

USAID's Regional Energy Security, Efficiency & Trade Program (RESET)

Regional Energy Dispatch Issues

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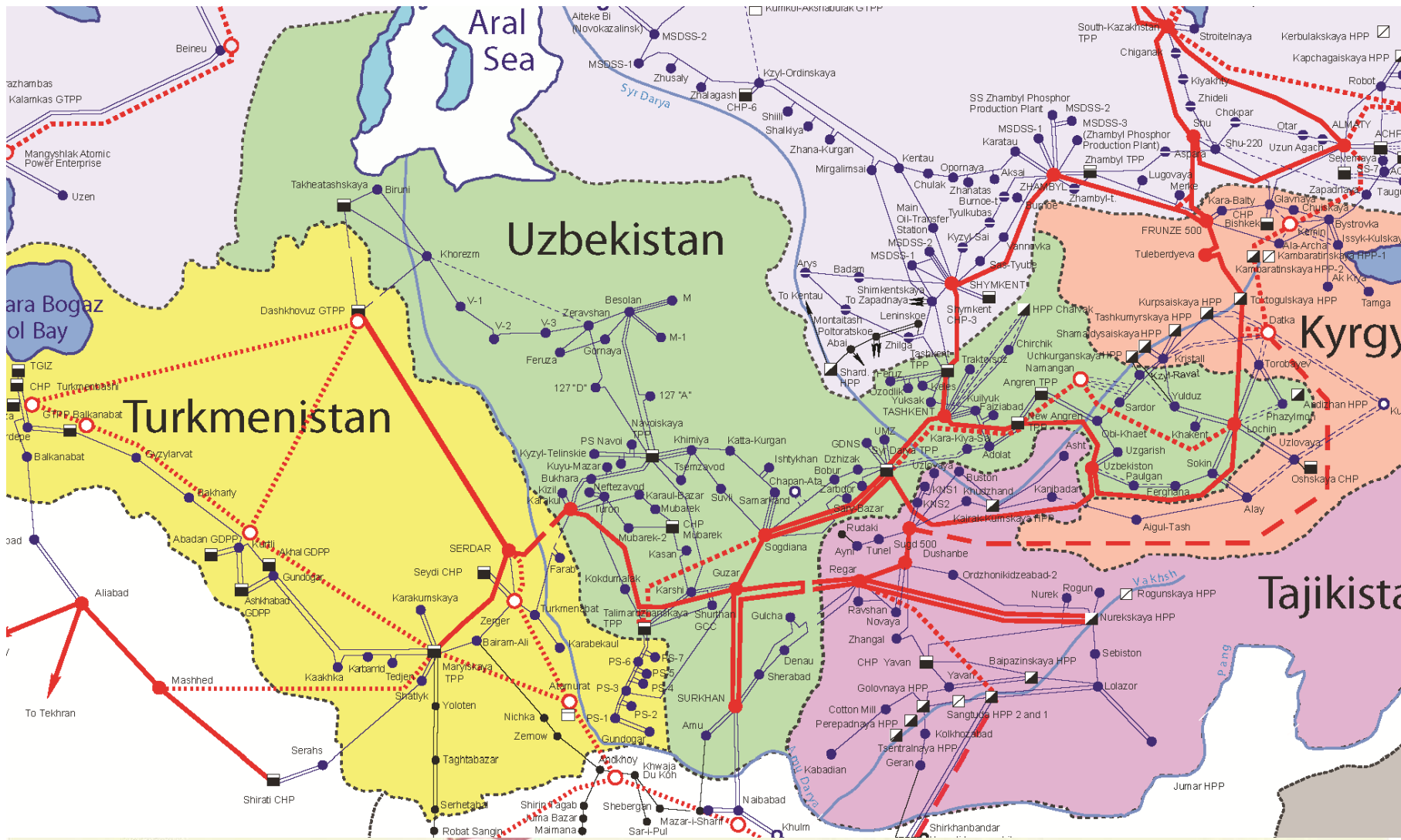
Key Topics

- Brief history of regional power system operation
- Overview of regional dispatch issues – what are the missing pieces?
- Classification of issues:
 - Reliability – ancillary services
 - Wires (transmission issues)
 - “Sleeper” issues – transit, water management

