

Cooperation within the framework of the Central Asian Unified Power System

Tashkent

April 2024 г.

CDC Energia

Central Asian United Power System

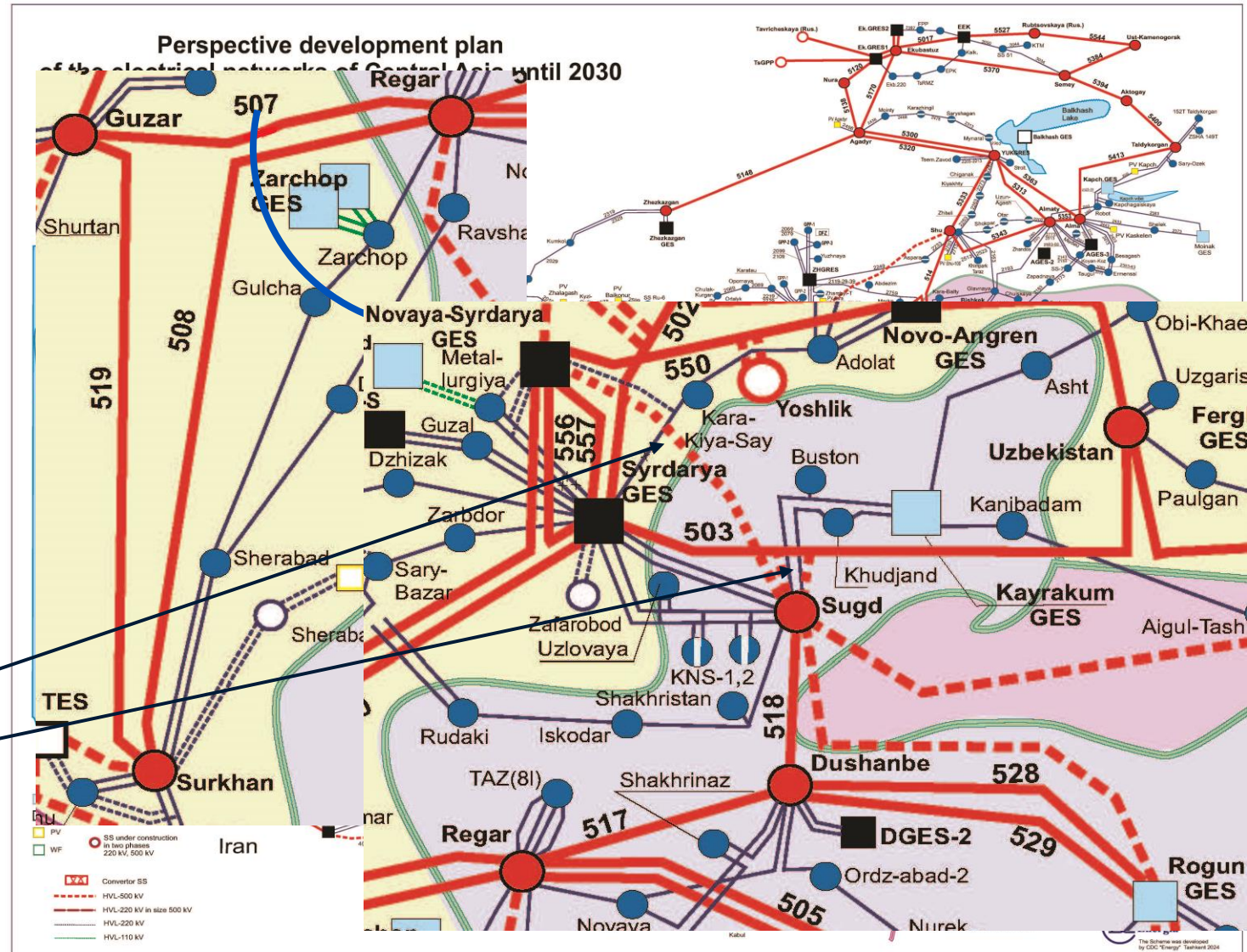
- ▶ Currently, the energy systems of Kazakhstan, Kyrgyzstan and Uzbekistan participate and operate in parallel in the Central Asian United Power System (CA UPS).
- ▶ Since December 2009, the Tajikistan energy system has been operating autonomously from the CA UPS
- ▶ Currently the process of reconnecting the Tajikistan energy system to the Central Asian United Power System is underway. The grid activity-based schedule on connecting to the CA UPS has been drawn up. The connection will be completed by beg.-May this year.



