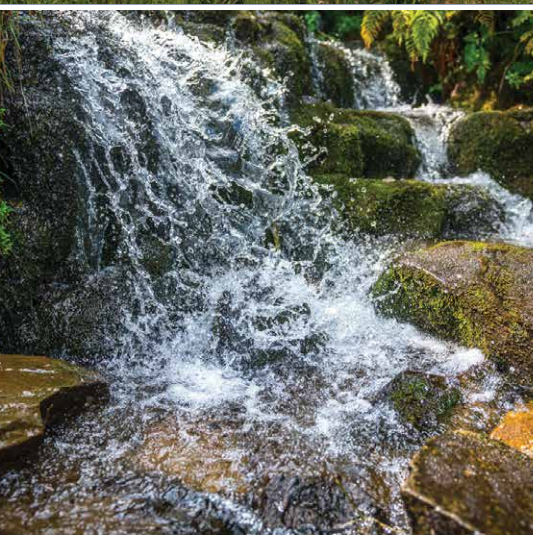
National Investment Council of Ukraine



Renewable energy sector

Unlocking sustainable energy potential

Introduction

National Investment Council of Ukraine

Yuliya Kovaliv
Head of the Office
of the National Investment Council
of Ukraine

Since 2016 Ukraine has achieved macroeconomic stabilization, the country switched its focus to supporting economic growth and modernization of the economy.

The need for the new FDIs is crucial for sustainable economic growth and increase of people's well-being. Together with day-to-day business environment improvement, the state-backed investment attraction and promotion is a pivotal component of attracting FDI back to the country. The National Investment Council was established by the President of Ukraine to set a public-private dialogue with key business leaders on investment promotion, boosting FDI and tackling key obstacles of Ukrainian regulatory environment.

The Office of the National Investment Council is a non-government organization which serves as a platform for public-private dialogue bringing together representatives of the business community, IFIs and Ukrainian officials.

The Office of the National Investment Council provides analytical coverage of the key sectors of Ukrainian economy, highlighting their potential for investments, key regulation and issues related to investing in these sectors.

We are focusing on practical steps needed to address investors' needs and concerns, enhancing public-private dialogue and promoting actions to strengthen the business climate in Ukraine.

Our goal is to maintain a dialogue between foreign institutional and private investors, IFIs and government to promote Ukraine as an investment destination and to facilitate the development and implementation of legislation to improve business climate.

Government strategy of reducing dependence on energy import and strengthening energy security within the last 4 years lead to decrease in energy consumption and a growth of internal energy production, including one from renewable sources. As a result, renewable energy became the fastest-growing sector of power generation in Ukraine. At the same time RES became not only the most investment attractive energy segment, but also one of the top-10 sectors bringing FDI to the country.

In the last few years RES showed roughly 15% yearly growth with increase of installed capacities by more than 50% since 2014. In that period more than $550 million have been invested in the sector making Ukraine a regional leader in RES development.

This report details not only the country's potential for RES development, but also provides proposals for legislative foundations which will make Ukraine a place with predictable conditions for doing business.

Our hope is that it will become a useful tool for investors and all the stakeholders of Ukrainian economy. We are looking forward and will appreciate your feedback.

This Report is a brief outlook of one of the rising sectors of Ukrainian economy – renewable energy. It is aimed to inform foreign investors and local stakeholders about key developments and challenges for the sector's further growth.

Electricity sector overview

Market structure

The total installed generation capacity as of January 2017 is 55,7 GW, including 13,8 GW nuclear power stations, 27,9 GW – TPP, 6,5 GW – CHPP, 6,2 – HPP and 1,3 GW of renewable power stations.

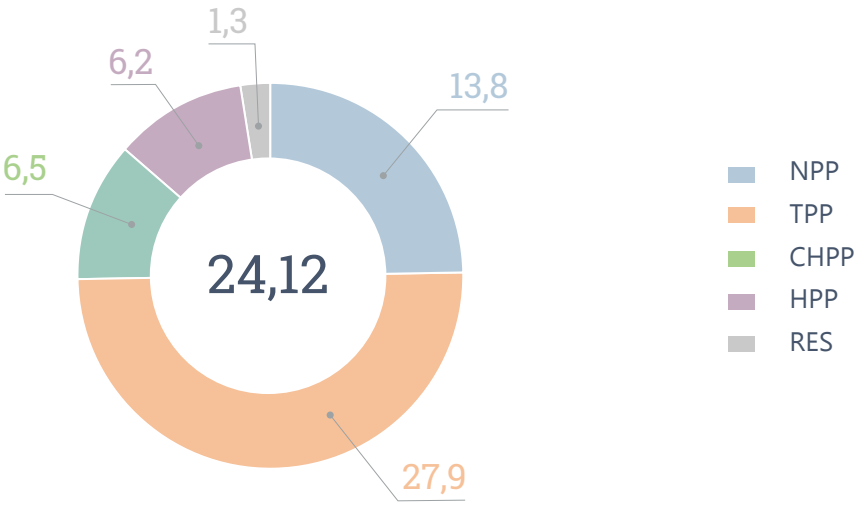
The major generation power is concentrated in:

Nuclear power stations operated by the state-owned company "Energoatom". The company operates 4 nuclear power stations, including – Zaporizhzhya, Rivne, South-Ukraine and Khmelnytsky. The company operates 15 nuclear power reactors, 13 of with 1000 MW capacity each and two others with the capacity of 415 and 450MW respectively.

Hydro and hydro-acumulated power plants – all HPPs of Dnipro Hydro Cascade and Dniester HPP are operated by state-owned company Ukrhydroenergo. Due to the shortage of efficient regulation in Ukraine's electricity sector, various investment projects for hydro rehabilitation and construction of hydro capacities are under development, in particular, hydro power rehabilitation project (co-financed by the IBRD and the EBRD)

12 thermal power stations, including 83 generation units with the capacity of 150 MW (6 units), 200 MW (32 units), 300 MW (38 units), 800 MW (7 units). Thermal power plants are operated by state-owned company Centrenergo and private – DTek and Donbasenegro. The Ukrainian TPP units were mainly commissioned in 1960-1975. Major fuel for TPPs is coal while natural gas and heavy oil are used as a backup and firing fuel. Available capacity of the majority of TPPs is much lower than their installed capacity due to its condition, outdated and worn-out equipment, poor quality of coal and lack of investments into maintenance and rehabilitation. Given the lack of efficient regulation of the energy system, TPPs play an important role in regulating the load curves in addition to providing base load electricity.

