



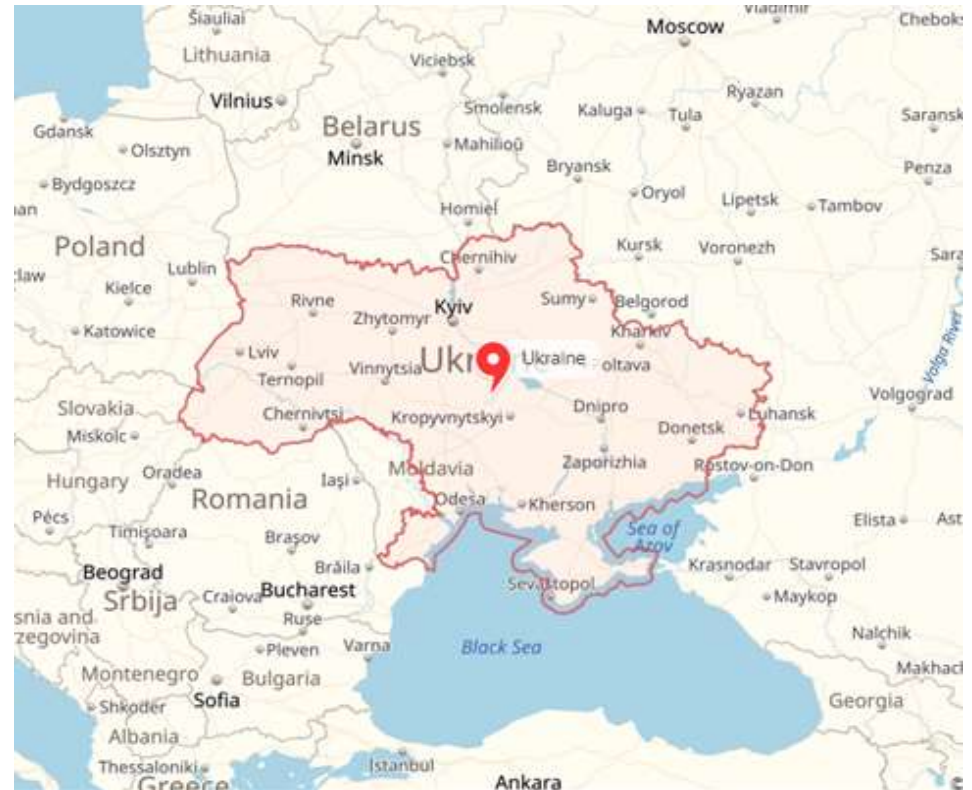
# Hydropower Development in Ukraine





# Ukraine

Location	Eastern Europe
Population	around 44 mln
Area:	603,628 km <sup>2</sup>
Border	by Russia, Belarus, Poland, Hungary, Slovakia, Romania and Moldova and the Black Sea and Sea of Azov
GDP	\$ 8272 (per capita)
Economy	<ul style="list-style-type: none"><li>- one of the world's largest grain exporters.</li><li>- large heavy industry sector, particularly in aerospace and industrial equipment.</li><li>- major manufacturer of weapons-tanks, military transport aircraft, anti-aircraft missile systems.</li></ul>





Flag



President  
Petro Poroshenko



«An-225 Mriya, NATO name "Cossack"» - largest  
and most powerful cargo aircraft in the world



Emblem



Klitschko brothers - Ukrainian  
heavyweight boxers.



Andriy Shevchenko - Ukrainian footballer who played  
for Dynamo Kyiv, Milan, Chelsea as a striker





# Law of Ukraine «On Ukraine's Accession to the Statute of the International Renewable Energy Agency (IRENA)»

(reg. № 2222-VIII as of 05.12.2017)

On February 24, 2018 Ukraine officially became IRENA's member!

