

- Electricity market of ukraine
- Nuclear power sector
- Wind and solar
- Thermal generation

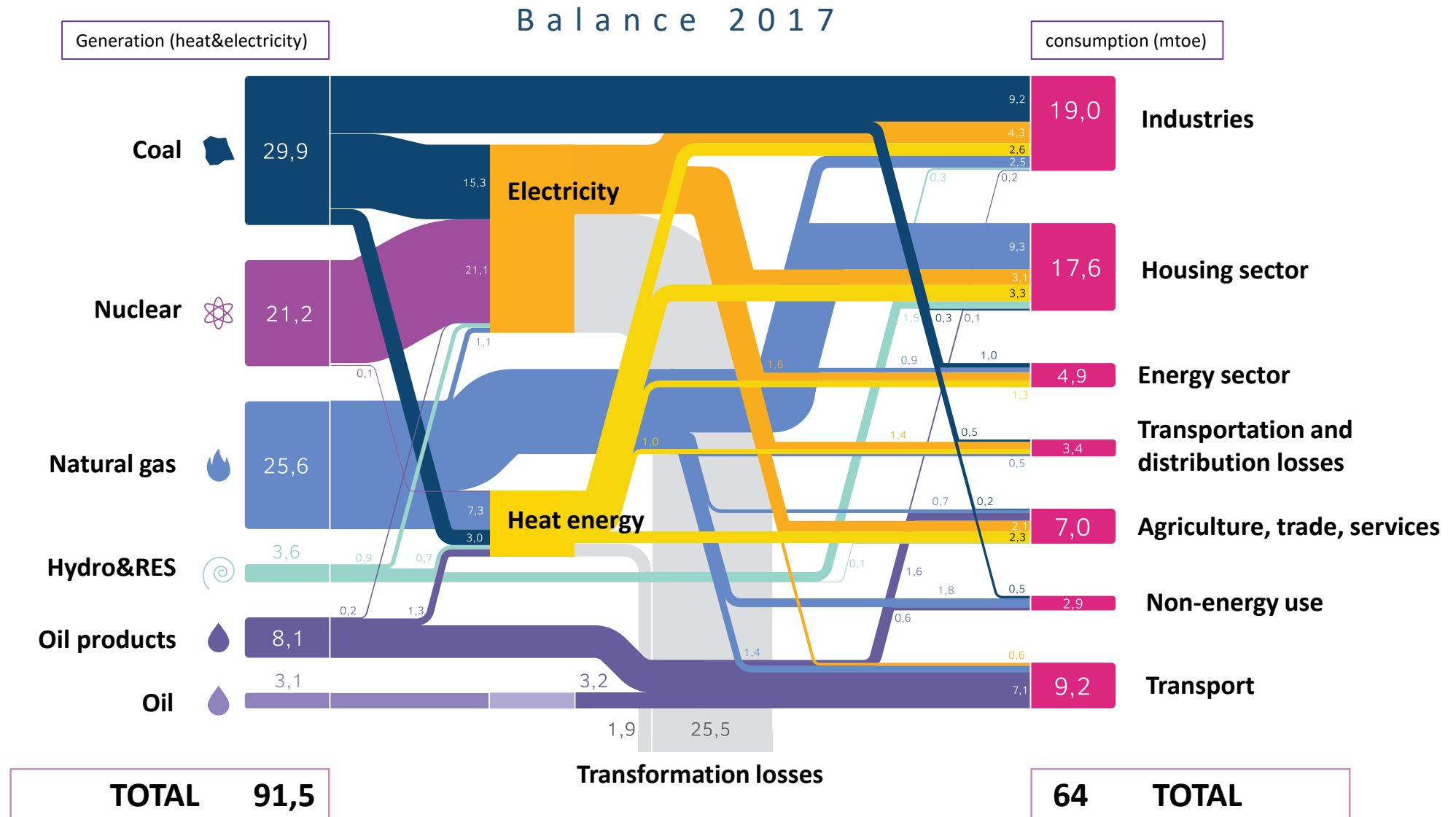
UKRAINE ELECTRICITY MARKET, trends and opportunities



