CASA-1000

CASA-1000: Progress and Review

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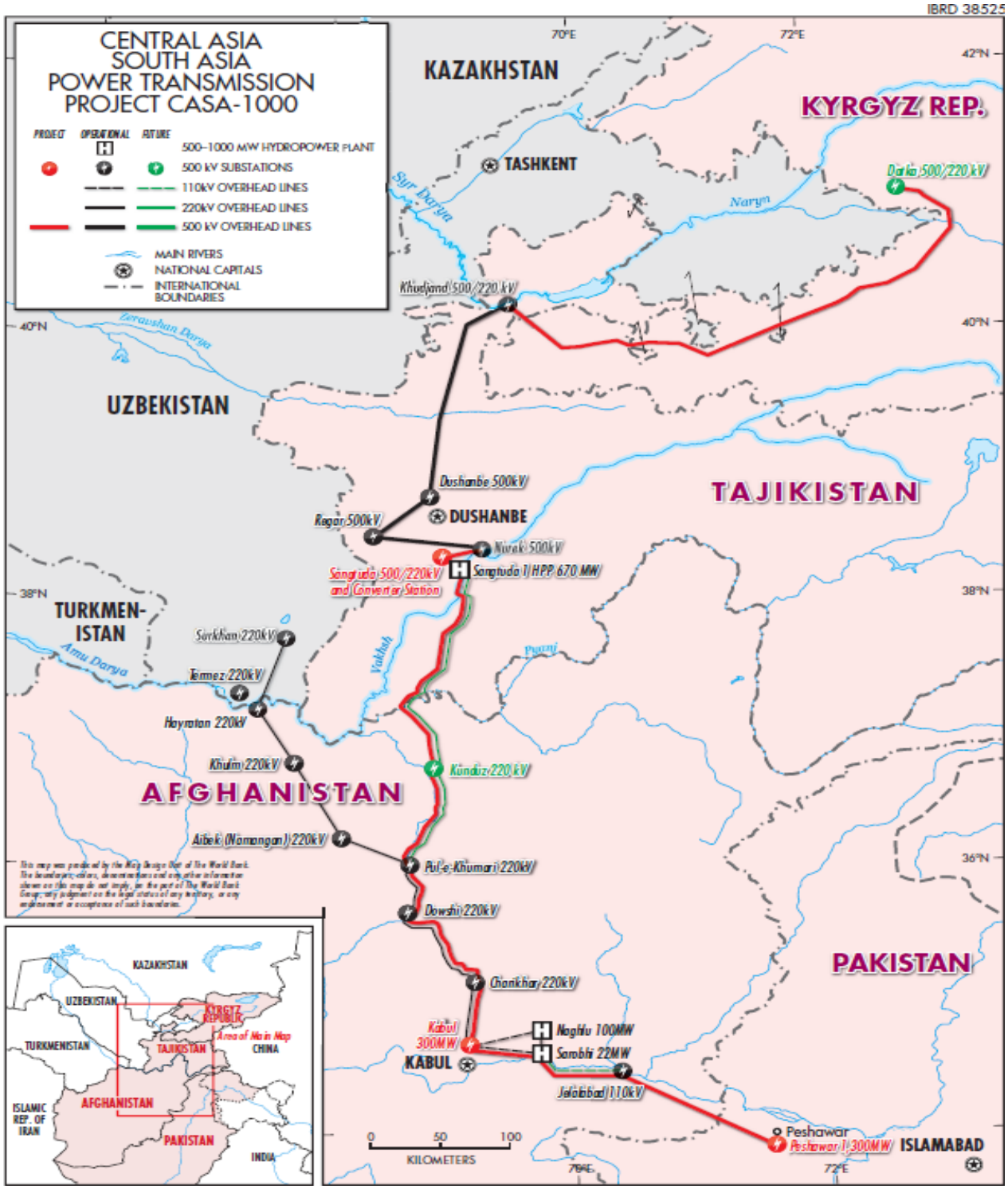


The proposed CASA-1000 transmission facilities would:

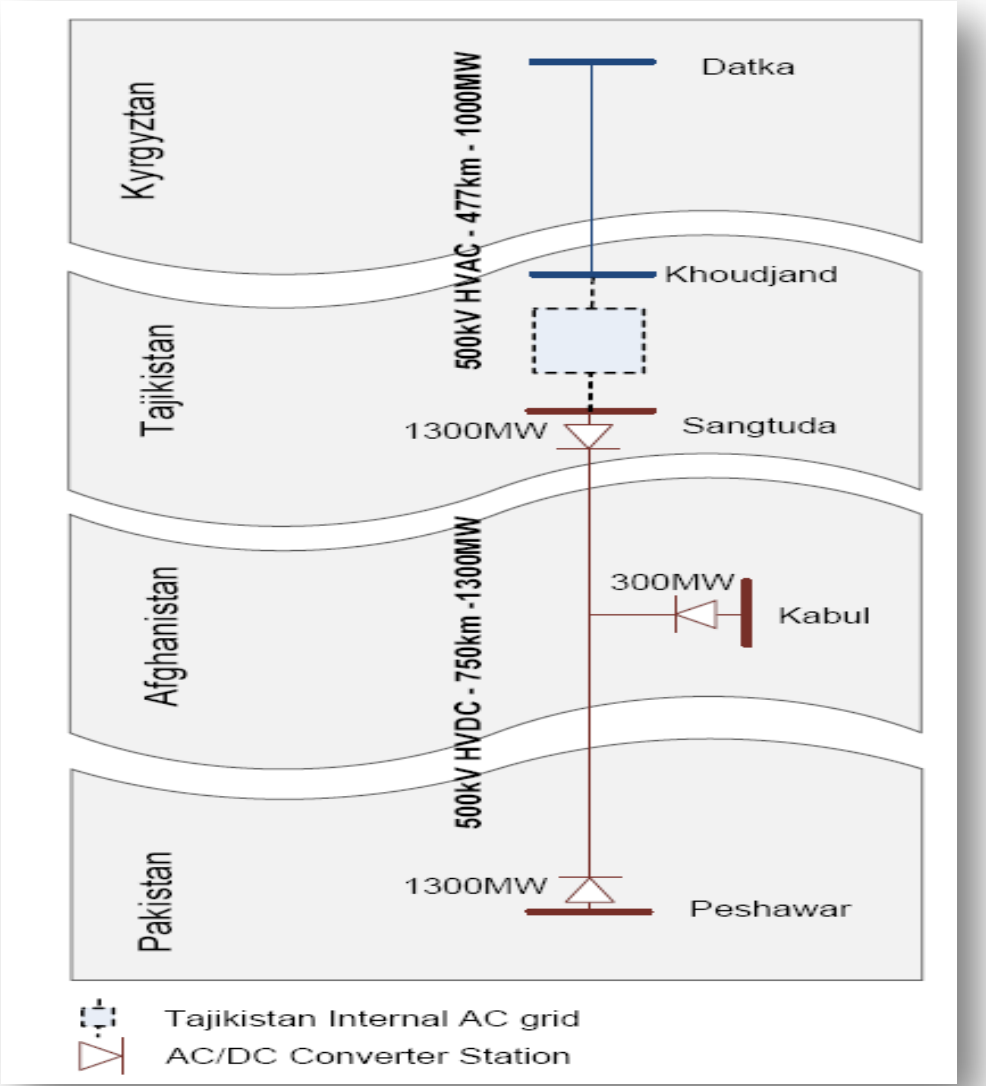
maximize the use of 1,300 MW renewable summer electricity surplus from existing plants in Central Asia (Kyrgyz Republic & Tajikistan)

and

provide electricity to consumers in electricity deficient South Asia (Afghanistan & Pakistan)

The CASA-1000 Project Includes:

- 500 kV line Datka-Khudjand (477 km), with Tajik network transferring Kyrgyz exports to Sangtuda.
- Tajikistan Grid Strengthening.
- 1300 MW AC-DC Convertor Station at Sangtuda.
- 750 km HVDC line Sangtuda-Kabul-Peshawar.
- 300 MW Convertor Station at Kabul (with both import & export capability).
- 1300 MW DC-AC Convertor Station at Peshawar.