## Ukraine's membership at IRENA:

- ✓ renewable projects financing by the Abu Dhabi Fund for Development (ADFD) under 1-2% for up to 20 years;
- ✓ legislation improvement;
- ✓ "green" investment attraction;
- ✓ additional guarantees to investors;
- ✓ cooperation with development countries in renewable energy;
- ✓ access to the IRENA's database.



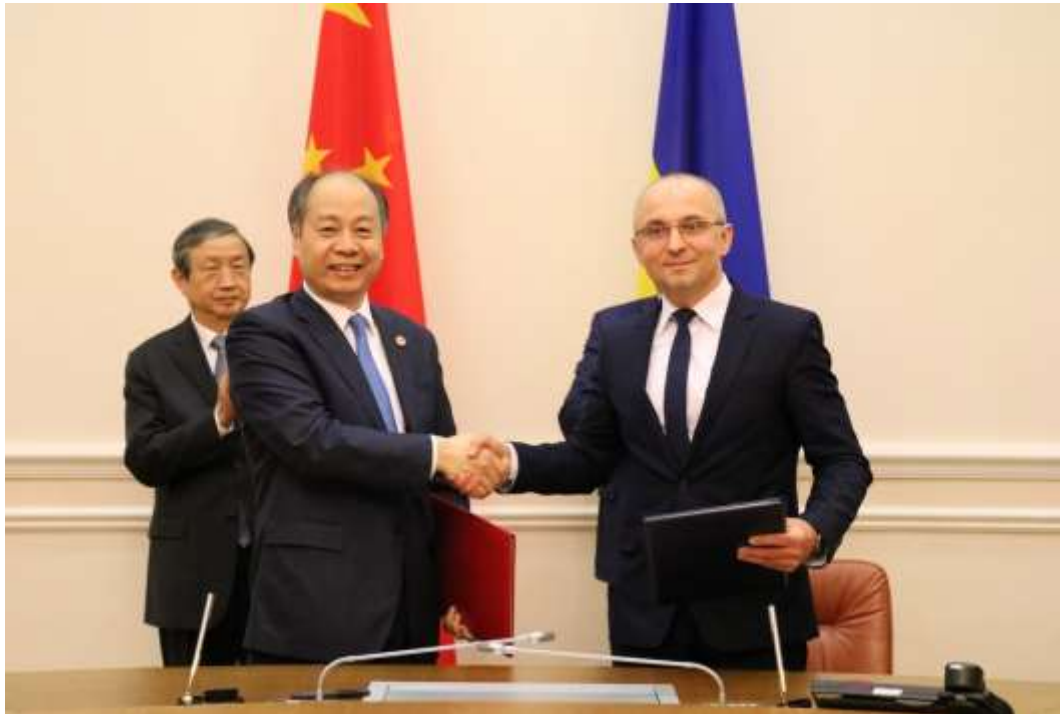
- **157** IRENA's members
- **25** countries started the accession procedure



## INTERNATIONAL COOPERATION

To promote energy efficiency and renewable energy development in Ukraine the State Energy Efficiency Agency signed the agreements with:

**China, Slovakia, Cyprus, Slovenia, Portugal, Finland, Denmark, Moldova**



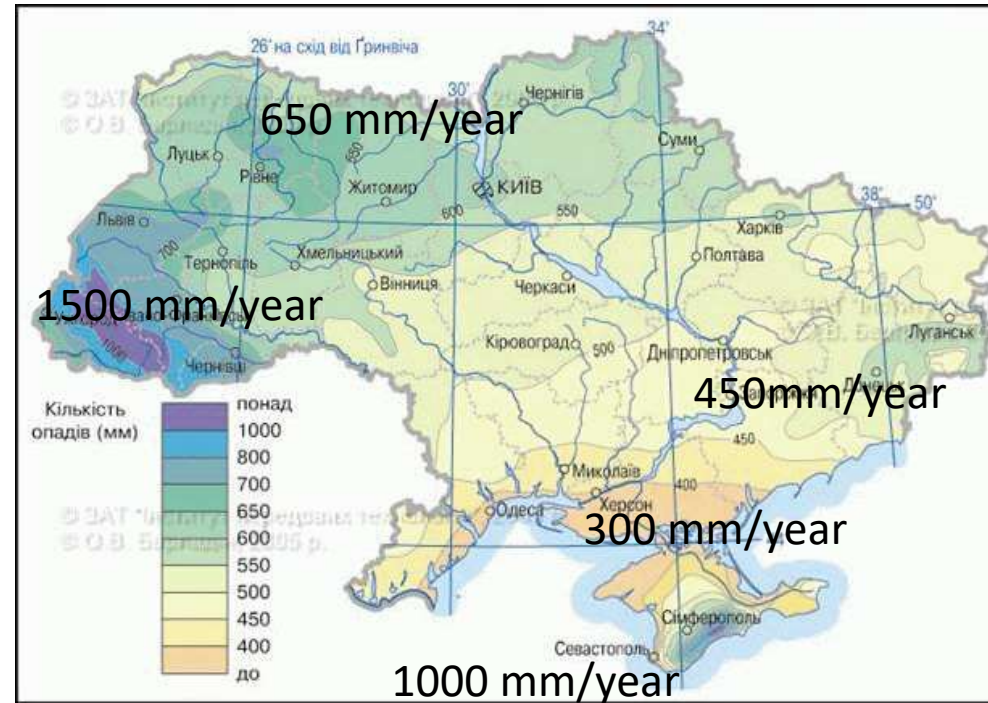
**The signing of the Memorandum with State Agency on Energy Efficiency and Energy Saving of Ukraine and National Energy Administration of People's Republic of China in 2017.12.05**



The landscape of Ukraine consists mostly of fertile plains (or steppes).

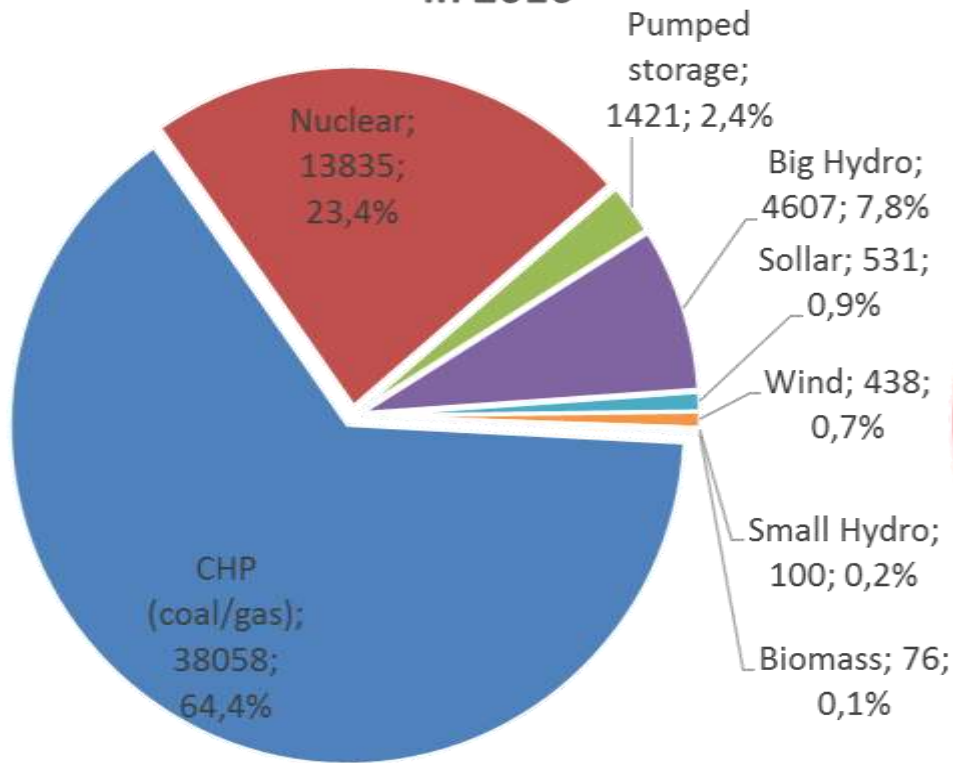
The country's only mountains are the Carpathian Mountains in the west, of which the highest is the Hora Hoverla at 2,061 metres, and the Crimean Mountains on Crimea.