Interconnections

The power systems of Kazakhstan, Uzbekistan and Kyrgyzstan, which synchronously operate and Tajikistan and Turkmenistan, which operate autonomously, are mainly interconnected by 220-500kV transmission lines. 2 stages are planned to get the Tajikistan power system connected to the CA UPS:

- 1st stage: to get connected to the **South part** of Uzbekistan power system (2 transmission lines 550kV SS Guzar – SS Regar and SS Surkhan – SS Regar and 2 transmission lines 220kV SS Regar – SS Gulcha and SS Regar – SS Denau)
- 2nd stage: SS Sughd (Tajikistan) will be connected to the existing 500kV transmission line in Uzbekistan as per **Incoming – Outcoming line** circuit. As well a **new 500kV** transmission line will be constructed to interconnect New Syrdarya TPP (Uzbekistan) and SS Sughd (Tajikistan). ADB supports the project on linking Tajikistan power system to the CA UPS



Main areas of cooperation

The main areas of cooperation by and between Central Asian energy systems are:

- trade in electric energy;
- development of interstate power grids;
- joint construction of power plants;
- planning the integrated development of energy systems.



Energy trade

- ▶ The CA UPS and Turkmenistan have been actively co-operating in the field of electricity trade and system services.
- ▶ In order to rationally utilise the water and energy resources, the energy systems of Tajikistan and Uzbekistan conclude annual contracts for electricity supply from Tajikistan to Uzbekistan in summer. This minimizes the spilled water discharges from Tajikistan's hydropower plants, while Uzbekistan's energy system reduces the fuel consumption, maintains and repairs the heat power plants.
- ▶ Turkmenistan energy system exports electricity practically all year round, but since it does not operate in parallel with the CA UPS, the energy is supplied by standalone generators connected to the Uzbekistan power grid. Electricity is exported to the energy systems of Kyrgyzstan and Uzbekistan.
- ▶ Last years Kazakhstan has been transmitting the electricity to Kyrgyzstan for the purpose of sustaining the water resources at the Toktogul HPP. Current autumn-winter period, the Russian Federation has supplied the electricity to Kyrgyzstan, and Kazakhstan power grid has been a transit vehicle.
- ▶ Electricity supply contracts are bilaterally concluded. Electricity supply which requests employing the power grids of third countries, is also a subject to a contract for electricity transit.

Electricity trade by the CA UPS

Turkmenistan exported electricity, mln. kWh:

- ▶ to Uzbekistan
- ▶ to Kyrgyzstan

2021	2022	2023
4209.9	4529.4	4014,6
498.2	813.5	1770,7

Tajikistan exported electricity, mln. kWh:

- ▶ to Uzbekistan

1146.8	839.4	907,5
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Kazakhstan exported electricity, mln. kWh:

- ▶ to Kyrgyzstan

686,8	696,6	1440,9
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Also, the energy systems of Uzbekistan, Tajikistan and Turkmenistan supply electricity to the energy system of Afghanistan.

Thus, the export of electricity to Afghanistan amounted to mln kWh:

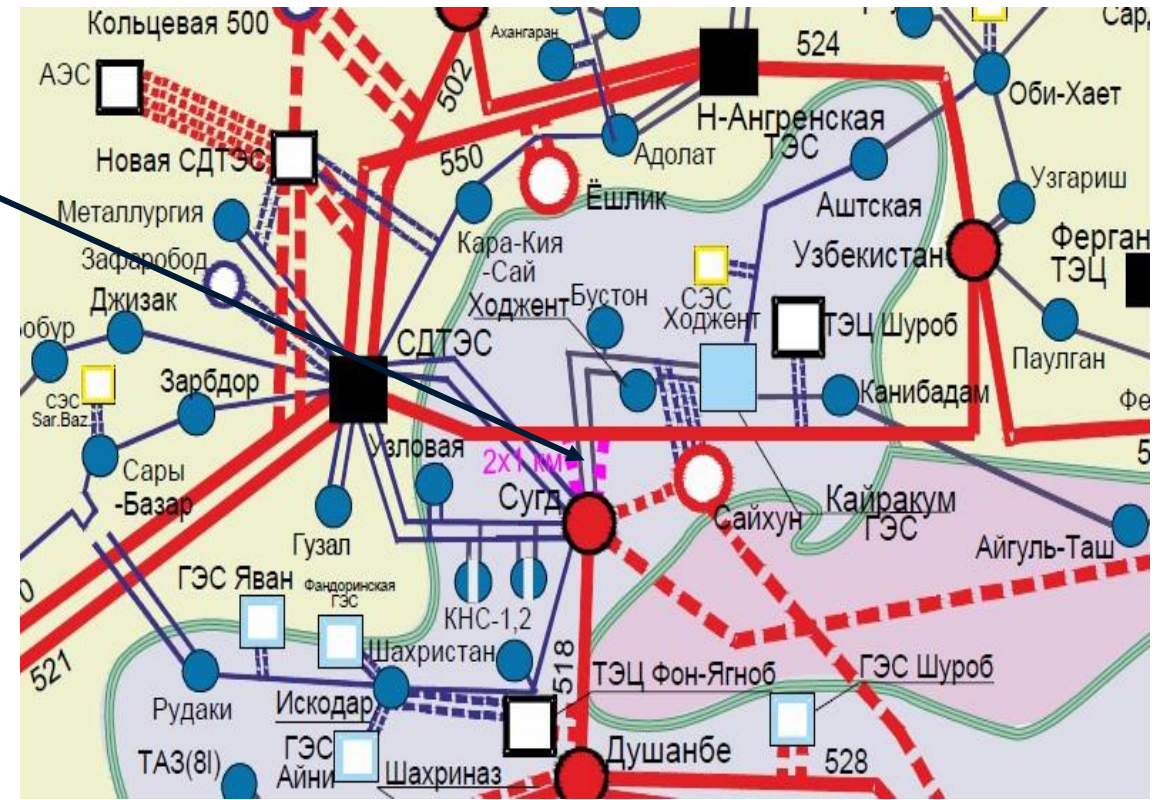
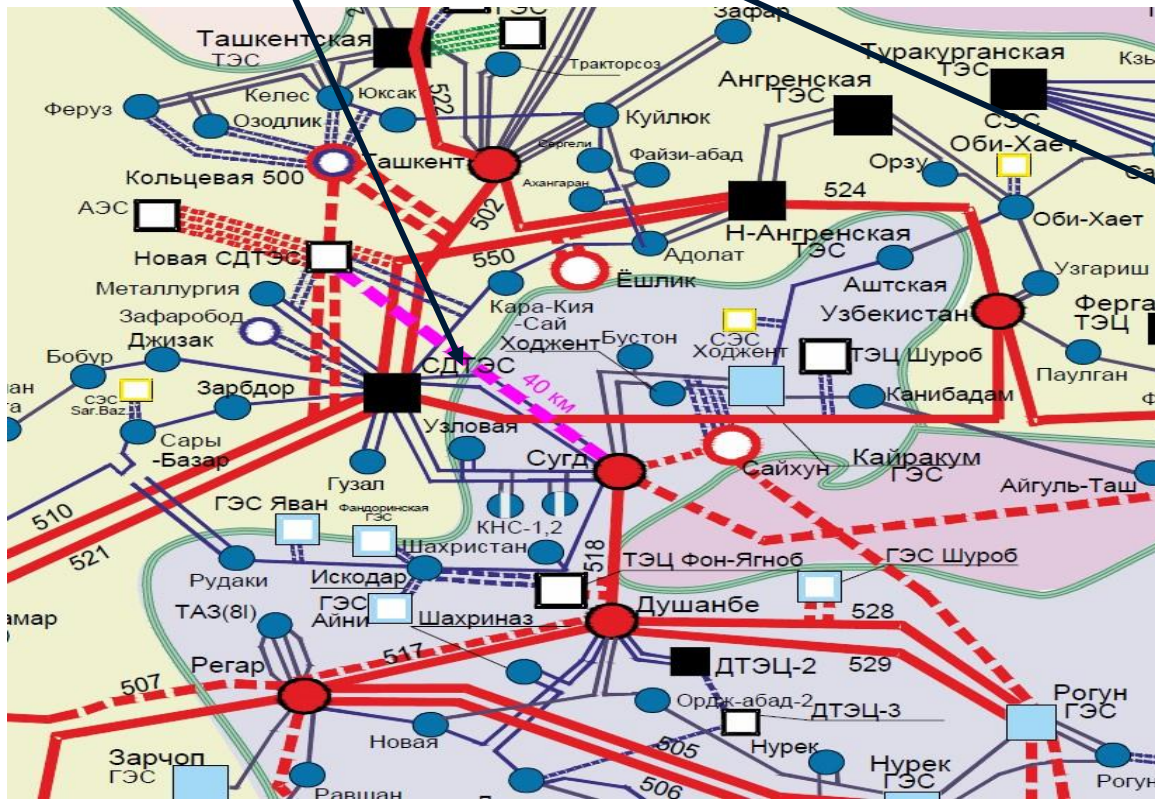
	2021.	2022.	2023
▶ from Uzbekistan	2151,3	1425,6	1823,5
▶ from Tajikistan	1275,2	1663,7	1534,5



