# Country Report

# Energy Sector: Tajikistan

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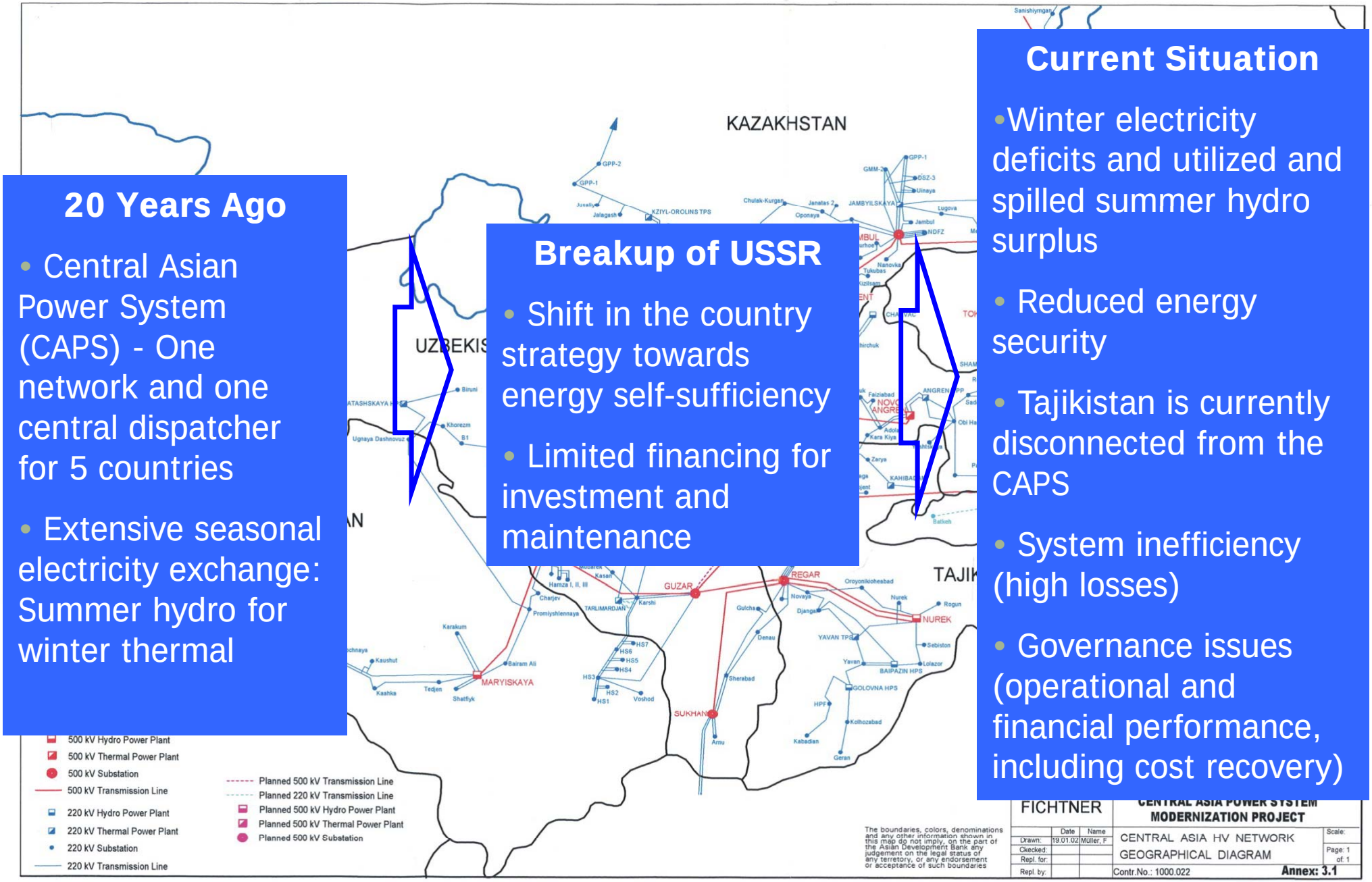
# Tajikistan – Profile

- Situated in Central Asia
- Former Soviet Republic
- Civil war (1992-1997)
- 143,000 square kilometers
- Borders with Afghanistan, Kyrgyzstan, Uzbekistan and China
- 8 million population out of which 73% live in rural areas

