Coordination and Dispatch Center “Energy”

Issues of regional cooperation within the Central Asia Integrated Power System

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Meeting of the Energy Sector Coordinating Committee of CAREC

September 2-3, 2009

Almaty, Kazakhstan

A brief description of the CA UES at a stage of its establishment

- A configuration of the CA UES was developed in 1970-s .
- The CA UES was designed as a single whole .
- With 30% of HPPs and 70% of TPPs, the structure of the UES is optimal in terms of frequency and capacity control;
- A long-term planning of CA UES operation modes took into account the composition of power generating sources in power systems of the UES, as well as issues of centralized fuel supply for thermal power plants;
- Such modes were based on both power generation and irrigation needs (that were closely interconnected);
- An optimization of mode intended to minimize fuel costs and electric losses in the networks throughout the entire power grid.

A brief description of the CA UES at a stage of its establishment

- Maintenance schedules were coordinated and spare parts centrally supplied;
- Operation and dispatch control of the regimes had a strict vertical hierarchy with Central Dispatch Control Administration of the USSR's power grid being the highest level (although the UES worked separately);
- The integrity and close interrelation of operation regimes of the CA UES power systems is a major precondition to enable control of power system operation regimes from a single regional center and to establish UDC in Central Asia (UDC "Energy") and similar units in related sectors (WBOO* "Syrdarya" and WBOO "Amudarya");

**Water Basin Operating organization*

Establishment of United Dispatch Control enterprise in CA

- Established in 1960;
- Name of enterprise – United Dispatch Control Department (UDC) in CA;
- Location – Tashkent city;
- Functions - operation and process control of the Central Asia united power system (that incorporates the power systems of Uzbekistan, South Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan);
- Subordination – Central Dispatch Department of the USSR's power grid;
- Financing - Ministry of Energy and Electrification of the USSR.

Brief description of the CA UDS following the collapse of the USSR

Following the collapse of the USSR:

- centralized supply of energy materials and resources had finished;
- all power systems urgently undertook measures to ensure their energy independence, that is to reach self sufficiency in terms of power generation and fuel supply. But the countries were at different starting points;
- water and power generation regimes turned out to be imbalanced;
- An objective of getting an optimal operation mode within the UES was no longer a first priority.

History of CDC “Energy” in brief

None of the power systems could independently ensure a full scale reliable power supply to its consumers;

A major task was to maintain parallel operations within the separately functioning UES;

In order to maintain parallel operations the management of the power systems in Ashgabat on November 19, 1991:

•signed an Agreement on Parallel Operations of the power systems of the Republic of Kazakhstan, Kyrgyz Republic, Republic of Tajikistan, Turkmenistan and Republic of Uzbekistan;

• established enterprise “United Dispatch Control Department of CA Power Systems”, and shared its funding.

History of CDC “Energy” in brief

- The enterprise was registered with Mirzo-Ulugbek Khokimiat of Tashkent (September 28, 1993) as an enterprise providing operation and processing control of the Central Asia United Power System and assigned a status of state enterprise of the Republic of Uzbekistan;
- Since 1994, this enterprise has been functioning under name of UDC (United Dispatch Center) “Energy”;
- The Board of the CA United Energy System consisting of the top managers of the power systems had become a governing body to control and coordinate parallel operations of the CA UES.

History of CDC “Energy” in brief

In 2002, as a result of power system restructuring, the Board of the CA UES made a decision to bring in line with new realities the:

- status of the Board of CA UES;
- status of UDC “Energy”, the enterprise being assigned a status of nongovernmental institution.

History of CDC “Energy” in brief

On October 27, 2004 the power systems of Central Asia countries entered into an agreement on coordination of their activities in the field of electrical power engineering in Central Asia;

Pursuant to Article 1 of this Agreement there was established a Coordinating Electrical Power Council of Central Asia (CA CEPC) being a deliberative body for replacement of the existing Board of CA UES;

History of CDC “Energy” in brief

At a meeting of the CA CEPC held on September 29, 2006, its participants endorsed articles of association for establishment and activity of non-governmental non-commercial organization CDC “Energy” whose main functions were: and