Development of interstate power grids

As part of reinstating operation of the Tajikistan power system in parallel with the CA UPS, following projects are underway:

- a **new 500kV** transmission line will be constructed to interconnect New Syrdarya TPP (Uzbekistan) and SS Sughd (Tajikistan).
- SS Sughd (Tajikistan) will be connected to the existing 500kV transmission line in Uzbekistan as per **Incoming - Outcoming line** circuit;



Joint construction of power plants

- ▶ Kyrgyzstan, Uzbekistan and Kazakhstan signed a memorandum of intent on the Kambarata HPP-1 construction project. Establishing a joint venture between the parties is in progress
- ▶ Negotiations are progressing between Tajikistan and Uzbekistan and between Tajikistan and Kazakhstan on electricity supply from the Rogun HPP. As lately updated, the stakeholders from Uzbekistan and Tajikistan came to an agreement on this matter.
- ▶ Currently, Tajikistan and Uzbekistan are jointly working on a project for constructing two hydropower plants of total capacity of 320 MW on the Zarafshan River in the Sughd Region (Tajikistan). The countries have established TAUZ Hydro JSC, which is responsible for project management.



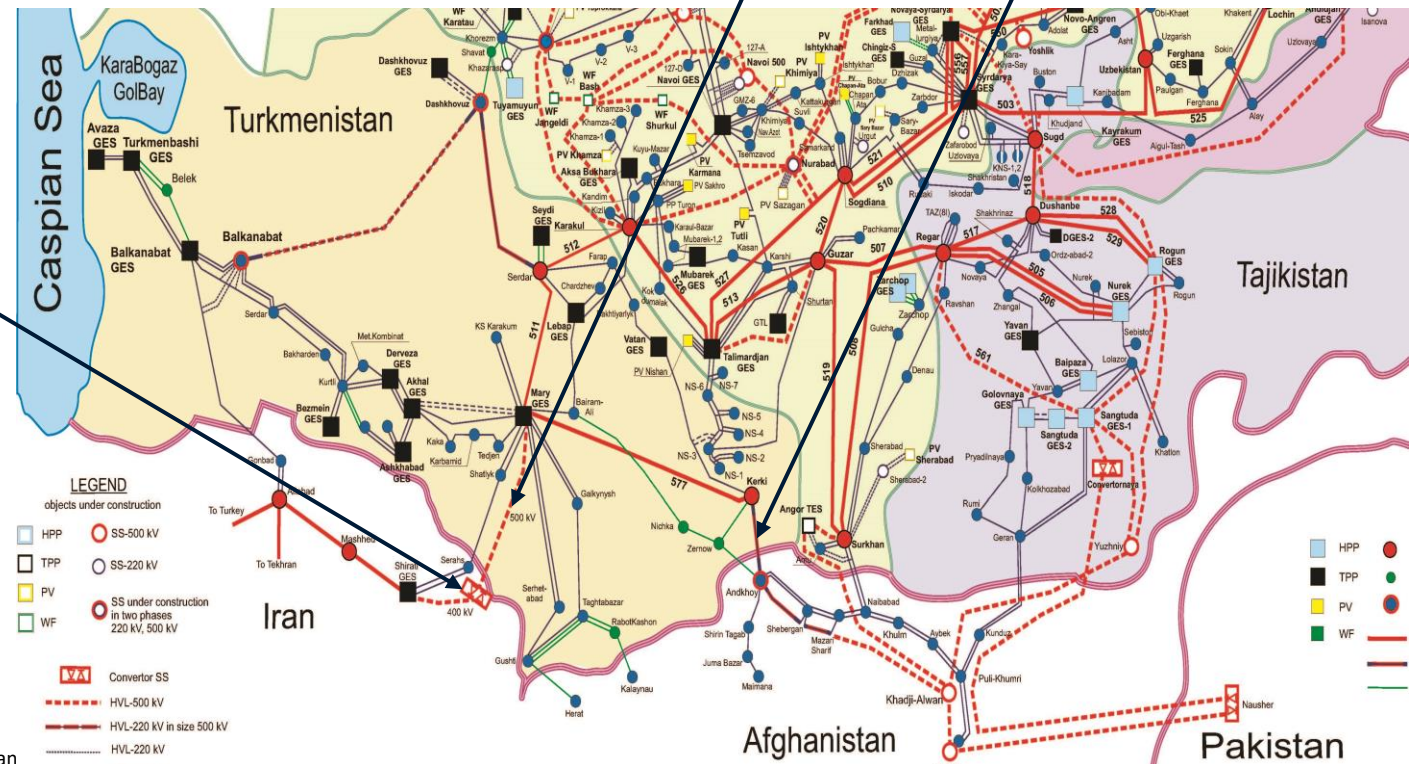
Planning joint development of energy systems.