Final Report of Feasibility Study Update available at:

http://www.casa-1000.org/1)Techno-EconomicFeasbilityStudy_MainRep_English.pdf
http://www.casa-1000.org/2)Techno-EconomicFeasbilityStudy_MainRep_Russian.pdf

Objectives of CASA 1000 Review

- Confirm that the CASA 1000 project complements the Afghan Power Sector Master Plan (APSMP) and will help optimise investment timing;
- Given the unusually wide range of uncertainties, in Afghanistan how do alternative investment decisions perform when risks as well as costs are taken into consideration;
- Address issues for further investigation:

1. Options to facilitate investments in domestic power transmission development that also support power transit opportunities;
2. Make best advantage of characteristics of HVDC and HVAC transmission technologies and construction alignments.

Afghanistan Power Planning Issues

- 2012 APSMP by Fichtner focusses largely on domestic generation, transmission & distribution development to support growth;
- Assumes increased imports from TKM (300-1000MW), UZB (300MW) and TAJ/KRG (300MW) with modest growth of domestic generation. No exports to 2030.
- Long HVAC lines will need voltage support and facilities to facilitate connection of Afghan generation in accord with Grid Codes
- Interconnection with asynchronous power systems in Iran/TKM, IPS/UPS (UZB); TAJ/KRY, & Pakistan

