CAPS: NEW OPPORTUNITIES AND TECHNICAL CAPACITY OF CDC ENERGIA
Need for Improvement

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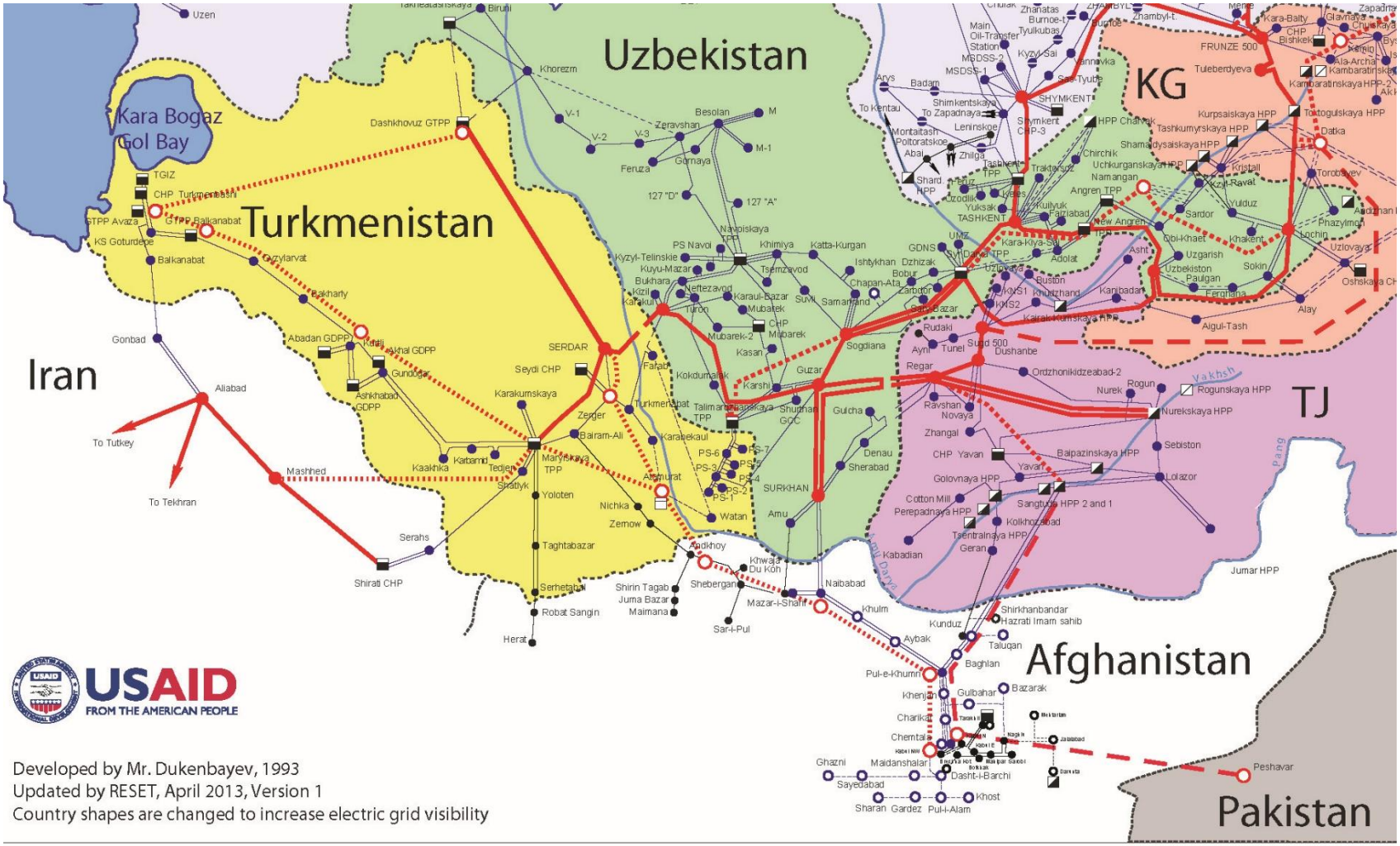
14th Meeting of the Task Force on