# Tajikistan - Profile

- Agro – industrial and mountainous country with more than 72 peaks over 6,000 m, 6% covered by glaciers
- GDP about 8 bln USD
- Main export – aluminum and cotton
- Country is dependent on remittances – 50% GDP
- The country has a great potential in hydropower development. It takes 8 place in the world in terms of absolute potential and 2 place among CIS after Russia
- 96 % of electricity is now produced by hydropower. However, it is underutilized – only 5% is used

# Central Asian Power System (CAPS)




## 20 Years Ago

- Central Asian Power System (CAPS) - One network and one central dispatcher for 5 countries
- Extensive seasonal electricity exchange: Summer hydro for winter thermal

## Breakup of USSR

- Shift in the country strategy towards energy self-sufficiency
- Limited financing for investment and maintenance

## Current Situation

- Winter electricity deficits and utilized and spilled summer hydro surplus
- Reduced energy security
- Tajikistan is currently disconnected from the CAPS
- System inefficiency (high losses)
- Governance issues (operational and financial performance, including cost recovery)

# Current Energy Policy and Measures

- Ministry of Energy and Water Resources is responsible for energy sector (policies)
- State Agency on Energy Control and State Utility Enterprise “Barki Tojik”
- No specific law on electricity
- Two track approach to energy reform:
  - Reforming domestic energy sector, e.g., energy pricing, financial and governance disciplines, social protection programs and private sector participation
  - Export oriented strategy of electricity
- Several laws were adopted and modernization of existing objects are underway for enhancing export

# Electricity Export

The Government attaches high priority to regional trade:

- The Government has entered into a 20 year power purchase agreement with Afghanistan in 2010 (3.5 cents per kW/h).
- The Government is also exploring potential coal-fired power generation for export to South Asia. This option has certain limitations given the winter shortages and associated environmental aspects.
- CASA-1000 project is underway, which stipulates transmitting electricity from Tajikistan and Kyrgyzstan to Pakistan and Afghanistan ($1 bln)

# Policies and Measures

- Development of SHPSs is priority by government. There is a state program under which 189 SHPSs should be built by 2020
- In the long run, the government aims to build Rogun dam with 335 m in height and 3600MW
- For the short run, policies towards energy efficiency and effectiveness are given priority
- Along with hydropower development, government is exploring new sources of energy like coal-fired power, solar panel, wind power, ect.

# Direction of policy towards renewable energy use

- The government of Tajikistan in February 2007 adopted “Comprehensive program to target the widespread use of renewable energy sources, such as the energy of small-rivers, solar, wind, biomass, and underground sources for 2007-2015.”
- The potential of small and mid-size rivers of the Tajikistan is greater than 30 million kW and their annual electricity output is about 100 billion kWh per year. About 300 SHPSs have already been built.
- On the inflow of the river, in the mountainous region, it is technically possible and economically appropriate to build more than 1000 small hydropower stations with a power capacity ranging from 10 to 3000 kW.

# Progress in Engagement of Private Sector

- Agreement with RAO/UES of Russia to respectively hold 25%/75% of the shares in Sangtuda I
- Build-Operate-Transfer (BOT) contract with Iran at Sangtuda II
- Pamir Private Power Project continues to be a symbol of private sector participation success:
  - 22-24 hours of power availability in the winter period in a highly remote area;
  - Government's continued support to Pamir Energy Company is seen as important

# Major Development Partners in Energy Sector

- **ADB** – Regional Power Transmission, Nurek 500kV Switchyard, Regional Power Interconnection (cofinanced by **IsDB, OFID**), Power Rehabilitation (cofinanced by **IsDB, SECO**), Emergency Baipaza Landslide Stabilization
- **China Eximbank** – Lolazor-Khatlon 220kv, South-North 500kv
- **Government of India** – Varzob HPS-1
- **IsDB** – Sangtuda-2, SHPPs in rural areas;
- **KFAED** – Rehabilitation of Dushanbe Distribution Network
- **KfW** – Nurek Switchyard 220kV,
- **SECO** - Energy Loss Reduction, Pamir Private Power
- **WB** - Pamir Private Power, Energy Loss Reduction, Energy Emergency