Installed electricity capacity
Period: 2017
Score: GWt

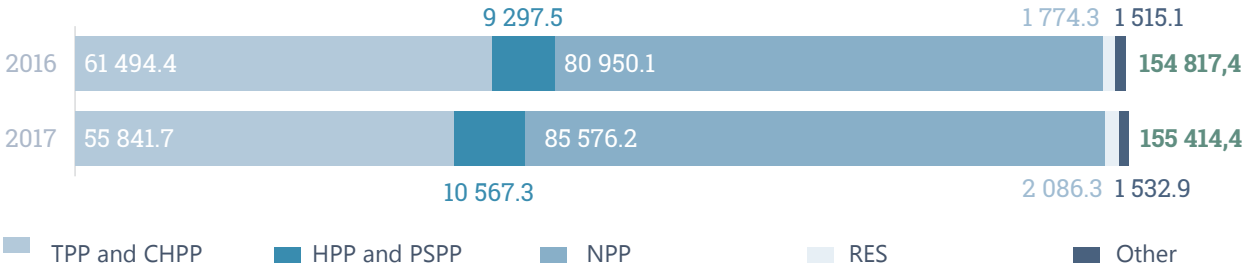


Source: NERC, MinEnergo

Electricity sector overview

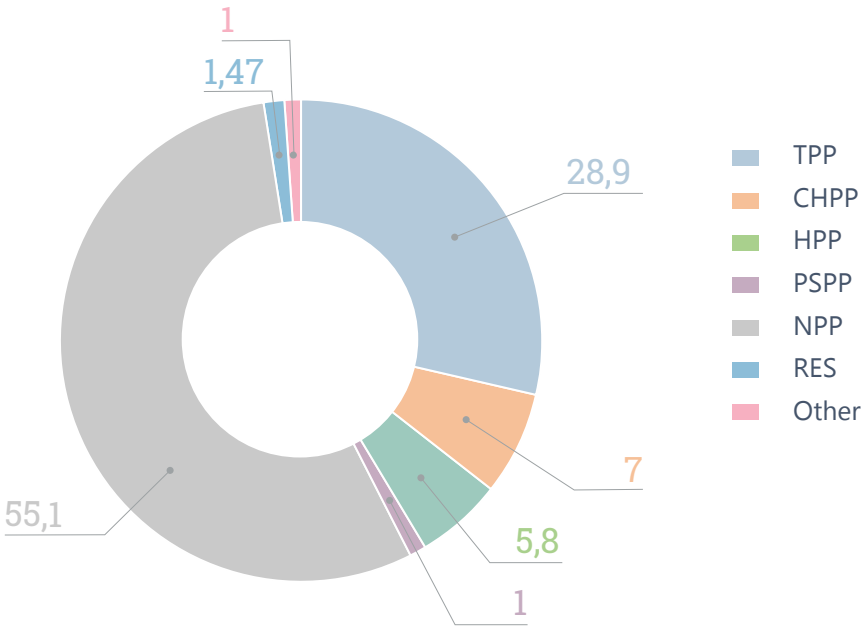
In 2017 total electricity production reached 155,4 bln kWt/h with the 0,4% growth to 2016. 55% of electricity generated in 2017 was produced by NPPs with the total output of 85,5 bln kWt/h. NPPs demonstrated total production increase by 5% 2017/2016. 28,9% of total electricity was produced by TPPs – 44,9 bln kWt/h with a decrease of production by 10% 2017/2016. Renewable sector output increased by 17,5% and reached 2 bln kWt/h.

Energy production dynamics
Period: 2016-2017
Score: KWt/h



Source: NERC

Energy production structure
Score: %
Period: 2017



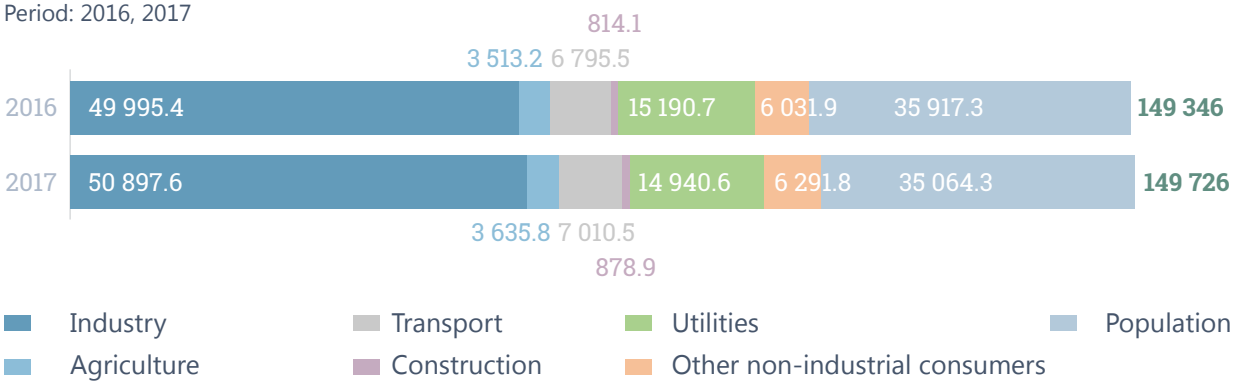
Source: NERC

Energy consumption

Overall energy consumption level in 2017 remained barely the same as in 2016. Taking into account technical losses, energy consumption increased by 380 million KWt/h (0.3%) in 2017 compared to 2016. Industry increased consumption by 1.8%, agricultural sector – by 3.5%, transport – by 3.2% and construction – by 8%, which correlated with more moderate yet growth in respective sectors. Due to energy efficiency measures together with prices' liberalization households decreased their consumption by 2.4% and utilities – by 1.6%.

Industry share in the total consumption in 2017 increased to 42.9% as compared to 42.3%. At the same time households' share in the total consumption in 2017 decreased to 29.5% from 30.4% in 2016.

Energy consumption
Score: mln KWt/h
Period: 2016, 2017



Source: NERC, MinEnergo

Electricity transmission networks include 22.9 thousand km of high voltage electricity transmission lines and 136 power substations of 110 – 750 kV in voltage and around 78.9 GVA in capacity. Transfer capacity of the high voltage lines connecting the country's energy system with the ENTSO-E system will provide great foundation for electricity export from Ukraine.

In the last few years the TSO has started implementation of the grid rehabilitation program. In the mid-term, the focus is on removing several internal transmission constraints and bottlenecks as well as ensure more reliable electricity supply in certain regions of Ukraine.

Electricity distribution networks include about 1 mln km of overhead and cable power transmission lines of 0.4 – 150 kV, about 200 thousand substations of 6–150 kV. About 20% of aerial and cable lines as well as substations are subject to rehabilitation or replacement. Operators of distribution networks are regional power supply and distribution companies (Oblenergos) which are mainly privatized. However, government still owns majority stake in 6 regional electricity distribution companies that are expected to be privatized in the coming year.

Electricity market model

Wholesale Electricity Market (WEM) is the core part of the electricity market in Ukraine (over 90% of electricity is supplied through the WEM) and the only institutionally arranged electricity market in the country. In compliance with the Law of Ukraine "On the Electricity Sector", power plants are obliged to sell electricity produced exclusively to the WEM. The WEM is arranged based on a "single buyer" model.

Commercial relations in the WEM are regulated by bilateral contracts between the WEM members and the state enterprise Energorynok.

Existing WEM does not have segments of direct bilateral contracts with consumers, balancing market and market of ancillary services. Currently, only hourly spot "day ahead" electricity market is functioning in the framework of the WEM. Its competitive segment functions on one-side auction principle with large TPPs, which are dispatched based on the price and capacity bids submitted to Energorynok.

All other power plants are dispatched on a priority basis (taking into consideration system constraints set by the TSO) and sell electricity to SE Energorynok at the "cost plus" fixed tariffs approved by the National Commission that Performs State Regulation in the Power Sector (NERC).

Activity on electricity transmission is unbundled from electricity generation, distribution and supply and is performed by the national TSO which is also responsible for centralized dispatch management. TSO functions are performed on an exclusive basis by the state enterprise NEC Ukrenergo. Being the WEM Operator, Energorynok purchases these services from the TSO on behalf of the WEM members. Tariff for the TSO services is regulated by the NERC.

Electricity Distribution and Supply. Electricity distribution networks are owned and operated by Oblenergos holding simultaneously two NERC's licenses – (i) for electricity distribution and (ii) for electricity supply at regulated tariff. Unbundling according to the 3rd Energy package is expected to be implemented within the reform of the sector in coming years. Independent suppliers must enter into contract relations with Oblenergos to use their networks for electricity distribution and pay for respective services on the basis of respective tariffs approved by the NERC.

New electricity market to be implemented by July 2019

Following the path of integrating Ukraine economy into the European market, Government has taken obligations to implement 3rd Energy package and to liberalize Ukrainian energy market. To achieve this goal, Parliament adopted a new Law "On the Electricity Market of Ukraine" in June 2017.

The law dismisses the single-buyer wholesale market model and introduces a multi-segmented liberal market. The new market pattern includes:

- the day-ahead market,
- the intraday market,
- the balancing market
- the ancillary services' market,
- the market of bilateral contracts, which is in line with customary practice in many EU countries

The majority of the power volumes can be expected to be traded in the day-ahead market (where the bids are submitted, and the market is cleared on the day before the actual delivery) and bilateral contracts. The day-ahead market will provide transparent and publicly available price references and price signals for all

market participants. The day-ahead market will be complemented by the intra-day market where buyers and sellers can trade volumes close to real time after the gate closure of the day-ahead market. The intraday market segment is expected to grow with the enhanced penetration of renewables and their integration into the power system.

The new law also provides for the legal and functional unbundling of distribution system operators. Significant fines are provided for a breach of the unbundling requirements (up to 10% of the annual revenue of a TSO, a distribution company or a vertically integrated undertaking).

The purpose of this law is to harmonize Ukrainian legislation with requirements of the European Union's Third Energy Package, implement competitive mechanisms for the electricity market and set conditions to attract private investments in the sector.

In particular, it envisages various electricity buy&sell mechanisms. They include bilateral contracts, day-ahead market, intraday market, balancing market and ancillary services market.