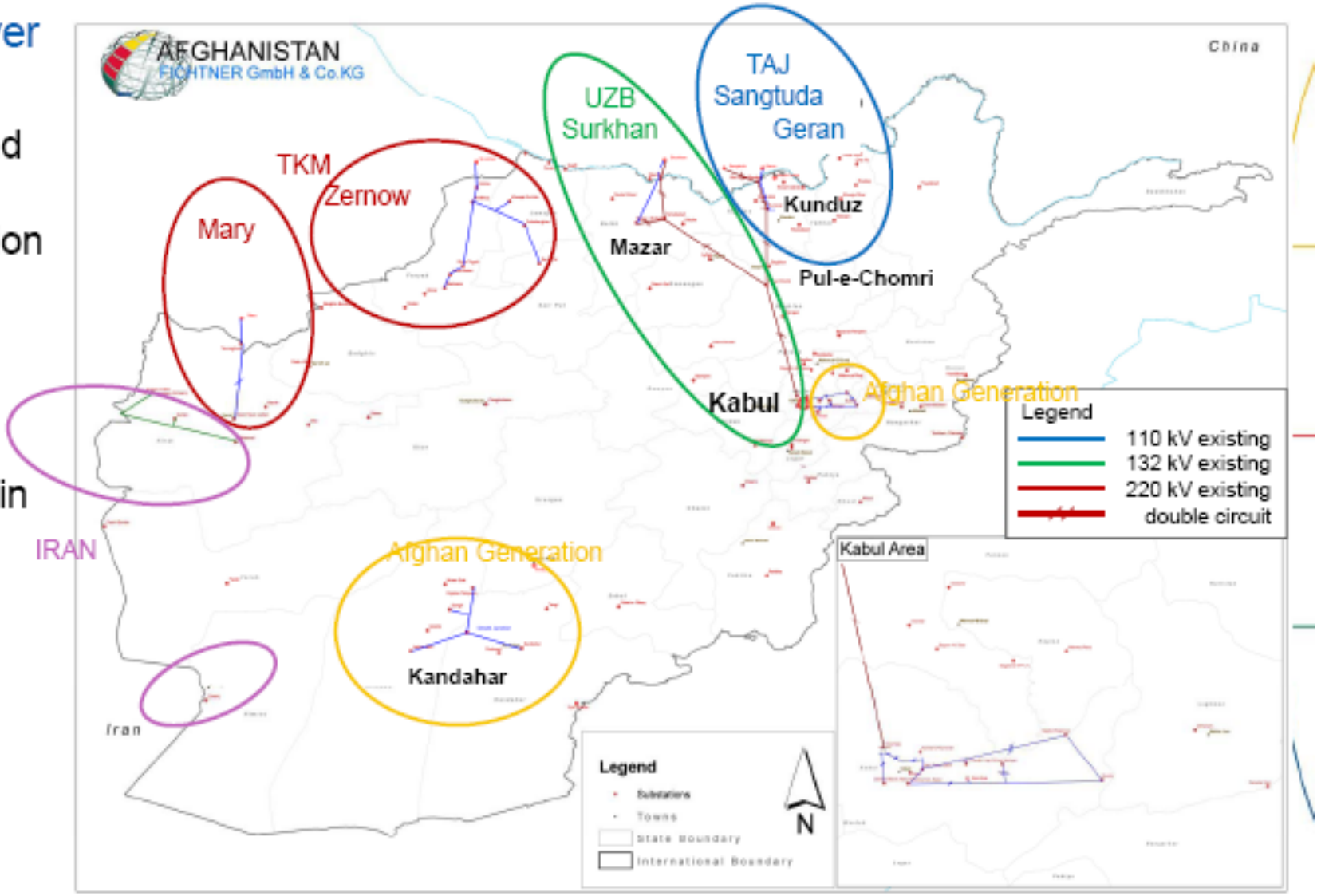
APSMP Assumptions

- Electricity demand growing thanks to CAR existing and planned imports;
- US$10b G,T&D required to support domestic growth to 2030;
- Includes provision for development of 500kV system to import 1000MW from Turkmenistan costing $1.2b; duplicate 500kV line needed to support exports to Pakistan
- Develop synchronous Afghan grid isolated from neighbours with US$850m HVDC b/b facilities;
- Doubts about Afghan ability to deliver local coal or gas resources to sustain growth;
- Hydro developments capital intensive and seasonal source of energy

Transmission Assets and Expansions, Existing System

Existing Power System

- 220 kV and 110 kV transmission system
- Fed from different sources
- Operated in islanded network sections



Demand Forecast – Results

Preliminary forecast based on Fichtner methodology with the following assumptions

- Load factor 0.60, increasing to 0.63
- Connection rate at least 50% by 2020 if currently <10%, otherwise 60%/70%/80% in 2017 depending on current connection rate; Kabul 90%in 2017
- Population growth initially 2% p.a., declining marginally (1.7% in 2032); Kabul initially 3% p.a.
- Forecast of GDP growth by IMF
- Commercial losses decreasing from 30% to 8% in 2032
- Technical losses decreasing from 15% to 9% in 2032

Year	Demand [GWh]	Peak Load [MW]
2010	2,584	506
2011	3,086	628
2012	3,465	687
2013	3,846	753
2014	4,258	824
2015	4,701	900
2016	5,182	987
2017	**5,761**	**1,091**
2018	6,159	1,160
2019	6,536	1,225
2020	6,945	1,295
2021	7,335	1,361
2022	7,805	**1,444**
2023	8,261	1,525
2024	8,700	1,602
2025	9,160	1,683
2026	9,642	1,768
2027	10,157	1,858
2028	10,687	1,951
2029	11,237	2,047
2030	11,810	2,147
2031	12,406	2,251
2032	13,028	**2,361**

