

# Energy Sector Issues in Uzbekistan

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# 1. Introduction

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## Background:

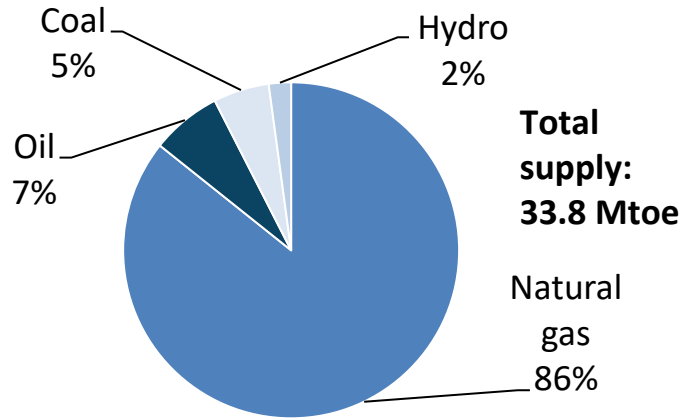
- Uzbekistan faces structural energy supply issues and growing energy demand
- Energy crisis 2019 revealed the severity of these problems:
  - The planned refurbishment of largest thermal power plant significantly reduced generation
  - As a result the country ran into regular black-outs with cut-offs of consumers
  - Production of natural gas is declining while export obligations are increasing
  - UZB had to purchase gas from domestic LukOil Kandym plant at export prices due to production sharing agreement (PSA), generating USD 600 m debt in 2018 according to LukOil

## Purposes of this Policy Briefing

- **Identify key energy sector issues in Uzbekistan**
- **Target further analysis**

