

CAREC

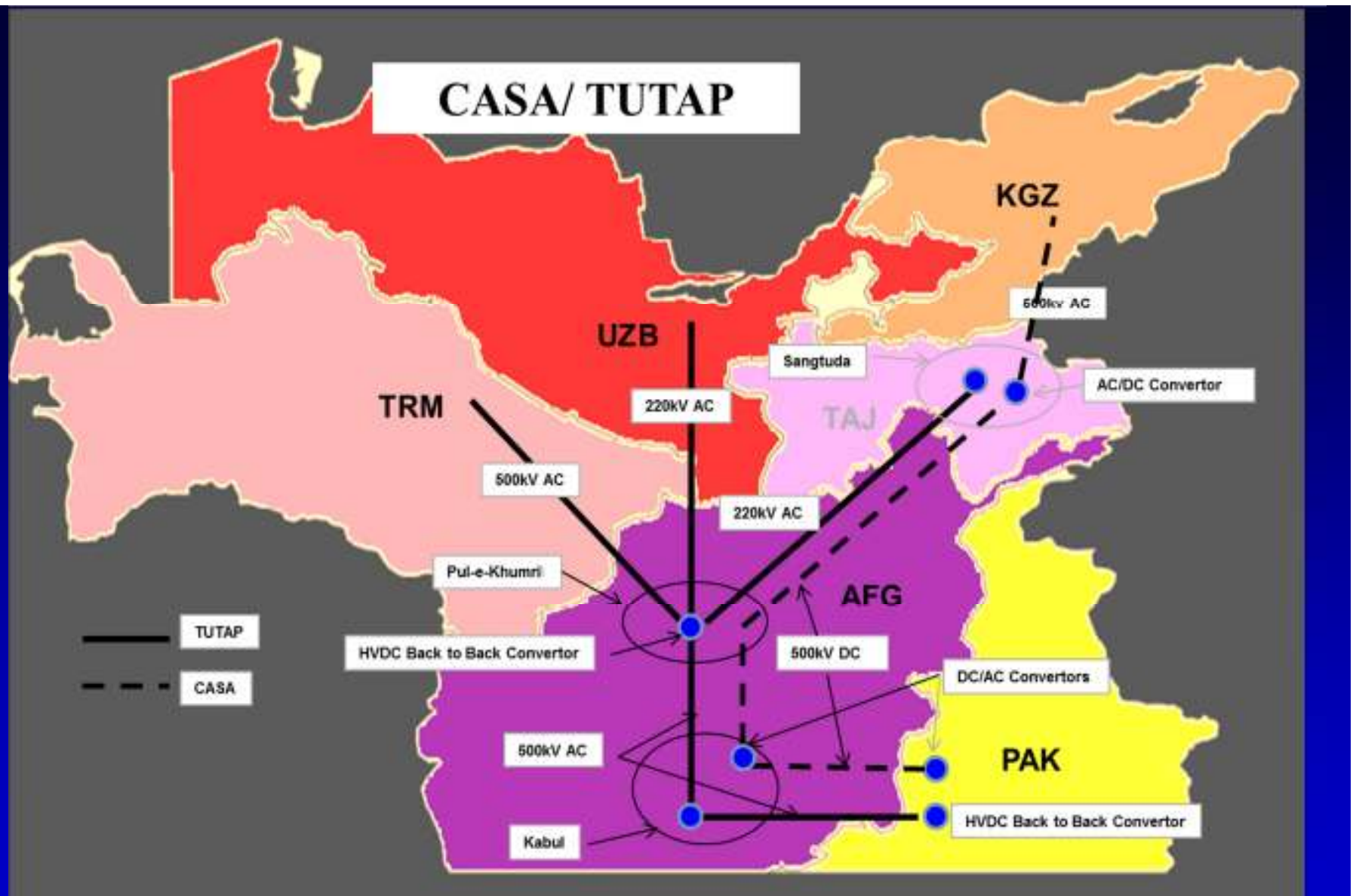
ESCC Meeting Beijing 4 and 5 September 2014