Key outcomes:

- Electricity market to be liberalized and restructured in compliance with the requirements of the Third Energy Package
- Free market and competition to be established in production, supply and trade segments of the electricity market
- Regulatory framework for renewables to get stabilized and embrace the responsibility for imbalances
- Bankability of renewable projects to be enhanced as PPAs will become possible at early stages of development projects
- Electricity market is to open up for international cross-border trade and exchanges, and to continue synchronization with neighboring markets and integration into the European regional power system. In the summer of 2017, Ukraine and Moldova signed agreements regarding the conditions for future interconnection with the electricity transmission system operators of the ENTSO-E Continental Europe Region. In the next five years, the transmission system operators of Ukraine (Ukrenergo) and Moldova (Moldelectrica) should implement a catalogue of measures, including a series of technical requirements to facilitate synchronization with European power systems.
- Investments to be more readily raised for the network upgrade and development, including through the privatization of energy assets and introduction of RAB tariffs.

New Energy Strategy of Ukraine until 2035

On 18 August 2017, the Cabinet of Ministers of Ukraine adopted Energy Strategy 2035.

The main goals declared in the new Energy Strategy were: **liberalization of markets, establishing effective regulation** and, as a result, **attracting investors** to the energy sector.

The new Energy Strategy will be implemented in three stages.

1 Energy sector reform 2020

Complete implementation of the Third Energy Package is envisaged during this period, allowing for the creation of full-fledged natural gas and electricity markets in accordance with EU energy legislation. Also, during this stage institutional integration of Ukraine into the ENTSO-G network is expected, as well as meeting most of the requirements for integrating Ukraine's unified power system (UPS) into the ENTSO-E grid.

Moreover, this stage involves reforming energy companies in accordance with Ukraine's Energy Community treaty obligations, increasing primary energy source production, reducing GDP-based energy demand, and further developing renewable energy capacity.

Finally, by 2020, Ukraine is expected to radically advance in the field of renewable energies by increasing its share in final consumption by 11 % (8 % of total primary energy supply –TPES). This will be pursued through stable and predictable policies both to promote the development of renewable energies and to attract investment.

The main activities aimed to implement strategic goals in the field of electricity generation are:

- Introduction of the new model of electricity market, which presupposes adoption of the necessary primary and secondary legislation and market transformation for the sake of transition to the market conditions;
- Launch of all the market segments: market of bilateral contracts and forward/futures market; 'a day in advance' market; internal and day market;
- Unbundling – separation of the functions of the distribution system operator from the functions of sales; establishment of market operator; re-organization of current management bodies in the field;
- Approval of retail market functioning terms; introduction of the market of universal services, selection of 'last resort' suppliers;
- Liquidation of cross-subsidies between consumers, bringing the prices for domestic consumers to the market level and introduction of market mechanisms of tariff setting;
- Minimization/removal of external technical and administrative limitations;
- Release of closed capacities to electricity grid development program and implementation of projects aimed at removal of external restrictions;

- Launching the support program for investments into construction of new capacities;
- Completion of privatization of the state share in the companies with coal generation capacities and electricity distribution;
- Setting the minimum standards for energy consumption security, setting the requirements for the quality of energy supply;
- Support of main power transmission lines development, including unblocking of 'closed' NPS capacities.

2 Optimization and innovative development of energy infrastructure through 2025

The second stage of NES implementation will be geared towards operating in a new market environment and under Ukraine's actual TPS integration into the European grid, which will significantly affect the rationale in selecting facilities for renovation (or new constructions in the energy sector) and boost energy efficiency as well.

General activities:

- targeted energy balance development till 2035;
- establishment of the expediency of conservation of TPS with due account of the dynamics of electricity market development;
- development of the program of replacement of withdrawn capacities with new ones, with indication of the structure of new capacities by the generation types and according to GPES forecast and development of the mechanism of such replacement (long-term contracts for electricity purchasing, contracts for price difference, credit guarantee programs, tax benefits for electricity producers, involvement of export crediting for equipment supplied from other countries).

Meanwhile, renewable energy sources are expected to be the fastest-growing sector in terms of power generation, with an envisioned share increase within the total primary energy supply structure to 25%.

25%

Renewable energies targets

- Stimulation of solar and wind power stations construction;
- Increase of biomass use in electricity and thermal power generation;
- Stimulation of electricity generation by low-capacity RES plants;
- Ensuring implementation of projects relating to energy supply decentralization locally (using renewable energy, 'smart grids', raising energy efficiency);

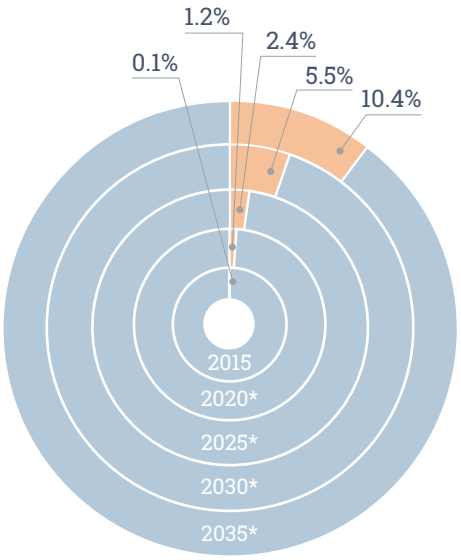
- Development of the system of logistic support and infrastructure for biological raw materials collection, their marketing and transportation to the consumer and processing;
- Study of the possibility and, if expedient, introduction of accumulator use to balance the energy system;
- Improvement of the mechanism for stimulation of energy equipment production in Ukraine.

3 Sustainable development through 2035

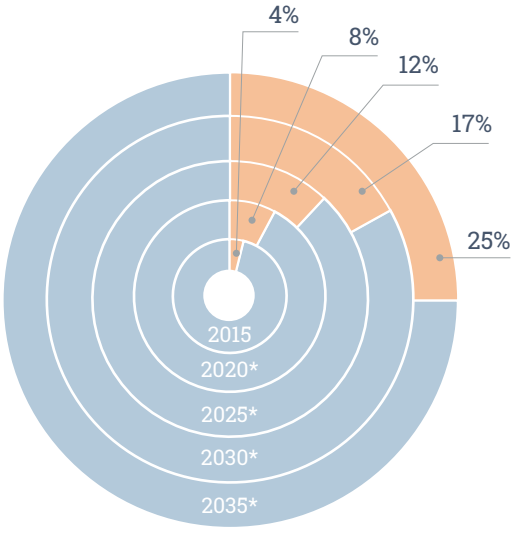
The third stage of the Energy Strategy anticipates innovative development of the energy sector and the construction of new-generation facilities. It also looks to secure investments in new power generation facilities to replace those to be decommissioned. Selected types of generation will depend on projected fuel prices and the growth rate of each energy generation system, which will in turn raise the level of competition within the sector.