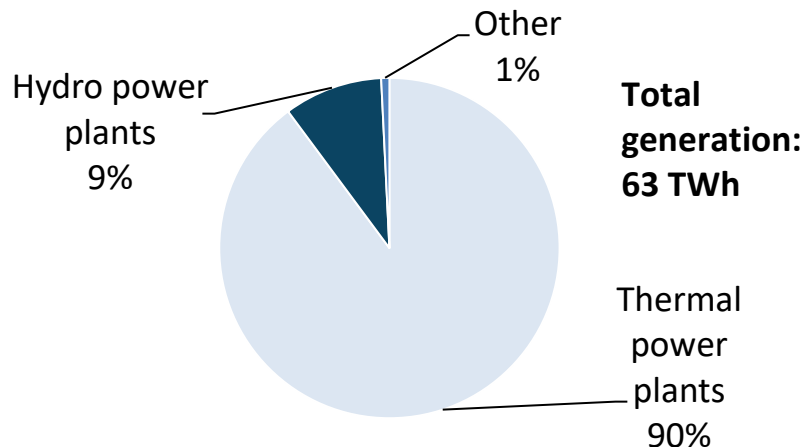
## 2. Main energy sources

Total primary energy supply by source 2017



Source: IEA

Electricity generation by source 2018

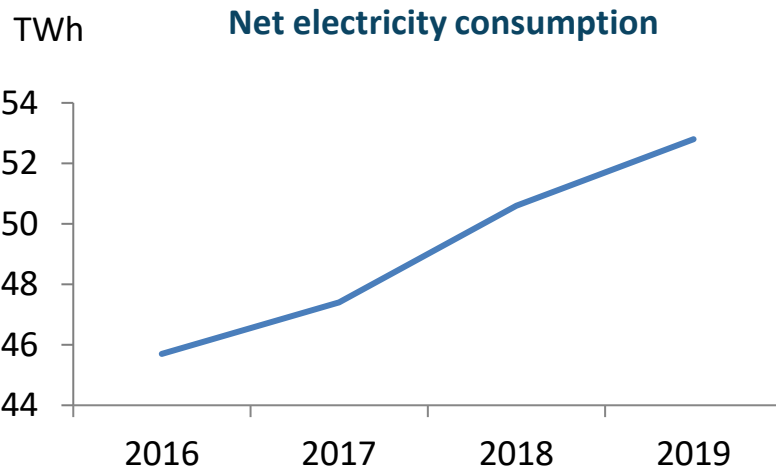


Source: UzStat

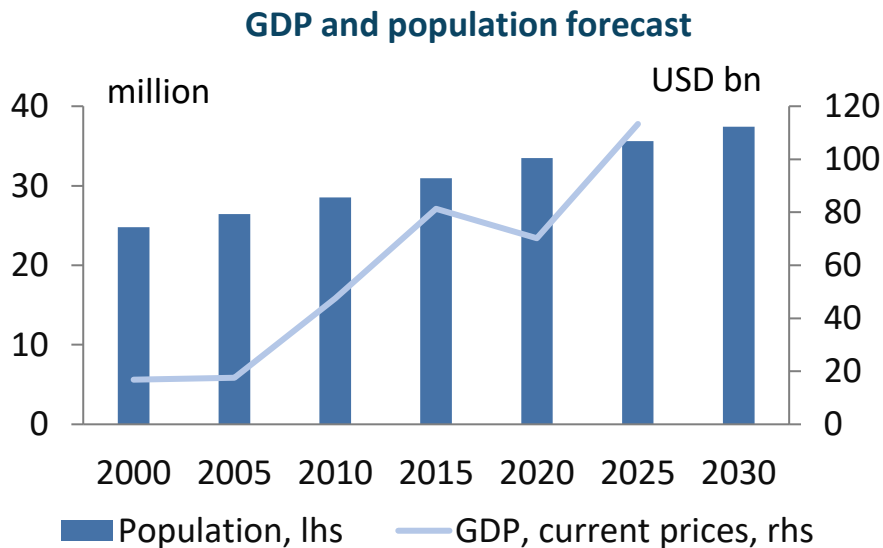
- UZB has been reliant on rich natural gas and oil reserves in the past
- Fossil fuels primary energy source:
  - 98% of total primary energy supply in 2017
- But: Fossil reserves are depleting
- Reserves exploited by state-owned Uzbekneftegaz and int. joint ventures under production sharing agreements (PSAs)
- National demand for natural gas increasingly competes with export obligations

➤ **With depleting reserves, high dependence on natural gas becomes problematic**

# 3. Electricity – Demand



Source: MinEnergO



Source: UN, IMF

## Growing demand

- Uzbekistan’s economy has been growing fast in recent years
- Government forecast estimates consumption to double in 10 years time
- Fuelled by GDP and population growth, net electricity consumption has on average grown 4% per year since 2016
- Already now, demand exceeds supply – especially in the residential sector
- Blackouts and planned cut-offs are common
- **Electricity supply needs to be significantly increased to keep up with growth in demand**

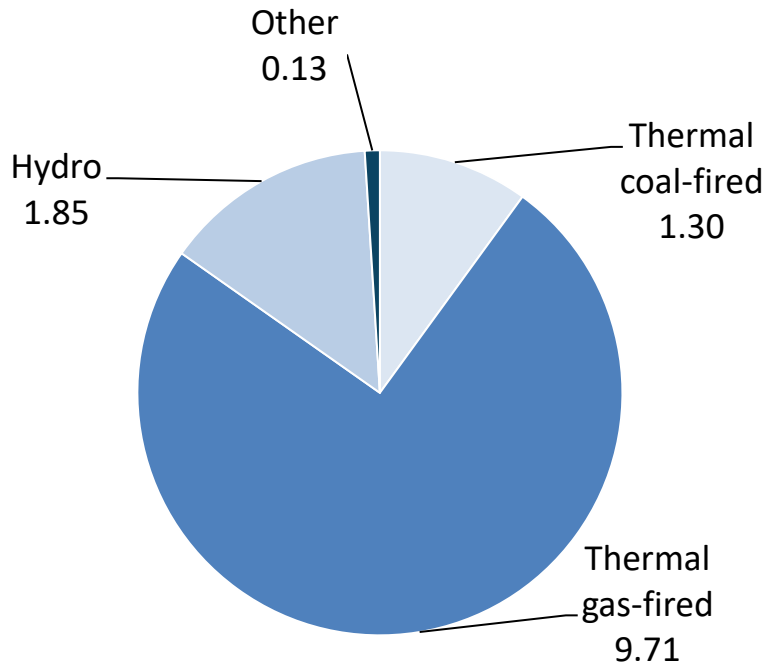
# Potential effects of COVID-19 on electricity demand

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- GDP growth projections likely to be revised downwards
- Industrial electricity demand (around 40% of total consumption) could be adversely affected
- Population growth will still be a major driving force for electricity consumption growth
- **Short- and medium-term forecasts for electricity demand should be reassessed**

# 3. Electricity – Generation and transmission

Available capacity 2019, GW



Source: MinEnerg

## Ageing infrastructure

- Average age of transmission and distribution lines is 35 years
- Most generation assets are 40–50 years old and in poor condition

## Low efficiency of thermal plants

- Existing gas-fired plants are designed as baseload generation, i.e. their efficiency for flexible peak load generation is low
- Average TPP efficiency of 33% only (compared to 55% for advanced combined-cycle gas turbine technology)

## High losses in transmission and distribution

- Electricity transmission losses reported at 18%, distribution losses at 14%
- **Deteriorating assets signal urgent need for investment**

# 3. Electricity – Potential of international integration

## Electricity imports and exports

	2016	2017	2018	2019
Imports, TWh	0	1.2	2.6	3.5
Exports to Afghanistan, TWh	1.5	1.8	2.5	2.0