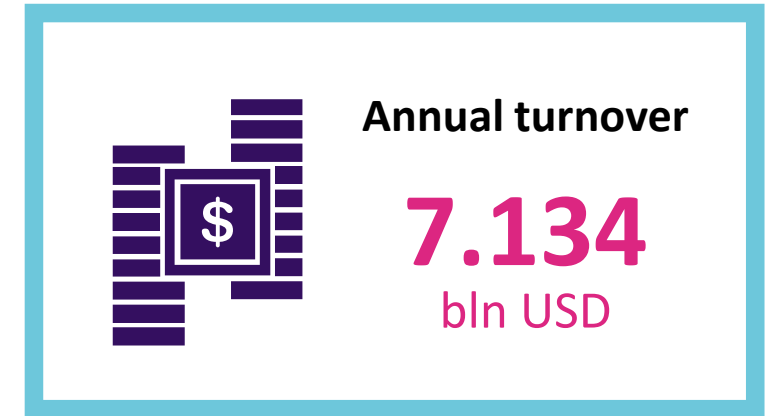
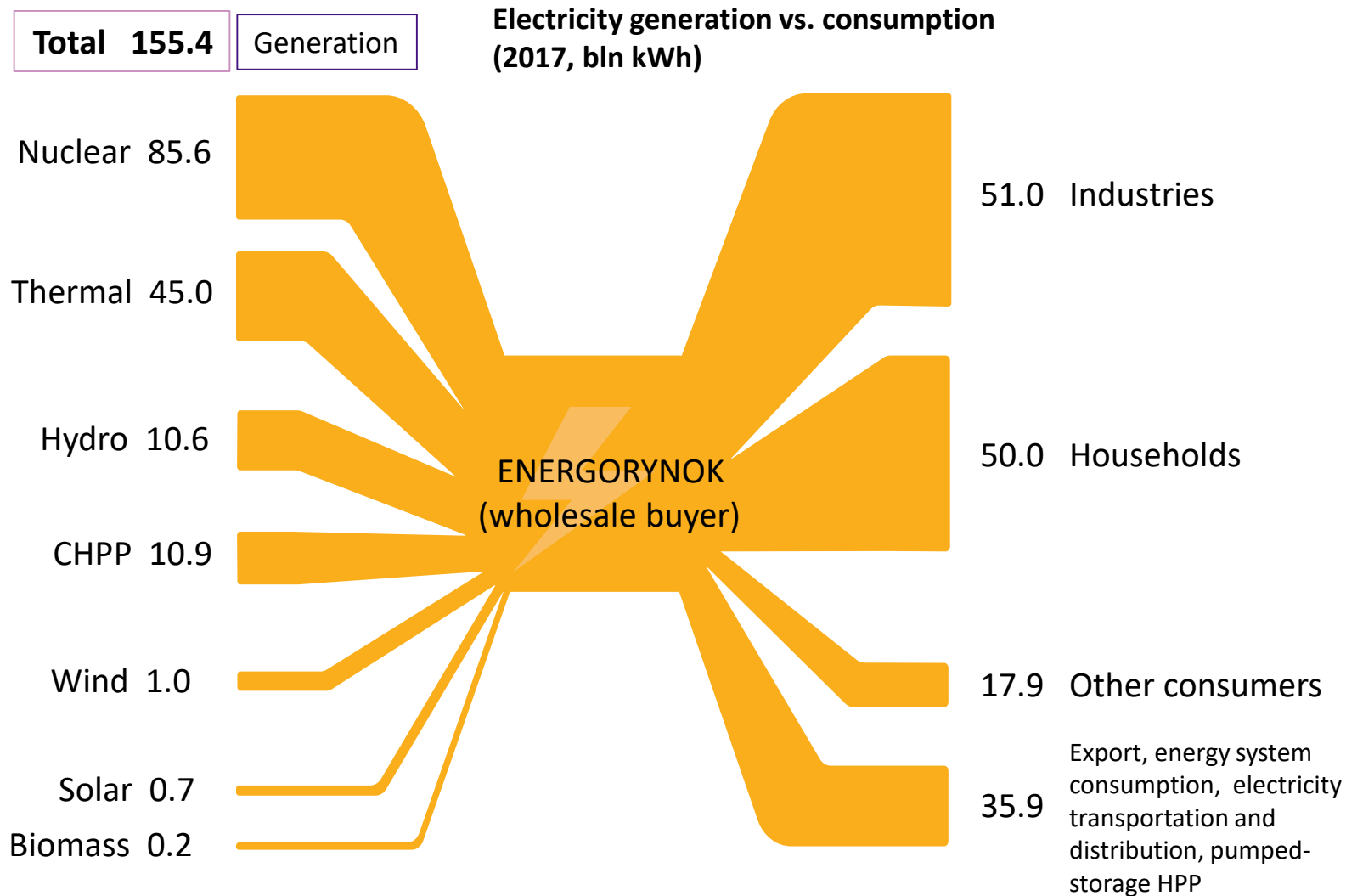
UKRENERGO

State enterprise | National power company

ENERGY SECTOR OF UKRAINE AT GLANCE



ELECTRICITY MARKET OF UKRAINE: KEY ELEMENTS

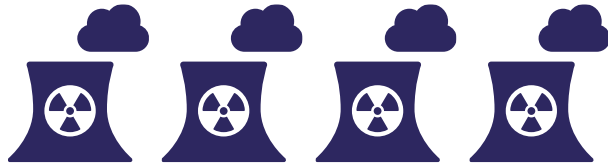


- Key Trends:**
- Free competitive electricity market (2019)
 - More RES **1% (2017)** → **13% (2035)**
 - Digitalization and IT solutions
 - Major modernization of NPP (new technologies) and TPP (less pollution)
 - Comprehensive energy efficiency modernization (households, transport)