Regional Energy Cooperation in Central And South Asia (RECA)

Ashgabat, Turkmenistan

November 7-8, 2017

Regional Power System



Regional Power System

- The regional Central Asian power system had been created as a single integrated complex aimed at
  - efficient use of fossil fuel and hydro energy resources unevenly distributed over the territory
  - resolving the issue of land irrigation for the agricultural needs.
- Management of such a complex structure requires a strong coordination between the power and irrigation agencies and – desirably - a rigid centralized control.
- After creation of the newly independent states different parts of this integrated complex went to different countries and began to be used for the national interests rather than for the common benefits.

Can the regional power system be operated efficiently again but based on the market economy principles?

Regional Power System: Efficiency

How efficient was the power system of the United Dispatch Administration of Central Asia?

- The formation of this system as per its initial design had not been completed.
- Average capacity factor of thermal plants was pretty low.
- The designed modes of operation were possible un a centrally controlled regional transmission system, however they cannot ensure sufficient profitability of thermal power plants.

This is the main reason why it has proved impossible so far to find a universal and broadly acceptable formula for the electricity swap of summer power from upstream countries for winter power from the downstream countries.

Is it possible to improve the efficiency?

Is it possible to improve the efficiency of seasonal swaps?

The efficiency of electricity swaps between the hydro and thermal power plants will improve if:

- the swaps do not occur during peak demand periods of national power systems, that is if the swaps do not affect thermal power plants that have to cover the national consumption peak;
- the thermal power plants that are capable of meeting peak demand of a neighboring country, have the opportunity to operate efficiently during the rest of the year;

Otherwise the winter power from thermal power plants can only be supplied at a very high marginal price; an example: power deliveries from Kazakhstan to Kyrgyzstan in winter 2014 – 2015.

Potential for improvement

Application of market mechanisms for improving efficiency of the energy and irrigation operations

- It is highly problematic because any hypothetical trading mechanism will have in essence to combine two markets: electricity market and a system of river's flow regulation, that is a water market.
- Both commodities – electricity and water – are distinguished by being costly or almost impossible to store.
- Power systems of the individual countries rely on different kinds of limited primary energy resources. It relates to both Tajikistan with Kyrgyzstan (dependence on water inflow) and Uzbekistan (gas deficit in winters).
- The situation results in a significant difference - by several times -in electricity prices over the region. Due to the same reason, the national power systems have to be severely regulated, which hampers development of competitive electricity markets.

As a result: almost all intersystem exchanges require special intergovernmental agreements.

New Opportunities: Turkmenistan

- Since 2003 when Turkmenistan made a strategic choice for independent development of its electric power sector the electric power industry has reached significant success.
- Turkmenistan's large electricity export potential which provides both a foundation for the future country development and an opportunity to support economic development of the neighboring countries, including Afghanistan, Iran, Turkey, and former partners in the Central Asia.
- During this period Turkmenistan has expanded its power generating fleet by about 2.5 GW in eight new OCGT power plants, having reached the total sector's capacity of more than 5.1 GW.
- By that time the national grid will be significantly strengthened with a range of internal transmission lines, including 220 kV lines from Serdar to Turkmenabat to Watan and 500kV line from Mary TPP to Atamurat to Ankhoy, to support development of the Garlyk industrial zone in the South-East of the country and facilitate export to Afghanistan.

New Opportunities: CAPS

- Development of the four CAPS members in the last decade has also showed a clear trend toward seeking energy independence - a core element of the national energy security.
- All four CAPS countries have successfully strengthened their transmission infrastructure to create conditions that would allow them to supply their native load by using exclusively national resources.
- An important event in 2016:
  - a new 400 MW CHP was commissioned in Dushanbe which will allow Barki Tojik to fully eliminate electricity supply rationing.

New Opportunities: A Turning Point?