Source: MinEnergo

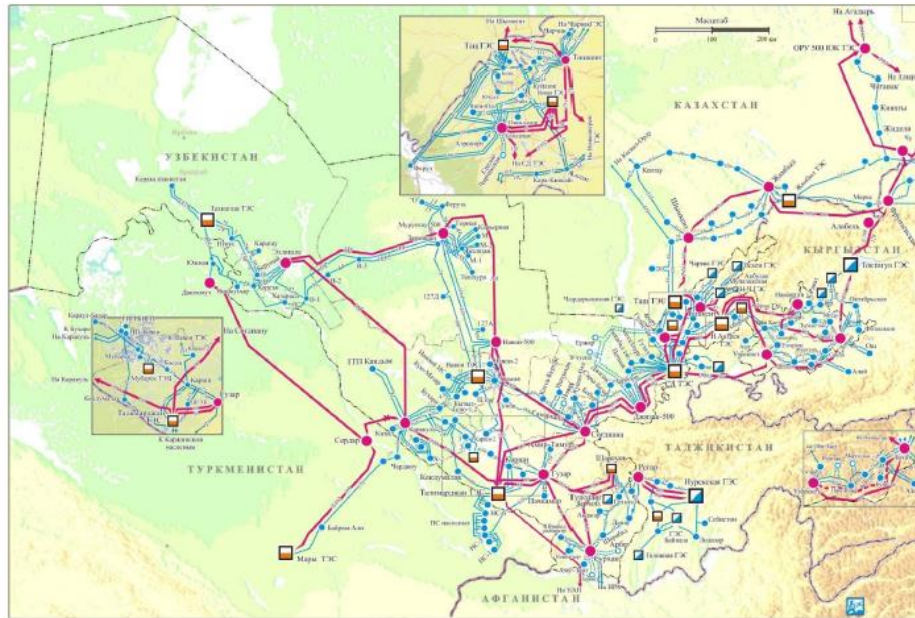
## UZB trade volumes are increasing

- UZB used to be net exporter of electricity but rising imports in recent years due to growing domestic demand
- Imports from hydro-rich Kyrgyzstan (at ~1.2 UScts/kWh) cheaper than thermal generation cost in UZB
- Turkmenistan started supplying 15 GWh/day to Uzbekistan from December 2019
- UZB exports to Afghanistan at 6 UScts/kWh are profitable
- **Increased regional balancing could reduce the need for additional generation capacity in UZB**



# 3. Electricity – Potential of international integration

## 2030 plan for transmission and distribution system modernisation



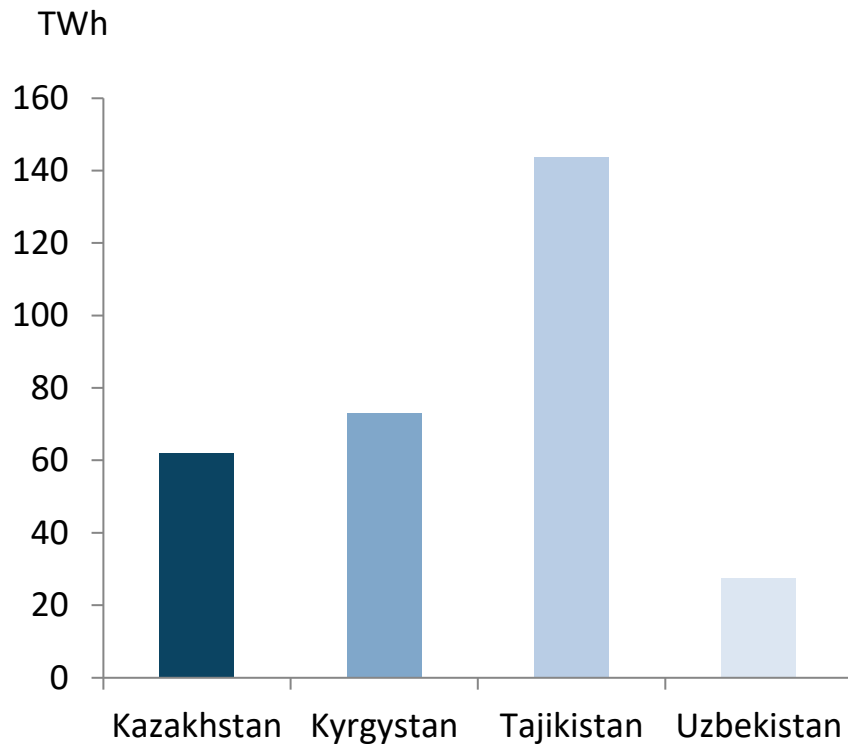
Source: SAESP 2017

## Opportunities and limitations of regional trade

- Initiatives such as the Central Asia South Asia 1000 kV high-voltage line (CASA1000) aim at increasing regional electricity trade
- But: Most Central Asian electricity systems still lack transparency and accounting
- Hard to assess the true cost of electricity generation e.g. due to cross-subsidies
- No competitive wholesale markets in place
- **Without market-based relations, regional trade heavily depends on politics**