Transmission Planning Objectives

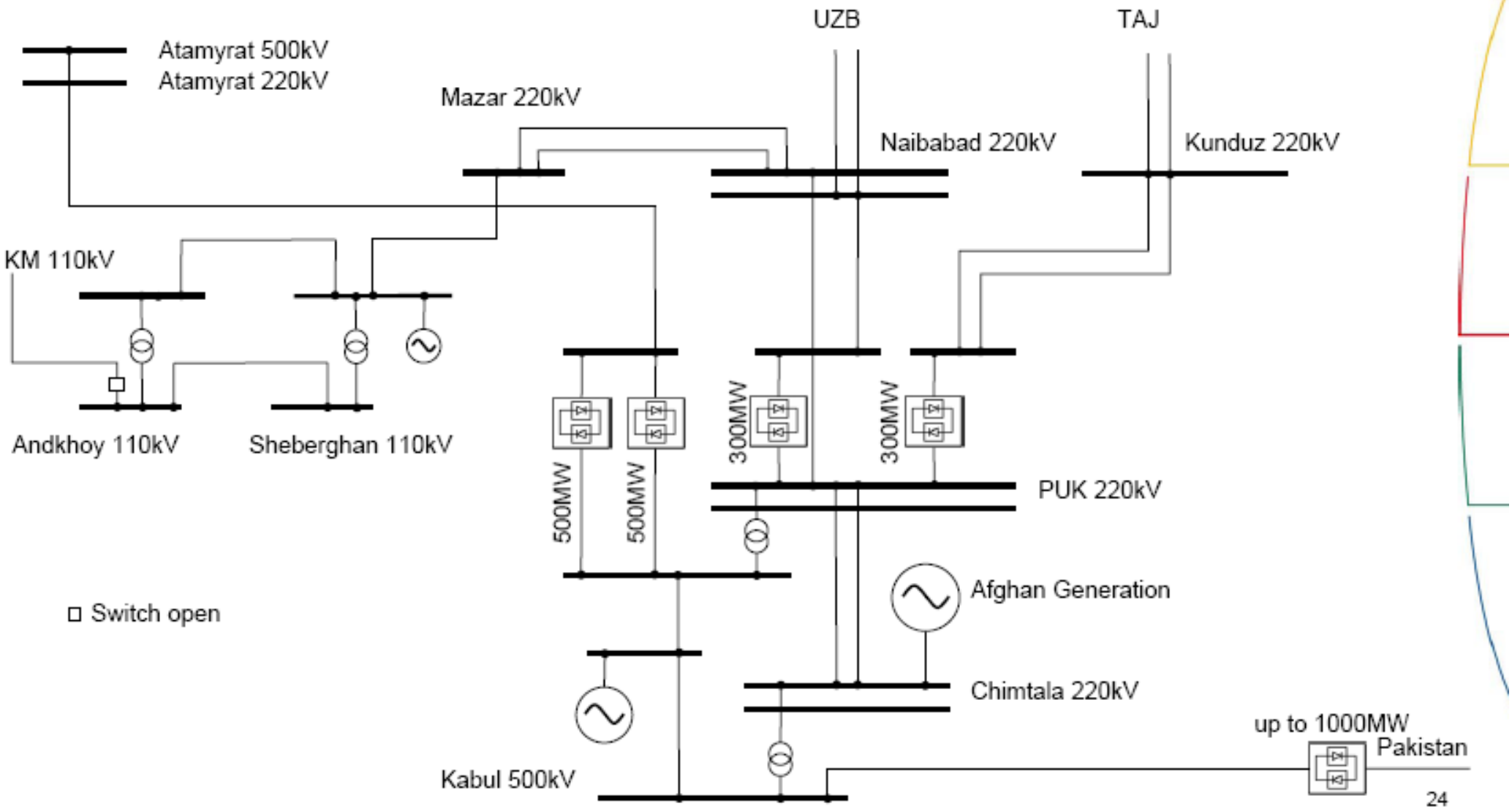
- HVDC and HVAC Transmission projects should be integrated with national least cost power planning to enhance reliability & security;
- Lines have 60-80 year life so design should be flexible and robust– options such as building for 500kV and operating at 220kV can be considered;
- Diversify routes & technologies for security and reliability of supplies and to enable HVAC extensions to un-electrified areas;
- Simplify contractual arrangements for power wheeling;
- HVDC and other special equipment will stabilize voltage conditions in Kabul to facilitate synchronising local generation

Synchronous Interconnections

- Unlikely that major neighbouring systems IPS/UPS, Iran/Turkmen and Pakistan blocks can ever be synchronised;
- NEPS/SEPS must comply with respective Grid Code to synchronise its domestic generation;
- CAR countries may be re-synchronised when there is political agreement to do so;
- Some HVDC or VFT facilities will always be required to facilitate interconnections – either HVDC b/b or HVDC long lines;

