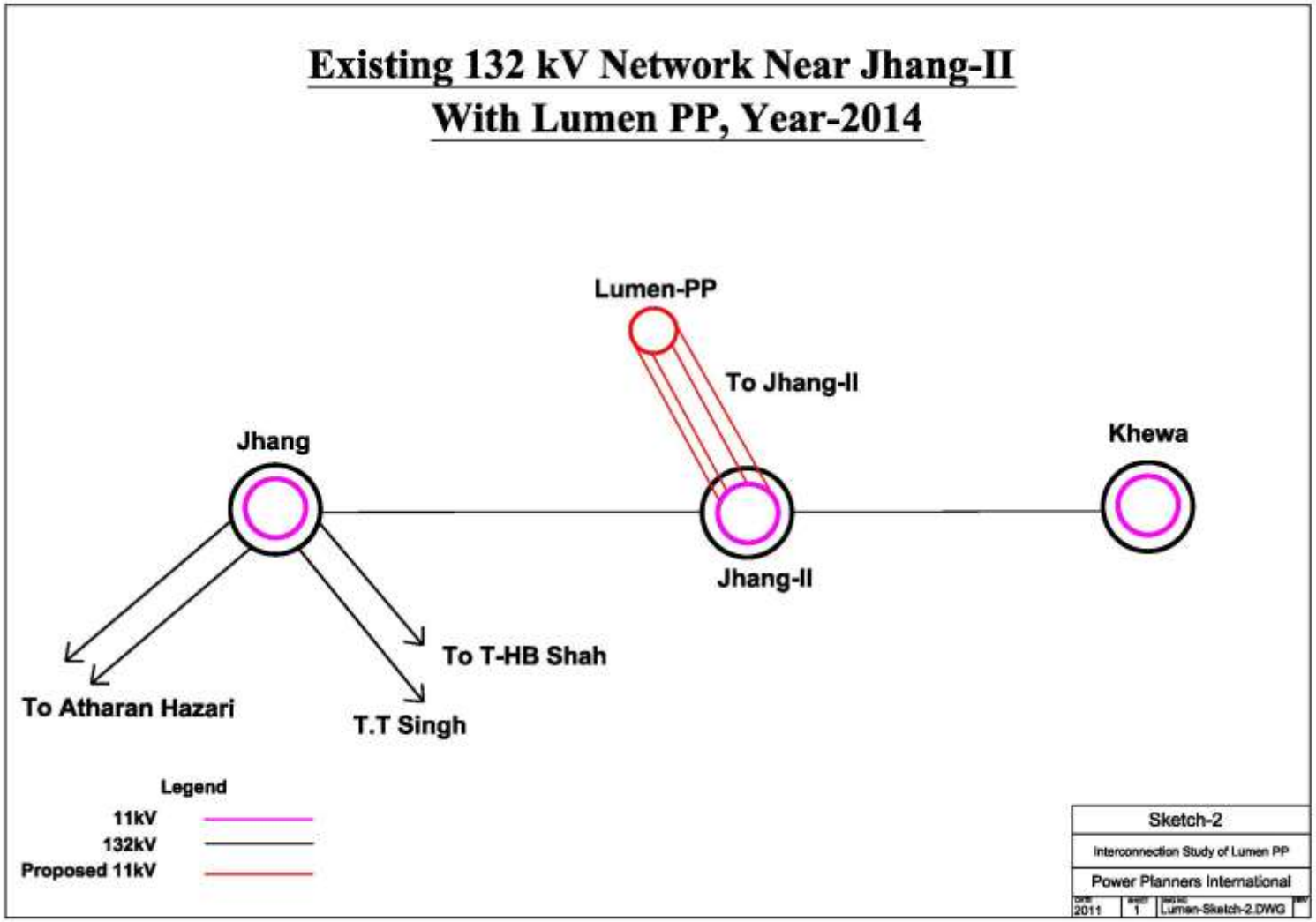
12 MW Biomass Power Plant by Lumen Energia
Interconnection Scheme