# JICA in Tajikistan

- Has been active since 1993 by providing tarining courses for civil servants
- Opened its office in 2006
- Has several programs mainly directed on two pillars: socio-economic development in Khatlon region (water, agriculture and health sectors) and development of economic infrastructure (energy and transportation)
- Energy sector is high priority for JICA Tajikistan
- Currently, no any ongoing projects on energy sector

# Traditional Energy Sources of Tajikistan

**Fuel Resources**

- **Coal.** Predicted coal reserves in Tajikistan are estimated to be 4-5 billion tonnes, and industrial and prospective reserves for coal deposits are 1 billion tonnes. It is necessary to use the latest extraction and raw material processing technology in order to avoid harming the local ecology.
- **Oil and Gas.** Of the energy resources of Tajikistan, oil and gas makes up around 3%. Assumed depths of deposits of productive oil beds are 6000 meters or more.

**Hydro resources:**

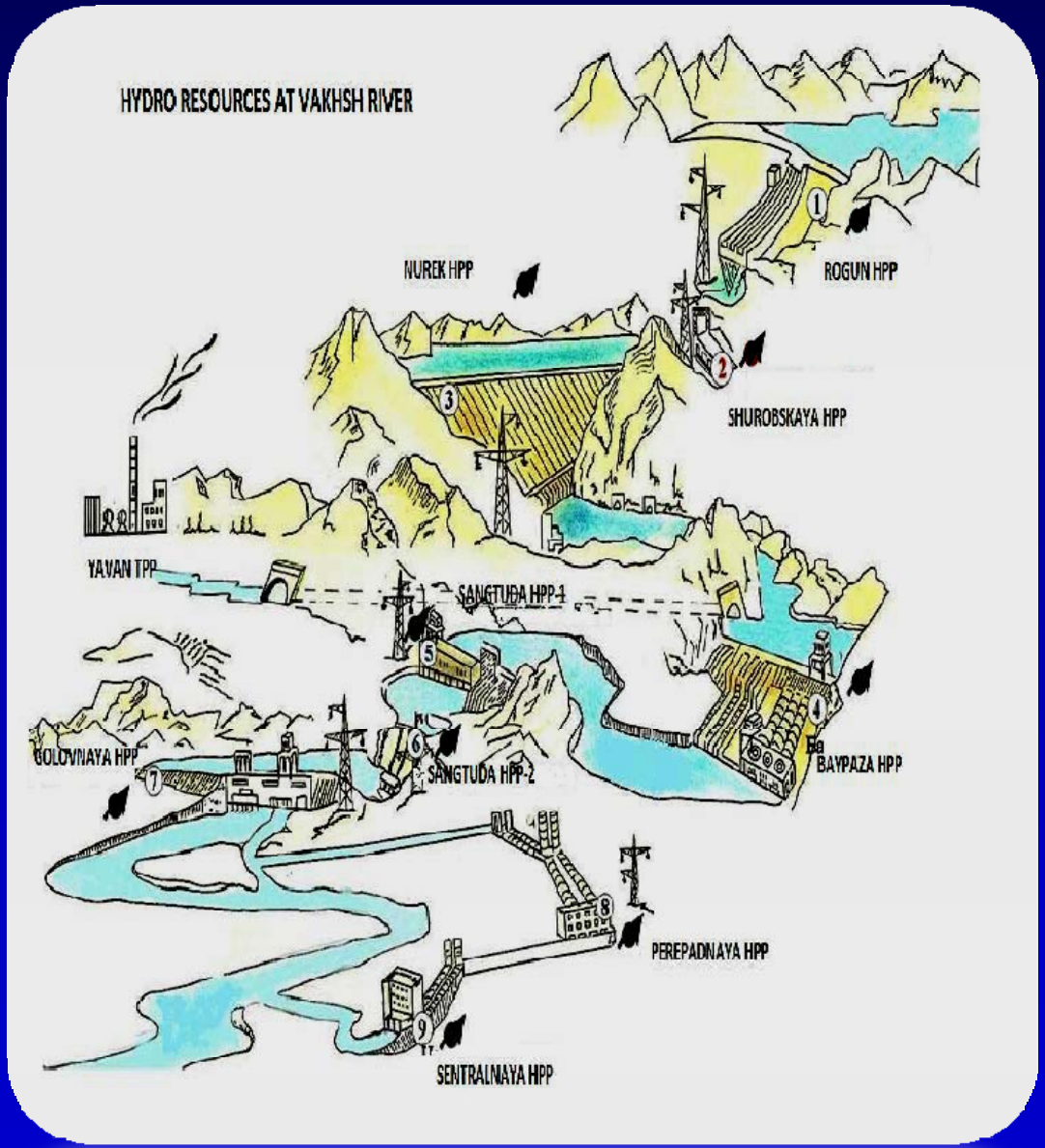
- Potential resources of Tajikistan make up more than 527 billion kWh, currently 5% is realized.