**Update on
Addendum to Afghanistan Power Sector Master Plan**

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Addendum to AFG Master Plan addresses impact of CASA on AFG Master Plan

Addendum to AFG Master Plan

March 2013 Master Plan (MP) recommended:

- *Develop domestic coal, gas and hydro generation/ continue use of imports*
- *Construct an integrated AFG grid for domestic needs >>spin off benefit of allowing linkage between Central Asia and South Asia.*

The MP did not consider regional project CASA-1000 as:

- *Unclear benefits to AFG*
- *Outside AFG control*
- *Development uncertain*

Feb 2014 World Bank approved CASA-100. Addendum considers:

- *Impact of CASA-1000 on MP recommendations.*
- Addendum also considers :
 - *Impact of delayed TKM interconnection*
 - *TAJ-AFG rating corrected to 600MW*
 - *Options for AFG to synchronize with neighboring countries*

Changed Scenarios

CASA-1000

1,300 MW ex TAJ, 300MW to AFG, 1,000 MW to PAK. Commissioned 2020

Turkmenistan - Afghanistan

Phase	Capacity (MW)	MP Schedule	Addendum : <i>Conservative Scenario</i>
1	300	2017	2017
2	300+200= 500	2020	Deferred: schedule unclear
3	500+500=1,000	2015	Deferred

Tajikistan- Afghanistan

- MP assumed capacity based on IPS/UPS limit of 300MW max outage
- Export TAJ to AFG can be increased to 600MW based on thermal limit of line being 600MW and:
 - N-1 contingency not applying
 - increasing IPS/UPS limit using Emergency Control System
 - Increased limit required in any case for CASA

**MP Scenarios: Cases 1, 2 & 3 with and w/o CASA
and
New Conservative Scenario: Cases 4 (CASA Forced) & 5 (Optimized)**

Project	Year	Base tariff \$cent/kWh	MP Scenarios Case 1: No load shedding Case 2: Load shedding Case 3: Schedule Sensitivity	New Conservative Scenario Case 4: Optimizes CASA Case 5: Forces CASA exports in 2020
TAJ Imports	Now	3.5	300 MW	600 MW
CASA-1000	2020	7.0	Zero	300 MW
Sheberghan Gas Plant	2020	5.6	400 MW	200 MW
TKM Imports	2017	5.5	300 MW	300MW
	2020		500 MW	Zero
	2025		1,000 MW	Zero
New Coal (Bamyan)	Candidates selected as per optimization results			Not before 2032
New Hydro (Kunar, etc)	Candidates selected as per optimization results			Not before 2032