Key targets for development of RES till 2035

The share of RES in TPES of Ukraine



The share of RES, including hydropower capacities and thermal energy in TPES



*forecast
Source: MinEnergo, UWEA

Renewable energy sector overview

Renewable energy sector overview

National Investment Council of Ukraine

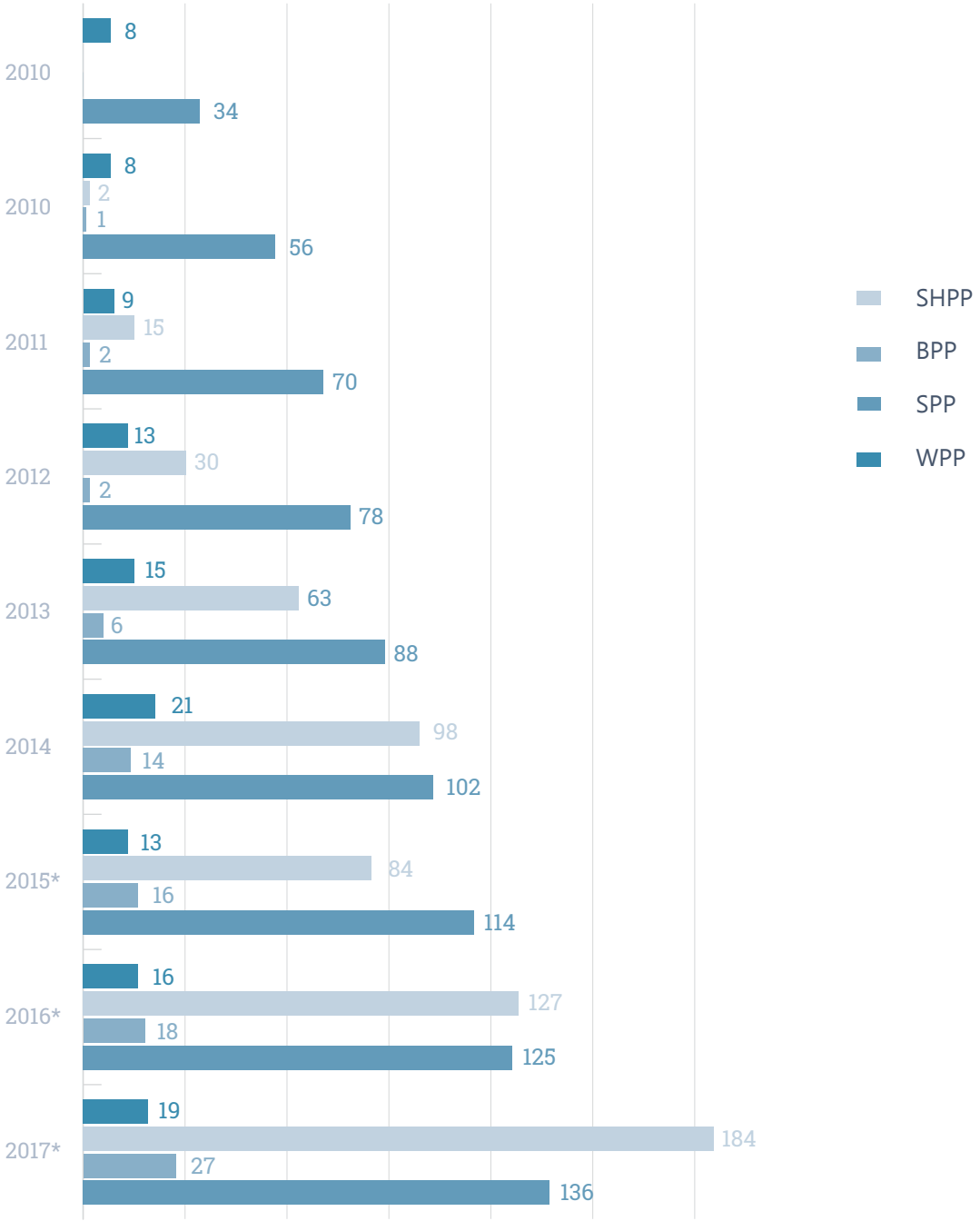
Renewable sector is still small compared to other types of generation in Ukraine, but at the same time RES shows constant growth making Ukraine the regional leader in RES.

Since 2014 the amount of RES facilities grew from 967 MWt to 1375 MWt by the end of 2017 and to 1534 MWt by the 1st quarter of 2018.

More than $550 million have been invested in new RES facilities since 2014.

$550 million

Quantity of RES-electricity generating capacities by energy source
Period: 2009-2017



Source: SAEE, UARE
* Crimea not included

Renewable energy sector overview

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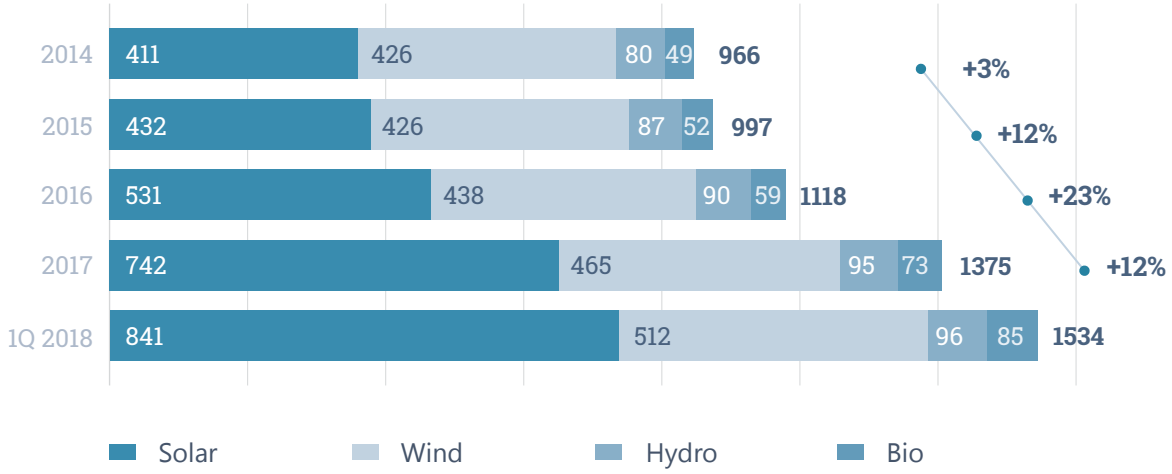
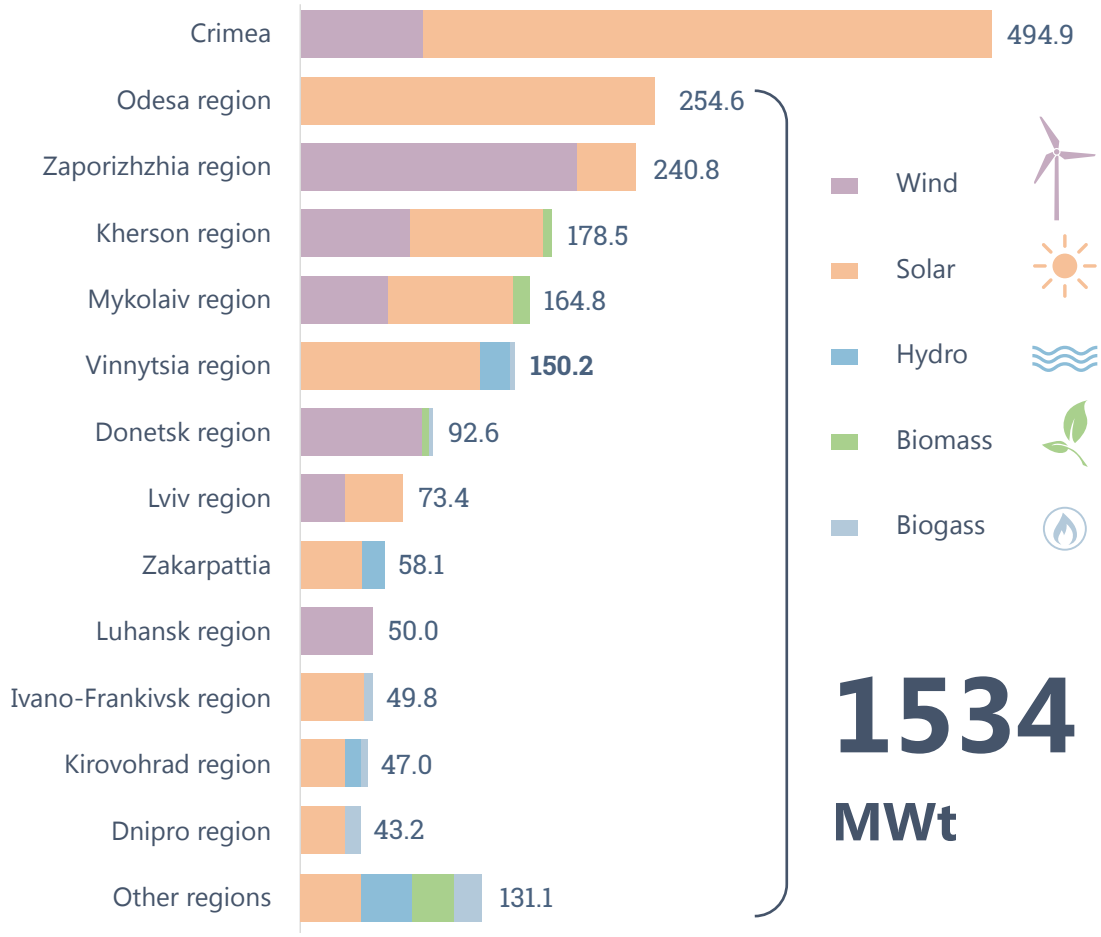
RES growth
Score: MWt
Period: 2014-1Q 2018