Ukraine has a mostly temperate climate, with the exception of the southern coast of Crimea which has a subtropical climate. Average annual precipitation decreases from North-West to South-East from 650 mm to 300 mm. Maximum precipitation in the Carpathian mountains (more than 1500 mm) and Crimea mountains (more than 1000 mm).



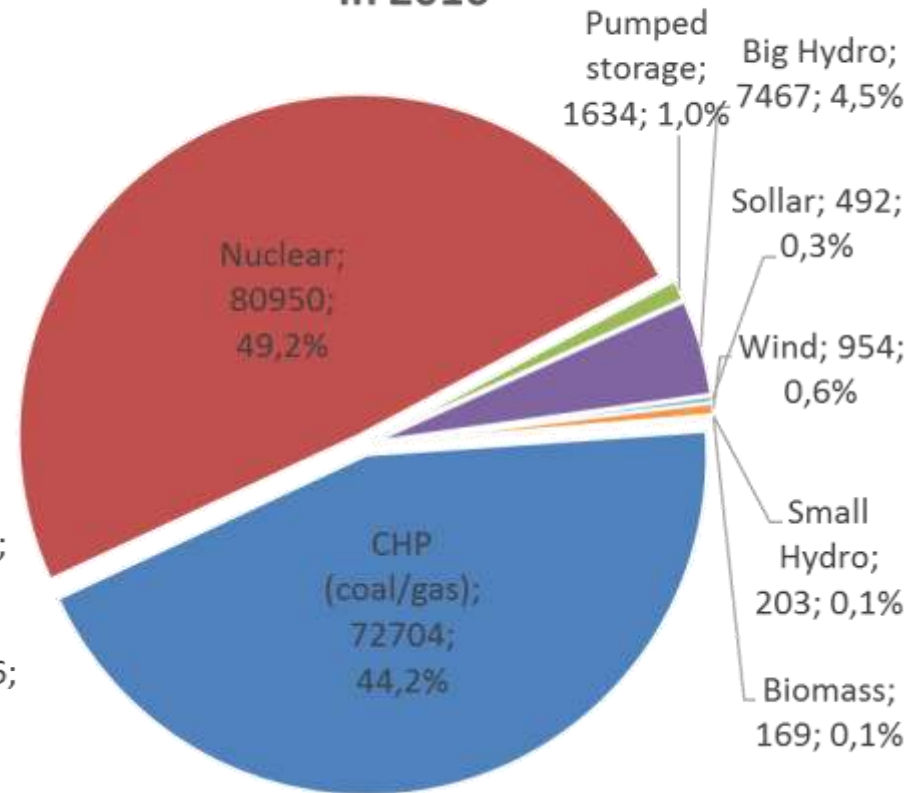