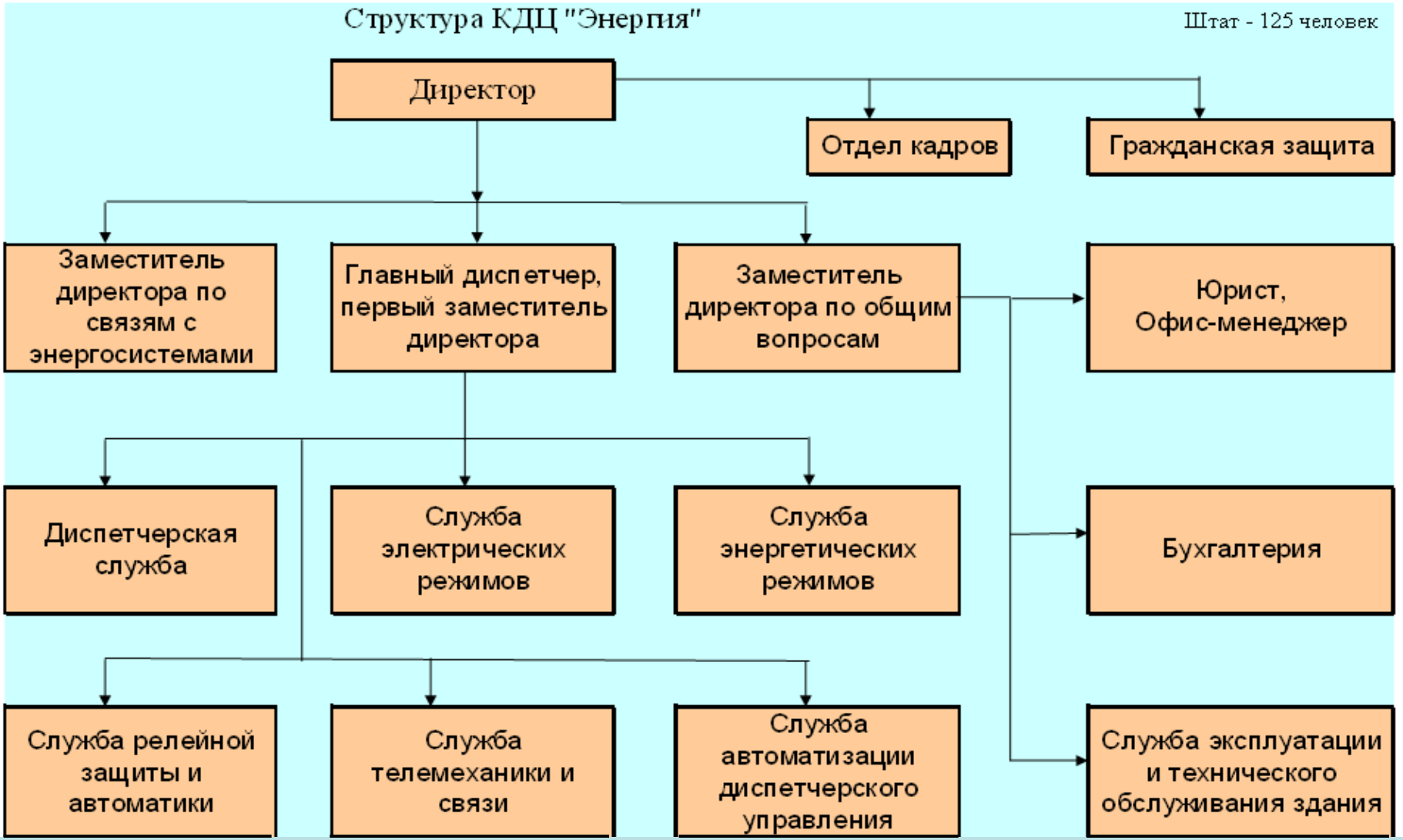
- provision of parallel work;
- coordination of operational and dispatch activity of Central Asia power systems.

Pursuant to its articles of association the CDC “Energy” is prohibited to conduct commercial activity.

The articles of association of the NNO CDC “Energy” were registered with the Ministry of Justice on May 28, 2007 and CDC “Energy” started functioning as an entity since July 1, 2007 .