Source: SAEE

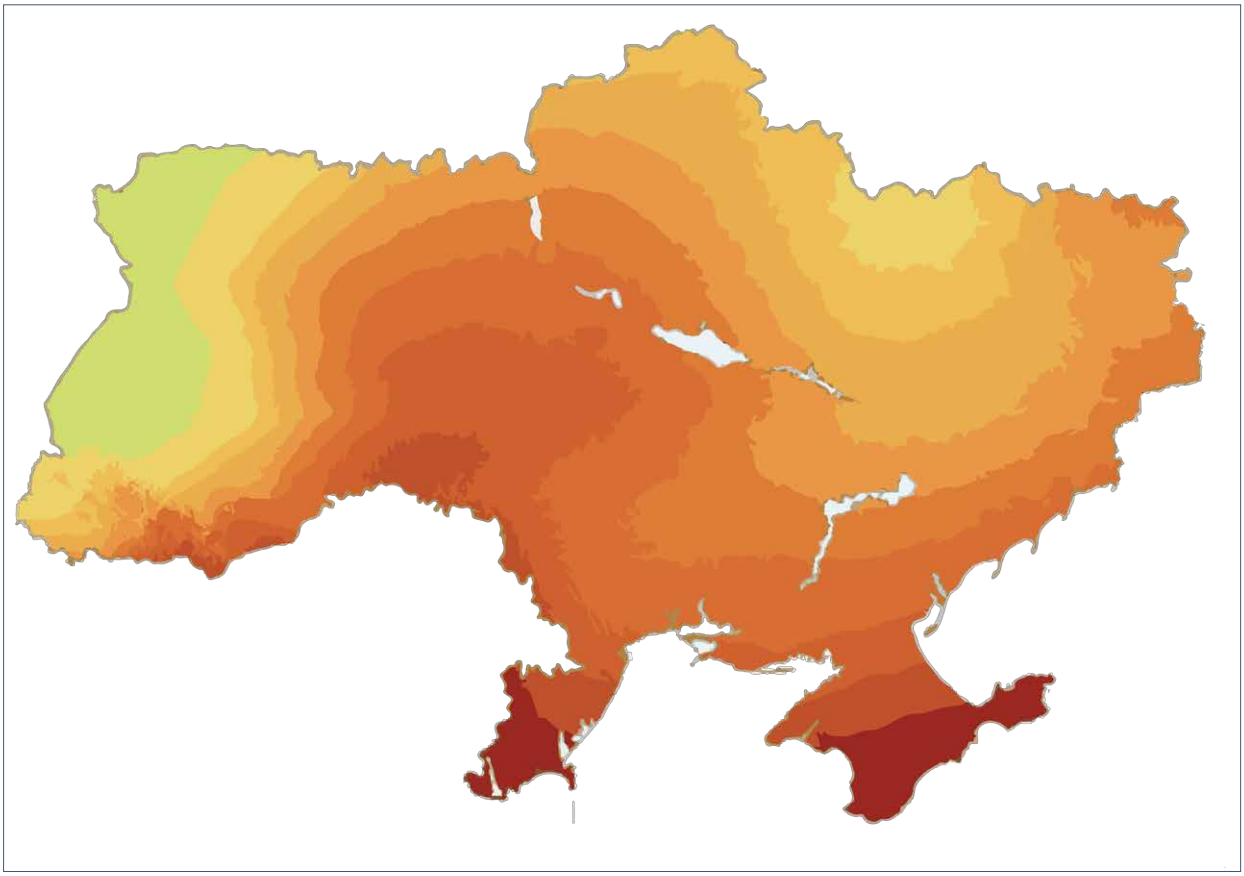
RES generation installed by region
Period: 1Q 2018
Score: MWt



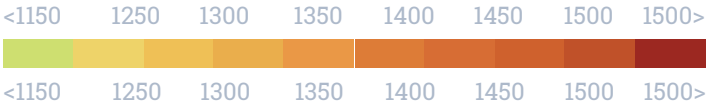
Source: NERC

As solar energy is the most popular type of RES in Ukraine, one can observe that the regional distribution of installed RES facilities correlates with the insolation level. The key focus is made on the regions with the highest solar activity as seen on the map below:

Ukraine irradiation and solar electricity potential



Yearly sum of global irradiation [kWh/m2]



Yearly electricity generated by $1kW_{peak}$ system with performance ratio 0.75 [kWh/kW_{peak}]

Source: European Commission JRC

In 2017, **87 new renewable energy facilities** with a total capacity of **257 MW** were introduced according to State Agency for energy efficiency , of which:

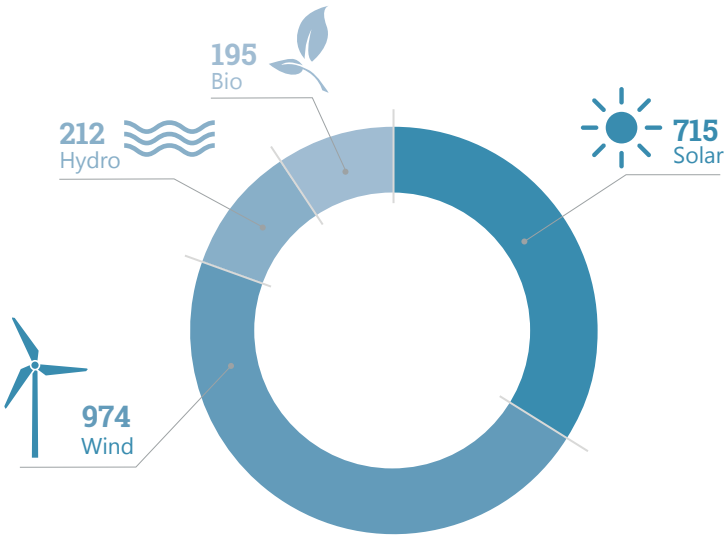
- **64 solar** power facilities with a total capacity of **211 MW**;
- **3 wind power** facilities with a total capacity of **27.4 MW**;
- **9 biomass power plants** with a capacity of **14 MW**;
- **3 small hydropower objects** with a total capacity of **4.6 MW**;

In 2017 the total amount of energy produced by RES was 2096 mln KWt/h according to State Agency for energy efficiency.

Renewable energy sector overview

National Investment Council of Ukraine

Structure of energy produced by RES facilities
Score: GWt/h
Period: 2017



Source: SAEE

Since 2015 only 13 facilities have obtained special bonus to the tariff for using equipment produced in Ukraine (local component bonus). These 13 facilities account for 45,7 MWt in total. These include:

- **6 solar** facilities totaling 37 MWt
- **3 wind** facilities totaling 8 MWt
- **4 small** hydro facilities totaling 0.7 MWt

The Ukrainian segment of renewable energy sources (RES) comprises 376 companies. Most of them work in segment of solar generation and operate small solar power plants, with the exception of CNBM and Activ Solar. The wind power segment is represented by 20 companies. The smaller number of wind generators can be explained by different market entry thresholds: lower implementation costs for solar power projects compared to wind farm projects due to cheaper technologies, lower construction costs and less strict requirements for player experience and expertise.

Largest renewable energy players:
Score: MWt

ACTIV SOLAR	CNBM	DTEK Wind Power	WIND PARKS OF UKRAINE
(SPPs)	(SPPs)	(WPPs)	(WPPs)
441	267	200	180

VINDCRAFT UKRAINA	Solar Energy Plus	ECO OPTIMA	TOKMAK SOLAR ENERGY
(WPPs)	(SPPs)	(WPPs)	(WPPs)
31	15	13,2	10

From open sources

State support and regulation of the renewable energy sector

State support and regulation of the renewable energy sector

National Investment Council of Ukraine

For the **stimulation** of use of renewable source energy (RSE), the Government has introduced **feed-in tariffs ("green tariffs") which are compatible to EU feed-in tariffs:**

- The secured feed-in ("green") tariff is provided till **2030** and defined by the **Law "On Electric Energy"**
- The tariffs are fixed in **Euros**, and thus, have **zero UAH currency risk**.
- The Law guarantees **purchase of 100% of energy produced from RSE** by wholesale operator.
- The Law also determines that a bonus for Ukrainian equipment usage is provided on the level of **–5-10% additionally to the existing feed-in tariff**
- Long-term PPA are introduced which significantly secure investors' and creditors' rights
- National Commission for Energy Regulation **(NERC) is responsible for setting feed-in tariffs, licensing RES**, granting and distributing financial support to the eligible parties.