AS FOR 2017, UKRAINE IS NEAR TO NEW YORK STATE IN TERMS OF ELECTRICITY GENERATION

NUCLEAR POWER SECTOR

Capacities – 13 880 MW



4 NPP



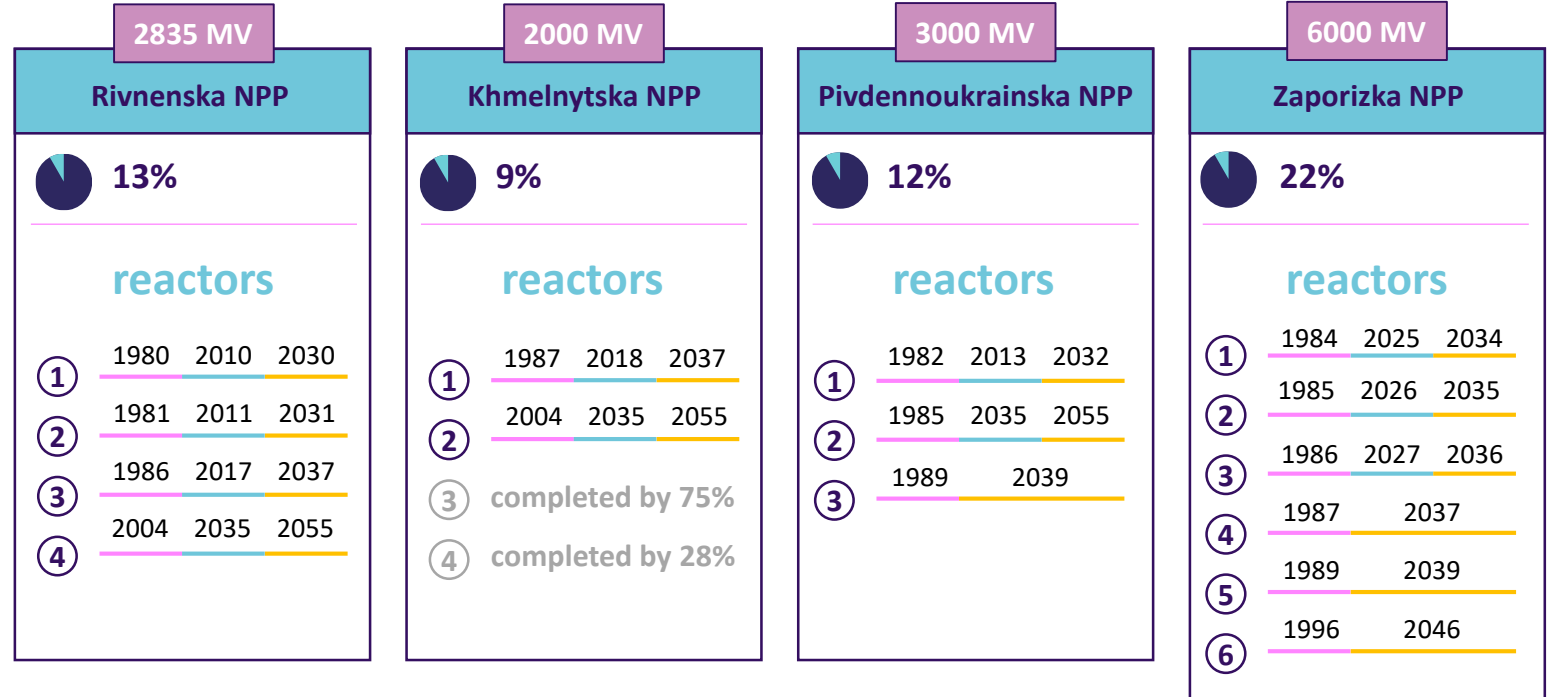
15 REACTORS

(13 VVER 1000 and 2 VVER440)



2 REACTORS
UNDER
CONSTRUCTION

(temporary frozen)

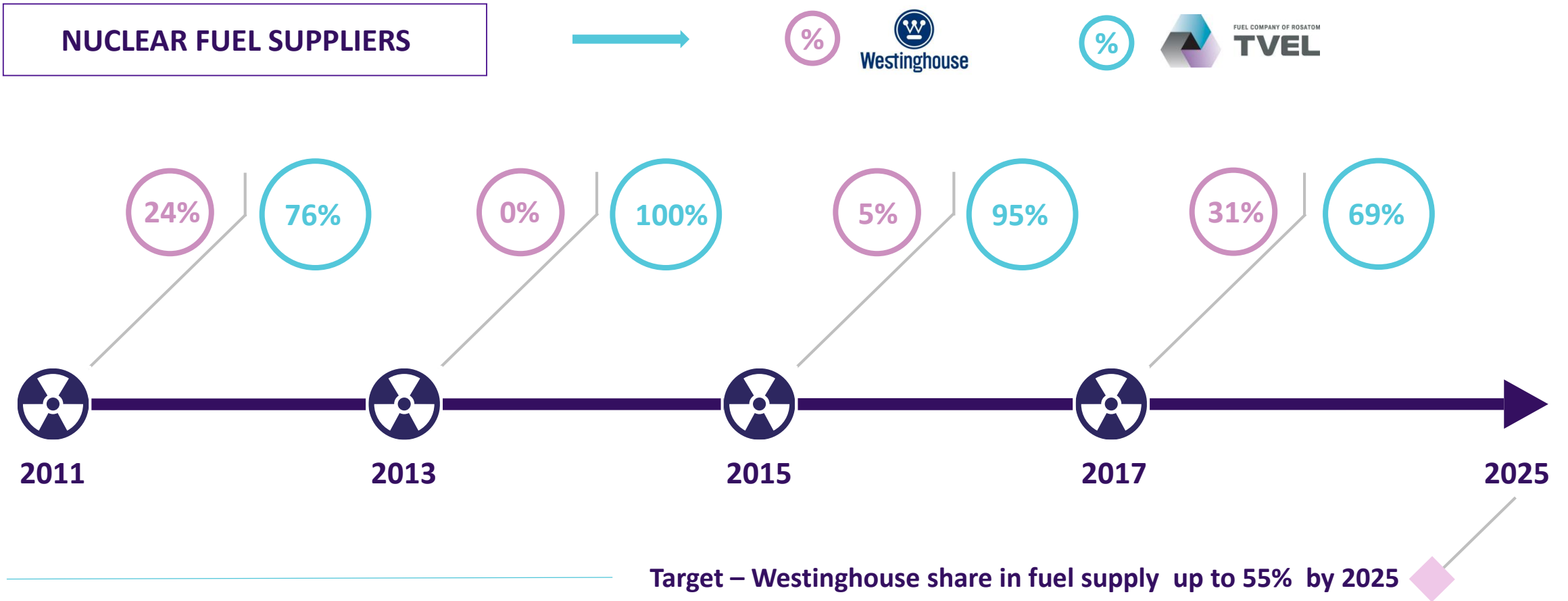


Date of commissioning Lifetime expiry Maximum lifetime share in total electricity production

Energy strategy of Ukraine 2035 – NPP capacities up to 18 000 MW, around 50% of total electricity generation



NUCLEAR POWER SECTOR

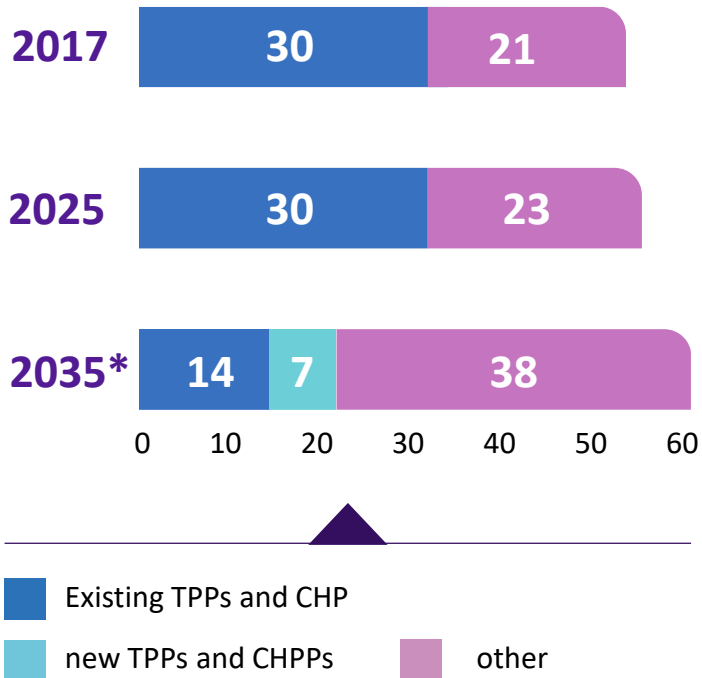


Key challenges: NPP lifetime extension; nuclear fuel diversification; nuclear fuel utilization; NPP closure