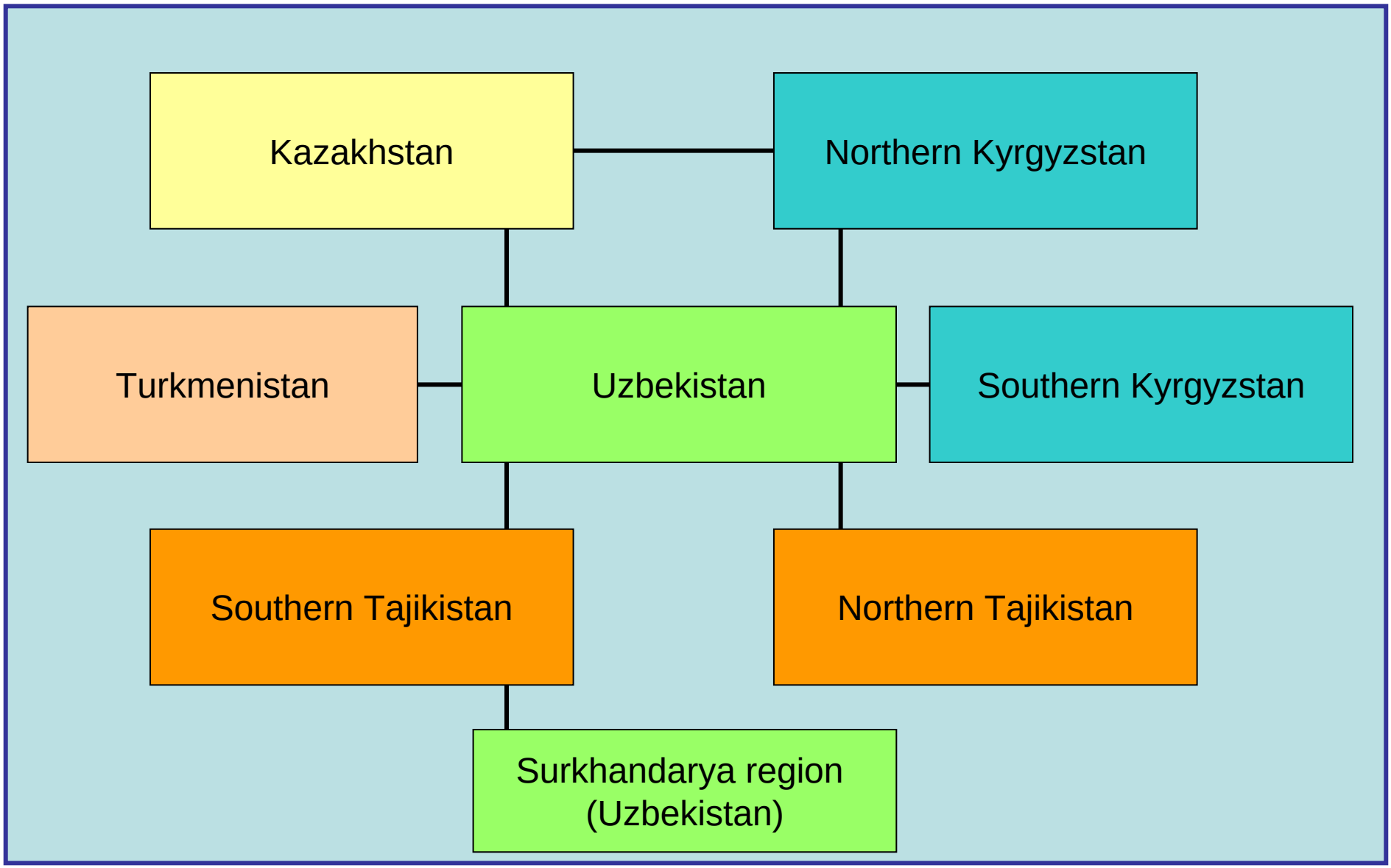
CDC “Energy” is subordinate to CA CEPC, its superior governing body.

History of CDC “Energy” in brief



Operational and process control coverage area of CDC “Energy”