# 3. Electricity – The hydro-electricity trade-off

## Estimated hydro-electricity potential in Central Asia



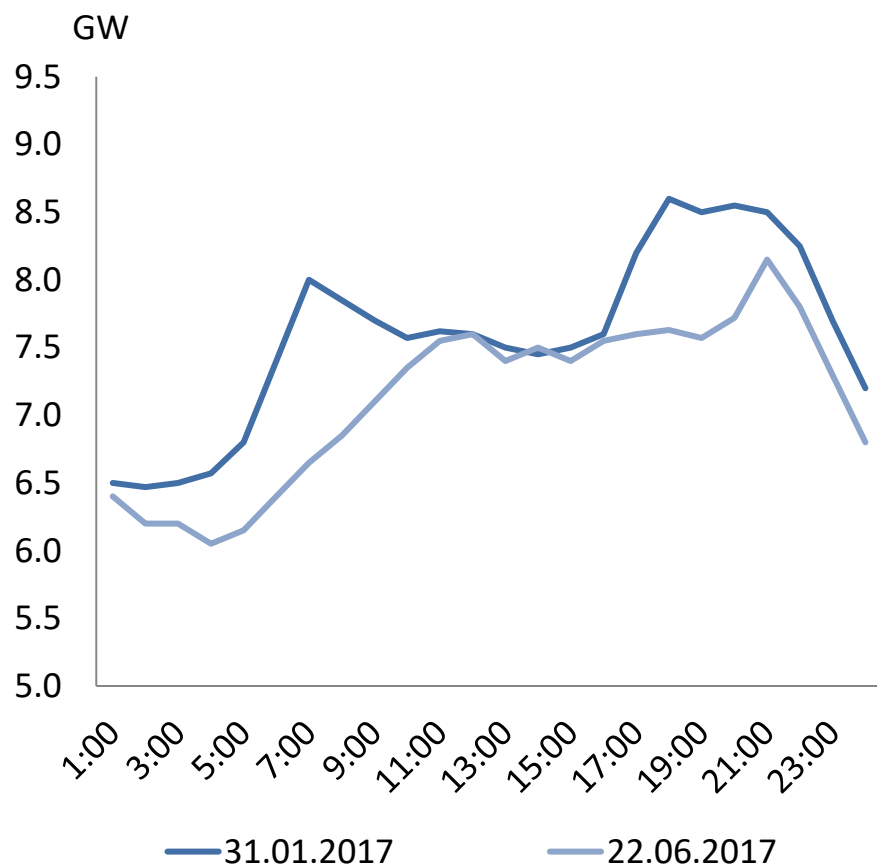
Source: CADGAT No.19 2019

## Agriculture needs water in summer

- 82% of UZB water consumption for irrigation purposes
  - Dams need to release water in summer for irrigation, imposing constraints on hydro electricity generation
  - Irrigation constraints reduce the flexibility of HPPs to serve peak demand
  - Limited potential to expand existing hydro capacities
  - Kyrgyzstan and Tajikistan export excess hydro electricity in summer at low prices
- **Steady need for irrigation during summer limits hydro-electricity potential**

# 3. Electricity – Peak load management

### Hourly load on 31.1 and 22.6.2017



Source: Own calculations

### Strong electricity consumption peak

- Electricity consumption peak around 8/9pm due to residential consumption
- Data might even be an underestimation – as some consumers are switched off in the evening for lack of electricity
- Solar peak will be around noon, meeting evening load will require large ramp-up

### System flexibility and trade as remedies

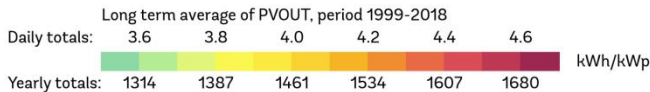
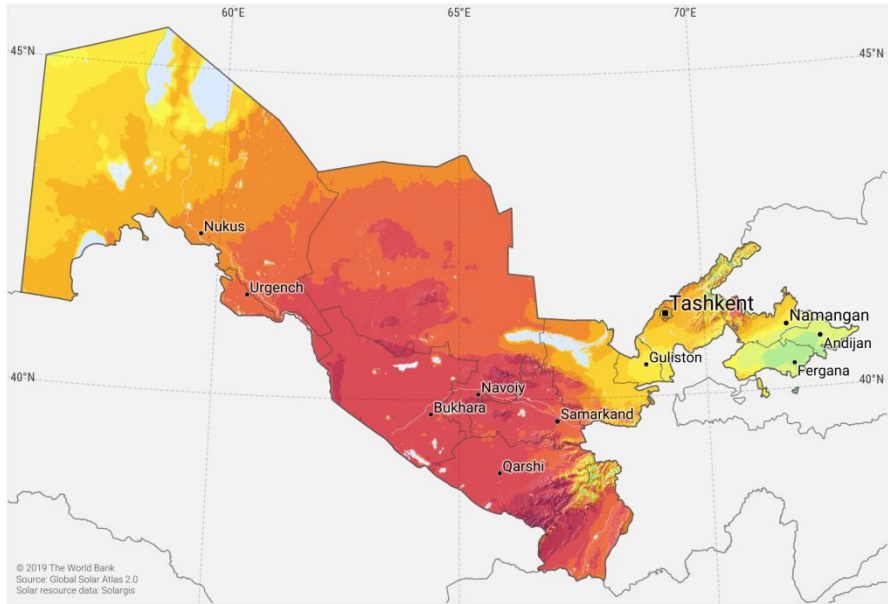
- Flexible capacity needs to be added in UZB
  - KGZ & TJK hydro plants can provide part of UZB peak flexibility demand
  - UZB could provide gas baseload electricity to the region in turn
- **Increased trade and more flexible system complementary in improving peak load management**