### Capacity of energy system in Ukraine in 2016



**Total capacity – 59 066 MW**

### Electricity production in Ukraine in 2016



**Total production –164 573 GW\*h**





## National Renewable Energy Action Plan till 2020

**11% of energy, produced from  
RES**

In total energy consumption



**Energy Strategy of Ukraine till  
2035**

**25% of energy, produced from  
RES**

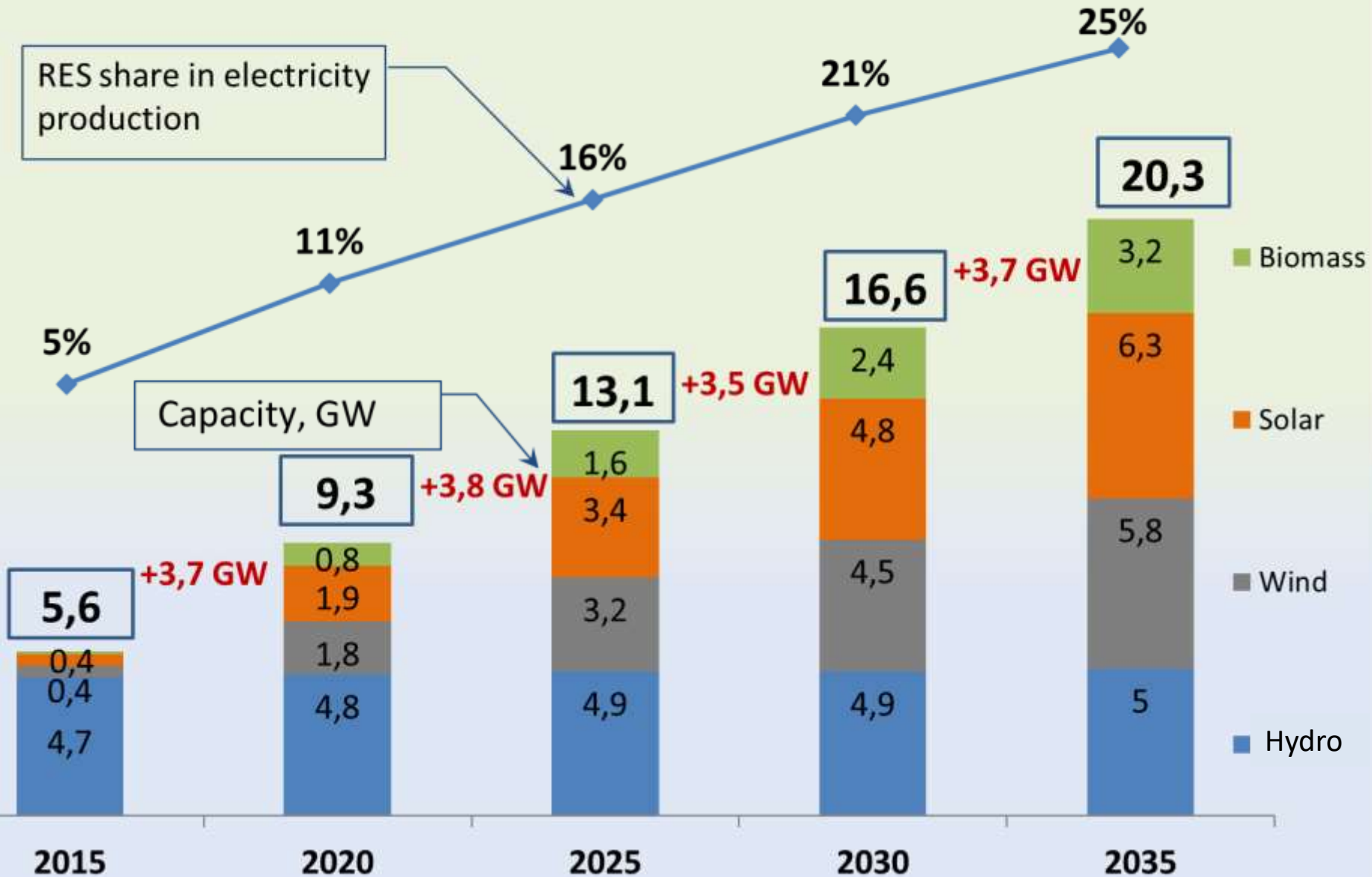
In the structure of primary energy supply