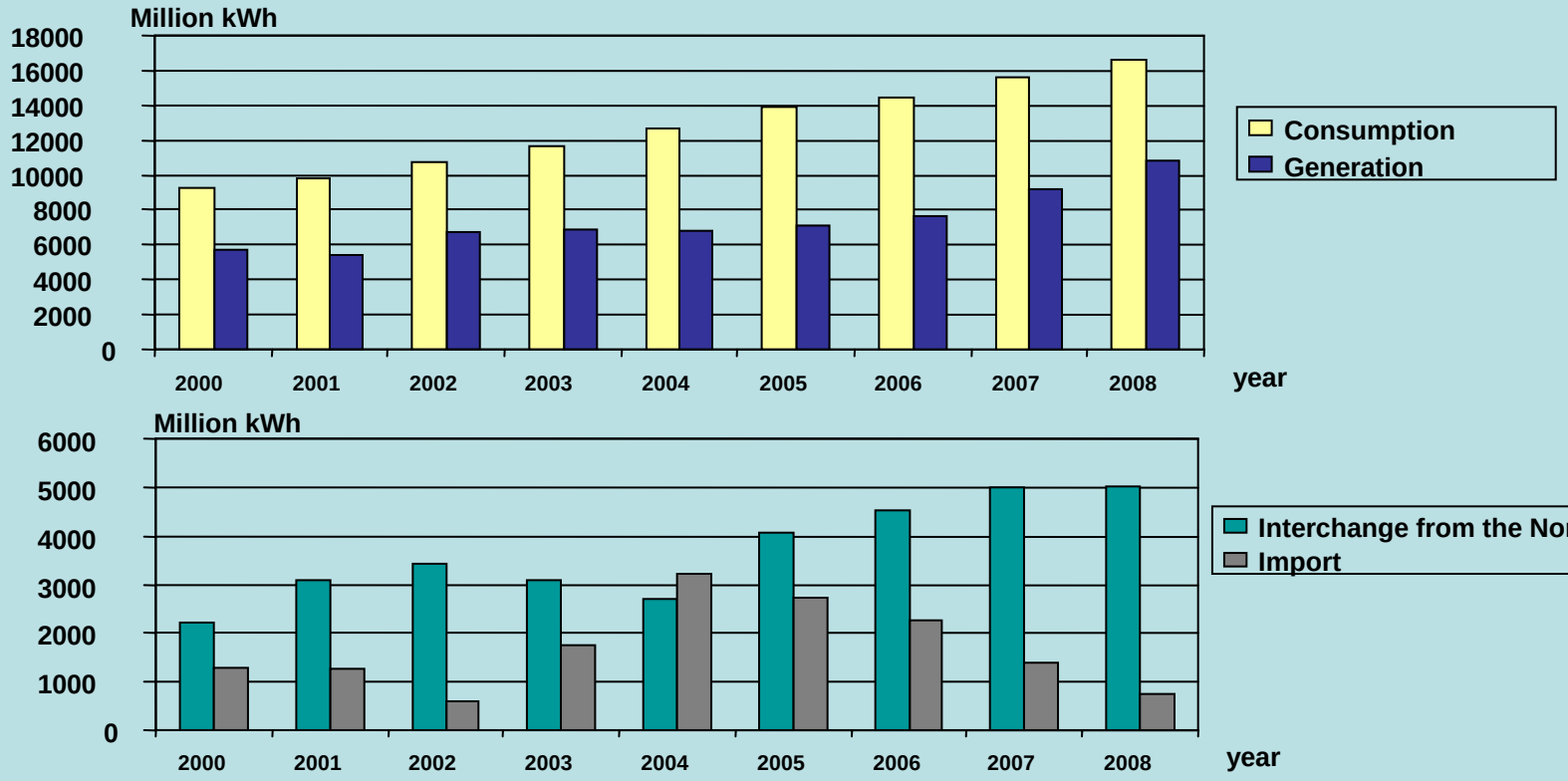
Structural links of the CA UES power systems



Brief description of the CA UES power systems

South Kazakhstan's power system

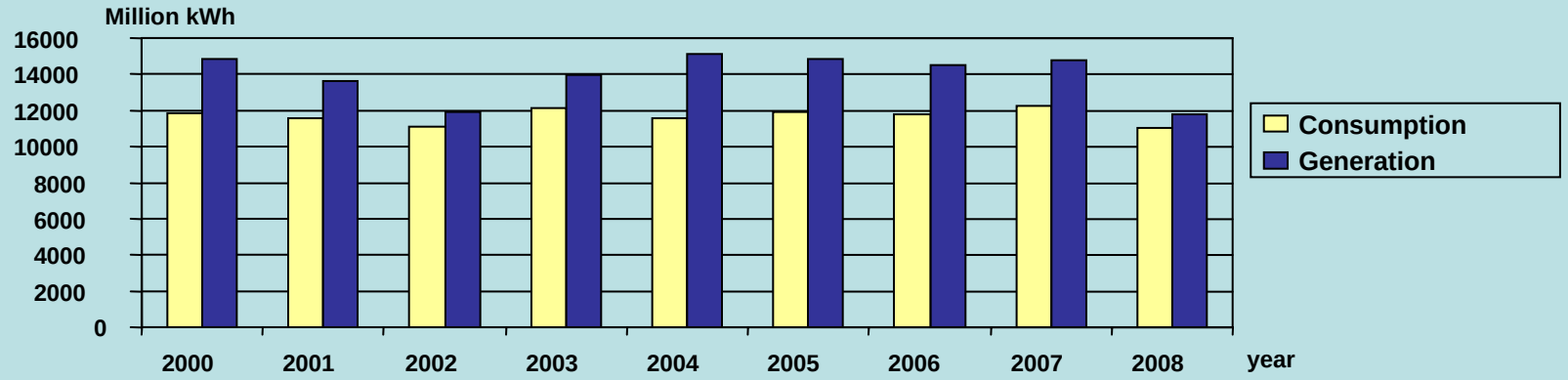
The power system of South Kazakhstan, incorporating power networks of four regions, is deficient for it has insufficient energy resources and is connected to North Kazakhstan's power system incapable of ensuring its reliability and stability.