Brief History

- The Central Asia Power System (“CAPS”):
 - Formed in the 1980s
 - Operated so as to enhance the reliability of the regional power system
 - While achieving rational utilization of fuel, energy and water resources across the region
- Was the last created united power system (UPS) among those that formed the Unified Power System (UES) of the Soviet Union
- Unlike most other UPSs, it operated as a fully self-reliant control area, which most of the time functioned in an isolated mode under dispatch control by the United Dispatch Center of Middle Asia located in Tashkent (now – CDC Energia)
- It included the national power systems of Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan and power facilities of Southern Kazakhstan

Central Asian United Power System



Current State of Affairs

- CAR UPS is currently the only international power system within the territory of the former USSR that has preserved parallel operation & continues to operate as a united power system, but:
 - Parallel operation now involves only 3, not 5 national systems
 - Funding for CDC Energia had been sharply reduced because only three power systems remain in parallel operation, and they have not increased their payments to CDC to compensate for the loss of funds previously paid by Tajikistan.
 - (Recently, a partial solution was found by allowing Kazakhstan's Samruk Energo to participate in the Coordinating Council as an associate member.)
- ***In the autumn-winter peak load period, CAR UPS operates in an emergency mode most of the time.***

Overview of Regional Dispatch Issues

The CAREC sponsored study by Fichtner has determined that for 2015 an interconnected mode of operation would create US\$550 million in economic benefits, if the following conditions could be met:

- Energy exchanges take place strictly in accord with agreed terms of trade with minimum violations;
- The interconnections and “dispatch regime” are seamless and efficient so that full system integration is achieved; and
- Market principles of energy trade are adopted and fully adhered to.

The Missing Pieces

Let us return to the observation emphasized on a previous slide:

- ***In the autumn-winter peak load period, CAR UPS operates in an emergency mode most of the time.***
 - This observation indicates that the most important pieces of regional energy dispatch are missing.
 - The missing pieces are those associated with the issues of power system reliability, primarily a deficit of operating reserves and a shrinking range of regulation.
- ***As experience in the operation of electric power markets has shown, no sustainable market benefits can be achieved in the absence of reliable operation of the power system.***

Reliability Issues

- The most important reliability issue in the region is the provision of operating reserves, both spinning and non-spinning.
- Operating reserves are needed to assure that the power system can withstand contingencies such as a sudden loss of generating resource(s) or unforecast increase in demand.
- The fact that CAR UPS operates in emergency mode during peak load periods means that the amount of operating reserves in the system is inadequate to withstand possible unforeseen events.
- Historically, operating reserves in the CAR UPS were provided by hydro generation resources in Kyrgyzstan and Tajikistan. With Tajikistan having been disconnected from parallel operation, the situation with respect to operating reserves has worsened.

Unplanned Power Flows: a Reliability Issue

- In the last few years, the situation with unplanned cross-border power flows has emerged as a highly contentious issue and now threatens the reliable operation of the regional power system.
 - In the winter of 2011/2012, the inability to resolve the issue threatened to halt the parallel operation of CAR UPS.
- This issue is not new in CAR UPS. Previously, it was mainly a settlement issue, but it has now become a reliability issue due to the altered character of the unplanned power flows.
- To the extent that unplanned power flows are inadvertent and are an inevitable part of parallel operation of two or more power systems, they usually become a matter for commercial settlement.
- But when these flows are no longer inadvertent, and in some hours reach a magnitude of several hundred megawatts, they become first and foremost a reliability issue.

Unplanned Power Flows: a Reliability Issue

(cont'd)

- The power flows that present the greatest threat to reliable operation of the power system are not the unplanned and inadvertent power flows, but the power flows that result from deliberate and unsanctioned/disputed withdrawal of power from the grid.
- From the point of view of maintaining reliable system operation, the unsanctioned/disputed withdrawal of 500 MW of power may represent a larger threat than the loss of a 500 MW generator.
- Fortunately, during the past winter season, the impact on reliability of unsanctioned/disputed withdrawals of power from the regional grid did not manifest itself to the extent it did during the winter of 2011/2012, although such withdrawals still took place in amounts that were problematic.

Ancillary Services Market

- One remedy for dealing with reliability issues could be the introduction of market arrangements that assure the provision of key ancillary services, such as frequency and capacity regulation and operating reserves.
- A market-based methodology for paying for regulating capacity has been in place, to some extent, for the past 14 years.
- This methodology is now also being applied on an ad-hoc basis to the settlement for the unsanctioned/disputed withdrawal of power.
- As inadequate as it is, this methodology helps to serve its intended purpose of providing payment for the service of regulating capacity.