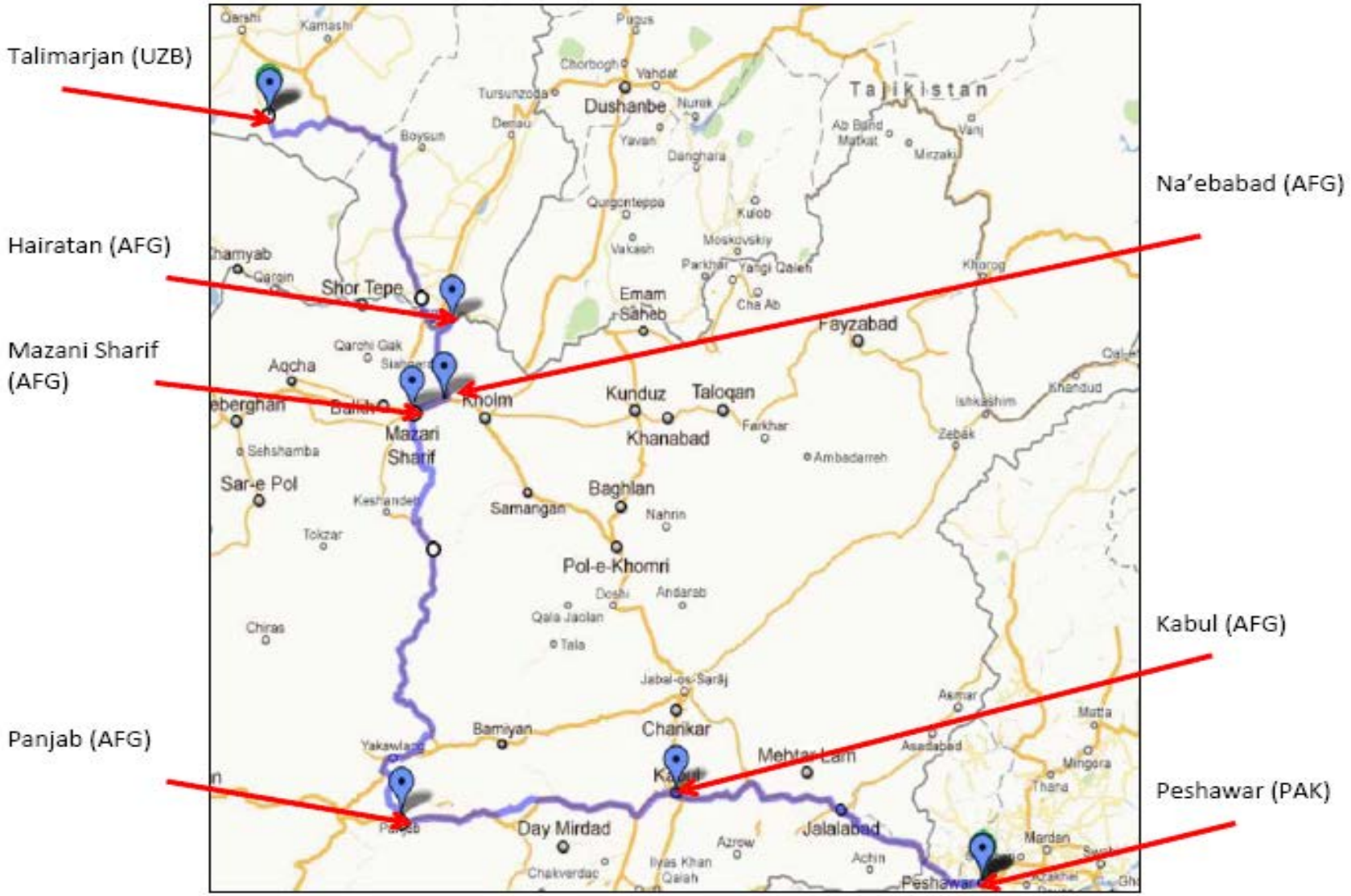
APSMP Concept for Power Imports & Exports

Phase 4, Export to Pakistan



Diversity of Transmission Routes

HVDC Transmission Line Route Proposed by SNC/Lavalin under UAP_EST Study



Features of Power Transit Projects

- Financial Costs should be allocated according to Risks and Rewards of proponents – best suited to HVDC for long lines between asynchronous systems;
- Afghanistan should receive wheeling charge sufficient to pay for HVDC line construction;
- Upfront Power Purchase & Transit Agreement (PP&TA) between parties prior to investment;
- HVDC and HVAC lines can be used in parallel for long distance power transfers to provide diversity and security to all parties.