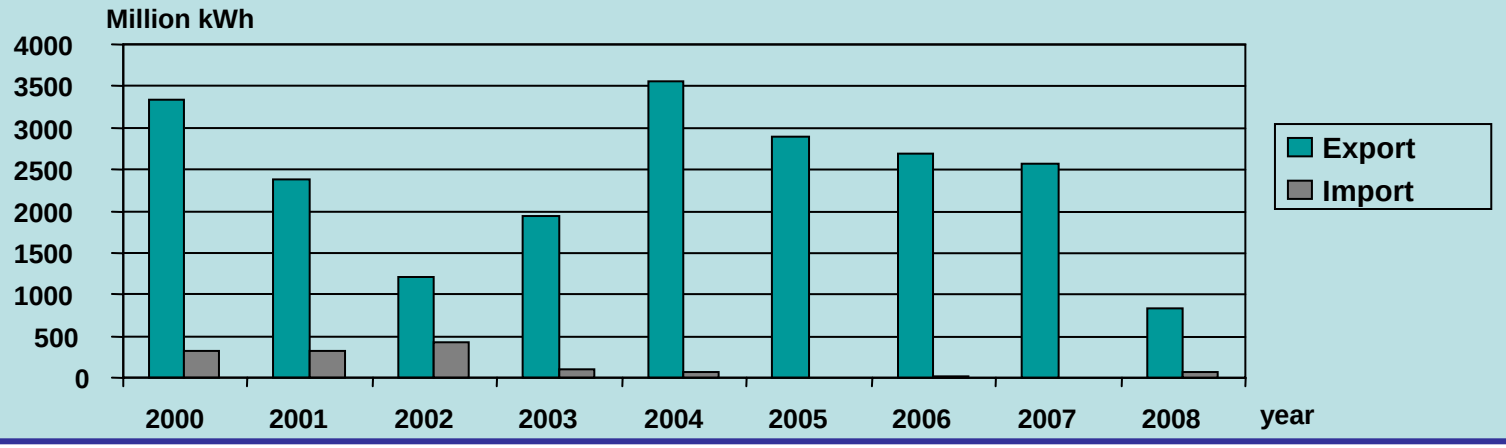


Brief description of the CA UES power systems

The power system of Kyrgyzstan

The power system of Kyrgyzstan is excessive and interrelated with all power systems of Central Asia in part of power trade and provision of capacity regulation services