# 3. Electricity – RES potential

## Solar resource map Uzbekistan

SOLAR RESOURCE MAP

### PHOTOVOLTAIC POWER POTENTIAL UZBEKISTAN



This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

Source: World Bank

## Massive potential for solar and wind

- Very high solar potential
- Wind potential highest in western UZB, implying higher transmission cost
- Full exploitation of hydro potential constrained by agricultural irrigation needs

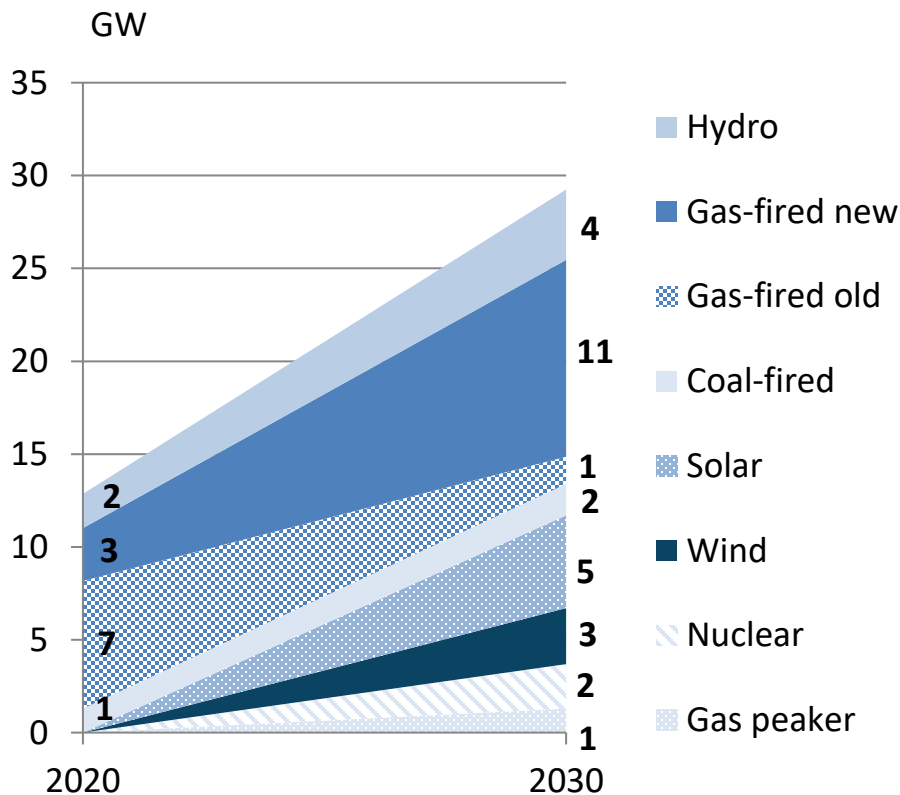
➤ **Solar is the prime candidate for large-scale expansion**

## Significant projects in the pipeline

- First open tender in 2019 for public-private partnership (PPP)
  - Emirati company won tender for 100 MW of solar and will supply at 2.7 UScts/kWh
- More PPP tenders to be announced soon
- **Gov pursues PPPs as main instrument for reaching 8 GW of RES in 2030**