Key opportunities: Fuel supply; technical services; trainings sessions; new NPP technologies

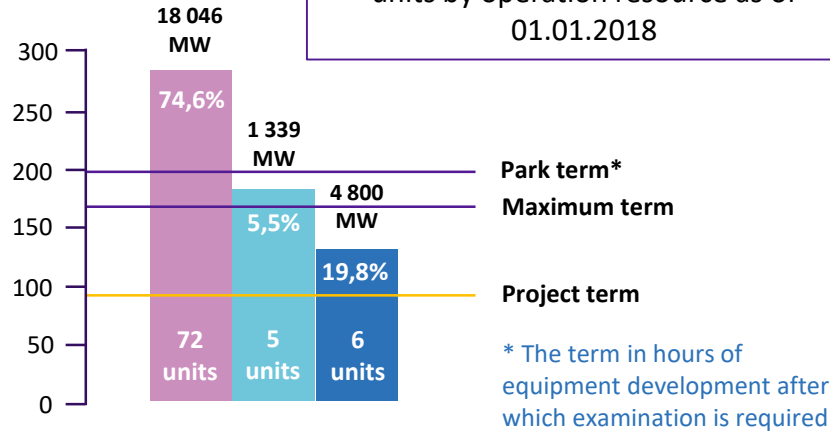
THERMAL GENERATION

Forecast of installed capacity of thermal generation (2017-2035)



* The share of thermal generation in total production will remain at the level of 25-30%

Technical condition of thermal power units by operation resource as of 01.01.2018



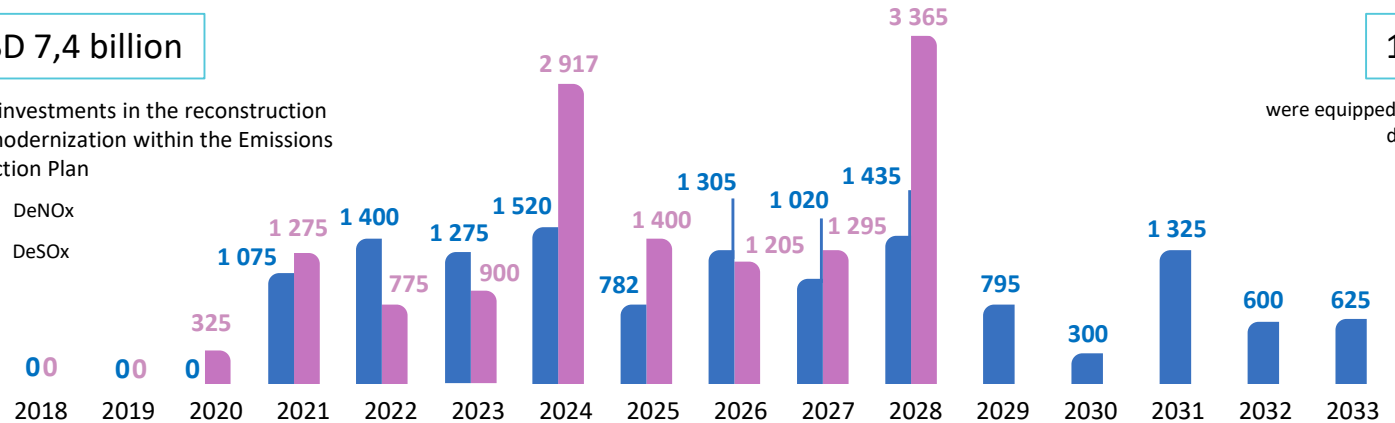
Maximum volumes of emissions for all large combustion units included in the National Plan of Emissions Reduction (tons per year)

Date	SO ₂	NO _x	Dust
31.12.2018	1017034.5	191300.5	205878.2
31.12.2022	630622.5	154631.1	125595.7
31.12.2027	147607.4	108794.9	25242.6
31.12.2033	51004.4	53791.3	5172.0

USD 7,4 billion

Total investments in the reconstruction and modernization within the Emissions Reduction Plan