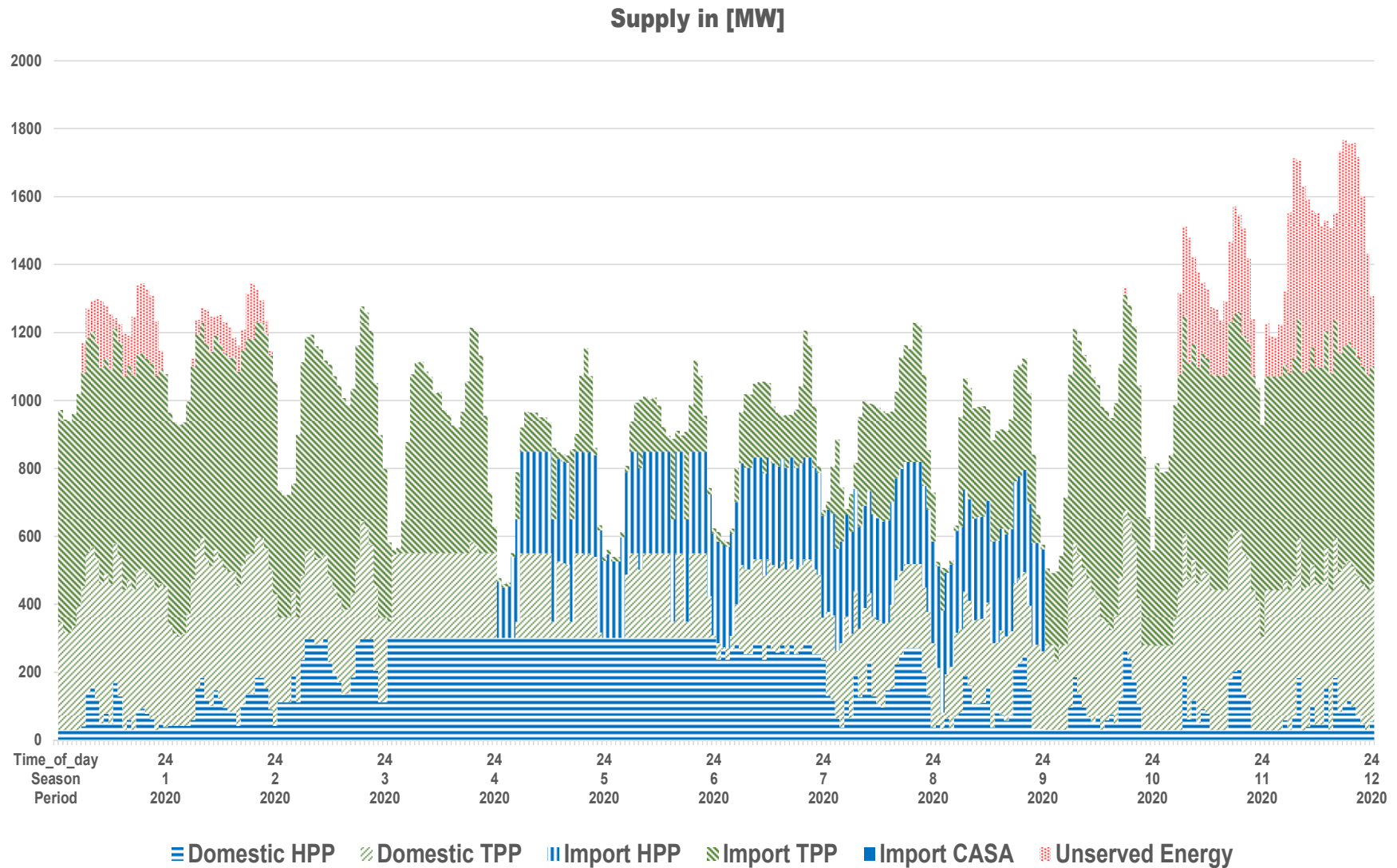
Impacts of CASA-1000 to year 2032

Optimization results for 5 Cases

#	Scenario and result	Unserved demand	CASA supply to AFG
1	Unserved Energy at 8.0\$/kWh. 4GW plant added by 2028 (new gas, coal, hydro). \$5B.	Demand Met from 2020	No
2	Unserved Energy at 0.35\$/kWh. 3.6GW added by 2028 (gas, coal, hydro). \$4B.	~2% of total demand not served after 2024	No
3	Sensitivity	Various	No
4	Only new projects are TKM 300MW, Sheberhghan 200MW, CASA-1000. CASA forced result at 2020	Rising to 6,000 GWh in 2032	From 2020 100%
5	As case 4. No forced result> Least cost solution	As Case 4	Starts in 2027 at 16MW rising to 300MW in 2030