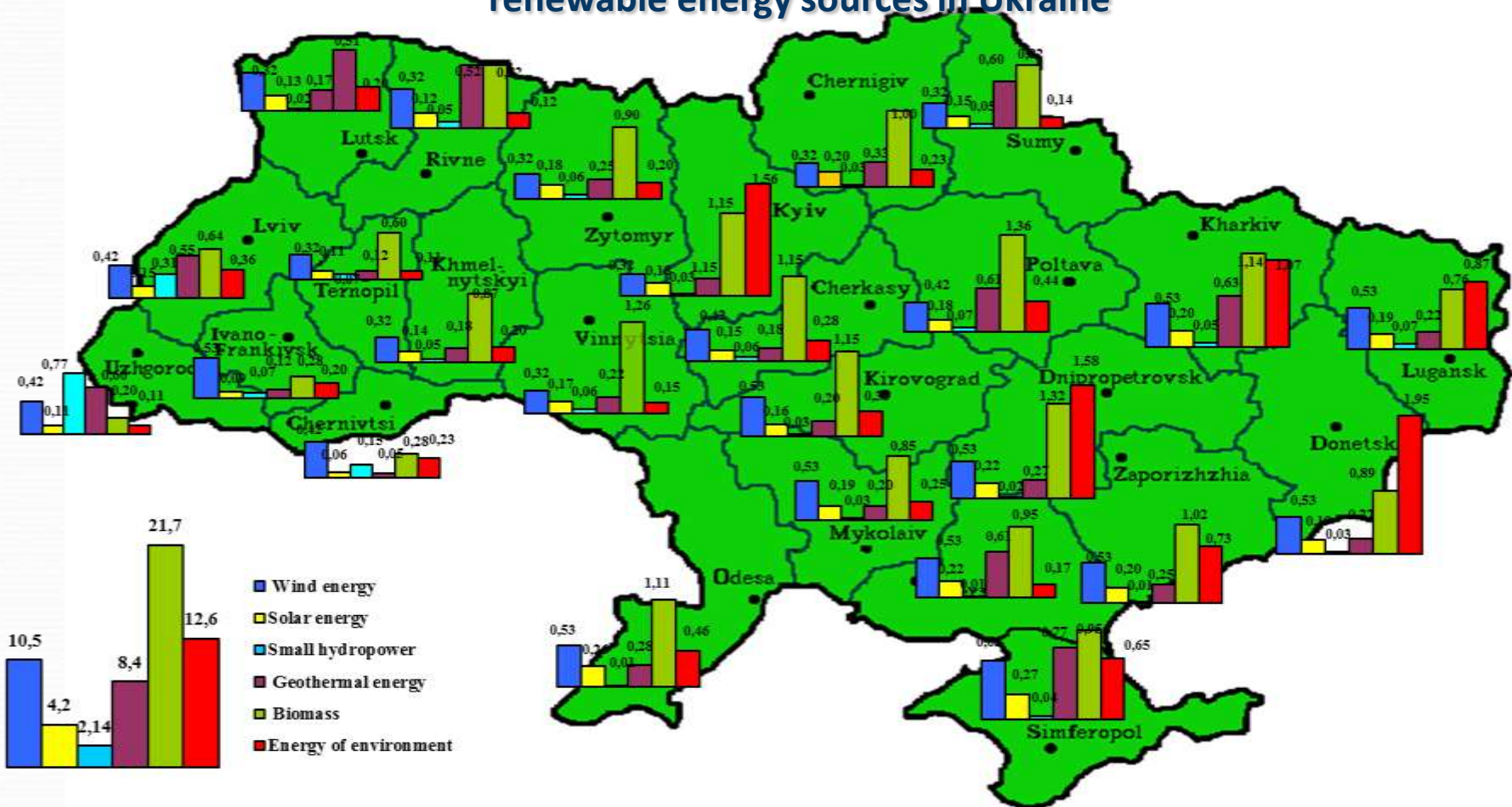


## The development of renewable electricity by 2035





## Total technically accessible potential of renewable energy sources in Ukraine



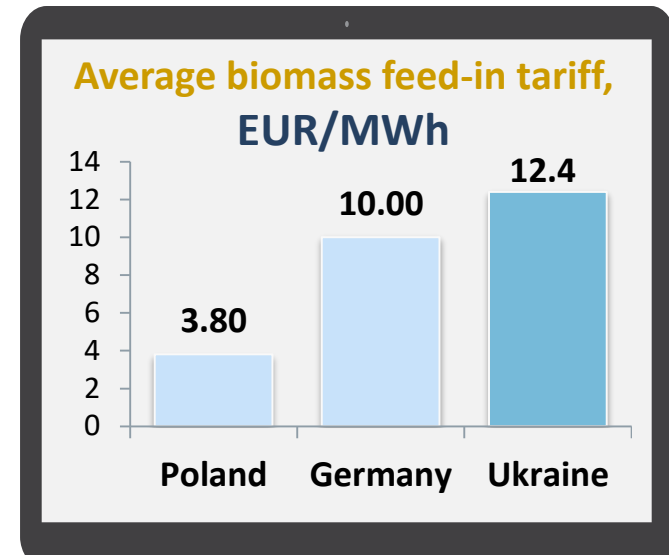
**Total RES potential 68,6 million tons of oil equivalent**

in 1960 in Ukraine were more than 1000 small hydro power station.



# Favorable conditions for renewable energy development

1. Feed-in tariffs are fixed in EUR till 2030;
2. Feed-in tariff for electricity from biomass and biogas increased by 10%.
3. There are no requirements for "local" component.
4. Premium for Ukrainian equipment usage is provided – **5-10% to existing tariff**;
4. Introduced "green" tariff:
  - for **geothermal energy**;
  - for **private household solar and wind turbines power capacity up to 30 kW**.
5. **Signing of bankable long-term Power Purchase Agreement (PPA) with feed-in tariff till 2030**;