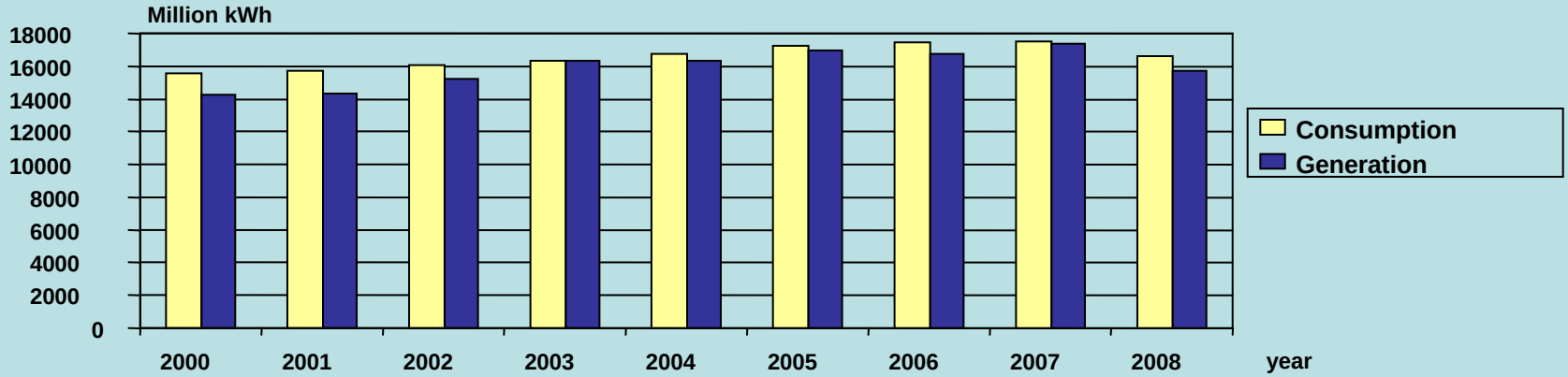


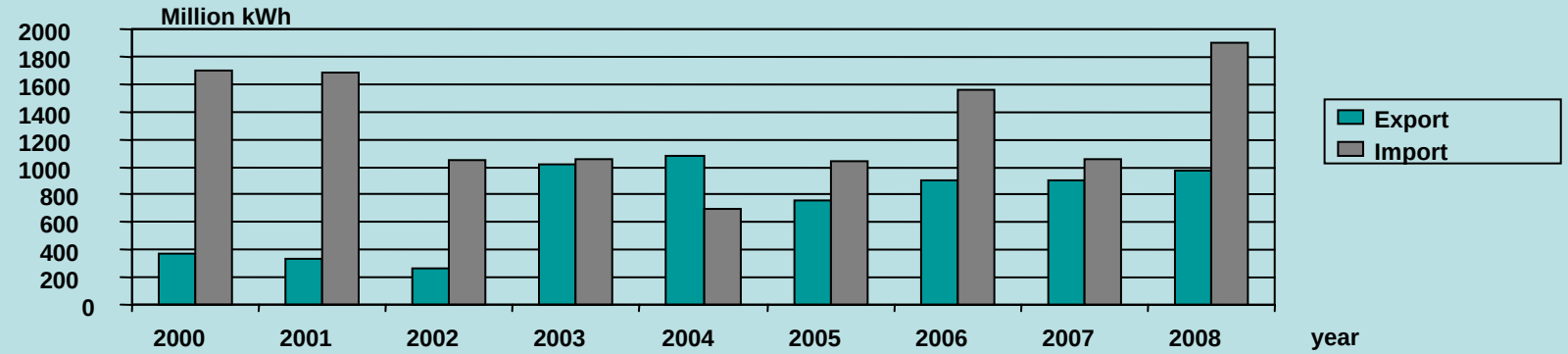


Brief description of the CA UES power systems

The power system of Tajikistan

The power system of Tajikistan is excessive in summer and deficient in autumn and winter. This system is interrelated with the power systems of Uzbekistan, Kyrgyzstan and Kazakhstan in part of power trade and provision of capacity regulation services.

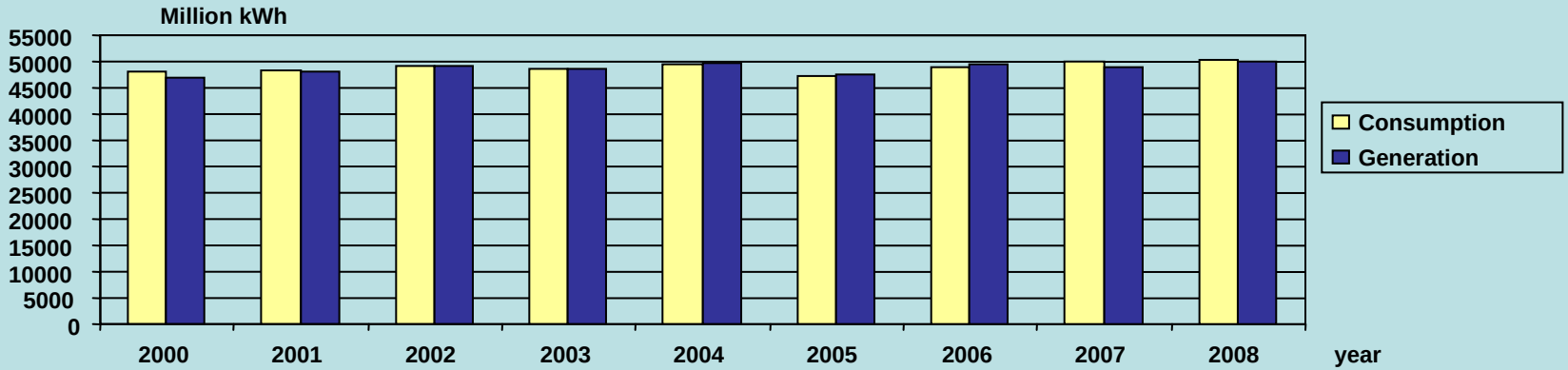




Brief description of the CA IPS power systems

The power system of Uzbekistan

The power system of Uzbekistan is excessive in terms of power generation and capacity but its operation mode is strongly dependant on fuel supply. It is interrelated with the power systems of Tajikistan and Kyrgyzstan in part of electric power trade and provision of transit services.



Putting a question point-blank

To a certain extent all countries of the region have new construction of power networks and generating facilities under way. Yet all the countries are seeking to achieve their power safety and independence.