Comparison of tariffs in Ukraine and in other European countries

	Wind		Solar		Geothermal	Biogas		Hydro		Biomass	
Ukraine	5.82	11.63	15.03	18.09	-	15.03	-	12.39	10.45	17.45	-	12.39
Germany	1.4	8.38	8.91	12.7	-	25.2	5.66	23.14	3.47	12.4	5.72	14.42
Hungary	no feed-in tariff		-	10.3	4.2	11.5	4.2	11.5	4.2	11.5	4.2	11.5
Czech Republic	-	7.1	-	9.7	-	12.2	-	10.5	8.2	10.1	4.6	12.1
Slovakia	-	4.42	-	8.5		10.87	5.97	10.2	9.8	11.12	7.03	9.21
Moldova	-	6.5	-	8.8		n/a	n/a	n/a	n/a	n/a	n/a	
Turkey	-	5.3	-	10.3		8.1		10.3		5.6		10.3
Bulgaria	n/a		10.9	13.02	n/a		n/a		n/a		n/a	
Poland	no feed-in tariff, auction system											
	max	max										

Source: State Agency on Energy Efficiency and Energy Saving of Ukraine; RES Legal Europe

Highlights on the RES regulation in Ukraine

Producers of electricity from RSE are granted special conditions for **connection to the grid**:

- Suppliers that transmit electricity to their own distribution grid **do not have the right to refuse** producers of electricity from RSE connection to the grid
- Connection to the power grid of stations producing electricity from RSE has **favorable financing**:
  - 50% - from the tariffs of the transmission of electricity;
  - 50% - **from repayable financial assistance** provided by the producer to the electricity transmission company. The term for returning financial assistance is to be determined by the National Energy and Utilities Regulation Commission resolution and should not exceed ten years.

There is also a **tax incentive** to stimulate production of electricity from RSE:

- Zero **value added tax** and customs duties on imports of equipment related to the production of electricity from RSE, which is determined in the list approved by the Government of Ukraine;

On **April 13th 2017** the Parliament adopted a new **Law "On the Electricity Market of Ukraine"**.

- The Law sets a new competitive market model with bilateral contracts, and balancing market to replace the current wholesale electricity market model.
- The Law aims to create competitive electricity market and provide reliable and uninterrupted power supply to customers.

Under this law, the role of RES was established and integrated in the design of the new electricity market, aimed at introducing a liberal, open and competitive market in Ukraine in compliance with the Third Energy Package.

The Electricity Market Law became effective on June 11, 2017 (except for certain provisions relating to changes in the launch of the new market segments, scheduled for July 1, 2019).

Key provisions of the Law regarding **renewable energy**:

1 **long-term Power Purchase Agreement (PPA)** with Guaranteed Buyer within feed-in tariff up to 2030

As a result of a series of the amendments introduced in September 2017 and January 2018, the form of the PPA has improved considerably in terms of its bankability and insurability.

Previously, PPAs were concluded for a one-year term, subject to annual extensions. The amended form expressly allowed PPAs to be concluded before the completion of construction or putting a plant into operation.

Most of the risks associated with changes in the law or events beyond the control of parties are expressly vested in the off taker. Direct agreements are allowed, whereby creditors can enter into a PPA without any additional consent of the off taker in case of a producer's default. Producers will have broad rights to terminate and seek reimbursement from the off taker, including by triggering the change of law clause.

The reimbursement amount is broadly defined to include, amongst other things, the principal and interest on the loan extended by creditors.

Following the amendments, creditors obtained additional securities relative to a PPA, such as step-in rights. Producers can assign, pledge or otherwise encumber the rights to receivables under a PPA to third-party creditors.

The right for parties to refer PPA disputes to international arbitration was recognized (subject to jurisdictional rules), and the role of extrajudicial dispute settlement remedies – including mediation – was enhanced. It has been expressly established that parties can refer disputes for mediation under the auspices of the Dispute Resolution and Negotiation Centre of the Energy Community Secretariat. Previously, disputes arising out of, or in connection with, the PPA could be brought only before Ukrainian courts.

2 Step-by-step introduction of payment for **unbalanced power supply**

The law provides gradual introduction of RES producers' responsibility for imbalances. Producers willing to sell electricity under the FIT should join the so-called "balancing group" led by the off taker (the guaranteed buyer), with the guaranteed buyer being responsible to the transmission system operator for the settlement of imbalances of such balancing groups.

Producers should pay a certain share of costs incurred by the guaranteed buyer to settle imbalances. From January 1, 2021, producers should pay 10% of the imbalance settlement costs to the guaranteed buyer; this share will increase by 10% each year, until it reaches 100% by 2030. In order to settle imbalances, the transmission system operator will sell electricity on the "balancing market", which is scheduled to be launched on July 1, 2019.

3 **Establishment of a "range of tolerance"** for an error in forecasting the volumes of electricity production from RES. Allowable variation of declared amounts of power production:

- for Wind Power Plants – 20%
- for Solar Power Plants – 10%
- for Small Hydro Power Plants – 5%

After the share of all market participants producing electricity from RES reaches 5% of the annual energy balance of Ukraine, such permitted deviation will be reset at 10% for wind power, and 5% for both solar and hydro power plants.

4 **Exemption from payment for imbalances** of RES facilities put into operation before the adoption of the Law.

Responsibility for imbalances will not have a retroactive effect, and will not apply until December 31, 2029, (the date of expiry of the FIT) to those facilities put into operation before the enactment of the Electricity Market Law. Beginning in 2030, all RES power producers will bear full liability for their imbalances, whatever the date a facility becomes operational.

Source: PV mag

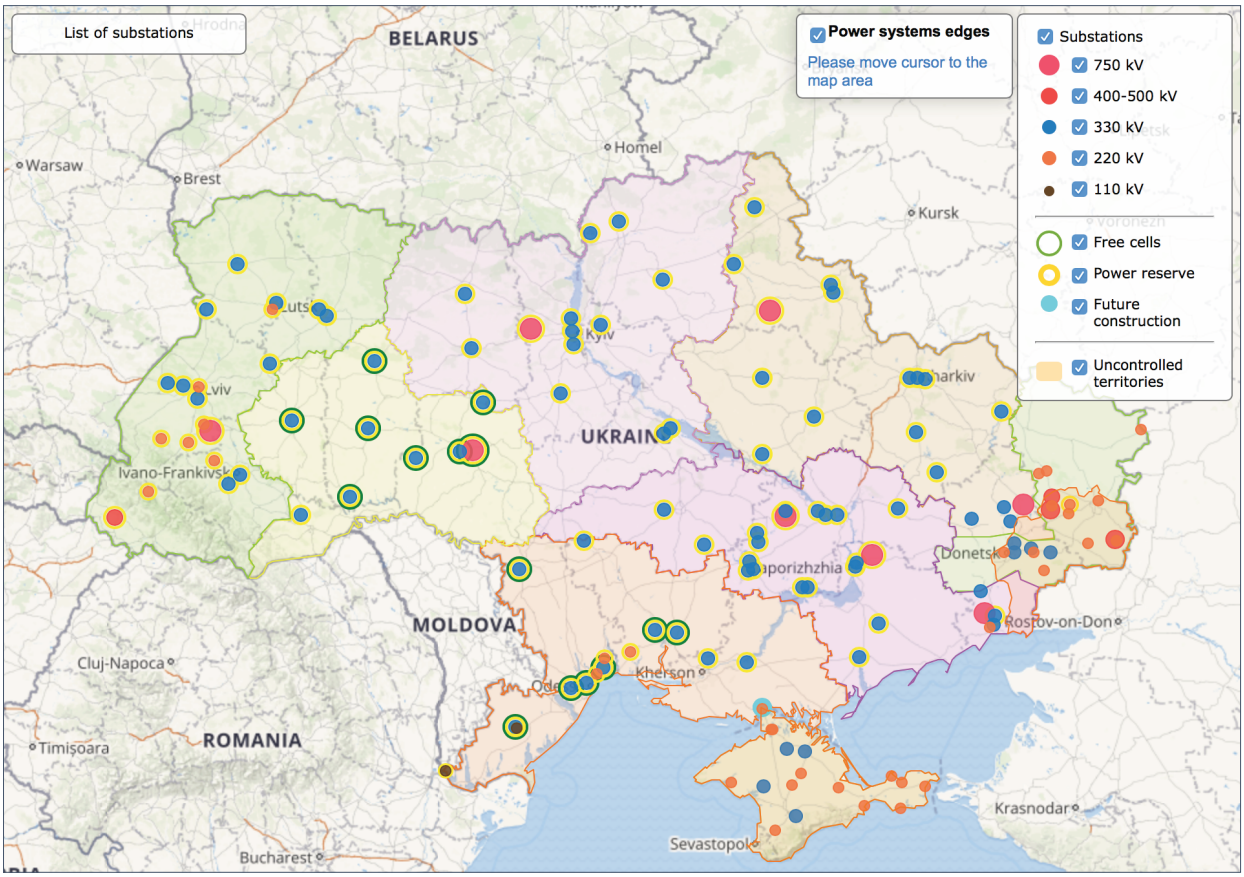
Single window for connection to the grid

Ukrenegro – stated-owned transmission operator - provides a simple and comprehensible connection algorithm. By introducing in 2017 a "single-window" for connection the company made a significant step forward in simplifying the procedure of issuing and approving connection specifications, reviewing and approving feasibility studies, providing input data for development of capacity output schemes for generating plants, etc.