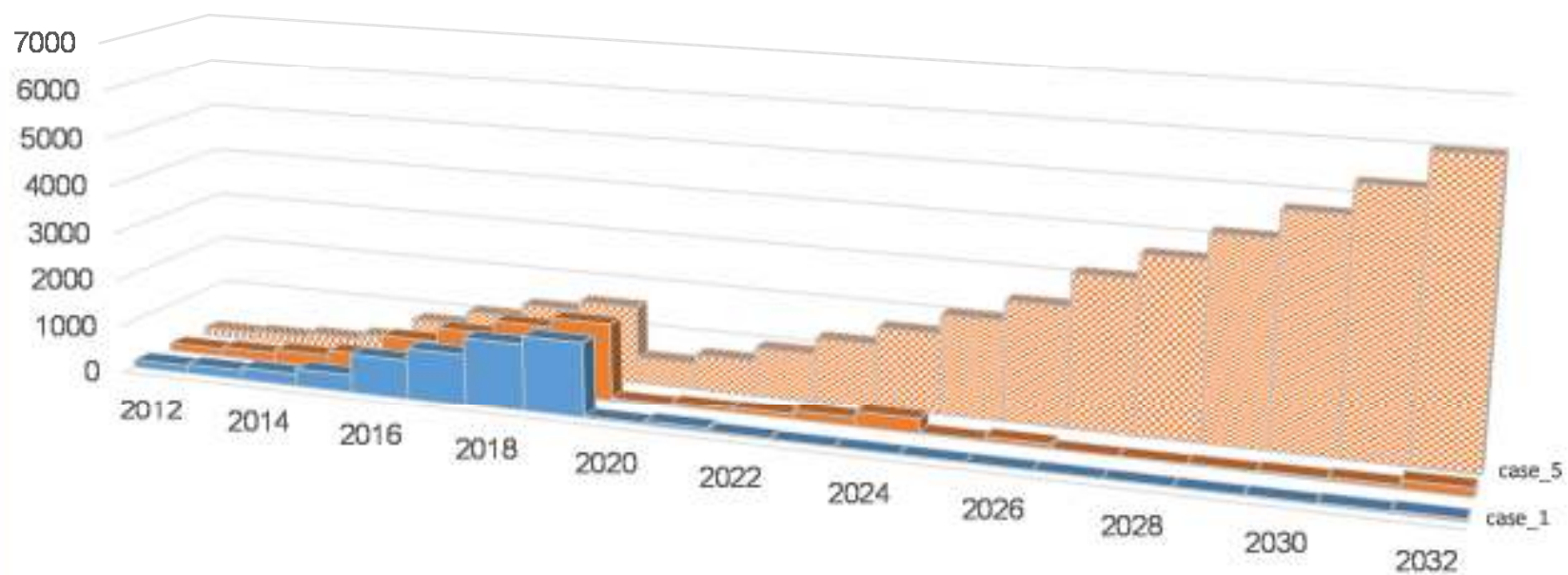
- *Optimization program selects CASA imports only in Case 5 (starting 2027) as lower cost options are i) domestic supply and ii) thermal and non CASA hydro imports*
- *Case 4 (CASA forced at 2020) overall system cost \$224m higher than Case 5*