Whether power systems constituting the CA UES can sustainably operate separate from one another either nowadays or in near-term outlook (taking into account future construction of power network facilities)?

Major problems of separate operations

Kazakhstan:

- Following an overall completion of the second “North-South” circuit the power system of Kazakhstan would be able to cover its demand (in terms of both power and capacity) except for repair and emergency states;
- However an issue of power interchange control via the North-South link would remain unresolved even under normal conditions due to the absence of regulating hydro-stations in Southern Kazakhstan;
- Voltage control related problems are possible;
- An issue of water supply in southern regions of the country would become irresolvable;

Major problems of separate operations

Kyrgyzstan:

- Concentration of power generation sources in the south and of consumption in the north, given a poor connection between them, would not help ensure power safety without power network being strengthened;
- Kyrgyzstan would be deprived of a possibility to export electric power, its major export item, and of revenues from provision of power management/regulation services;
- Enforced transfer of the cascade of Naryn HPPs to solely power generation regime would result in overall disorganization of water regime and worsened relations with downstream countries;
- Poor networking would limit consumption in the north and result in escapages at HPPs in the south of the country.

Major problems of separate operations

Tajikistan:

- Following the completion of new construction of the 500 kV “North-South” power transmission line the Tajik power system would be able to supply power to its northern areas using country’s own power network, except for a state of emergency or repair;
- A problem of winter time power deficit could not be resolved without power supplied from neighboring power systems;
- Separate operation in summer would entail high power excess and escapages.

Major problems of separate operations

Uzbekistan:

- Intended commissioning of electric power facilities would make it possible to ensure independent power supply (in terms of power and capacity) except for repair and emergency states;
- A major problem is acute shortage of regulating capacity and, as a consequence, impossibility of adequate frequency (capacity) control;
- The power system, with thermal power plants constituting 90 % of generating facilities, would not be able to ensure a good quality and reliable power supply due to irregularity of fuel supply under sharp climatic fluctuations ;
- Imbalanced water supply all along the Naryn-Syrdarya water-energy way .

Major problems of separate operations

In all power systems:

- Separate operation of power systems would increasingly worsen problems related to noncompliance with reliability principle (N-1);
- Impossibility of regime optimization would result in additional power losses and overconsumption of fuel and hydro-resources;
- Violation of adjusted dispatch control system would lead to increased occurrence of breakdown and extended periods required for their elimination;
- Availability of excessive and/or deficient electric power and/or capacity requires mutually beneficial cooperation, that is development of regional trade both within the UES and with other power systems;
- A main function of power systems – reliable and cost-effective power supply to the customers – would not be maintained adequately.

Parallel operation is an objective necessity

From the abovementioned and yet far incomplete list of problems it results that:

- Parallel operations of the Central Asia Integrated Power System with the power grids of Kazakhstan and Russia shall be preserved;

- Operational experience of power systems in Western Europe, featuring a better balance and infrastructure, confirms that integration of power systems delivers more advantages in terms of both power supply reliability and market development;

- A CA UES functioning model that would take into account its potential benefits should be developed;

Determination of the countries to ensure their power independence should be welcome. Energy independence does not imply separate operations but is a precondition for establishment of a more objective model for regional electric power market.

Regional trade of electric power and associated services

- During the Soviet period there was a regional model used for exchange (not trade) of electric power and energy resources that took into account advantages of conjoint operations within the integrated power grid as had been designed;
- In 1990-s, a model of barter exchange of power and energy resources was used;
- Following a ban imposed on barter transactions the abovementioned exchange was carried out under intergovernmental agreements – multilateral initially and bilateral later;
- Procedure for making such agreements is difficult and time consuming for it has to take into account various factors concerning relations between both the entities and the states;

Regional trade of electric power and associated services

- The introduction of market economy mechanisms in trading electric power and, mainly, energy resources has violated the existing models;
- Models proposed by various international organizations and institutions did not take into account a major feature of the CA UES, i.e. close interconnection of water and power generation regimes;
- One of the main obstacles to develop power trade in the region is a difference in price level for electric power and energy resources in domestic markets as compared to foreign markets in the countries of the region. It should be noted that such a situation is not a feature specific to this particular region but quite a common thing throughout the world.

What issues have to be resolved to develop a regional model of energy market? – Model 1

1. It is necessary to determine whether the model should consider all components specified below:

- water discharge from reservoirs in excess of own needs during a vegetation period;
- electric power associated with them;
- return supply of hydrocarbon energy resources in autumn and winter period.

