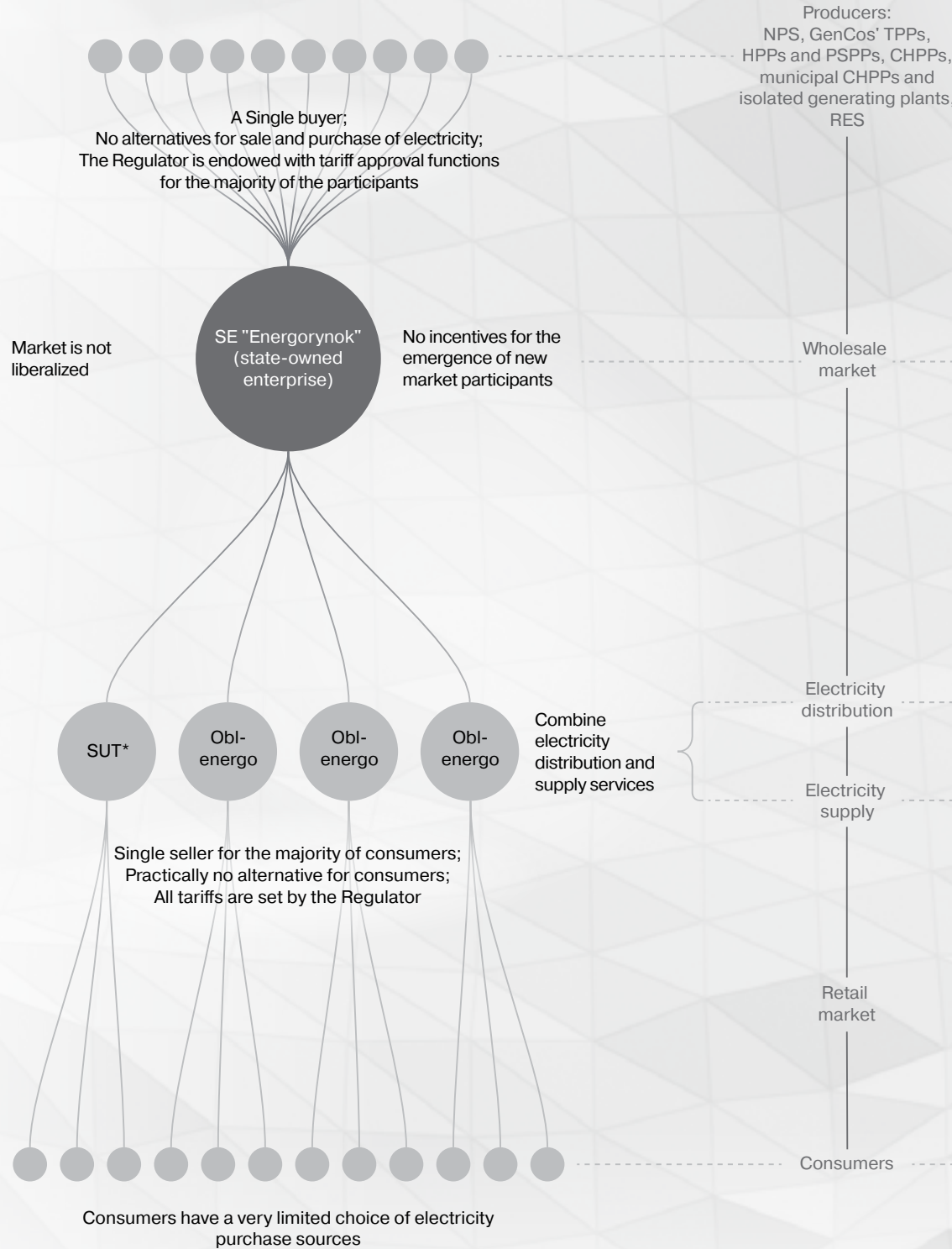


Ukraine is reforming the electricity market to switch to the European model

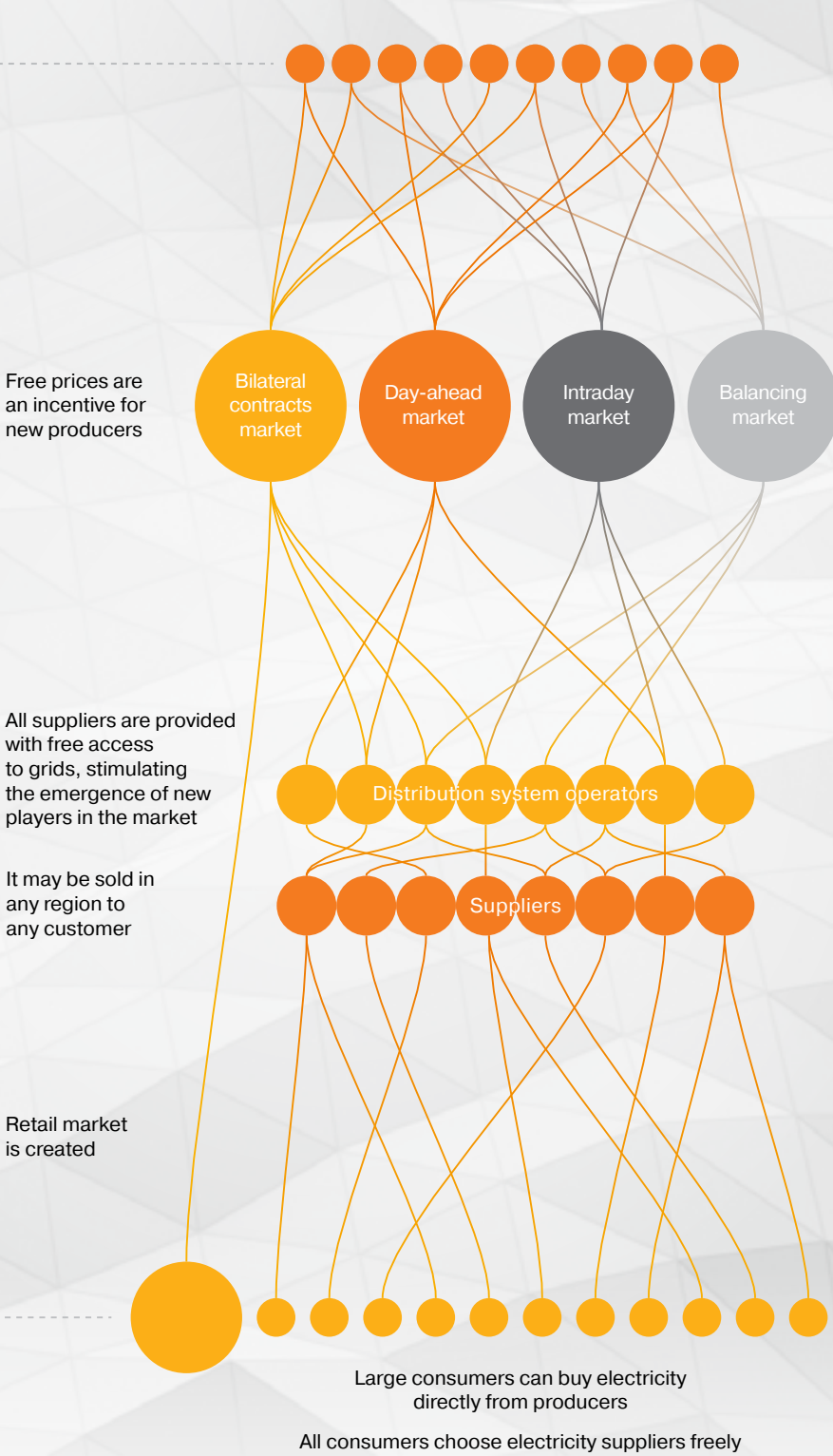
The most important development of the industry in 2018 is the energy reform. The reform completely changes the model of interaction between the participants. Liberalization of the market opens up opportunities for the industry to