- Currently, all CAPS countries are, at least theoretically, prepared to operate in an islanded mode, (with Tajikistan actually implementing it), without constraining their own customers.
- Both Tajikistan and Kyrgyzstan would continue to build new thermal generating capacities while Uzbekistan will need more flexible generation to provide efficient power and frequency control.
- It can be said that the factor of strong mutual dependence, which had been giving some countries disproportionally great influence over others, is gradually disappearing from CAPS relationships.

This may mark a turning point in the CAPS development and at the same time pose a new question: what may be now the main reason to continue coordinated operations within CAPS?

New Challenges: Turning Point?

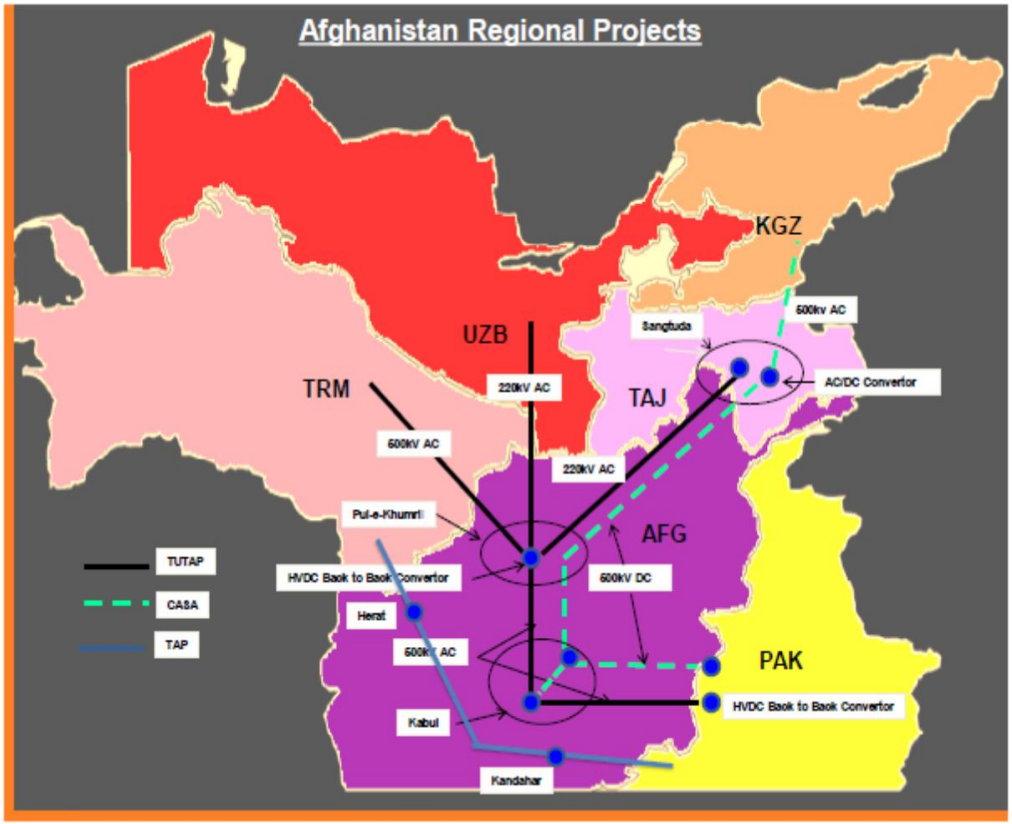
The energy independence at the national level is very costly:

- each country has to keep thermal plants and CHPs that can only be used during a limited period of year;
- operate expensive flexible GT plants or hydro resources that, ideally, have to predominantly be used in the irrigation mode and whose summer electricity cannot be sold at a decent price to the neighboring CAPS countries.

To alleviate the financial burden of energy independence, the national energy authorities should seek export opportunities outside the region as the most reasonable economic option.