# 3. Electricity – Investment plans

2030 government capacity investment plan



Source: MinEnergo

## Big investment need

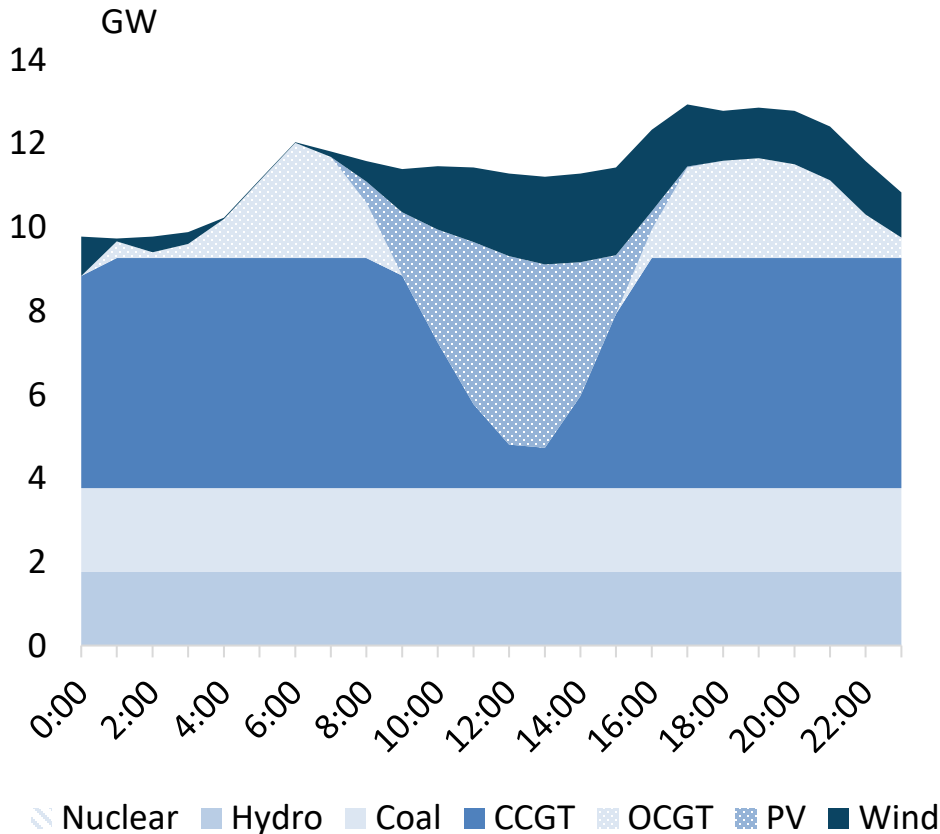
- Gov plan foresees generation capacity to more than double until 2030
- First nuclear plant (2.4 GW) and 8 GW of modern combined-cycle gas turbines (CCGTs) to provide baseload generation
- At the same time, deploying 8 GW of RES implies higher need for flexibility
- Less inflexible base- and more flexible peakload (e.g. gas peakers) preferable
- **Plans biased towards inflexible baseload generation and imply higher cost**

## Unclear financing

- Even if investors pay building cost under PPPs, generation cost will be higher than today
- **Who will pay the increasing tariffs?**

# 3. Electricity – Modelling the optimal power plant park

Optimal dispatch of UZB electricity system for one representative day in 2030



Source: Own calculations

## GET UZB policy briefing on power plant park scenarios for 2030\*

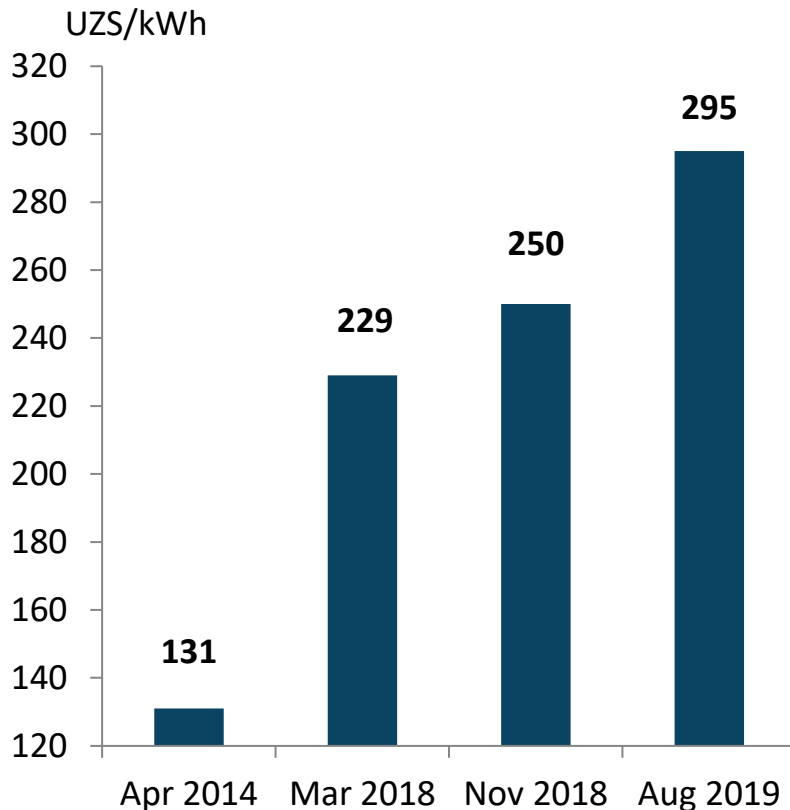
- Aim: Assess if 2030 plan is cost-efficient
- Electricity system modelling allows to find cost-optimal power plant park setup
- GET UZB has compared costs of different power plant park setups
- Result 1: With full realisation of 2030 plan, excessive baseload share implies highly inefficient dispatch
- Result 2: When RES and gas peakers partly replace baseload capacity (nuclear & CCGT), costs can be significantly reduced