move to qualitative transformations and disengage from investment isolation, and for the consumer it gives the right to choose a supplier which stimulates the quality improvement and the emergence of new services.

Participants, interaction model before the implementation of the reform

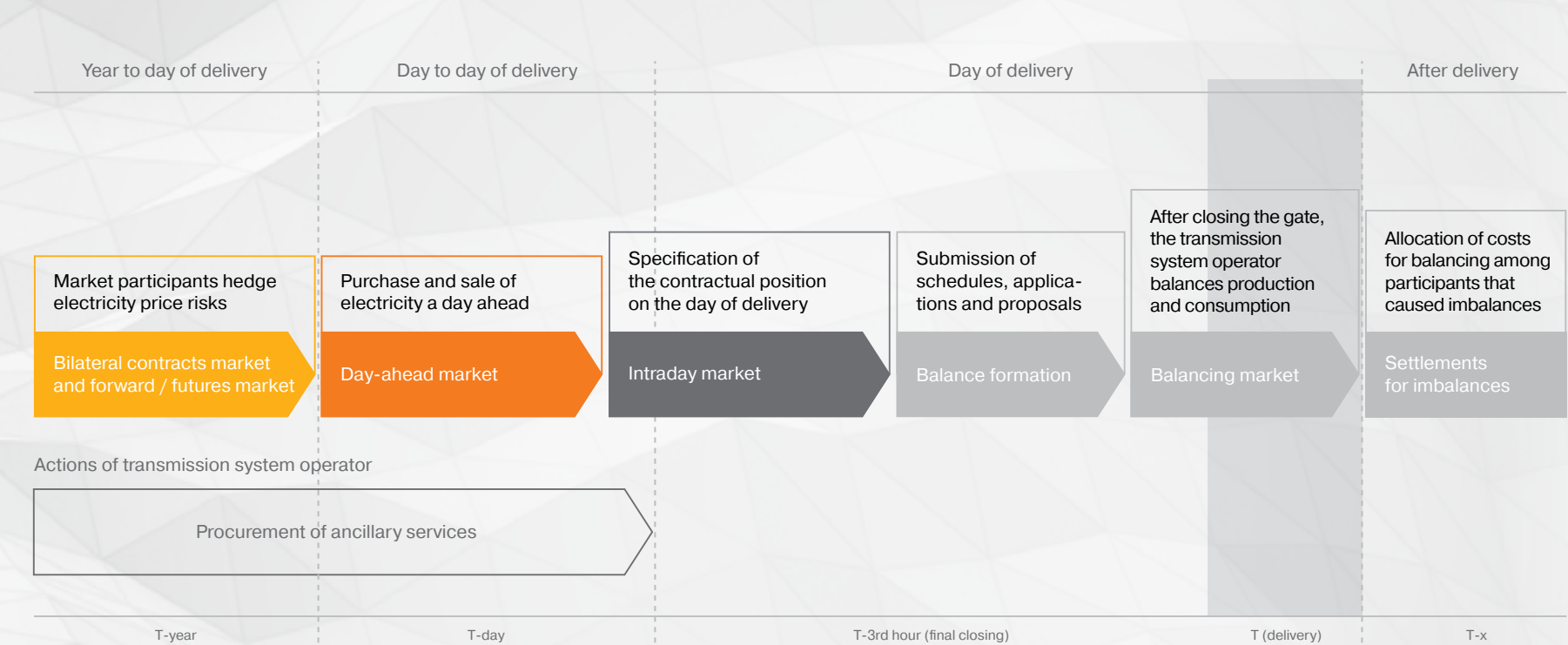


* SUT — Suppliers of electricity at unregulated tariff (SUT)