■ DeNOx
 ■ DeSOx



13.5 GW

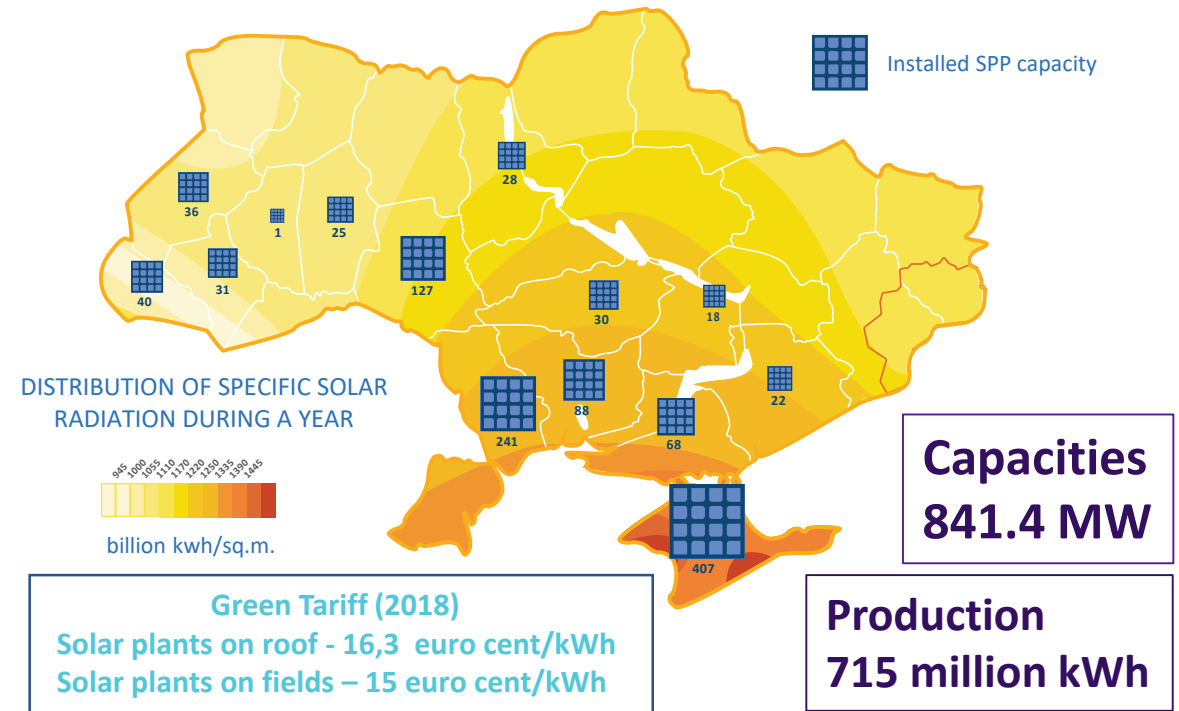
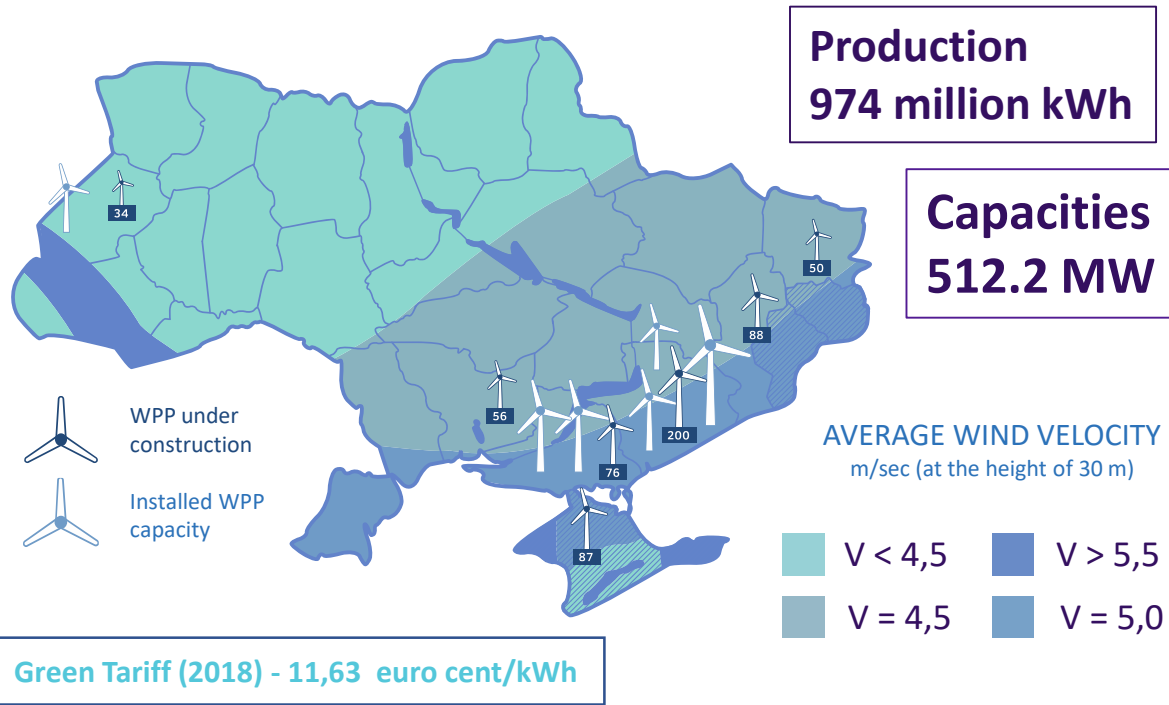
were equipped with deNOx and deSOx installation

Key challenges: Financing and of outdated equipment, reconstruction for lower pollution, coal dependence

Key opportunities: Balancing and reserve capacities for RES, strategic reserve for emergency cases, strong demand for new environmental programs and technologies

WIND AND SOLAR

ACCORDING TO THE ENERGY STRATEGY OF UKRAINE UNTIL 2035 THE PRODUCTION OF RES IN 2035 WILL BE 25 BLN KWH



The cost of building wind power plants in Ukraine:
1600 Euro - 1 kW (2015) / 1248 Euro - 1 kW (2017)