# Energy Capacity – Supply Side

- The capacity of the energy system of Tajikistan is 5,070MW. Of that, thermal electric power plants represent only 320MW
- Hydropower production is highly dependent on rates of stream flows (all the existing reservoirs provide seasonal and not cumulative water storage)
- Fuel availability at thermal power plants also varies. Compared to 1991, production of oil dropped by a factor of 2.6, gas by 5.7. The consumption of natural gas decreased four-fold, and coal consumption decreased eleven-fold.
- The electricity production varies between 13 and 18 billion kWh annually.

# Main HPPs

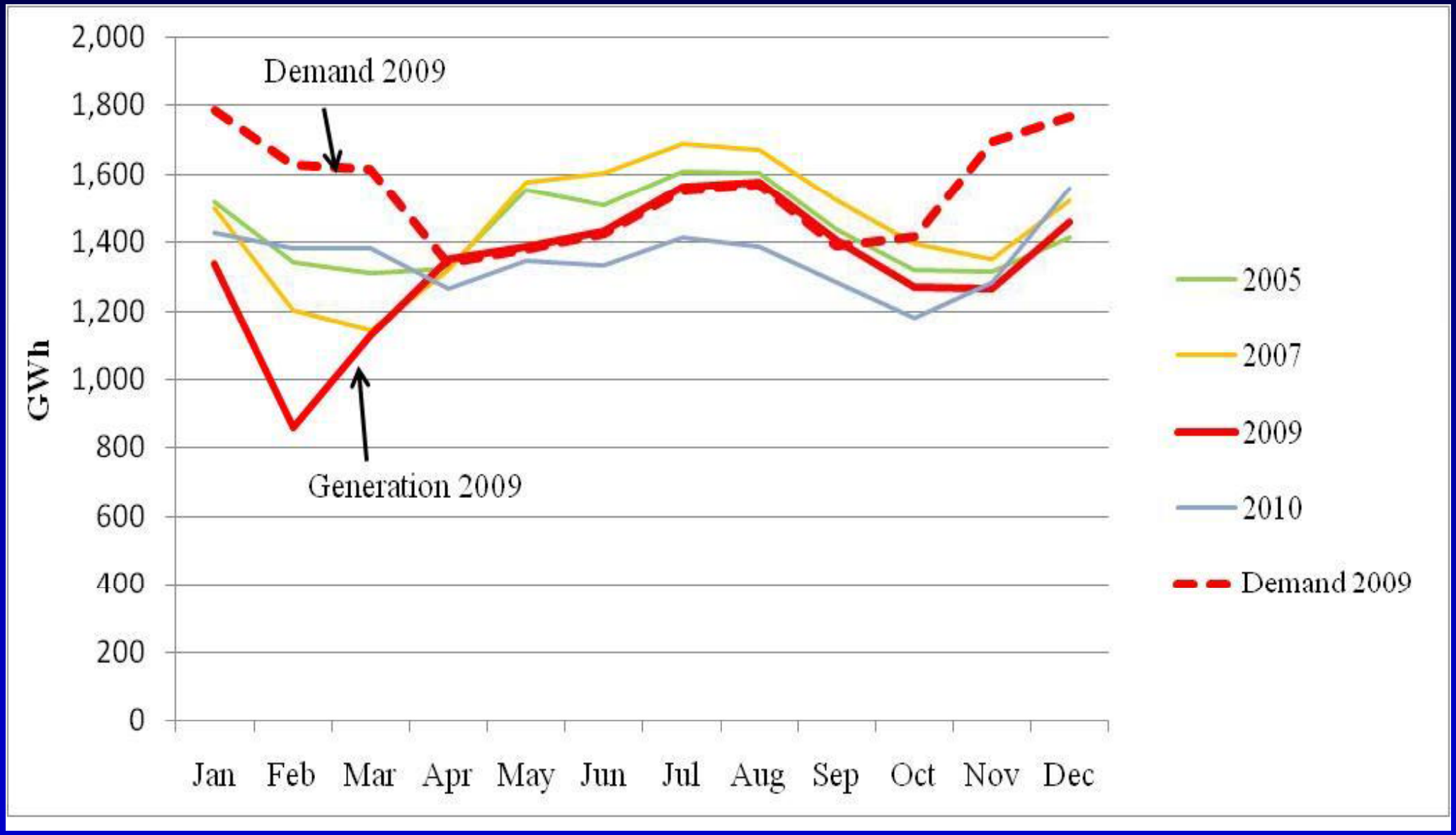
| Item | Capacity MW |
|---|---|
| Nurek HPP | 3000 |
| Baypaza HPP | 600 |
| Sangtuda – 1 HPP | 670 |
| Sangtuda – 2 HPP | 220 |
| Golovnaya HPP | 240 |
| Perepadnaya HPP | 29,5 |
| Sentralnaya HPP | 15,1 |