Concept proposed for Exports from Central Asian Countries under APSMP

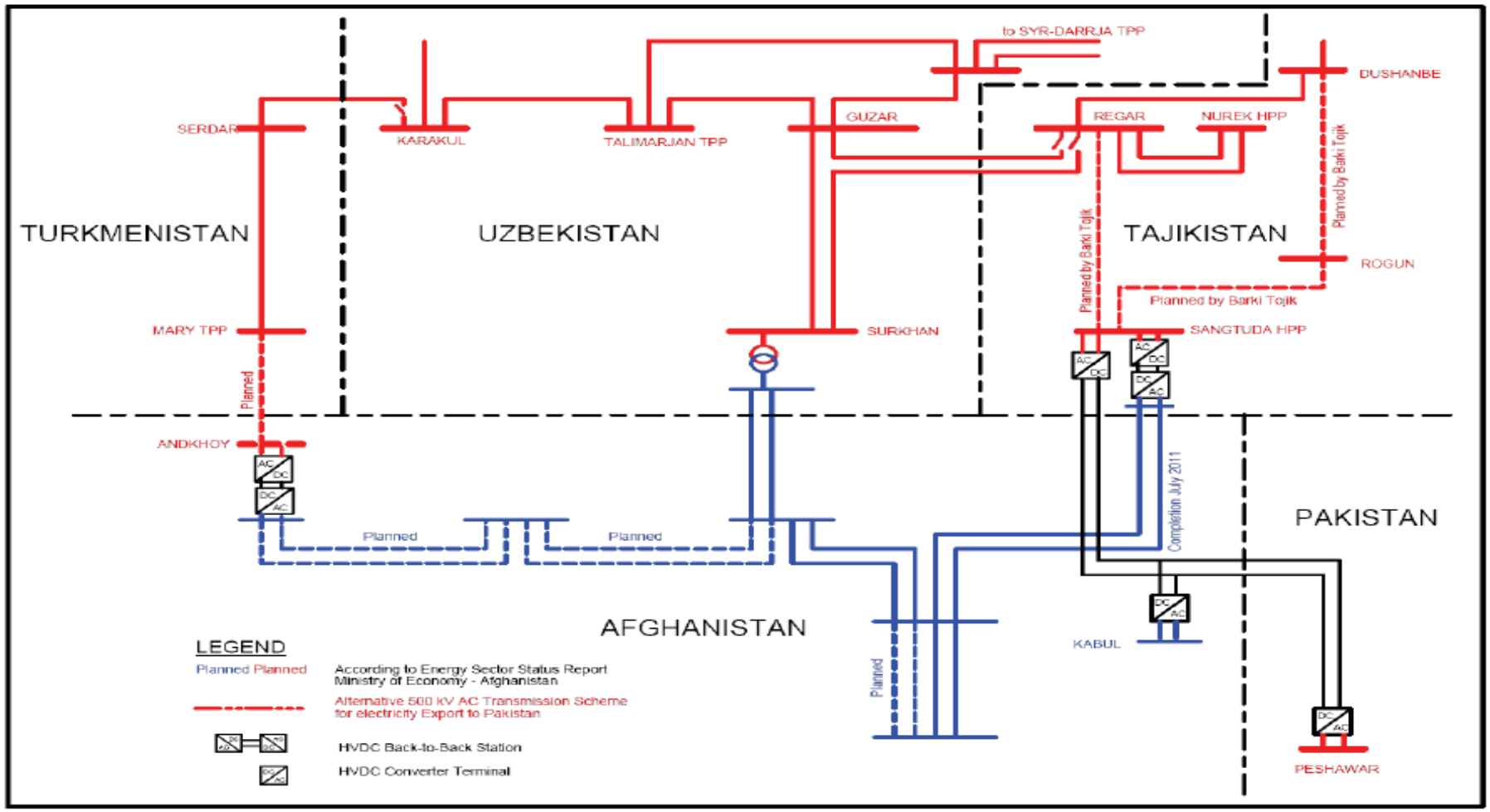


Figure 11.2.2.3-2 Alternative Transmission Scheme with HVDC Back-to-Back Stations and HVDC Line for Electricity Export to Afghanistan and Pakistan

Рисунок 11.2.2.3-2 Альтернативная схема передачи с компенсационной станцией ВВ постоянного тока, и линии ВВПТ для экспорта электричества между Афганистаном и Пакистаном

HVDC versus HVAC

HVDC versus HVAC Applications

- HVDC Best for long lines with 2-3 terminals that can be sized in load increments.
- Connect asynchronous systems and stabilise AC at each terminal
- Low profile, long spans, minimum maintenance
- New VSC technologies versus traditional LCC

US$ 250k/km d/c plus $110/kVA per terminal

- HVAC needed to supply multi-substation synchronous power systems.
- Difficult to send power over long distances without voltage support.
- Can build & operate 500kV lines at lower voltages e.g. 220kV until load grows

