



#### CASA and TUTAP Power Interconnection Projects 11 April 2016 Islamabad, Pakistan



### Afghanistan - Power Sector Overview



- Existing power supply heavily dependent on power imports.
- Major focus of energy sector development efforts directed towards transforming Afghanistan's electricity grid from isolated islands into an integrated national transmission grid.
  - In 2006 Afghanistan had 9 isolated electric grids. Today these have been consolidated into 3 major grids:
    - North Eastern Power Grid (NEPS) with Kabul as the major load center
    - South East Power Grid (SEPS) with Kandahar as the major load center
    - Western Power Grid (WPG) with Herat as the major load center
- Energy imports in 2014-2015 represented about 80% of the total power supply.
- DABS *customers* connected to the National Grid have *increased by more than 60%* during the last 6 years.

Current Sources of Power				
SI. No.	Source of Power	Share in MW (%)		
1.	Fossil Fuels (Diesel & Gas)	10%		
2.	Hydro	8%		
3.	Renewable Energy	2%		
4.	Power Imports	80%		
	TOTAL	100 %		





- Power imports are backed by long-term PPAs, but future challenges regarding continuity and tariffs remain.
- In 2002 only 6% of Afghans had access to electricity. Today more then 30% have access.
- Enhancing access to about 65% over the next 5 years and meeting the growing demand of the existing load centers high priority of the Government.
- Several provinces dependent on diesel generation resulting in extremely high cost of generation.
- Various *supply augmentation initiatives underway*:
  - CASA 1000
  - Turkmenistan Uzbekistan Tajikistan Afghanistan -- Pakistan Interconnection (TUTAP).
  - Grid Integration between NEPS and SEPS.
- Meeting the above goal requires harnessing additional power supply sources including those closer to the loads.

### **DABS - Generation and Transmission Profile**





**Afghanistan Installed Generation** 

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

#### Transmission Capacity for Power Imports (MW)



Republic of Uzbekistan	326
Islamic Republic of Iran	164
Republic of Tajikistan	433
Republic of Turkmenistan	77
Total	1,000



Import in kWh				
Republic of Uzbekistan	1,565,615,999	35.15%		
Republic of Tajikistan	1,358,508,751	30.50%		
Islamic republic of Iran	931,746,000	20.92%		
Republic of Turkmenistan	598,758,046	13.44%		
Total	4,454,628,796			
Core generation in kWh				
Hydro	1,170,749,800	89.6%		
Diesel generation	83,695,583	6.4%		
Thermal	51,520,000	3.9%		
Solar	1,086,000	0.1%		
Total	1,307,051,383			
Total Energy for system	5,761,680,179			

#### Import Core generation



### DABS - Cost of Imported Energy





• Cost of imported energy increased by about 385% from 2009 to 2016.

## **Central Asia-South Asia Connectivity**



Benefits

- ✓ Least cost option for meeting south Asia power needs
- ✓ Diversification and expansion of central Asia energy exports
- ✓ Trade driven economic growth

### Central Asia South Asia Regional Electricity Market "CASAREM"

### **CASA-1000**



Project cost ~\$1B as:

$\triangleright$	KGZ	\$200m
	NGZ	\$200m

- ➤ TAJ \$270m
- ➢ AFG \$300m
- ➢ PAK \$200m
- Funded by WB/IsDB/Others
- \$512m approved by WB in March 2014
- IFC Transaction Advisor
- 4 countries will form a Commercial Joint Venture to appoint EPC contractor and O&M contractor for DC portion
- Commercial Agreements under negotiation
- Commercial Operation 2018

## CASA-1000 Technical featuresoenix ()



AC/DC Converter Station

• 500kV AC line KGZ to TAJ (95% in KGZ)

POWERING UTILITIES

- TAJ grid to be reinforced
- 1,300MW AC/DC Station at Sangtuda.
- 750km HVDC line TAJ-AFG-PAK
  - o (TAJ 117km, AFG 562km, PAK 71km)
- 300MW AC/DC Station at Kabul
  - o (import & export capability)
- 1300MW AC/DC Station at Peshawar.
- 5 TWh/year to be exported



### **CASAREM Project: TUTAP**



- ADB financed Afghanistan Power Sector Master Plan\* identified the need for a unified Afghanistan grid with asynchronous connection to neighboring central Asian countries.
- TUTAP uses existing and planned assets in Afghanistan to connect Central Asia to Pakistan
- TUTAP is an acronym of countries to be directly connected to Afghanistan grid, being Turkmenistan, Uzbekistan, Tajikistan, Afghanistan and Pakistan

www.adb.org/projects/43497-012/documents



### AFGHANISTAN POWER SYSTEM, 2012-2032







- 9 islands fed from different systems
- Peak load 850MW
- Annual consumption 3,800GWh
- 70% of the power from imports
  - ▶ 57% Uzbekistan
  - > 22% Iran
  - > 16% Turkmenistan
  - ≽ 4% Tajikistan

- Integrated transmission network of AFG
- Share of domestic production increases to 67 %
- Electrification rate : 83%
- Peak load of about 3,500 MW
- Annual energy consumption of 18,400 GWh
- Power exchange options with neighboring systems

### **Proposed Asynchronous Operation**



- UZB, TAJ and TKM systems are not operated in synchronism.
- Asynchronous interconnection will be via a common HVDC Back to Back hub at Pul-e-Khumri (PUK).
- Future connection to Pakistan again with HVDC BtoB.



## Benefits of HVDC back to back

- Modular technology- built in stages to meet evolving needs
- Facilitates integration of remote diverse resources
- Controllable -power injected where needed
- No stability distance limitation
- Proven technology
- Facilitates power wheeling to Pakistan

### **TUTAP/CASA** Technical Features



### DABS – Future Growth Plans – Transmission Projects

- Scope includes construction of 750 km 500 kV HVDC between Tajikistan (117km) through Afghanistan (562 km) to Pakistan (71 km) & construction of HVDC converter stations at Sangtuda (1300 MW), Kabul (300 MW) and Peshwar (1000 MW).
- Will enable trade of 1300 MW of hydropower from Central Asia (Kyrgyz Republic & Tajikistan) to South Asia (Afghanistan & Pakistan). Afghanistan will import 300 MW of power, with supply period from May to September. Project cost of USD 1170 million, funded by multiple multilateral agencies.
- □ Specific Benefits/Implications for Afghanistan:
  - Estimated annual revenue as transit fee from Pakistan: USD 45 million.
  - ✓ Tariff structure: Transmission-2.98 cents/unit, Energy- 5.15 cents/unit. Total of 8.13 cents.
  - ✓ Estimated project cost: USD 404 million (Afghanistan).
  - ✓ Additional 300 MW of power for North East region during May to Sep for 15 years.



Contd...

CASA-1000 (World Bank)

# Thank You

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