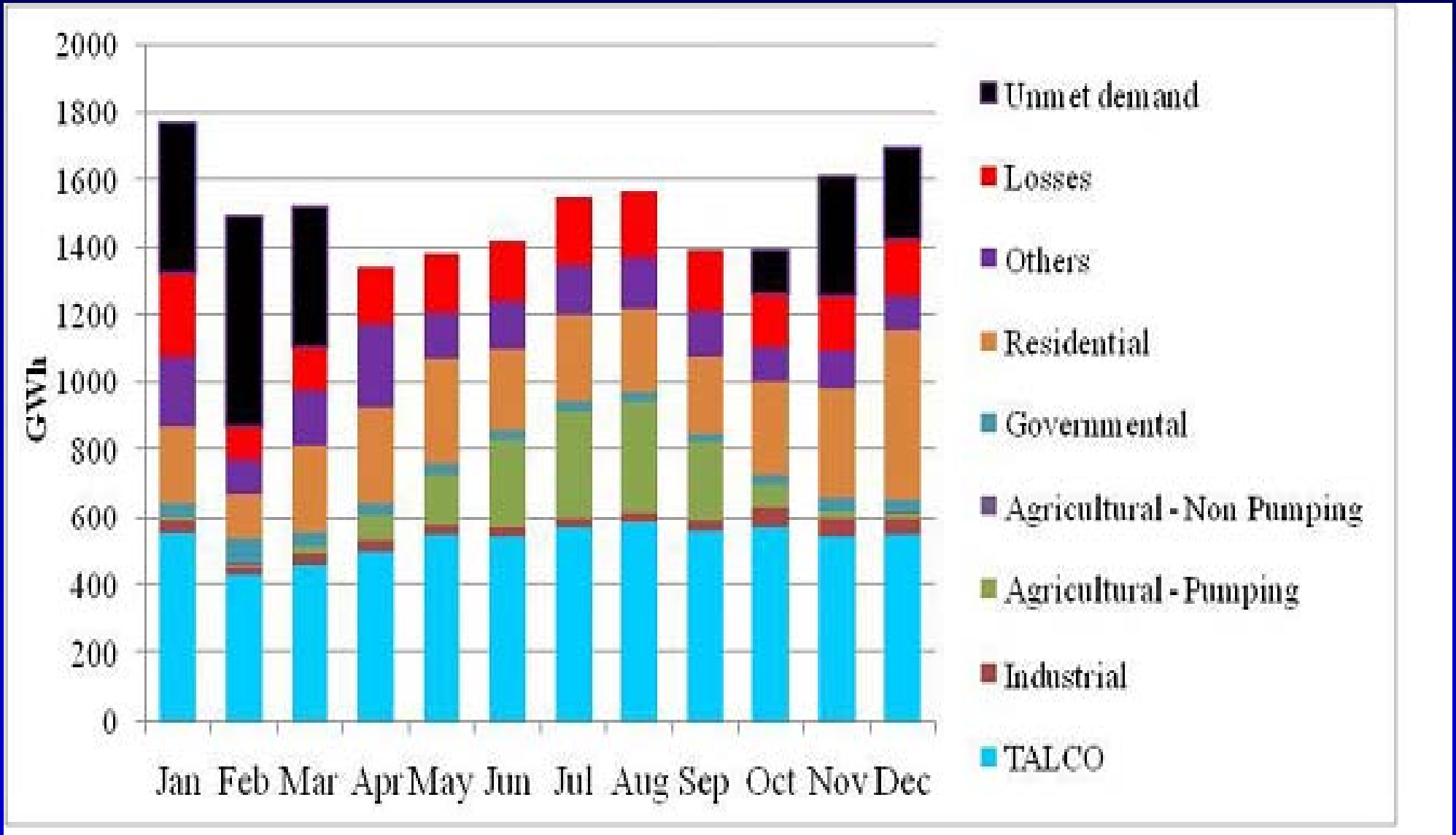
# Energy Demand and Supply

- Over the last decade, Tajikistan had an annual electricity demand of between 16,000 and 17,000 GWh
- However, in recent years the demand has increased up to 19-21 GWh due to expansion of the population and new buildings and installations.
- The aluminum smelter TALCO accounts for 40% of demand. The second largest customer group is the residential sector at 44%.
- At present, the deficit of electricity during the fall-winter period is 4-4.5 billion kWh. During this period, there is a limited electricity supply mode, and that has a significant impact on the economy of the country. During the summer time, the country has the same amount of excessive electricity supply

# Electricity Supply and Demand



# Monthly Demand by Sector, 2009



# TAJ Actual Export and Losses 2000-2008

| Year | Spillage | Export | Total |
|---|---|---|---|
| | GWh | GWh | GWh |
| 2000 | 299.30 | 369.60 | 668.90 |
| 2001 | - | 333.80 | 333.80 |
| 2002 | 2,971.79 | 266.10 | 3,237.89 |
| 2003 | 758.37 | 1,017.10 | 1,775.47 |
| 2004 | 183.10 | 693.60 | 876.70 |
| 2005 | 1201,06 | 755.50 | 755.50 |
| 2006 | 50.37 | 900.00 | 950.37 |
| 2007 | 20.93 | 904.20 | 925.13 |
| 2008 | 71.44 | 994.70 | 1,066.14 |
| **Average** | **483.92** | **692.73** | **1,176.66** |
| **TOTAL** | **4,355.30** | **6,234.60** | **10,589.90** |

*Source: Coordinating Dispatch Center (CDC)*

# Generation Gap

- As it is evident, Tajikistan's power system cannot currently meet demand, leading to significant shortages in winter months. The unmet demand was estimated by WB at 2,700 GWh (2012) at the consumer level. Taking into account losses during transmission and distribution of electricity, the deficit at the generation level amounts to about 3,100 GWh during winter
- Winter deficit/Summer surplus issues:
- (i) low efficiency of existing assets;
- (ii) lack of trading arrangements with neighbors; and
- (iii) lack of investment for alternative sources (coal, gas and additional hydroelectric power)

# Implications of Electricity Shortage

- The environment for energy development in Tajikistan has changed dramatically since independence, with very strong growth in demand but loss of sources of thermal supplies during winter.
- About 70% of the population currently suffers from blackouts during the winter (get only about 2 to 6 hours of electricity), imposing direct costs in terms of: (a) foregone revenue from economic activity; (b) additional costs due to damage to equipment and interruption of business processes; and (c) costs from household equipment damage.