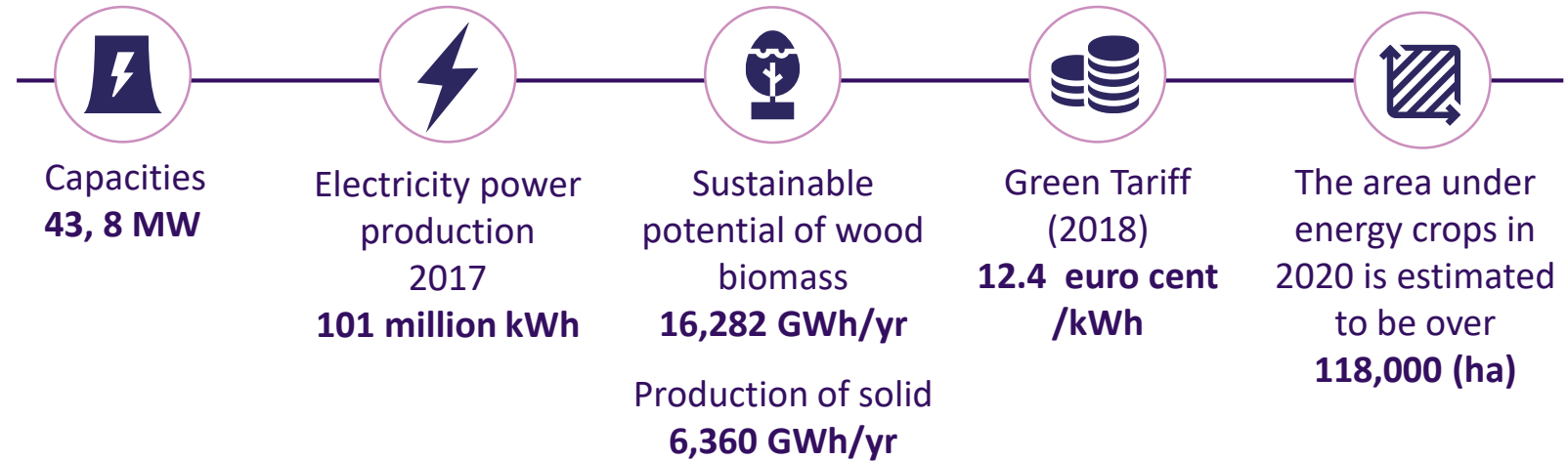


The cost of building solar power plants in Ukraine:
1250 Euro - 1 kW (2015) / 709 Euro - 1 kW (2017)

Key challenges: Legal uncertainty (green auctions vs fixed feed in tariff), high bank interest rates, integration into the grid

Key opportunities: attractive climate conditions, political support according to energy strategy 2035, qualified personnel, convenient logistic via sea ports

BIOMASS



Key challenges:

- The Ukrainian biomass-to-energy market is quite fragmented
- There is a lack of established links in the market among players
- The share of biomass in total electricity generation only about 0.2%
- The lack of biomass market

Key opportunities:

- Demand is represented by biomass-to-energy facilities:
- Heat suppliers use biomass boilers to sell heat to schools, hospitals and small industrial plants
- Electricity producers implement projects to process biomass into biogas and sell electricity to the grid
- An extremely low level of biomass generation

WASTE



<p><u>Key challenges:</u></p> <p>high bank interest rates, undeveloped regulatory framework, low experience of cooperation between local authorities and business</p>	<p><u>Key opportunities:</u></p> <p>Low level of waste recycling gives the opportunities to enter the market</p>
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COAL

Ukraine is ranked 7th in the world in terms of coal reserves



102 mines

but only 33 mines are on the controlled territory, 4 of which work profitably

17 coal mines belongs to private owner DTEK Energo

Lviv-Volyn coal basin



Donetsk coal basin



= 3.5 – 5 MW

Grid connection of one coal mine: 3.5 – 5 MW

Dniprovsky coal basin



According to the Energy Strategy of Ukraine until 2035, the coal production will drop from 34 mln tons(2017) to 12 mln tons (2035)

Key challenges:

technological backwardness of coal mines

Key opportunities:

business re-engineering of closed state owned coal mines (RES, tourism, exhibition center)

US-UKRAINE COOPERATION TRENDS



State/USAID Assistance since 2014 – over \$2 billion

2018 received and registered as technical assistance in Ukraine

Energy security		\$ 84 mln
Electricity market		\$ 5 mln
Media market		\$ 35 mln
Reform of healthcare sector		\$ 23 mln
Support to the Eastern Ukraine		\$ 62 mln
Competitive economy of Ukraine		\$ 42 mln
National Police of Ukraine		\$ 10 mln

ASSISTANCE BY ACCOUNT	FY 2016	FY 2017	FY 2018 Enacted
TOTAL (\$ in thousands)	377,140	454,315	420,700*

*Until September 2019

US companies involved into USAID programs:



Deloitte Consulting LLP



Chemonics International Inc.



The Solidarity Center



The Peace Corps



Tetra Tech, Inc.



Western NIS Enterprise Fund



Federal Trade Commission (FTC)



Johns Hopkins University

Source: <https://www.state.gov/p/eur/rls/fs/2018/284748.htm>

The U.S. business in Ukraine key achievements 2016 - 2018



210.4 mln \$

Coal supply



401.27 mln \$

Nuclear fuel supply, maintenance and upgrading, trainings



Around 400 mln \$

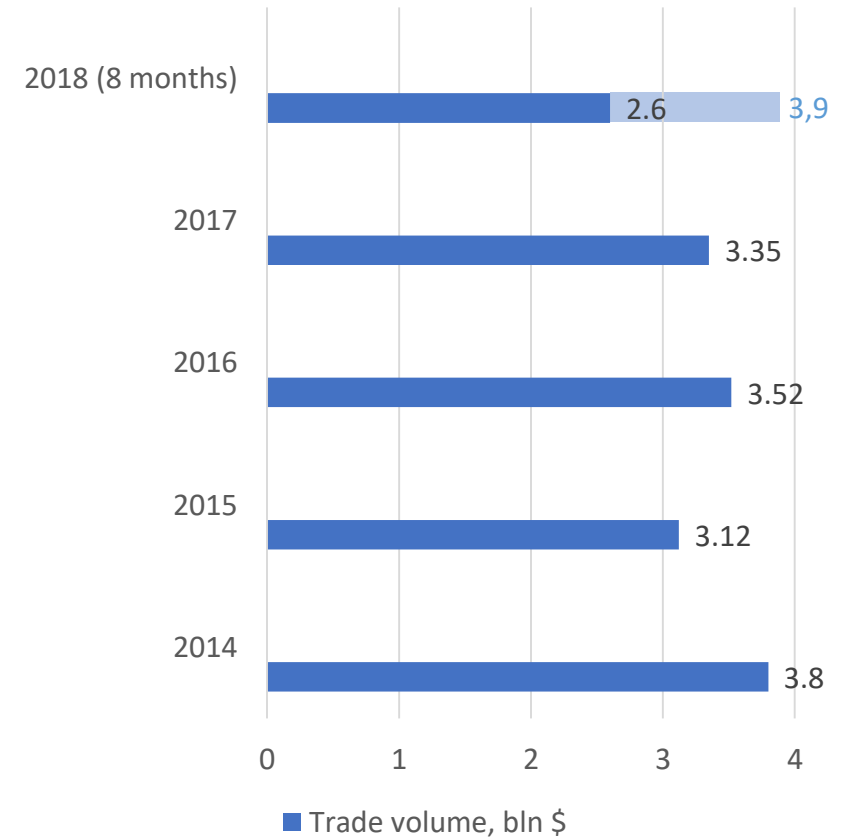
2 VVER-440 power units of the Rivne NPP with SMR-160 modular reactors; equipment and systems for Central Spent Fuel Storage Facility (CSFSF)