- ▶ In 2023, the Integrated Central Asia Energy Concept was drawn up. The Concept was elaborated by the Almaty Power Engineering and Communications University in cooperation with the experts from Energia CDC.
- ▶ The concept studies the current state of power grids participating in the CA UPS, identifies the constraints stiffening the trade and the sustainability, reviews the action plans on developing the national energy systems and provides recommendations on the power generation structure and grid development.
- ▶ On 29 February 2024 KEGOC JSC (Kazakhstan) organised a meeting convening the energy system directors from Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan and the Russian Federation. The meeting focused on the national power grid development.



Planning joint development of energy systems

- ▶ Getting the Turkmenistan power system connected to CA UPS is a key issue to be reviewed.
- ▶ The Turkmenistan energy system currently operates in parallel with Iran. Whereas it operates with CA UPS in an **"island" mode** using the standalone generators to export the electricity.
- ▶ At the same time, Turkmenistan has built 500kV transmission lines to the border of Iran and to Afghanistan.
- ▶ It is planned to use 500/400kV transformer to get linked with Iran which is featured with 400kV lines, i.e. parallel operation mode.
- ▶ Afghanistan planned to operate in parallel with the CA UPS. Hence, Turkmenistan will get connected to Afghanistan with B2B (back to back substation) to be built on the TKM-AFG interface.
- ▶ We believe that it is more expedient for Turkmenistan to switch to operating in parallel with the CA UPS, while connection with Iran should be made with B2B, which is less costly (1 B2B is cheaper than 1 B2B + transformer).
- ▶ The role of Turkmenistan as a transit power system will push expanding the Central Asian power trading region to South Asia, to be further extended to West Asia (Iran, Turkey and neighboring Armenia and Georgia).
- ▶ This will allow to widely utilise the time zone effect in intra-day trade as well as seasonal interchanges (winter-summer) between the regions



RES integration into CA UPS

The CA UPS stakeholders have been integrating the renewable energy sources alongwith the modernizing and retrofitting the traditional generating facilities and commissioning highly efficient combined cycle gas turbine plants and modernizing the hydroelectric generating plants. Mainly solar photovoltaic plants and wind power plants are put into operation.

There are already 2,400MW of RES in Kazakhstan's energy system, including 1,200MW solar and 1,200MW of wind. The Ministry of Energy announces about 16 GW of RES-based generation to be commissioned by 2030.

Uzbekistan currently has a total capacity of 1,520MW of SPP and 100MW of WPP. At the same time, 8.6GW of SPP and 10.2GW of WPP, as well as 7GWh of BESS are planned to be implemented by 2030.