➤ **Investment decisions should be backed up by electricity system modelling**

\*[https://www.german-economic-team.com/usbekistan/wp-content/uploads/sites/6/GET\\_UZB\\_TN\\_06\\_2019\\_en.pdf](https://www.german-economic-team.com/usbekistan/wp-content/uploads/sites/6/GET_UZB_TN_06_2019_en.pdf)

# 4. Energy prices

## Electricity tariff changes for residential consumers



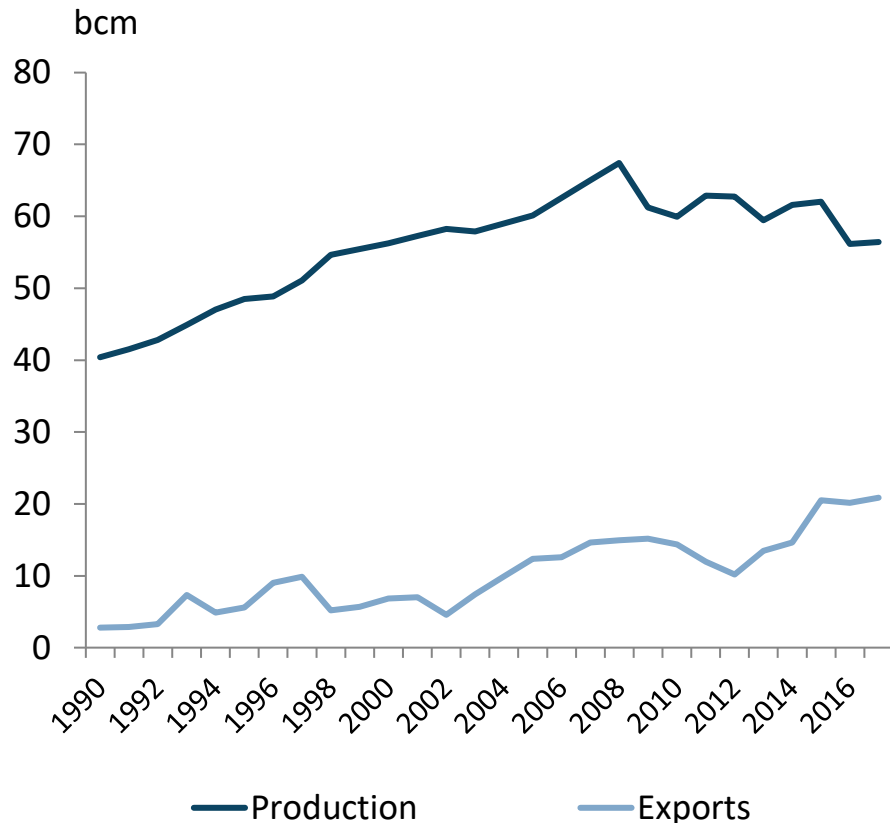
Source: MinFin

## Tariffs increase but still no cost coverage

- Residential tariffs up 125% since 2014 but now still only at ~3UScts/kWh
  - Tariff reform accompanied by increases in minimum wage and pensions
  - GDP-adjusted tariffs are among the highest in Central Asia
  - Tariff increases especially hurt low-income households
  - Most thermal plants are incurring losses
  - Gov envisages transition to cost-recovering tariffs until 2023
  - Suppliers not reimbursed in tariff for capital costs
- **Tariffs increases necessary but still insufficient for cost-recovering generation and a burden for consumers**

# 5. Gas sector issues

Natural gas production and exports 1990-2017



Source: IEA

## Domestic supply is decreasing

- Low investment into exploration and prospecting
- The remaining rich fields are being occupied by joint ventures with international companies
- State-owned Uzbekneftegaz accounts for about half of UZB production

## Increasing exports commitments

- 8 bcm committed to China and 4.5 bcm to Russia in 2019, up 15% from 2018
- But: Gov projects that exports could stop in 2025

➤ **Depleting gas surplus means that diversification of energy supply is much needed**



# 6. Sector organisation

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## Important restructuring of responsibilities