CAPS integration through export

- Export to Afghanistan and Pakistan where there is growing demand for electricity is becoming a serious factor that favors integration of power systems of Central Asia.
- In the near and mid-term perspectives one of possible scenarios for the future is that with increased exports through the Central Asia – South Asia energy corridor the internal power exchanges within CAPS may be practically limited to loop flows or daily swap exchanges – both with zero net trading volumes. This trend can easily be observed during the last 10-15 years.

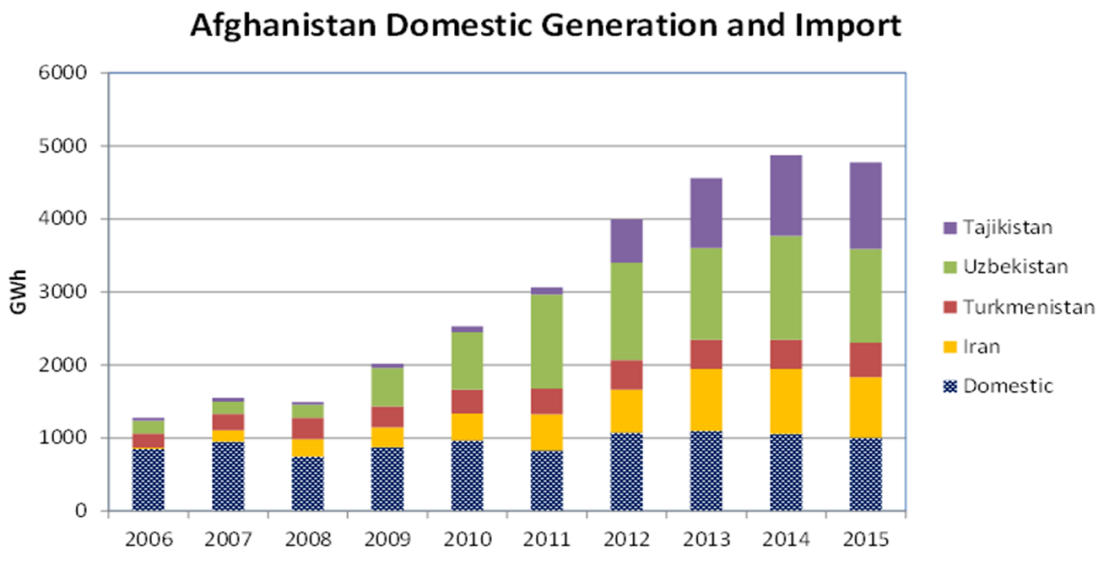


New Challenges: Turning Point?

Thus, in the near future CAPS success will depend on the ability of its members to:

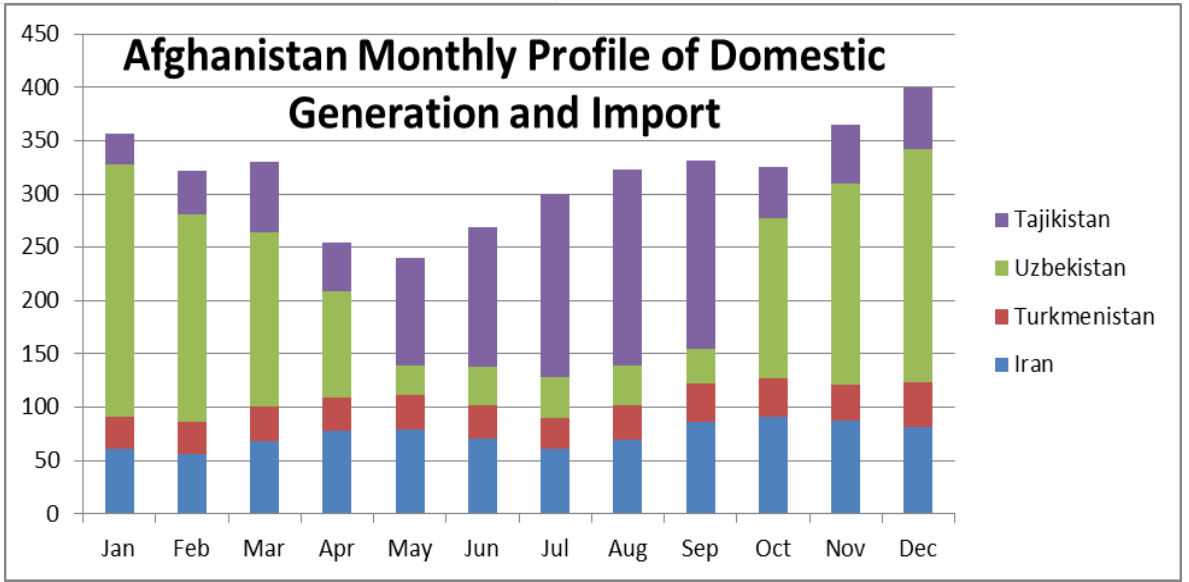
- export electricity to South Asian countries – Afghanistan and Pakistan;
- reach efficient seasonal allocation of export responsibilities among themselves;
- provide mutual support during emergencies;
- be collectively interconnected to ensure frequency control and fast access to generation reserves.