Around 1 bln \$

Locomotives TE33AC Trident

Bilateral USA-Ukraine trade:



NEW ELECTRICITY MARKET LAW



The new Electricity Market Law of Ukraine was adopted on April 14, 2017 and came into force on **June 11, 2017**

This law will introduce the rules of the EU Third Energy Package:



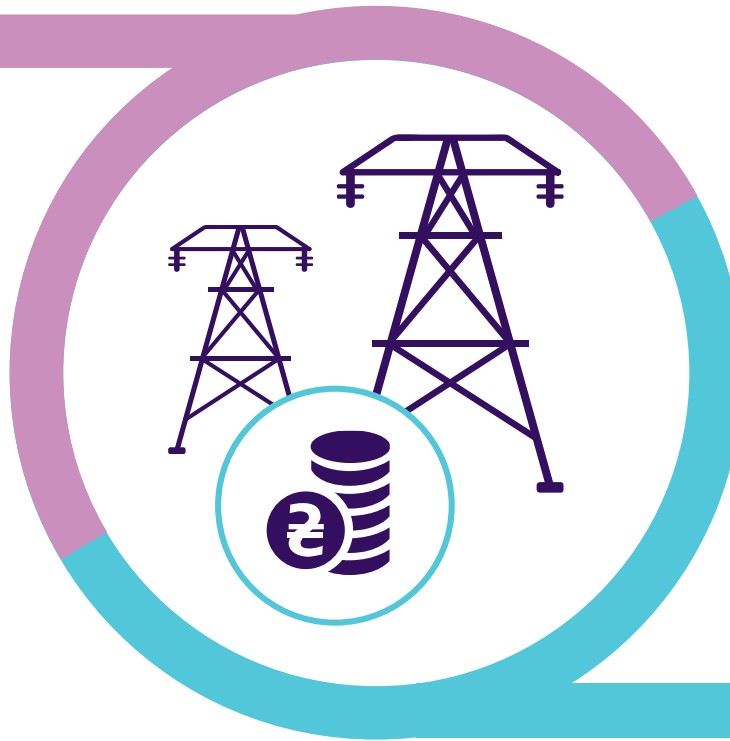
Directive 2009/72/EC concerning common rules for the internal market in electricity,



Directive 2005/89/EC concerning measures to safeguard security of electricity supply and infrastructure investment



Regulation (EC) No. 714/2009 on conditions for access to the network for cross-border exchanges in electricity



The law implies the following:

- Introduction on the following market segments: Day Ahead market, Intraday market, Balancing market and Ancillary Services market
- Launch of the Ukrainian Electricity Market – July 1, 2019

Key opportunities for US business:

- Free trading
- Free market pricing
- Deregulation of prices (no regulatory interference – prices will be set by market participants on its different segments)
- New opportunities for investments in generation

GRID DEVELOPMENT

The full modernization of Ukrenergo has started
It provides for



ALL SUBSTATIONS AUTOMATION (104) 2018-2027

- To increase the reliability of power transmission for energy-supplying company and consumers.
- To implement automated process control over substations
- To reduce operating and capital maintenance costs of substations

(30 € mln/year)

Total amount of automation program

1 bln €



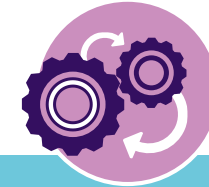
IT INFRASTRUCTURE ENHANCEMENT 2018-2024

Creation of an inclusive telecom network for the company through implementing **Optical Fibre Ground Wire Cable (OPGW)** programme