Kyrgyzstan announced a plan to introduce about 3-4GW of RES within 2-3 years.

In Tajikistan, two SPP with a total capacity of 60 MW are expected to be commissioned in 2024.



	Макс генерация на 25.03.2024
ФЭС Сахро	160
ФЭС Нишон	167
ФЭС Иштыхан	96
ФЭС Кўкбулоқ	45
ФЭС Шеробод	125
ВЭС Зарафшан	90

RES integration into CA UPS

Large-scale penetration of RES with a variable and intermittent nature of generation has a serious affect on the stability of the power system state. In this regard, the national energy systems are conducting studies to assess the impact of these sources on the power grid, and technical requirements for connection to the grid are being developed.

Experts from Energia CDC also participate in several studies conducted by USAID, the World Bank and other organizations. The results show that for successful integration of RES into the CA UPS joint coordinated efforts are needed to develop the demand management capacity in the region.

It is also necessary to make adjustments in the principles of emergency control of power systems taking into account the RES integration, to introduce a Centralized Emergency Control System (CECS) and Automatic Generator Control (AGC) system.



CAREC cooperation

- ▶ Cooperation with development partners is very important in advancing the national power systems and improving the performance of Energy CDC. After some pause due to the pandemic, the Energy Investment Forum was held on 28-29 November 2023 in Tbilisi, Georgia, where A.T. Mirzaev, Chief Dispatcher of Enerzia CDC, made a presentation. The 22nd meeting of the CAREC Ministerial Conference was held Tbilisi, Georgia on 30 November 2023.
- ▶ On 1 March 2024, a bilateral meeting on CAREC cooperation was held with ADB mission at Enerzia CDC (Lyaziza Sabyrova, Regional Head, Regional Cooperation and Integration Central and West Asia Department).
- ▶ On 25-26 September 2024, jointly with ADB, a workshop on energy transmission and interconnectivity on of energy infrastructure in Central Asia is planned to be held at Energy CDC in Tashkent with participation of representatives of CAREC countries to discuss the key considerations of cooperation.



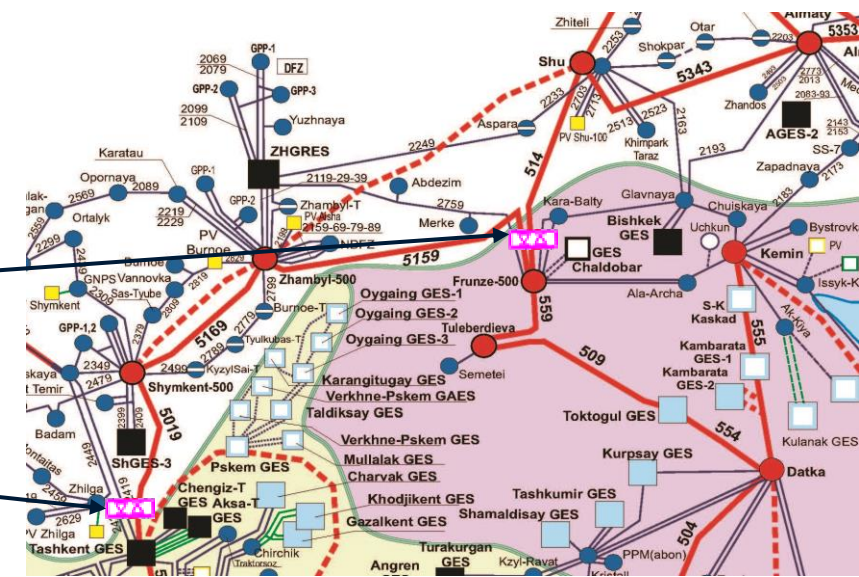
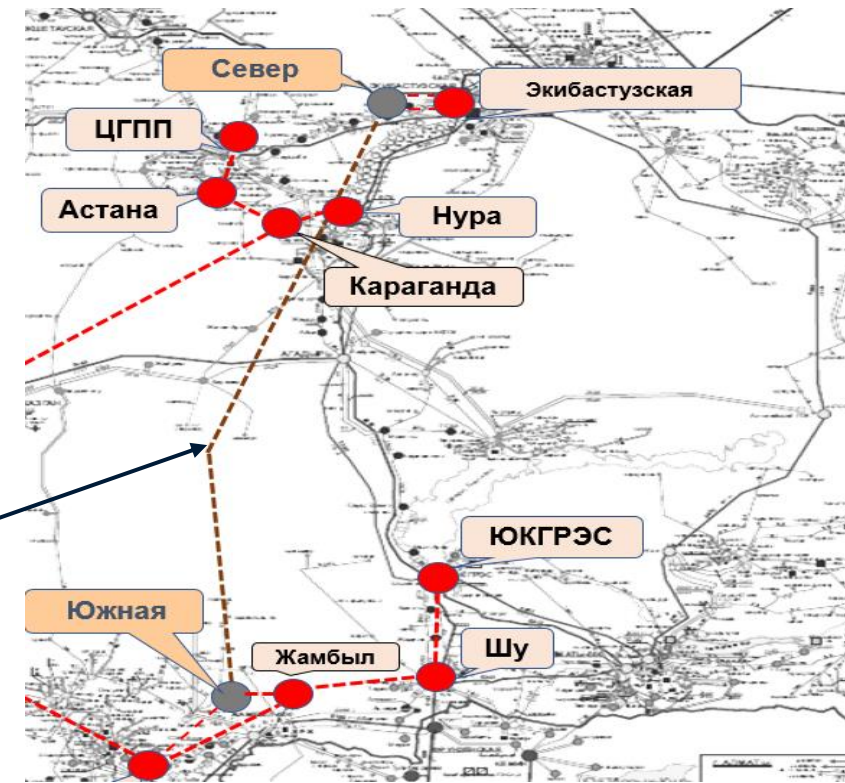
Subjects to discuss