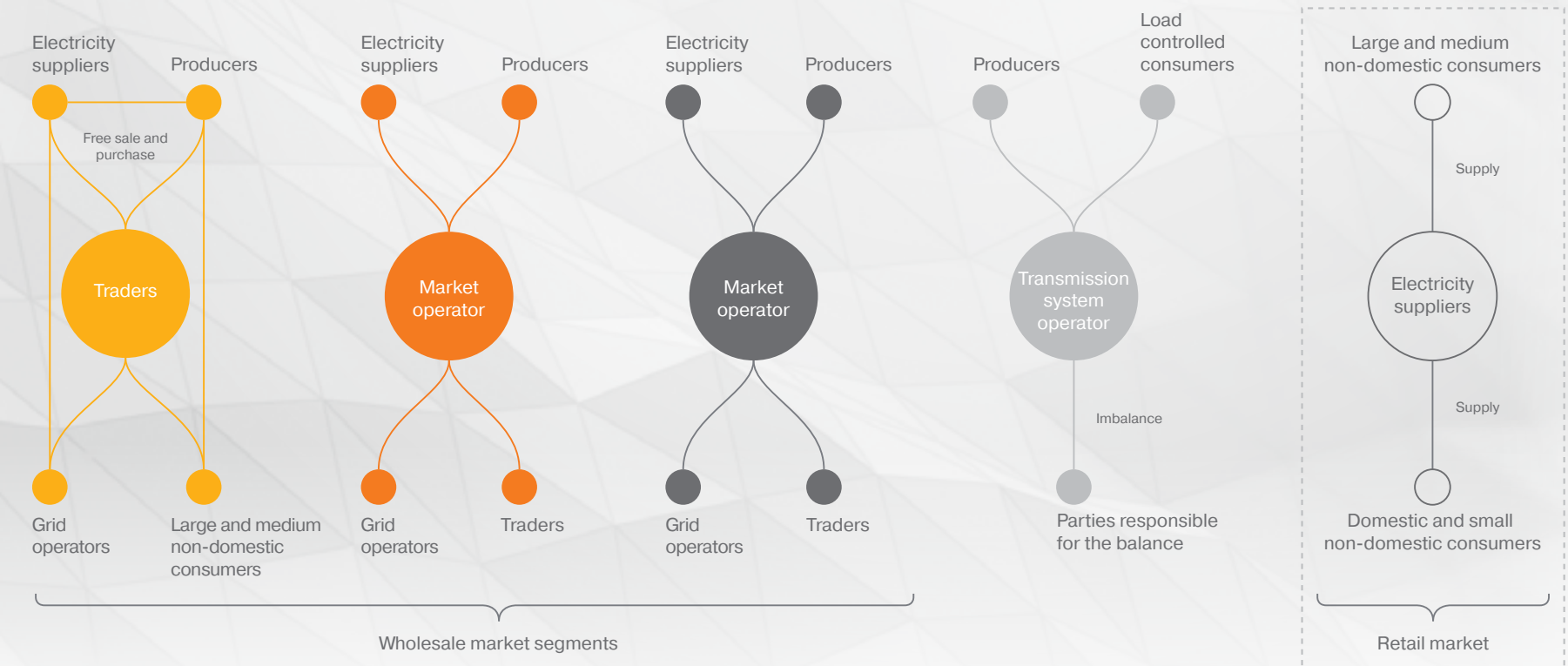
Electricity market as a result of the reform



Functioning of the wholesale electricity market



Electricity market participants



Electricity Market

Electricity balance

The United Energy System of Ukraine (UES) comprises power plants: nuclear, thermal, hydro, pumped-storage hydropower and renewable energy; combined heat and power plants, as well as the transmission and distribution of electricity grids. Centralized operational and process control the UES of Ukraine is carried out by National Power Company Ukrenergo. All business entities whose facilities are connected to the UES of Ukraine must adhere to the dispatcher's operational commands and instructions. Thus, electricity producers cannot deviate from the approved schedules by changing the load of the generating equipment at their own discretion.

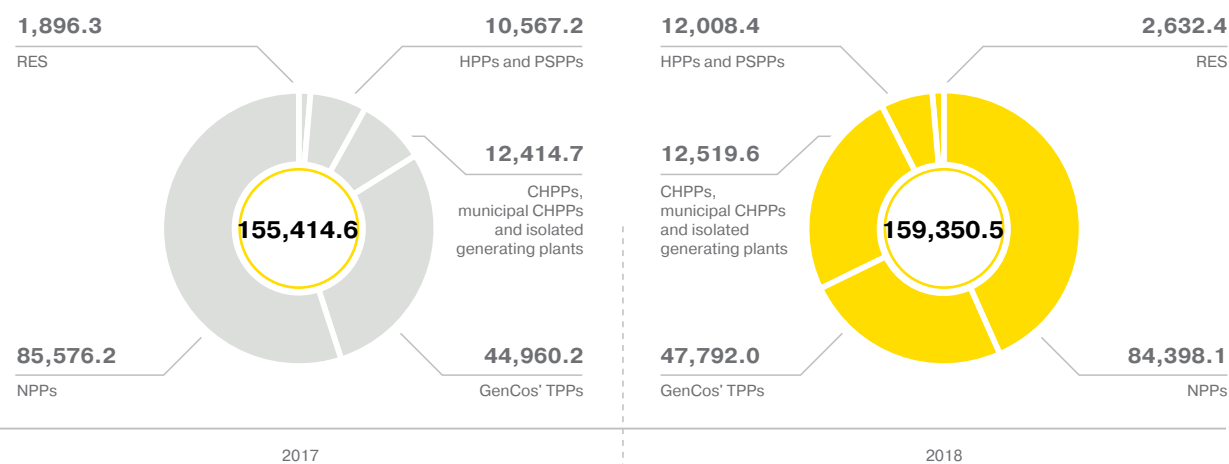
In the current "single buyer" model, all participants interact through the Wholesale Electricity Market, which is operated by SE Energoynok. Producers sell all electricity they generate to the Wholesale Market, and then suppliers buy electricity from the Wholesale Market to provide to their end consumers.