US $550k/km d/c with subs at $20/kVA; HVDC b/b $380/kVA

CASA 1000
Allocation of Financial Costs

CASA 1000 Cost Estimate per Final Report Feb 2011								
CASA 1000 Costs	Rate	Unit	Qty	Krygistan	Tajikistan	Afghanistan	Pakistan	Total
Converter Stations	113	k$/kW	2900		$128	$71	$128	$327
Electrodes	5000	k$/#	3		$5	$5	$5	$15
HVDC Transmision lIne	287	k$/km	750		$33	$162	$20	$215
HVAC Substation	9000	K$/#	2	$9	$9			$18
HVAC line	763	$/km	207	$151	$7			$158
In-country Reinforecment					$24	$4	$6	$34
EPC Costs				$160	$206	$242	$159	$767
Owner Engineers Cost	2%							$15
Contingency	10%							$78
IDC	9%							$80
Total Project Cost								$941

Further Work to Finalise Technical Design

- Neighbouring countries must advise Afghan what it needs to do to comply with their Grid Codes to connect HVDC terminals and enable synchronisation of domestic generation;
- The design of the HVDC terminal in Kabul should enable import or export of power and provide stabilising capacity to planned 220kV ring system;

Core Project Agreements

- 4 core PPAs assumed to be of 15 years (KR-AF, KR- Pk, TJ-AF and TJ-PK bilateral Agreements)
- One PPA between AFG-PAK
- Master Agreement (binding all the parties) :
  - Standard terms and conditions for PPAs
  - Framework for O&M, capacity allocation, Open Access, policy risk mitigation
  - Costs and Risks Allocation Principles
- Coordination Agreement: Technical and commercial aspects of wheeling of power between KR and TJ
- Technical Code for operational requirements
- Account Bank Agreement for security of payments following the “Payment Waterfall”
- Host Government Agreements reflecting reciprocate obligations of Governments

Project Status

- Preparation work is proceeding with Joint Working Group (JWG) through monthly VCs and face-to-face meetings. Next Inter Governmental Council Meeting on Sep 16 and 17 in Islamabad, Pakistan.
- **IGC Secretariat strengthened** – Executive Director (ED) appointed; USAID funding additional Advisor to the ED; Secretariat accounts audited.
- **Project commercial structure finalized** –The option of "Contractual JV" (without an SPV for CASA) is preferred by JWG; IGC resolution has been developed and endorsed by all countries.
- **Project commercial contract framework, Model PPA, Master Agreement and Coordination agreement** developed. Under review/discussion by the countries.
- **IFC Agreement to support procurement of constructor/operator** signed by all. Joint Working Group working closely with the IFC to prepare bidding documents for procuring engineer/procure/construct/operate services for the project. Pre qualification documents drafted.
- CASA-1000 included in the **CAREC Energy Work Plan** (2013-15).
- **Communications** established online (www.casa-1000.org)

Русский

CASA 1000

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Students in Tajikistan.

This project demonstrates landmark cooperation between the Kyrgyz Republic, Tajikistan, Pakistan, and Afghanistan.

Map of the CASA-1000 Vision

click to enlarge

Electricity. It's essential for modern life. Without it, development is delayed and poverty endures.

The Kyrgyz Republic and Tajikistan are two countries in Central Asia endowed with some of the world's most abundant clean hydropower resources with water cascading from the mountain ranges and filling the rivers every summer. Both of these countries have a surplus of electricity during the summer. Nearby in South Asia, Afghanistan and Pakistan are suffering from little or no electricity while trying to keep pace with a fast-growing demand for it. Pakistan cannot meet its' citizens' electricity needs, especially during the sweltering summer months, leading to frequent power cuts and millions of people living without electricity.

A new electricity transmission system to connect all four countries, called CASA-1000, would help make the most efficient use of clean hydropower resources in the Central Asian countries by enabling them to transfer and sell their electricity surplus during the summer months to the deficient countries in South Asia. The CASA-1000 project would also complement the countries' efforts to improve electricity access, integrate and expand markets to increase trade, and find sustainable solutions to water resources management.

What's New

May 16-17, 2012: Inter-Governmental Council (IGC) meeting in Dubai, UAE. All four country delegations led by Ministers and Deputies participated in the deliberation and took key decisions on advancement of project preparation, which were documented and signed by all.

April 12-13, 2012: Fifth Meeting of the CASA-1000 Working Groups (now called the "Joint Working Group") took place in Almaty, Kazakhstan. All four country teams were represented together with development partners who are assisting with preparing the project. The meeting deliberated on the structure of the Project and its mode of implementation, as well as the role of the IGC Secretariat. A short list of candidates for the selection of the Executive Director of the IGC Secrearitat was prepared from a pool of 63 applicants.

www.casa-1000.org