What issues would you like to discuss at the upcoming workshop in Tashkent?:

- ▶ Power systems of CA UPS and the Kazakhstan power grid are featured by long distances and irregularities between load and generation. All these determine the specifics of CA UPS operation in terms of stability, overloading. In some instances, there are dynamic transient processes caused by disturbance situations followed with subsequent degradation of backbone network. It is necessary to coordinate efforts to **solve and eliminate the bottlenecks**.
- ▶ To maintain the stable operation, it is necessary to regulate the power exchange and ensure the load – frequency control between the countries by creating a **Centralised Automatic Generator Control system** in the CA UPS (managed and hosted by Energia CDC). It will be gradually scaled up to the energy systems of Kyrgyzstan, Uzbekistan and Tajikistan. **A region-wide project** would be an expedient vehicle to achieve the task.
- ▶ To ensure resilience of power systems and the CA UPS as a whole, it is required to create a **Centralized Emergency Control System (CECS) managed and hosted by Energia CDC** . This task is also a **region-wide activity**
- ▶ Given that currently Kazakhstan is transiting to the electricity balancing market year and Uzbekistan announced a phased transition to the electricity market, there is a need to introduce an **automated meter reading and control system (AMRCS) hosted by Energia CDC**. USAID is in the process of developing the Regional AMRCS Concept.

Subjects to discuss

- ▶ Currently, the RES share is growing and the load is increasing in Kazakhstan, Uzbekistan, Kyrgyzstan and Tajikistan. Hence, the power imbalance will increase on the border between Kazakhstan national power grid and CA UPS:
- ▶ At the same time, due to parallel operation with the Russia's power system which performs the centralized frequency control of CIS power grid, the power imbalance of CA UPS will be reflected on the Kazakhstan and Russia interface and North-South Kazakhstan transit capacity can be overloaded
- ▶ Large power surges from CA UPS, which are not evitable if RES is widely introduced, may lead to increased deficit in CA UPS and unacceptable frequency reduction which would cause shutting down RES and CCGT facilities. All these may result in "frequency collapse" and blackout.
- ▶ To avoid switching off the extremely loaded North-South transit of Kazakhstan, the Kazakhstan stakeholders are investigating the issues of constructing HVDC from Ekibastuz GRES-1 to Zhambyl.
- ▶ Energinet CDC proposes an alternative option - transition from parallel operation to joint operation by and between Kazakhstan power system and CA UPS via B2B, which will exclude the power surges from CA UPS to the North-South transit of Kazakhstan. This means that CA UPS will independently regulate frequency. This proposal anticipates participation of 3 power systems, i.e. the proposed project is a region-wide .



THANK YOU