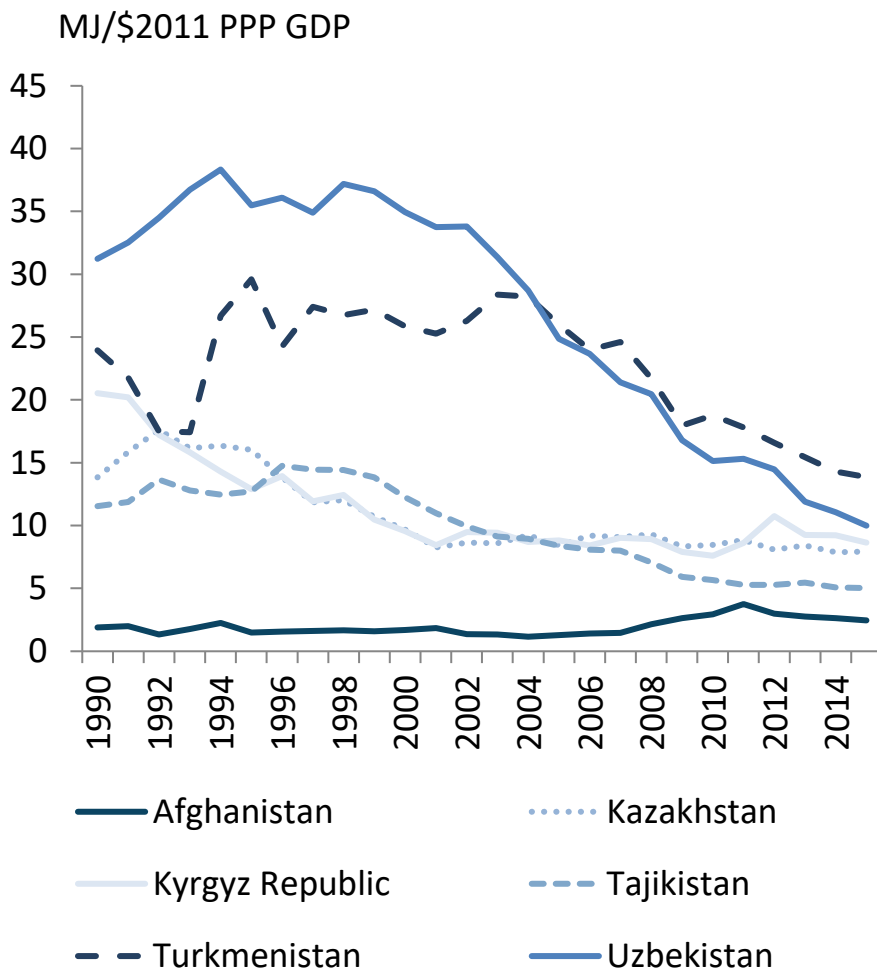
- MinEnergo now key player in energy policy
- Since 2019, strategic energy tasks from MinFin, MinEcon, State Agency, Uzbekenergo & Uzbekneftegaz concentrated at MinEnergo
- MinFin still responsible for tariff policy

## Unbundling of state energy companies

- Uzbekenergo has been unbundled into transmission, distribution and generation companies
  - Each power plant will negotiate tariffs individually with single buyer National Electricity Networks and sign Power Purchase Agreements (PPAs)
  - National Electricity Networks also responsible for cross-border trade and transmission
  - Uzbekneftegaz to be unbundled into exploration, transportation and distribution companies
- **De-monopolisation, deregulation and attracting private sector investment main instruments of gov policy**

# 7. Energy efficiency potential

## Energy intensity level of primary energy 1990-2015



Source: World Bank

© Berlin Economics

## Uzbekistan still one of the most energy intensive countries in Central Asia

- 14-18% transmission and distribution losses in the electricity sector
- Average efficiency of thermal power plants is 33% only

## Bad geographical situation of assets

- Electricity generation mainly in the north
- Gas production mainly in the south

## Tariff system has discouraged demand-side energy efficiency

- Metering develops slowly
  - Low tariffs have given little incentive for energy saving
- **Overhaul of electricity infrastructure key together with tariff reform**

## 8. Conclusion

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- Amid declining natural gas resources, diversification of energy supply is key
- Taking advantage of huge RES potential is a sensible strategy
- Investment plans should be reassessed to avoid excessive cost
- Unbundling and de-monopolisation crucial for improving competition
- Increased regional electricity trade represents a big opportunity to benefit from comparative advantages within Central Asia
- Ongoing tariff reform necessary to ensure cost-recovering electricity generation and incentives for energy efficiency

# About the German Economic Team



The German Economic Team (GET) advises the governments of Ukraine, Belarus, Moldova, Georgia and Uzbekistan regarding the design of economic policy reform processes and a sustainable development of the economic framework. As part of the project we also work in other countries on selected topics.

In a continuous dialogue with high-level decision makers of the project countries, we identify current problems in economic policy and then provide concrete policy recommendations based on independent analysis.

In addition, GET supports German institutions in the political, administrative and business sectors with its know-how and detailed knowledge of the region's economies.

The German Economic Team is financed by the Federal Ministry of Economics and Energy (BMWi). The consulting firm Berlin Economics has been commissioned with the implementation of the project.

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