Ukraine is switching from this model to a competitive electricity market. The Law "On the Electricity Market" No. 2019-VIII dated April 13, 2017 incorporated requirements from the EU Third Energy Package and set a July 1, 2019 deadline for transition to the competitive market. Markets will be opened for bilateral contracts, day-ahead, intra-day, as well as balancing and ancillary services.

Liberalization of the market ensures all participants can buy and sell electricity freely, and consumers will be able to interact with producers directly and choose their supplier.

Electricity generation, mln kWh

■ Data: The Ministry of Energy and Coal Industry of Ukraine.



40.27% (+4.17% by 2017) — the total installed capacity utilization rate of NPP, HPP and PSPP, GenCos' TPPs operating on the Wholesale Electricity Market under price-based bids in 2018.

Ukraine has increased its electricity generation for the third year in a row, with demand growing from both domestic and foreign markets.

Thermal power generation restores production volumes thanks to implementing the strategy of substituting imported A-grade coal with domestic G-grade coal, whose reserves are significant in Ukraine. In 2017-2018, four power units of DTEK Prydniprov'ska TPP, two of

Zmiyiv'ska TPP and two more of Trypils'ka TPP (Centrenergo) with a total capacity of 1,565 MW were converted from anthracite to G-grade coal. This reduces the risk of suspension of production due to fuel shortages and thereby increases the resilience of the country's energy system operation. In general, thermal generation has 10.2 GW of G-grade-coal-fired and 7 GW of the A-grade-coal-fired installed capacities.

Generation, ICUR* and specific fuel consumption of the thermal generation companies

* Installed capacity utilization rate (ICUR)

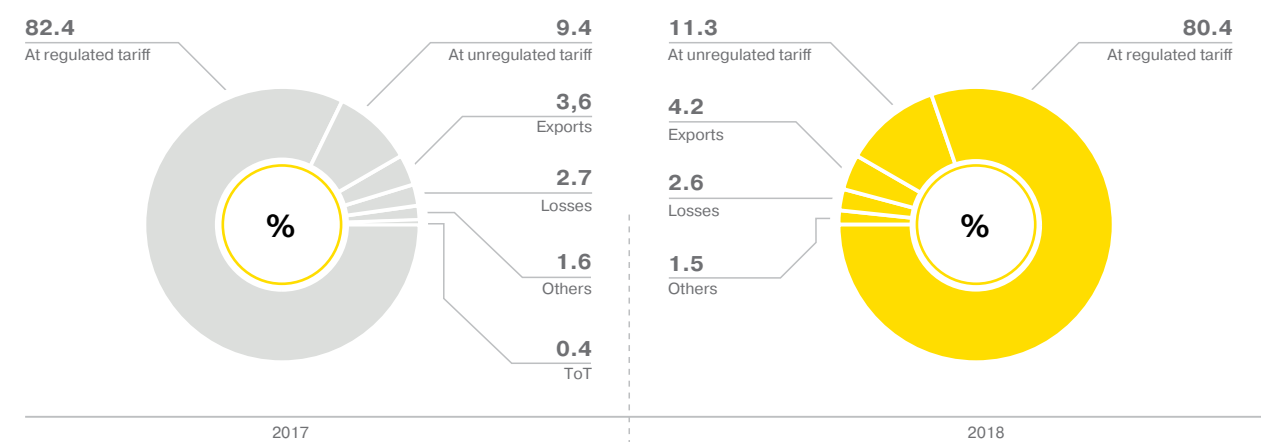
ICUR for DTEK Energy is indicated excluding power units under mothballing and oil/gas units.

Companies	Electricity generation, bln kWh		ICUR, %		Specific fuel consumption, g/kWh	
	2017	2018	2017	2018	2017	2018
DTEK Energy TPPs and CHPPs	37.5	36.0	35.7	35.2	402.3	405.4
Centrenergo	6.3	8.7	9.3	12.9	404.7	405.2
Donbasenergo	5.3	3.5	50.6	44.8	402.8	407.4

According to the report of SE Energoynok, the average daily composition of the equipment of GenCos' TPPs adopted to the specified load profile increased by one power unit and made at the average 33 power units in 2018.

Electricity purchase on the Wholesale Electricity Market, %

■ Data: SE Energoynok.



At regulated tariff — suppliers operating at the regulated tariff, at unregulated tariff — suppliers operating at an unregulated tariff, ToT — temporarily occupied territories of Donetsk and Luhansk regions.

142.4 bln kWh (+2.9% by 2017) of electricity was purchased on the Wholesale Electricity Market in 2018. 6.2 bln kWh was purchased for foreign consumers (+19.4%) and 134.0 bln kWh for Ukrainian consumers (+2.3%). At the same time, electricity suppliers using unregulated tariffs increased purchases to 16.5 bln kWh (+24.3%). In general, 125 suppliers operated at an unregulated tariff on the Wholesale electricity market, compared to 94 in 2017.