# Implications of Electricity Shortage

- Estimated economic loss of around US$200 million per annum or 3% of GDP
- Seasonal reduction of industrial production due to low electricity supply in Dec-April (e.g. more than 60 industrial enterprises in Sogd region were not functioning as only 3.5 million kWh/day of electricity was provided while 14 million kWh/day was required)
- About 30% drop in crop yield due to insufficient access to irrigation through water pumps
- Lower school attendance
- Deterioration of healthcare services, particularly for newborn infants and vaccination

# General Current and Future Situation

- In general, Tajikistan faces a crisis in energy security with serious economic and social consequences. As mentioned above, in 2012, winter electricity shortages were estimated at 2,700 GWh and according to WB estimate, in the absence of any offsetting measures, these deficits could increase to over 6,800 GWh and 2,550 MW by 2020. Without immediate attention, the electricity crisis in Tajikistan could affect stability in the country and the region
- Demand for electricity and the need for additional supply will continue to grow even as Tajikistan endeavors to meet current winter shortages.

# General Current and Future Situation

- Despite the magnitude of the hydropower potential, HPPs have several limitations in Tajikistan. Most significantly, lower river flows and cold weather reduce winter electricity generation, particularly from non-storage HPPs. In the current system, winter energy generation is about 70% of summer generation.
- Without prompt action to remedy the causes of Tajikistan's electricity crisis and with growing demand, the shortages could increase to about 4,500 GWh by 2016 (over a third of winter electricity demand) or worse.

# General Current and Future Situation

- Barki Tajik, the state power utility company, has kept Tajikistan's power system functioning under difficult circumstances, but the system is increasingly vulnerable to a major breakdown that would jeopardize the supply of electricity to all customers and cause enormous damage to Tajikistan's economy.
- The Government of Tajikistan recognizes both the importance and challenges of energy security as well as importance of energy saving policies, effective energy resources management, reductions of energy losses, and ongoing exploration of new energy supplies, including renewable energy sources.

# Tariffs Issues

| Industry | 4,87 cents US$ |
|---|---|
| TALCO | 8,3 cents US$ |
| Non-industry | 14,9 cents US$ |
| Communal providers | 1,94 cents US$ |
| Electric transport | 1,94 cents US$ |
| Irrigation pumps | 1,30 cents US$ |
| Population | 2,32 cents US$ |

# Immediate Priority Issues

- Between now and 2020, rehabilitation of the existing hydropower assets is an important component to address Tajikistan's winter electricity crisis. Many of the hydropower assets are operating well beyond their design life.
- Demand growth and the need to invest in new supply can be further contained through fuel switching and a variety of energy efficiency measures. According to WB estimate, these measures could reduce the demand by 1,900 GWh or 13% by 2020, equivalent to about 29% of the winter energy deficit estimated for 2020.

# Immediate Priority Issues

- Addressing system inefficiency
  - Intensify energy loss reduction efforts to cover entire country
  - SCADA System/National Dispatch Center Modernization
- Sustainable solutions to meet the winter deficit
  - Rehabilitation/modernization of Nurek HPP, Dushanbe Combined Heat and Power plant
  - Providing connectivity to areas not currently served by the grid
  - Rogun HPP, CASA 1000, Sangtuda I, and Sangtuda II)/Summer surplus (trade arrangements)
- Continue institutional capacity strengthening in line with sound economic, planning and governance principles:
  - Commercial, operational and financial performance of energy utilities
  - Reduce the large quasi-fiscal deficits by improving the energy pricing mechanism, corporatization of Barki Tajik and instituting appropriate institutional and governance reforms
- Attraction of private sector (legal and institutional framework attractive for Public Private Partnership)

# Conclusions and Recommendations

- Tajikistan has an immense reserve of energy resources, particularly hydropower one.
- The long-term politics of the supply of energy to the country must include a maximum and rational use of all forms of energy resources, while also making sure to consider using high performance technology to convert energy, supply energy, conserve energy, and protect the surrounding habitat.
- It is necessary to efficiently provide energy to the country's population. Renewable energy sources present in the regions should be used first.

## Conclusions and Recommendations

- At the same time, there exists a number of problems with the wide-spread expansion of renewable energy. In order to overcome these challenges the government and the international organizations assisting in the introduction of alternative sources of energy, must increase efforts to transfer modern technology as well as provide financial and legal support.
- This will enable not only to preserve the ecology of a mountainous country, but it will also improve the living conditions of the population and decrease the level of poverty.

# THANK YOU FOR YOUR ATTENTION!

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