Optimized Supply Structure 2020

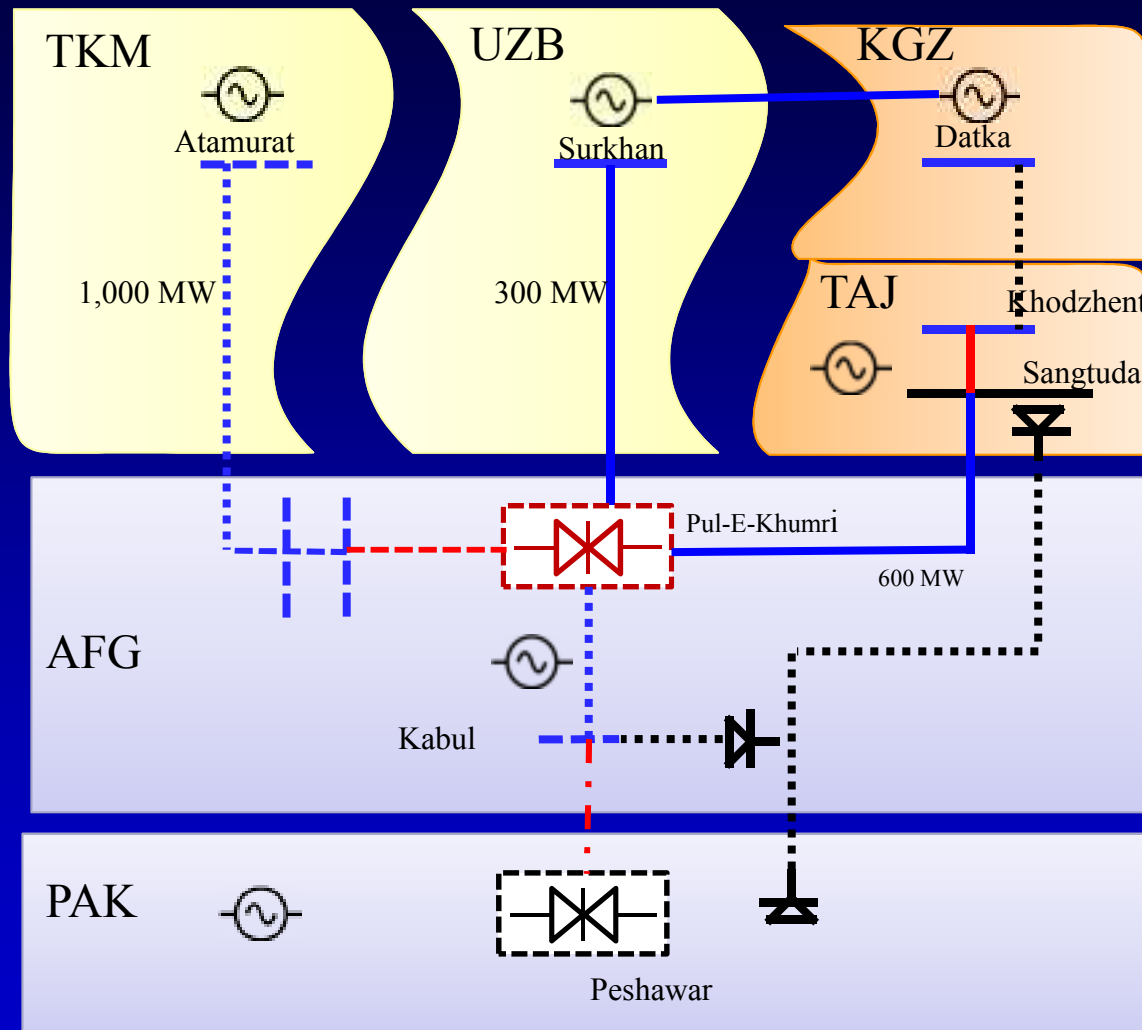


Unserved Energy Case 1,2,4/5

Unserved Energy [GWh/a]



TAJ to UZB synchronized via KGZ



- CASA-1000 will link TAJ to UZB via KGZ
- TAJ will then be synchronized with UZB
- Simplifies import options for AFG
- TAJ and UZB imports can then be paralleled in AFG

Synchronous Interconnection Options

Full Integration	<ul style="list-style-type: none">• Requires full power frequency control during normal and emergency conditions• Difficult and lengthy to implement
Commercial Interconnection	<ul style="list-style-type: none">• Serves medium and long term scheduled exchanges• simplified form of power-frequency control with curtailability• Requires Emergency Control System in permanent operation• Easier to implement as step towards full integration
Standby Interconnection	<ul style="list-style-type: none">• Provide spinning reserve with zero power exchange

Commercial Interconnection an option for AFG to connect with one neighboring system

Synchronization Candidates

Candidate / Criterion	Uzbekistan	Uzbekistan + Tajikistan	Turkmenistan + Iran
Frequency controlling system size	acceptable	very good (CAPS)	good
Interconnection capacity	moderate *	moderate *	good **
Uncertainties regarding implementation schedule	none	moderate	high
Supply security (Kabul area)	acceptable ***	acceptable ***	acceptable ***



Summary

New Conservative Scenario

- TKM 300MW + Sheberghan 200MW + CASA-1000 proceed
- AFG demand not met>> increasing load shedding to 2032
- CASA supply to AFG not required before 2027

Synchronous and Asynchronous Interconnections

- Benefits for AFG for commercial interconnection with UZB & TAJ
- Asynchronous TKM/AFG connection (500MW HVDC Back to Back) needed to meet AFG demand and supply PAK

Addendum to be posted on ADB Website In September

**Thank You
&
Questions**