Ancillary Services Market (cont'd)

- One reason for the deficit of operating reserves and the shrinking range of capacity regulation is that payments are made only on the basis of actual usage, but not for the reserve (regulating range) itself.
- Providing operating reserves and maintaining the regulating range may incur a “lost opportunity cost” unless payments are made to service providers to offset these opportunity costs.
- Water storage & management services may also be considered as ancillary services that impose a “lost opportunity cost” on the service providers for which they deserve pricing and payment.
- **Continuing to ignore these issues may accelerate the region’s reserve shortages and further aggravate system reliability.**

Coordinated Provision of Ancillary Services

- One distinct feature of ancillary services is that they do not have specific recipients. They are provided for the benefit of the entire power system. Therefore, provision of these services has to be coordinated.
- Typically, these services on a regional scale are coordinated by an Independent System Operator. Currently such coordination is performed by the regional dispatch center, CDC Energia.
- In fact, dispatch coordination and control itself is arguably one of the most important ancillary services. CDC Energia in the past has been chronically underfunded. It is regrettable that this problem has been critically aggravated as a result of the disconnection of Tajikistan from CAPS.

The Authority & Role of Independent System Operator

- Over the last 20+ years, the actual dispatch authority of CDC Energia has gradually decreased.
- Meanwhile, achievement of the projected savings in fuel and energy costs from increased power trading, requires recognition of the need to reintroduce centralized economic dispatch on a regional scale.
- That would require a regional Independent System Operator, acting in a role similar to that currently played by CDC Energia, but with greater independence and expanded responsibilities, including regional load forecasting, resource adequacy and other duties.
- Reintroducing central economic dispatch would also require creating a new market model, but would significantly mitigate some of the most troublesome issues that adversely impact the regional power system today (inadvertent power flows, unauthorized withdrawals of power, transit).

Reliability and Market-Based Approaches

- **Conclusion:** Many of the current reliability issues of the power sector can and should be solved using a market-based approach.
- In the words of one of the most prominent power market advocates in Russia:

“To assure reliability by non-market approaches is not reliable.”

Transmission Issues

- New lines interconnecting national power systems in the region are now in various stages of planning/construction.
- These new facilities include lines interconnecting Kazakhstan and Kyrgyzstan, and Kyrgyzstan and Tajikistan.
- Feasibility studies for these transmission facilities are completed or nearing completion. Additionally, USAID, through its RESET project, will fund a study intended to assess the impact of the planned construction of new transmission lines under the CASA-1000 project on the operation of existing CAPS facilities.
- Additional studies are needed to evaluate whether other new facilities would adversely affect the operation of existing facilities, and, if so, to propose mitigation measures and a method for allocating mitigation costs.

Power Transit Issues

- Usually the transit of power is associated with commercial transactions, the implementation of which requires wheeling power from seller to buyer utilizing transmission networks of a “third” power system or party.
- Wheeling of power from south to north of Kyrgyzstan, or from the Tashkent area of Uzbekistan to the Fergana Valley, also may arguably be considered as “transit” because the transmission networks of Uzbekistan and Kazakhstan are used in the first case and Kyrgyzstan’s network is used in the second case.
- However, starting in 1991 some national power systems in the region began to define loop flows through their systems as a “transit” transaction.

Power Transit Issues (cont'd)

- Since 2000, there has been an approved methodology adopted for transit of power through the 220 and 500 KV loop network.
- However, with the planned addition of new transmission lines and a changing regional transmission network topology, new challenges related to “transit” are inevitable.
- CDC Energia is currently evaluating the “ITC” methodology adopted by European transmission system operators for pricing “transit” services and considering its applicability to CAR UPS.
- Other approaches also under consideration:
 - “Average participation” methodology based on estimated levels of transmission network utilization.
 - “With and without” (WWT) transit methodology based on estimated cost differences for scenarios with and without transit.

The Power Market and Transit Connection

- If central economic dispatch and an appropriate new market model were to be adopted in the region, many thorny issues, including transit, would be alleviated.
- “Transit” arrangements have become a non-issue in regions that have adopted advanced power markets based on locational marginal pricing, regional transmission tariffs in conjunction with nodal price differences, and trading of lines’ transfer capability.
- RESET has conducted seminars for the technical staff of the power systems of various CAR countries at which issues of advanced power market operation, including reliability aspects and various approaches to power transit tariffs, were discussed in detail.

Thank You!

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