This model implies cross-interests of at least three ministries and therefore its establishment is feasible under intergovernmental agreements only. In this case the model would be administratively driven (with all negative features mentioned above) rather that market oriented.

What issues have to be resolved to develop a regional model of energy market? – Model 2

2. Country A concerned with obtaining sufficient water from Country B during a vegetation period shall ensure domestic power generation in excess of the country's own needs and supply of equivalent volume of electric power (energy resources) to Country B in order to prevent evacuation of water from its reservoirs in winter period.

Receiving hydropower during a vegetation period (May – August), Country A:

- saves on organic fuel as it does not have to burn it at its thermal power plants and can create stocks to be used in autumn and winter period;
- implements equivalent return supply of electric power (fuel) to Country B during the autumn and winter period (September - April).

In a case that the countries exchange an equivalent volume of energy resources, energy price is assumed to be the same in summer and winter periods, that is its rate would not have principle importance.

What issues have to be resolved to develop a regional model of energy market? – Model 2

Weaknesses:

- in a case that such exchange is carried out on a barter basis it is necessary to make an intergovernmental agreement that would involve all the abovementioned consequences;
- Country B is unable to secure sufficient amount of fuel for its thermal power plants during an autumn and winter period;
- the scheme is economically non-transparent and may cause delays in making agreements between the entities.

Strengths:

- simple;
- can be implemented with no additional elaborations.

What issues have to be resolved to develop a regional model of energy market? – Model 3

3. This model suggests considering only water and electric power, that is to take out the fuel component as being directly irrelevant to amount of water discharged and hydro-power generated.

A trade of organic energy resources between the countries should be subject to the state of market irrespectively of water – power generation modes.

In this case fuel costs of power generating companies shall be taken into account when calculating a summarized annual price of electric power supplied; that is average annual costs would be used to calculate an amount of electric power to be supplied under this model.

Expenses of other institutions for procurement of fuel, particularly sales to the public, shall not be included in the model (same as in case of gasoline and other petrochemicals).

What issues have to be resolved to develop a regional model of energy market? – Model 3

For example, company's fuel costs for thermal power plants are US$ XXX. This amount will be employed as a component contributing to a summarized price of hydropower in the power system. i.e. electric power supplied during a vegetation period would include fuel needs of the power system. A precise value of the fuel cost share is to be defined by relevant specialists.

Another component is related to evaluation of water in water reservoir subject to discharge.

Upstream countries endeavor to give water a status of a good, which, in turn, is unacceptable for downstream countries.

Nobody doubts that bottled water is a consumer good; but can the same approach be extended to water contained in a river or reservoir?

What issues have to be resolved to develop a regional model of energy market? – Model 3

One of reports of one of the countries stated that a major part of a river flow was being formed on its territory but the country made no use of that. At the same time this country had not even a single hydraulic work that would allow **readjusting** river flow.

This issue should be made clear:

- river water is not considered as a good for it does not contain a labor share required for its production;
- for the same reason water in a reservoir is not a good as well, but a process of its accumulation, storage and evacuation is conjugated with services of river water flow readjustment.

What issues have to be resolved to develop a regional model of energy market? – Model 3

The services of river flow readjustment are aimed to retain excess water during high-water years and to discharge more water in low-water years, and therefore should be paid for by the users on annual basis irrespectively of volumes of hydro-resources received. Probable, there is a point in introducing the term *"interstate water reserve"* as refers to a reservoir used for provision of long-term water flow adjustment services for which the owner of the reservoir would be paid.

Payment for services of maintaining the interstate water reserve should be made under a multilateral agreement incorporating responsibilities of the parties with respect to water accumulation and use.

How much would the service cost? – Assistance of independent international experts is needed to define it.

What issues have to be resolved to develop a regional model of energy market? – Model 3

The term “reservoir maintenance costs” is often improperly used assuming that these costs should be paid for too.

Water reservoir is an integral part of hydraulic works that are designed for power generation, its maintenance costs are already included in electric power price cost, and therefore no extra cost for “maintenance” should be charged.

What issues have to be resolved to develop a regional model of energy market? – Model 3

Therefore, price for electric power generated (by a hydropower plant with a long-term flow adjustment water reservoir) above own consumption needs shall include the following components as minimum:

- hydropower cost price;
- share of fuel cost allowance to ensure operations of company's thermal power plants in cold (autumn and winter) period;
- service fee for establishment of interstate water reserve in the reservoir.

When above hydropower price is defined the task of developing a model for electric power market in Central Asia region can be solved mathematically using well-known methods of nonlinear programming such as simplex-method.

Coordination and Dispatch Center “Energy”

Thank you!