The suppliers operating at the regulated tariff were regional power distribution companies (oblenergo), which transmitted and supplied electricity according to license conditions exclusively within assigned territory. Only suppliers operating at an unregulated tariff could perform business activities to supply electricity all over Ukraine.

Prompted by the transfer of Ukraine's electricity market to the European model, regional power distribution companies have unbundled their activities to establish a distribution

system operators and electricity suppliers. In turn, the Regulator revoked licenses for electricity transmission by local grids and licenses for electricity supply at a regulated tariff from January 1, 2019. The formed distribution system operators obtained licenses for their relevant business activity, which also became effective on January 1, 2019. Electricity suppliers separate from suppliers operating on a regulated tariff are universal services suppliers for a two-year period within their assigned territory.

Electricity consumption in Ukraine

■ Data: The Ministry of Energy and Coal Industry of Ukraine.

Consumer categories	Consumption, mln kWh				Share in total consumption, %	
	2017	2018	Change, +/-	Change, %	2017	2018
Consumption (gross)	149,725.9	153,214.5	3,488.6	2.3	–	–
Consumption (net)	118,927.1	122,143.6	3,216.6	2.7	100.0	100.0
Including						
1. Industry	50,952.0	52,023.1	2.1	1,071.1	42.6	42.8
2. Agricultural consumers	3,642.1	3,867.8	6.2	225.7	3.2	3.1
3. Transportation	7,044.0	6,955.0	-1.3	-89.0	5.7	5.9
4. Construction	891.8	964.4	8.1	72.6	0.8	0.7
5. Utilities	15,016.2	15,506.4	3.3	490.2	12.7	12.6
6. Other non-industrial consumers	6,361.1	6,880.1	8.2	518.9	5.6	5.3
7. Households	35,019.9	35,946.8	2.6	926.9	29.4	29.4

Since 2015, the industrial and domestic sectors (public utilities and household consumers), respectively — have consumed broadly the same amount of electricity. This reflects structural changes to the Ukrainian economy which have changed the pattern of electricity consumption and as a result increased the difference between the maximum and minimum daily consumption.

In 2018, the maximum level of daily electricity consumption in the UES of Ukraine increased by an average of 292 MW compared to 2017, and the minimum level by 331 MW. GenCos' TPPs are largely responsible for the flexibility required in the electricity generation in the UES of Ukraine.

According to the data from the State Fiscal Service of Ukraine, electricity exports amounted to USD 331.9 mln in 2018 (+40.9% from 2017).

The Ministry of Energy and Coal Industry of Ukraine, as specified in the forecast electricity balance in the UES of Ukraine, expects an increase in exports in 2019 to 6,420.0 mln kWh. Thereafter, the process of connecting the UES of Ukraine to the Continental Synchronous Area within the European energy system, ENTSO-E, will contribute to an increase in the amount of exports. The project is also designed to increase Ukraine's energy security, as it means the country is no longer partially-dependent on the energy systems of the Russian Federation and Belarus, as is the case now.

Electricity exports, mln kWh

■ Data: The Ministry of Energy and Coal Industry of Ukraine.

Countries	2017	2018
Hungary	2,851.6	3,594.4
Moldova	1,133.9	955.8
Poland	894.8	1,410.2
Slovakia	162.0	167.7
Romania	124.1	37.7
Total	5,166.3	6,165.7

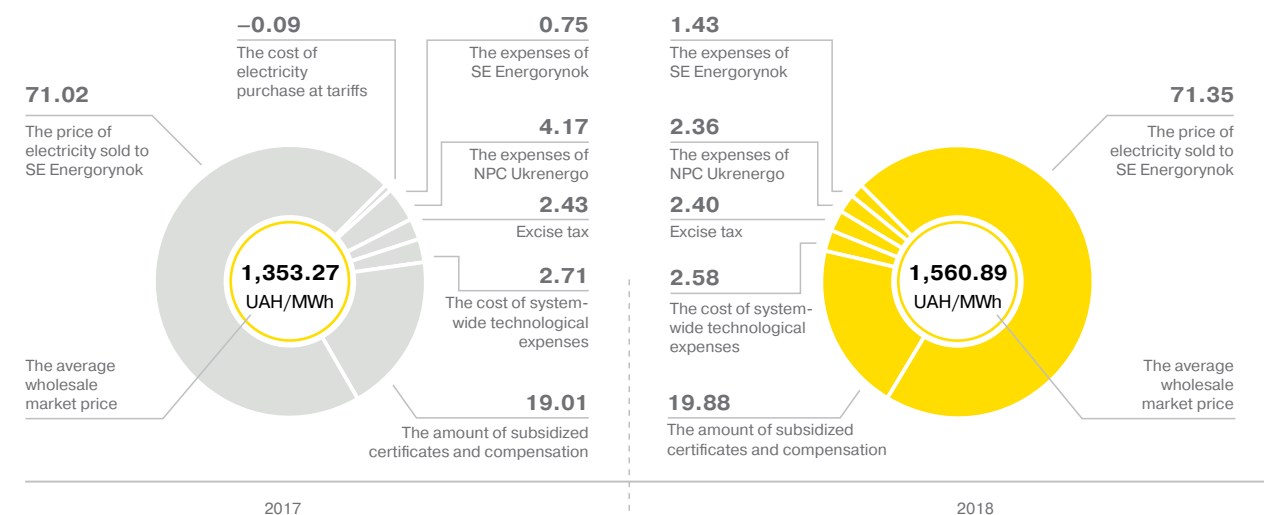
Sector regulation and tariffs

The National Energy and Utilities Regulatory Commission (NEURC) is a collective body acting independently from any governmental and local government bodies. Its objective is to carry out governmental regulation, monitoring and supervision of business entities in the energy and public utilities sector, which is exercised through the legislative and regulatory framework, licensing operations, and by setting price and tariff policies for producers and consumers.