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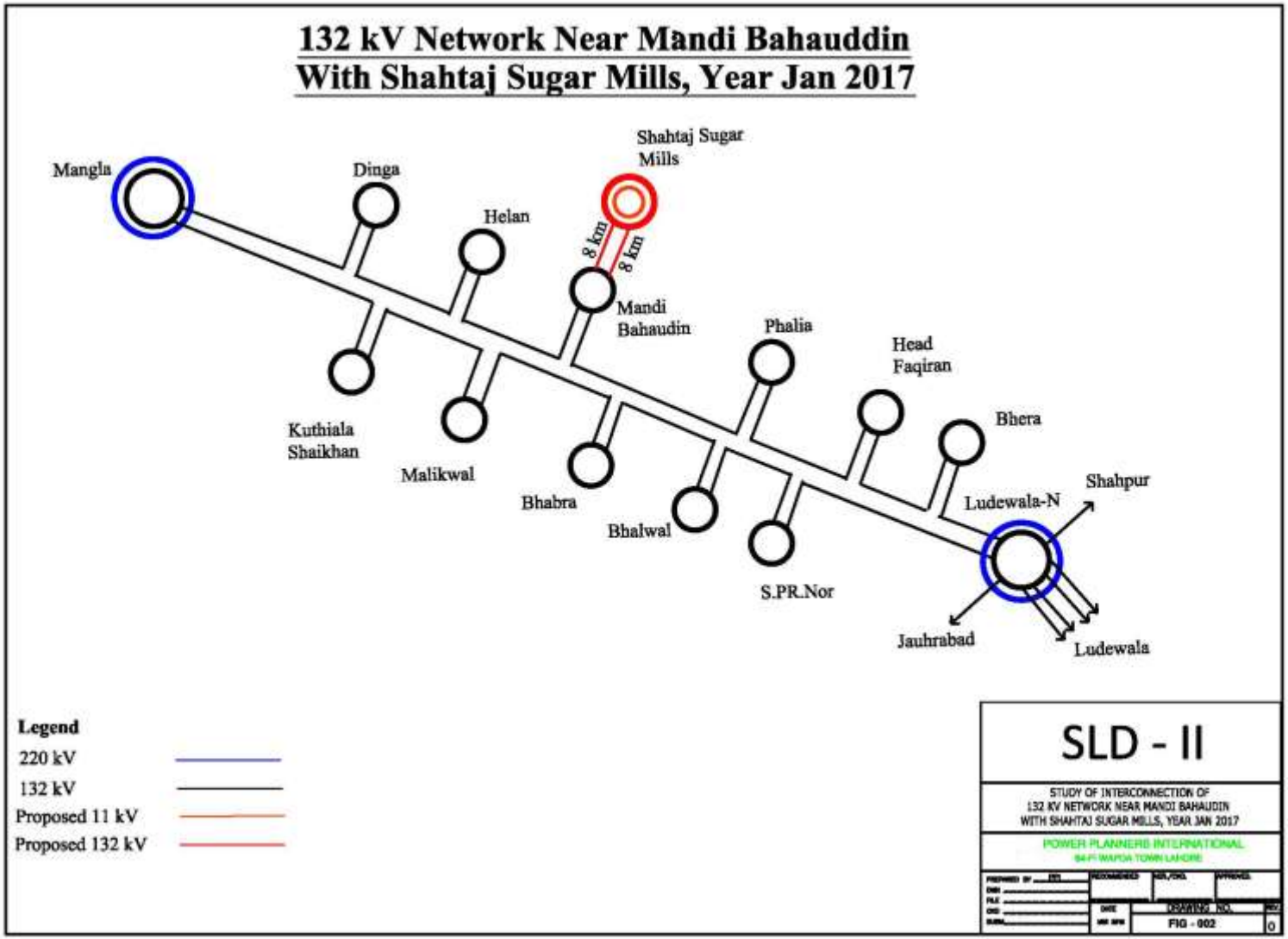
20 MW Biomass Power Plant by Shakargunj Energy
Interconnection Scheme



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Fundamental Studies required for Interconnection Study

- PPI is conducting Interconnection Study constituting following main components
- Load Flow study
  - Steady State performance
    - Adequacy of loading limits of circuits affected due to interconnection i.e no overloading on any line/Transformer
    - Voltage profile to be within the Grid Code ± 5 % off-nominal
  - Contingency Analysis
    - No overloading on any line/Trafo under one line out condition (N-1 Criteria of Grid Code)
    - Voltage Profile to be within ± 10 % off-nominal

Fundamental Studies required for Interconnection Study

- Short Circuit Study
  - 3-Phase and Single-Phase fault currents are calculated:
    - To determine the ratings of the equipment to be installed at the switching station of the power plant i.e. breakers, Isolators, CTs, PTs and other switchgear
    - To confirm if the fault levels on the substations in the vicinity of the new power plant are within the ratings of the equipment already installed there because fault current contributions from the new power plant would increase the fault levels on its neighbouring substations
    - To carry out protection coordination and relay settings of at the proposed power plant and also on the neighboring substations if so required

Fundamental Studies required for Interconnection Study

- Transient Stability Study
- If the system stays stable and does not loose synchronism after any severe fault happens on the system such as 3-Ph or 1-Ph faults by monitoring
  - Rotor angles of generators of the entire system must stay in synchronism
  - Power swings on transmission lines must damp rapidly
  - Voltage on bus bars recover soonest to the acceptable level i.e. within 2-3 seconds
  - Frequency recover after any dips or over-frequency event

Bagasse Power Plant

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