Total length of the OPGW cable – **6960 km**

The budget of the project

95,5 mln €



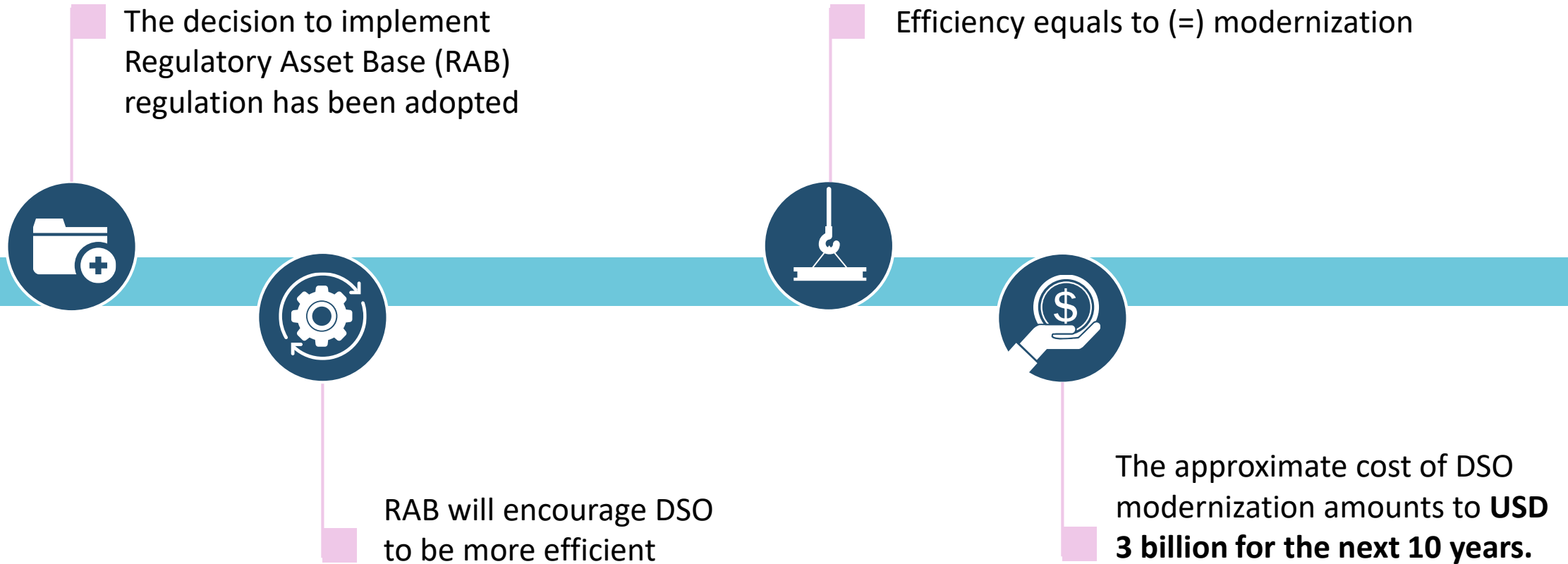
RE-ENGINEERING OF SYSTEM OPERATION FUNCTION

New SCADA/EMS system development through implementing several projects with IFIs

Key opportunities for US business:

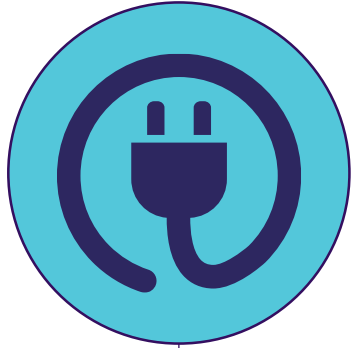
- A possibility of participating of US companies in tenders

NEW OPPORTUNITIES IN DSO BUSINESS



Key opportunities for US business: ▪ A possibility of participating of US companies in tenders.

DIGITALIZATION IN ELECTRICITY: NEW OPPORTUNITIES FOR US BUSINESS



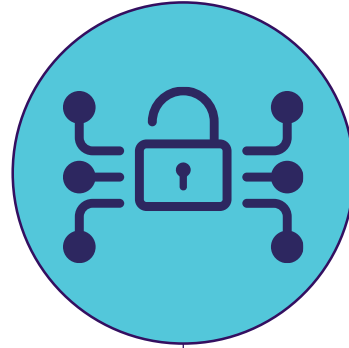
Level of digitalization in electricity is 15%



International trend: generation management is moving towards demand management



New markets - Day Ahead, Intraday, Balancing and Ancillary Services - require new IT solutions



Cybersecurity



Data collection, data storage, data(hub)



Approximate value of this market is up to USD 2 billion for the next 10 years

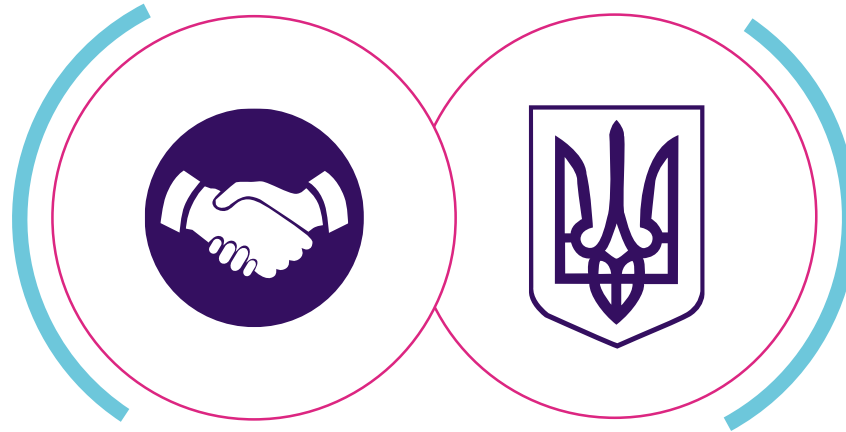
Key opportunities for US business:

- Participation of US companies in tenders
- New cooperation`s for development the best solutions for new markets

AGREEMENT WITH ENTSO-E

On June 28, 2017 in Brussels

Agreement on the Conditions for Future Interconnection of Power System of Ukraine with Power System of Continental Europe was signed



The Agreement came into force

On July 7, 2017

BENEFITS OF THE INTEGRATION INTO ENTSO-E:



Reduction in the active members' primary reserve shares due to synergy (by \pm 140-160 MW)



Easier control over the energy system in peak loads (due to non-coincidence of the Ukrainian and European peak hours)



Increased stability of the power system (due to addition in the Ukrainian power system inertia)



Increased stability of the power system (due to addition in the Ukrainian power system inertia)

Key opportunities for US business:

▪ Trading

▪ Investments in electricity generation

COMBATING CORRUPTION: UKRENERGO'S CASE

INTEGRATED APPROACH TO RECONSTRUCTION

PRICE MONITORING AND MARKETING RESEARCH TO PREVENT PRICE OVERSTATEMENT

Key measures and initiatives to combat corruption

- Anti corruption program
- Assessment of corruption risks
- Assessment of conflicts of interest
- Verification of business partners
- Transparency and simplification of connection to Ukrenergo grids

Corruption risks were identified in the following areas

- Public procurement
- External activity of the enterprise, in its relations with other enterprises, institutions, organizations or state bodies
- External corruption risks in activities of business partners



Compliance

Ukrenergo has formed a regulatory platform GOR the compliance office operation

Procurement

- Ukrenergo was one of the first in the country to join the system of electronic procurement ProZorro
- Money saving
 - attracting cheap loans
 - integrated approach to reconstructions
 - centralization and consolidation of purchases
 - Price monitoring and marketing research to prevent price overstatement

Economy (2015-2017) 312 mln. \$

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Thanks for your attention!