According to the "single buyer" model, the commission approved the forecast wholesale market price for electricity, tariffs for the electricity supply for individual producers and tariffs for all categories of consumers based on the forecast balance of electricity in the UES of Ukraine. Bearing in mind the planned transition to a competitive electricity market, the commission approved the forecast wholesale market price for 2019, while the effect of this resolution is limited to July 1, 2019.

Wholesale market price structure, %

■ Data: SE Energorynok.



The average selling price of electricity on the Wholesale Electricity Market was 111.36 kopecks/kWh (+15.9% from 2017) and the average purchase price including exports was 124.24 kopecks/kWh (+13.9%). Suppliers operating at the regulated tariff averaged 119.58 kopecks/kWh (+13.02%), suppliers operating at an unregulated tariff averaged 152.66 kopecks/kWh (+15.43%), and those supplying the export market averaged 151.40 kopecks/kWh (+15.24%).

There is only one competitive segment in the electricity market in the existing model — thermal generation market. Each generating unit of TPP submits daily a price-based bid for each hour of the next day. At the same time, there is a mechanism limiting the system marginal price, differentiating between daytime hours and nighttime hours. The marginal price of the system is determined by SE Energoynok taking into account restrictions set by the Regulator.

Based on submitted bids and forecasts for the next day's electricity demand, SE Energoynok prepares an order of merit for the generating units for each hour in ascending order, from the least expensive to the most expensive. Generating units that offered to produce electricity at the lowest price are the first to be included in the merit order. The last accepted bid sets the price for electricity for all TPP units included in the merit order for this hour.

Average producers' price-based bids, UAH/MWh

• Data: SE Energoynok

Companies	2017	2018
Centrenerg	1,504.9	1,876.9
DTEK Dniproenerg	1,414.2	1,647.6
DTEK Westenerg	1,233.6	1,482.8
Donbasenerg	1,284.0	1,429.8
DTEK Skhidenerg	965.4	1,357.7
The average selling price of electricity, GenCos' TPPs	1,595.7	1,777.7

The fuel component of producers operating under price-based bids in 2018 amounted to UAH 1,413.63 per MWh.

Regional power distribution companies performed the electricity transmission and supply to all categories of the consumers. There were also independent suppliers in the market that distributed electricity at an unregulated tariff, but did not own networks.

At the same time, the commission approved the tariffs at which the power supply companies sold electricity to the public at the same level all over Ukraine. Other electricity consumers are divided into two classes. The first class is represented by consumers connected to networks with a voltage of 27.5 kV or more, and the second class is made up of consumers connected to networks below 27.5 kV. Since April 2017, the commission has set tariffs for these consumers based on their region and consumption class in order to eliminate the region-based cross subsidies and move to market-based retail tariffs.

Subsidies to consumers, UAH bln



In 2018, preferential electricity tariffs were in effect for the following consumer categories:

- households;
- consumers paying for electricity at time-of-day based tariff rates;
- Moloda Hvardiia children's center.

As part of the transition to a competitive market, household consumers, small non-domestic customers, budget organizations, and other consumers have switched to being serviced by the universal services suppliers.

All large consumers connected to power grids with a contracted capacity of 150 kW had to choose an electricity supplier by January 1, 2019. If a large consumer did not choose a supplier and draw up a contract by January 1, they were assigned to the supplier of last resort. The supplier of last resort is a legal entity that does not have the right to refuse to supply electricity to the consumer. Supply is made within 90 days, and after expiration the electricity supply is terminated. The government assigned SE Ukrinterenerg as the supplier of last resort for the period from January 1, 2019 to January 1, 2021. NEURC set tariffs for the services of the supplier of last resort as well as for the electricity distribution services and universal service suppliers.

Incentive-based regulation in tariff setting (RAB regulation) was expected to be introduced as part of the ongoing energy reforms, but it never took place despite the regulatory document package adopted in 2013. RAB regulation provides that transmission and distribution system operators will impose tariffs and threshold value of returns for several years in advance, which will make it possible to raise investment for technical developments and the introduction of modern technologies.

Key legislative events of 2018

Energy reform is the number one priority for the Ukrainian energy industry. According to Law of Ukraine "On the Electricity Market of Ukraine" No.2019-VIII dated April 13, 2017, the liberalized market will come into operation from July 1, 2019.

During the preparatory period of the reform:

- Unbundling of the regional power companies was completed, as a result of which the distribution system operators were separated from the electricity supply (pursuant to Directive 2009/72/EC concerning common rules for the internal electricity market).
- The formed distribution system operators and electricity suppliers obtained the appropriate licenses to conduct business activities (the licensing conditions for business activities on electricity supply to consumers, NEURC Decree No.1469 dated December 27, 2017, and the licensing conditions for business activities on electricity distribution, NEURC Decree No.1470 dated December 27, 2017 became effective).
- The universal service suppliers and the supplier of last resort were determined.

These preparations enabled the introduction of the retail electricity market from January 1, 2019, as required by the Law "On the Electricity Market of Ukraine".