Key principles of the "single window"

- The maximum period for issuance of technical specifications for connection to power grid is 10 days;
- The applicant communicates to a "single window" operator using feedback forms;
- Customer orientation: operators will provide maximum assistance to customers to make sure that their documentation is compliant with Ukrainian legislation and the company's regulatory documents;
- The electronic form allows a potential customer to submit an online application for connection of customer's electrical plants of particular capacity to Ukrenergo's power grid.

Also, to simplify the preparation and planning process Ukrenegro provides an online interactive map. The map of trunk power grids would help assess a technical possibility of connecting a new power generating facility, and the "green calculator" would calculate an approximate connection cost.



Source: Ukrenergo

Ukraine joins International Renewable Energy Agency (IRENA)

Ukraine **become a member of IRENA on 7 January 2018** when the respective law took effect.

The International Renewable Energy Agency (IRENA) is an intergovernmental organization that **supports countries in their transition to a sustainable energy future**, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

With a mandate from countries around the world, IRENA encourages governments to adopt enabling policies for renewable energy investments, provides practical tools and policy advice to accelerate renewable energy deployment, and facilitates knowledge sharing and technology transfer to provide clean, sustainable energy for the world's growing population.

In line with these aims, IRENA provides a wide range of products and services, including:

- Annual reviews of renewable energy employment;
- Renewable energy capacity statistics;
- Renewable energy cost studies;
- Renewables Readiness Assessments, conducted in partnership with governments and regional organizations, to help boost renewable energy development on a country by country basis;
- The Global Atlas, which maps resource potential by source and by location;
- Renewable energy benefits studies;
- REmap, a roadmap to double renewable energy use worldwide by 2030;
- Renewable energy technology briefs;
- Facilitation of regional renewable energy planning;
- Renewable energy project development tools like the Project Navigator, the Sustainable Energy Marketplace and the IRENA/ADFD Project Facility.

With more than 170 member states actively engaged, IRENA promotes renewable resources and technologies as the key to a sustainable future and helps countries achieve their renewable energy potential.

Key projects under development

Key projects under development

National Investment Council of Ukraine

The Ukrainian segment of renewable energy sources (RES) comprises 376 companies according to the State Agency on Energy Efficiency. Most of them work in segment of solar generation and operate small solar power plants, with the exception of CNBM and Activ Solar. The wind power segment is represented by 20 companies. The smaller number of wind generators can be explained by different market entry thresholds: lower implementation costs for solar power projects compared to wind farm projects due to cheaper technologies, lower construction costs and less strict requirements for player experience and expertise

More than $550 million have been invested in new RES facilities since 2014.

Largest operating projects

Wind	Installed capacity MWt
Botiyevska wind power station	200
Wind park Novoazovskyy	58
Wind farm Krasnodonskyy	25
Wind farm Lutuginskyy	25

Solar	Installed capacity MWt
Solar power station in Vladyslavivka	110
Solar park Perovo	106
Solar park Ohotnikovo	83
Solar power plant Rengy Development	20
Solar power plant SPP Chechelnik	20
Solar power plant Dibrovka SPP	17

From open sources

Map of installed RES facilities

Biomass/Biogaz Facilities

Hydro Power Plants

Wind Park

Solar Power Plantss

Source: UARE

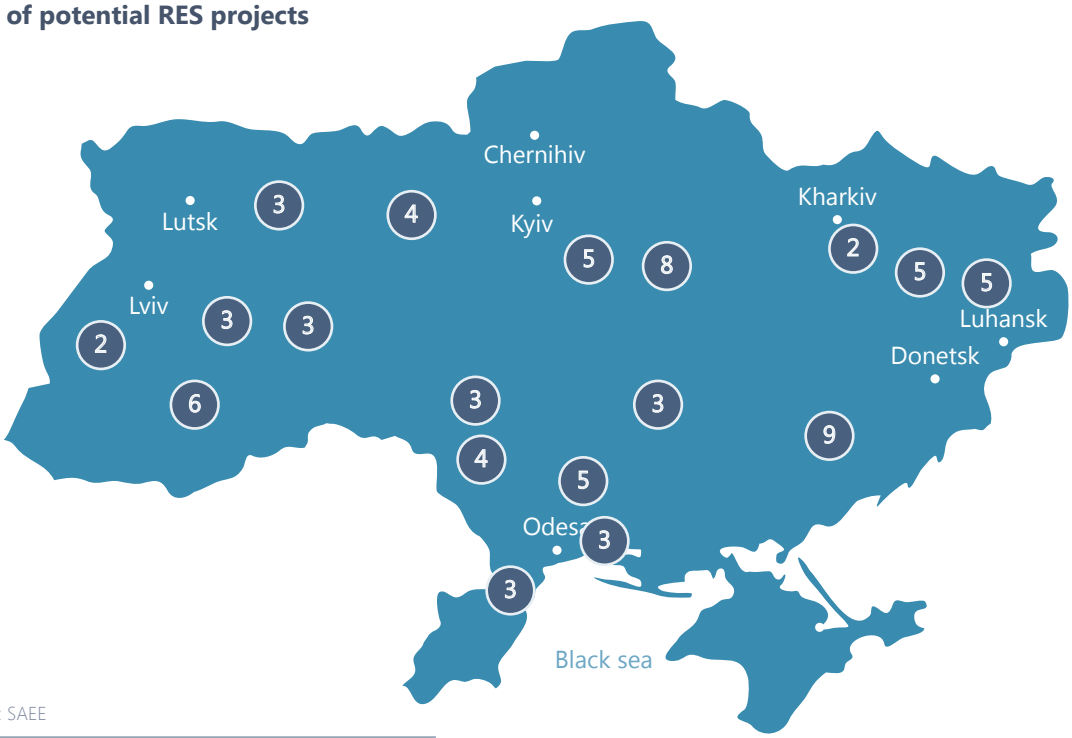
Largest pipeline projects

- **Eurocapewind farm**
  Eurocape is planned to become the largest wind farm in Ukraine and in Eastern Europe totaling **500 MWt**. The project involves a **$150 mln OPIC loan and $320 mln OPIC guarantees**
- **DTEK wind park Primorska**
  DTEK is constructing a **200 MWt** wind park in Zaporizhzhya region
- **Guris wind park**
  Turkish Guris is building a **80 MWt** wind farm in Odesa region which should expand wind farms portfolio in Odesa region to a **200 MWt**
- **Ozeryanivska wind farm**
  Windcraft Ukraine LLC has declared building a **70 MWt** wind farm in Kherson region
- **Novotroytska wind farm**
  Novotroytska wind farm being built by Windcraft Ukraine LLC in Kherson region should become one of the largest wind mills in Ukraine totaling **44 MWt**
- **Ochakivskiy wind park**
  Ochakivskiy wind park in Mykolayv region involves the development of two wind farms totaling **43 MWt**
- **DTEK and China Machinery Engineering corporation solar plant**
  One of the largest energy companies in Ukraine DTEK and China Machinery Engineering corporation have signed an agreement on construction of **200 MWt** solar plant in Dnipro region
- **Planetcore solar power plant**
  Planetcore Group from UAE has declared building a **100 MWt** solar farm in Odesa region
- **KNESS solar power plants**
  KNESS is developing three solar plants in Odesa region totaling **87 MWt** with EBRD financing involved
- **Scatec solar plant**
  Norvegian Scatec is building a **25 MWt** solar plant in Cherkasy region and claims it to be the first project of the company from its **200 MWt** portfolio in Ukraine which Scatec plans to set until the end of 2019

From open sources

In 2018 State Agency on Energy Efficiency developed a map of potential investment projects in RES including solar, wind, small hydro and biogas/biomass projects.