Export to Afghanistan patterns



Year by year export trends to Afghanistan

The shares of Uzbekistan and Tajikistan distributed over a year



Prospects for Inter-regional Trade

- Incentives for trading electricity within CAPS might be minimal because of almost uniform and relatively high reference electricity prices throughout the region (determined by export opportunity cost).
- However as recent World Bank study commissioned by Mercados showed, there is plenty of untapped benefits in the form of the lost opportunity costs derived from not fully utilized benefits of regional centralized dispatch of generating resources.
- As study results show magnitude of these benefits is such that sooner or later they have to be explored.

How to Utilize the New Opportunities

To realize these opportunities:

- Coordinating role of CDC Energia should be strengthened
- A robust legal basis for power transit operations should be developed in line with the Energy Charter Treaty principles
- CAPS methodologies should be improved and/or updated:
  - for determination of transit services
  - for determination of load-following ancillary services
- Cross-border commercial metering system should be modernized in order to enable transition to an hourly settlements periods in cross-border trades and transit services.
  In particular, shorter settlements periods in transit operations will make the it possible to apply advanced transit methodologies (ITC) and employ more cost-reflecting pricing for these services.

Coordinating role of CDC Energia

Coordinating role of CDC Energia should be strengthened



Support to CDC Energia should be given to improve its ability to:

- carry out high quality transmission planning and analysis processes.
- administer ancillary services methodologies (transit and load-following services)
- maintain security of the Central Asian grid in its capacity of a reliable exporting hub for the Central Asia - South Asia energy corridor

Technical support to CDC Energia 1

Technical support to CDC Energia is needed because in the past this organization has been chronically underfunded. Regrettably, this problem has been critically aggravated as a result of disconnection of Tajikistan from CAPS.

Now, with the new opportunities in CAPS, CDC Energia will need at least:

- **New high-speed communication channels and corresponding hardware and software to maintain information exchange with CAPS members' national dispatch centers, currently being equipped with advanced SCADA systems. Implementation of IEC 60870-6 TASE.2 (ICCP) protocol;**
- **Modern transmission system modelling and analytical software tool (PSS/E from Siemens or Power Factory from DigSILENT) with corresponding training.**

Technical support to CDC Energia 2

Several other issues can be listed as first priority for CDC Energia's ability to monitor and coordinate regional power flows:

New SCADA system

Existing system (OIC) is very slow. More importantly, it cannot accommodate the new generation and transmission equipment that is being introduced into CAPS, both in its telemetric data capacity and its ability to receive data using modern telemetry communication protocols.

Rehabilitation of the Dispatch Board

The telemetry equipment that currently sends information to the dispatch is obsolete and needs replacement. To receive information from the new SCADA some rehabilitation is needed.

Thank you!

Vladimir Tsyssin

Transmission systems, Energy Links