Main tasks and challenges in 2019

Continue reforms across the industry, the implementation of which requires the industry to:

- create a transmission system operator, conduct certification and obtain a license;
- create a market operator and a guaranteed buyer, obtain appropriate licenses;
- purchase and commission the software and technical support of the market operator, transmission system operator, guaranteed buyer, as well as train market participants to work with new software;
- prepare consumers and other market participants for work under new conditions;
- eliminate the mechanisms of cross-subsidization and bring prices (tariffs) for end consumers to an economically sound level;
- settle issues of arrears arising in the Wholesale Electricity Market; develop secondary legislation.

on January 1, 2019
the retail
electricity market
began to operate



Renewable energy sector

Installed capacity of facilities operating with a feed-in tariff, MW

	2016	2017	2018	2019 (forecast)
SPPs	530.9	756.0	1,427.3	3,000.0
→ SPPs of households	16.7	51.0	157.0	250.0
WPPs	437.7	465.1	532.8	1,300.0
Others	149.5	167.7	202.1	220.0
Total	1,134.8	1,439.8	2,319.2	4,770.0

■ Data: The State Agency on Energy Efficiency and Energy Saving of Ukraine, Ukrainian Wind Energy Association (UWEA). Information provided about the facilities located on the onshore territory of Ukraine taking into account private households.

Solar energy remains the biggest growth sector by installed capacity thanks to the availability and ease of constructing facilities and high flexibility over the size of new plants. The majority of companies responsible for growing Ukraine's green energy sector operate with solar energy.

In 2018, the wind energy sector showed the most dynamic growth it's had in the past four years. The Ukrainian Wind Energy Association believes the active approach on project financing from Ukrainian state-owned banks and international financial institutions has significantly improved the investment climate. By the end of 2018, 893.3 MW of capacity were under construction, and further 3,330 MW were at the design stage.

More generally, the green energy sector set a record in 2018 in terms of capacity growth rates with almost 900 MW of capacities commissioned, almost three times higher than the 2017 indicators. This shows that the sector appeals to investors, helped by a favorable regulatory environment, an effective mechanism of state support, as well as further development of technologies with the increased productivity.

By the end of year, the total amount of installed green generation capacity reached 2,319.2 MW, with household SPPs accounting for 157 MW. In Ukraine, there are 7,450 households that have installed solar panels and about half of those were commissioned in 2018.

The commissioning of new capacity did not have a significant impact on the share of RES in the aggregate electricity generation in Ukraine since the majority of these facilities were commissioned in the second half of the year. By the end of the year, the RES share in the aggregate electricity generation was 1.8%.

According to the forecast electricity balance prepared by the UES of Ukraine, the sector is expected to generate 3,500 mln of green kWh in 2019, which will account for 2.2% of total energy generation. The Energy Strategy of Ukraine sets out a more ambitious long-term performance target — 25% of primary energy consumption should be generated by RES by 2035. To achieve this, the sector must create an environment which encourages greater investment in the sector, particularly from international investors.

Electricity generation by RES, mln kWh

■ Data: UWEA.
The data does not include private households.

	2016	2017	2018	2019 (forecast)
WPPs	924.5	970.5	1,181.1	1,700.0
SPPs	492.6	710.7	1,101.2	2,950.0
Others	357.9	405.1	509.7	550.0
Total	1,775.0	2,086.3	2,792.0	5,200.0

■ Data: UWEA.
The data does not include private households.

Solar generation accounts for 65.6% of installed capacities in the RES sector, while its share in electricity generation makes 39.4%. On the contrary, 18.6% share of installed wind capacities accounts for 42.3% of electricity generation by the RES sector.

Largest renewable energy players

Companies	MW	Companies	MW
Current		Advanced project: development and under construction	
WPPs		WPPs	
→ DTEK Renewables	300.0	→ NBT	1,000.0
→ Wind Parks of Ukraine	184.7	→ DTEK Renewables	765.0
→ Windkraft	74.6	→ Windkraft	600.0
SPPs		SPPs	
→ CNBM	267.1	→ DTEK Renewables	460.0
→ DTEK Renewables	210.0	→ UDP	300.0
→ Rengy Development	131.6	→ Scatec Solar	250.0

■ Data: DTEK Renewables, UWEA, open sources.
The data includes all RES capacities located on the onshore territory of Ukraine as of May 30, 2019.

The asset portfolio of DTEK Renewables includes the largest operating facilities: Botievo WPP and Nikopol SPP. DTEK is strengthening its position with the implementation of a number of large-scale projects, with the company's total capacity in the green energy sector set to reach 1 GW by 2020.

Regulatory environment

The development of the renewable energy sector is one of Ukraine's key priorities in the energy industry. In July 2018, the government adopted the Low Carbon Development Strategy, highlighting that growth in RES production is vital for the reduction of greenhouse gas emissions.

The following important regulatory changes were adopted in 2018 to promote the development of the sector:

- At the beginning of the year, the National Energy and Utilities Regulatory Commission adopted a resolution making changes to the PPA agreements (a template power purchase agreement). According to the resolution, a direct agreement with SE Energorynok for lenders financing the implementation of a RES project (international financial organizations, funds, export credit agencies, and multilateral development banks) was introduced to protect the rights of investors.
- Law of Ukraine "On changes and amendments in some laws of Ukraine on investment attractiveness of construction of renewable energy facilities" No.2517-VIII dated September 4, 2018 simplified the regulatory requirements for construction of renewable energy plants, particularly wind power plants. According to this Law, the facilities can be classified as class of consequences CC1 "insignificant consequences" that simplifies expert assessment and expedites construction.
- Law of Ukraine "On changes and amendments in the Tax Code of Ukraine and some other legislative acts of Ukraine on improvement of administration and revision of certain taxes and fees" No.2628-VIII dated November 23, 2018 simplified the regulatory requirements for plots on which renewable energy facilities can be built, while exempting certain equipment imported to Ukraine for construction of green power plants from VAT.

At the beginning of the year, a key discussion in the expert community was the significant change in the incentive scheme following the introduction of auctions instead of fixed tariffs.