Map of potential RES projects



Source: SAEE

Opportunities

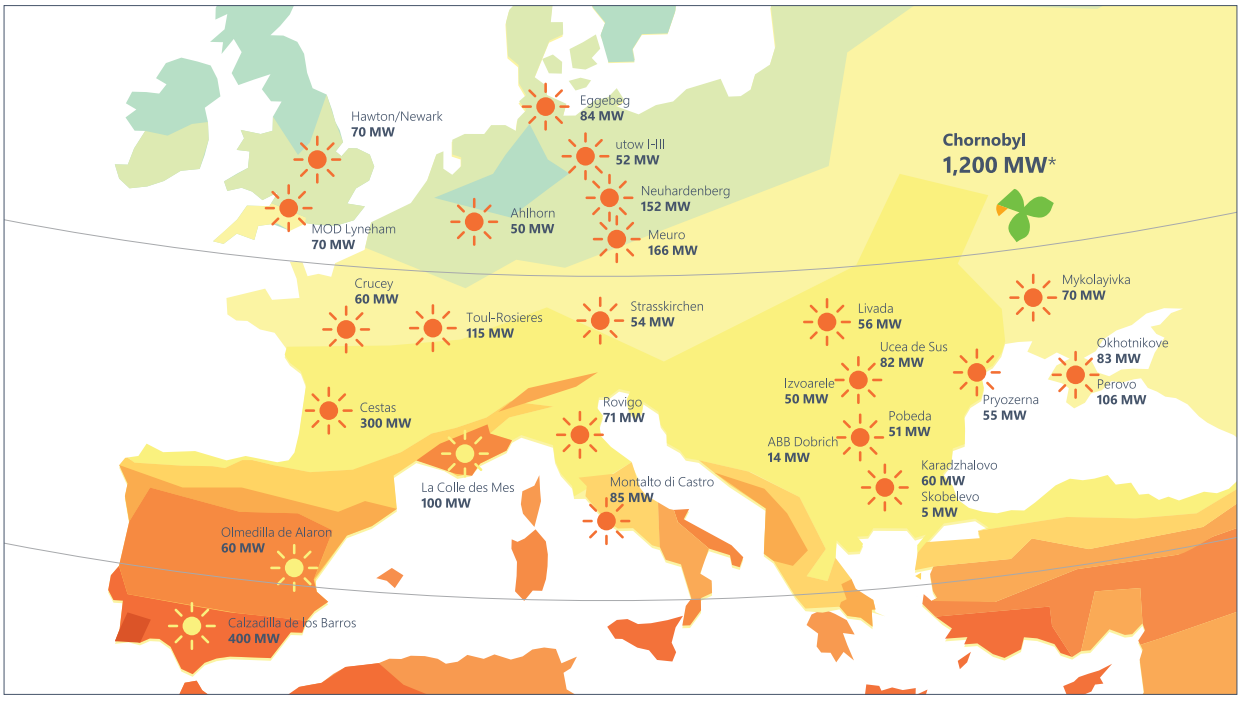
Chornobyl Solar Plant

Among all investment projects in the renewable energy sector, Ukraine has a unique opportunity of **constructing a solar power plant** with capacity of **1.2 GW** on the territory of the **Chornobyl Nuclear Power Plant.**

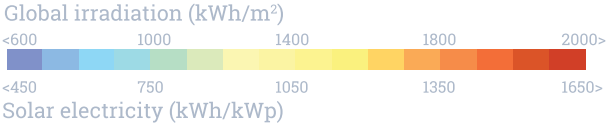
After the disaster at the plant in 1986, the huge territory near the reactor became polluted and unsuitable for human inhabitation for hundreds of years. However, in 2016 the radiation source was localized with the help of French engineers that constructed a shield around the station. Now the territory is suitable for short visits.

The available grid of the nuclear station and huge areas of uninhabited territories create a great opportunity for an SPP construction.

- **Photovoltaic solar electricity potential** in Chornobyl Exclusion Zone is higher than in most parts of Europe situated on the same latitude;



* Potential project under consideration



Source: EasyBusiness, Chornobyl R&D Institute, EU Joint Research Center (Institute for Energy and Transport)

- Estimated investments required – **$1.3 billion**;
- Acquisition of 2,500 ha of land plots in the 10km zone of Chornobyl power plant in close proximity to roads and power lines can be performed with a **special lease price**;

Key projects under development

- Total area available for solar power plants of first priority is 2500 ha, which corresponds to 1.2 GW of capacity. The project **has flexible scaling** due to the availability of easily acquirable land;
- Total capacity of approx. **1.2 GW** can be divided into **four stages**, and will require construction of new substations, including investments into infrastructure and land clearance;
- Most of the infrastructure is in **good working condition**;
- Grid and connection including transformer substation, open switchgear and high-voltage power lines **are available within close distances**;
- Up to **1,500 GWh** of annual energy output is expected;
- **Pre-feasibility study** developed by Tractebel France and funded by the French Ministry of Economy and Finance confirms project financial and technical sustainability;
- **Competitive auction** for long-term PPA is expected to be launched for the projects with the relevant amendments of legislation.

Forthcoming policy development

An indicative trend observed in European and other international markets has been towards the gradual "equalization" of the legal status of different power sources, the reduction or curtailment of state support mechanisms and subsidies for power production from RES, and introduction of conditions for free market competition for producers of power from different sources.

This is particularly justified in those countries where power production from RES is already achieving a considerable share of total energy production.

Even though RES generation has not yet reached significant share of total energy production in Ukraine, there are a number of reasons to move towards a policy change in order to make the RES development sustainable and advantageous for both investors and the state in the long run.

The reform is aimed to tackle the key issues:

1

RES support scheme in the long run

- Current RES support scheme in Ukraine foresees the end of green tariff by 2030 regardless of the date of launch and commission of the project. In most European countries the state subsidy usually is granted for 10-15 years as of the launch of the project. The end of state support and tariff drop since 2030 in Ukraine might decrease the investment attractiveness of RES projects due to preparation and payoff periods and make it more complicated to attract financing. Furthermore it puts to question the development of RES projects beginning from 2020. This brings up the need to extend the support period
- Ukrainian RES generation has one of the highest financial burdens on consumers in Europe. Experience of European countries shows that the scheme should be financialy sustainable for both investors (producers) and consumers. Otherwise it would lead to either lack of interest from investors' side or system crises with negative consequences for investors and sometimes even retrospective change of tariffs as it happened in Spain, Romania and Bulgaria. Ukrainian green tariff model is currently financially durable. At the same time, as Ukraine is moving forward to increase of the RES share from 7% to 25% by 2035, RES support scheme need to be designed to remain stable and affordable in a long run.
- Effective support policy should be ready to react to the technology development, decrease of costs for RES installment and production and improvement of RES operational effectiveness.

2

Connection to the grids. Ukraine is No 128 in The Ease of Doing business ranking in "Connection to the grid" category. It generally takes around 280 days and 5 permitting procedures to connect to the grid according to WB survey. Business still has much room for further improvement of the grid connection procedure, including simplification of procedure, increasing transparency and efficiency of connection costs and decreasing time needed to connect to the grids. Furthermore, uncontrolled and free application for grid connection with no time-limit for utilization of technical permission creates room for speculation when a number of companies which are not planning to invest and implement a project could jeopardize the connection of the real investor by "taking" all the available capacity of the grid and increase costs for further connection. A transparent mechanism for obtaining and utilizing connection technical requirements need to be developed and implemented.

3

Balance and stability of energy system. Due to their nature, RES sources, especially solar power plants, are often causing balancing issues in the system. Some countries are tackling them by restricting RES production, some, on the contrary, are stimulating the development of balancing facilities. According to the calculations of the Ukrainian grid operator Ukrenergo, the system can take up to 3000 MWt of RES without facing significant imbalances in the system. As of the first quarter of 2018, 1534 MWt of RES have been already installed in Ukraine. With the current pace of RES development Ukraine could reach the threshold of 3000 MWt by 2020. This means that in order to ensure the sustainability of the system and to protect current investors new solutions to the balancing issue should be found by the end of 2019.

The current RES support scheme in Ukraine is financially and technically viable in the long run. At the same time to provide more stability in the long run and to ensure that the interests of both producers and consumers are met, the Government needs to amend current support mechanism and put it in line with EU practice. Current EU countries' experience shows that one of the most efficient ways to optimize RES support scheme is to introduce an auction system. Open and transparent auctions for significant RES projects together with feed-in tariffs for small ones with increased support period (15-20 years) could ensure more profit for investors in the long run, guarantees for financial institutions supporting RES projects, as well as further development of RES in Ukraine in order to achieve the goal of 25% RES by 2035, as outlined in the Energy Strategy.

In March 2018 Office of the National Investment Council launched public discussion on the policy changes to future RES support scheme involving all major stakeholders including key business associations and investors, government agencies and regulator, experts, international financial organizations and financial institutions. It is expected that the policy changes will be drafted and discussed in Parliament by the end on 2018.

National Investment Council of Ukraine

European Bank for Reconstruction and Development

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For any questions or comments please contact office@nicouncil.org.ua

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