Experts and specialized associations, investors and banks all favored the earliest possible introduction of the relevant changes in the legislation. The changes are designed to improve the investment climate by creating transparent conditions for development and growth of renewable energy capacity, while reducing the financial burden on consumers. Eight bills proposing the introduction of green auctions were prepared in the first half of the year. Following expert discussions and hearings held at the Fuel and Energy Committee of the Verkhovna Rada, it was decided that one of the bills, No.8449-d, reflecting the positions of all stakeholders, would be submitted to the parliament. This draft law was reviewed at the parliamentary hearings, and adopted with a series of amendments as a Law of Ukraine "On amendments to certain legislative acts of Ukraine on ensuring competitive conditions for electricity production from alternative energy sources" No.2712-VIII dated 25 April 2019.

The main provisions of the bill include:

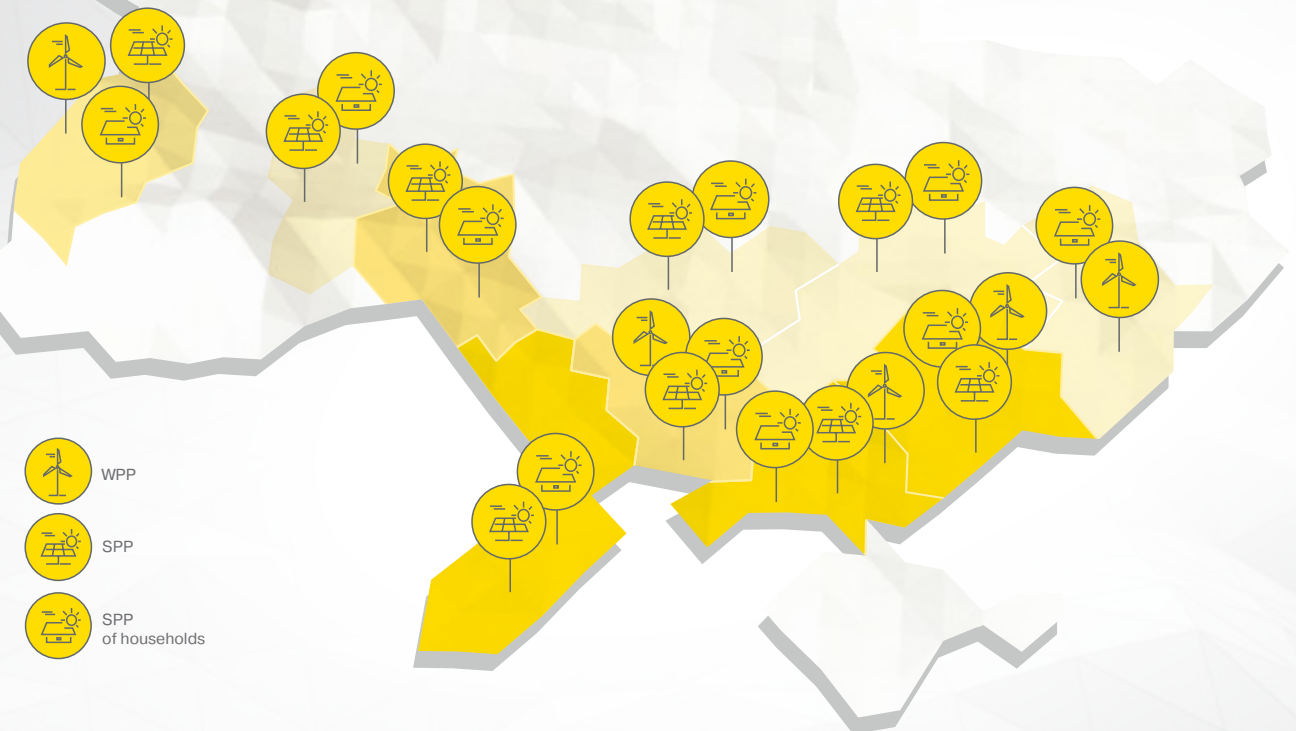
- introduction of auctions from January 1, 2020 for WPP projects with a capacity exceeding 5 MW and for SPP projects with a capacity exceeding 1 MW;
- conducting pilot auctions within six months of the law being adopted but no later than 31 December 2019;
- simplified procedure for feed-in tariff setting for households (up to 50 kW);
- green tariff reduction from 2020.

Tasks and challenges for the renewable energy sector in 2019

- The adoption of changes aimed at amending the incentive scheme to ensure dynamic development of the industry after 2020;
- Implementation of the energy reform and adoption of secondary legislation relating to RES;
- The development of projects for balancing the RES capacity to secure stability in the United Energy System of Ukraine.

Top 10 regions for placement of renewables by the end of 2018, MW

Data: NEURC, UWEA



Kherson, Lviv, Zaporizhzhia, Khmel'nyts'kyi and Dnipropetrovs'k regions were the standout areas in 2018 in relation to capacity growth rates of renewable energy sources. The growth was mainly ensured by the construction of solar power plants.

The security of balanced generation in the energy system, including by means of thermal generation and electricity storage systems is an important component in ensuring renewable energy sources are used most efficiently.

Regions	WPPs	SPPs	SPP of households	Others	Total
Kherson	77.5	256.6	8.6	3.3	345.9
Zaporizhzhia	199.9	94.4	1.2	0.5	295.9
Odesa	0.0	275.0	5.7	1.2	281.9
Mykolaiv	77.2	105.1	5.0	13.2	200.4
Lviv	33.9	150.7	5.9	3.0	193.4
Vinnitsia	0.0	143.5	4.4	24.1	172.0
Khmel'nyts'kyi	0.0	82.9	8.2	13.5	104.5
Dnipropetrovs'k	0.0	69.6	19.6	13.1	102.3
Kirovohrad	0.0	68.9	12.4	15.8	97.1
Donets'k	88.0	0.0	2.1	4.6	94.8