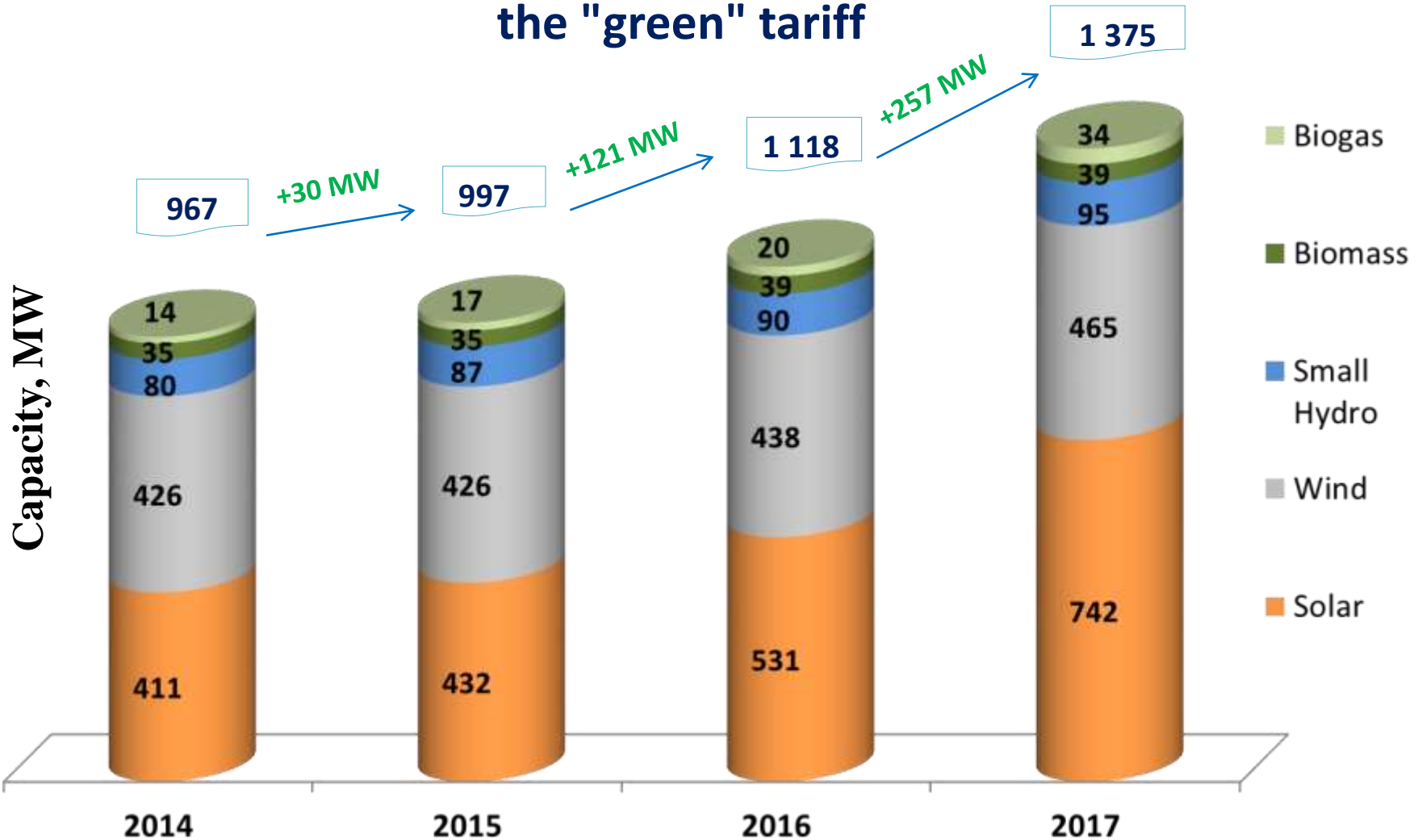
# FEED-IN TARIFF IN UKRAINE

EUR/MWh

Technology/Comm.Year	2017-2019	2020-2024	2025-2029
Biomass	123.86	111.48	99.09
Biogas	123.86	111.48	99.09
Geothermal	150.25	135.17	120.09
<b>Hydro (micro 0-0.2 MW)</b>	<b>174.47</b>	<b>157.24</b>	<b>139.47</b>
<b>Hydro (mini 0.2-1.0 MW)</b>	<b>139.48</b>	<b>125.48</b>	<b>111.48</b>
<b>Hydro (small 1.0-10.0 MW)</b>	<b>104.47</b>	<b>94.24</b>	<b>83.47</b>
Solar (ground based)	150.25	135.17	120.09
Solar (roof based)	163.71	147.56	130.86
Wind (>2MW)	101.78	90.47	79.16
Solar (private households)	180.94	162.63	144.86
Wind (private households)	116.06	104.47	93.16



# Installed capacity of renewable energy objects working under the "green" tariff



From the beginning of 2015, 408 MW were introduced and more than € 400 mln were invested.



## Renewable energy facilities that work by «green» tariff in Ukraine as of the end 2017

**Σ 376 objects\***  
**1375 MW\***

193 objects



**Solar**  
**742 MW**

20 objects



**Wind**  
**465 MW**

136 objects



**Small Hydro**  
**95 MW**

6 objects



**Biomass**  
**39 MW**

21 objects



**Biogas**  
**34 MW**

\*- excluding occupied territory of Crimea





# State Policy on Hydropower Development in Ukraine

## Executive authorities regulating hydropower sphere

- Ministry of Ecology and Natural Resources
- Ministry of Energy and Coal Industry
- Ministry for Regional Development, Building and Housing
- National Commission for State Energy and Public Services Regulation
- State Agency of Water Resources
- State Agency on Energy Efficiency and Energy Saving
- State Environmental Inspectorate
- State Architectural and Construction Inspectorate
- local administrations

## Legislation regulating hydropower sphere

- Water code
- Tax code
- Land code
- Law on the regulation of urban development
- Law on Electricity market
- Law on Alternative energy sources





# Ukrainian Rivers

Ukraine has around 23,000 rivers. The longest rivers of Ukraine are Dnipro (981 km), Pivdenny Buh (806 km), Dniester (705 km) and Siversky Donets (672 km).

In Ukraine, there are more than 1.1 thousand reservoirs

## Largest reservoirs

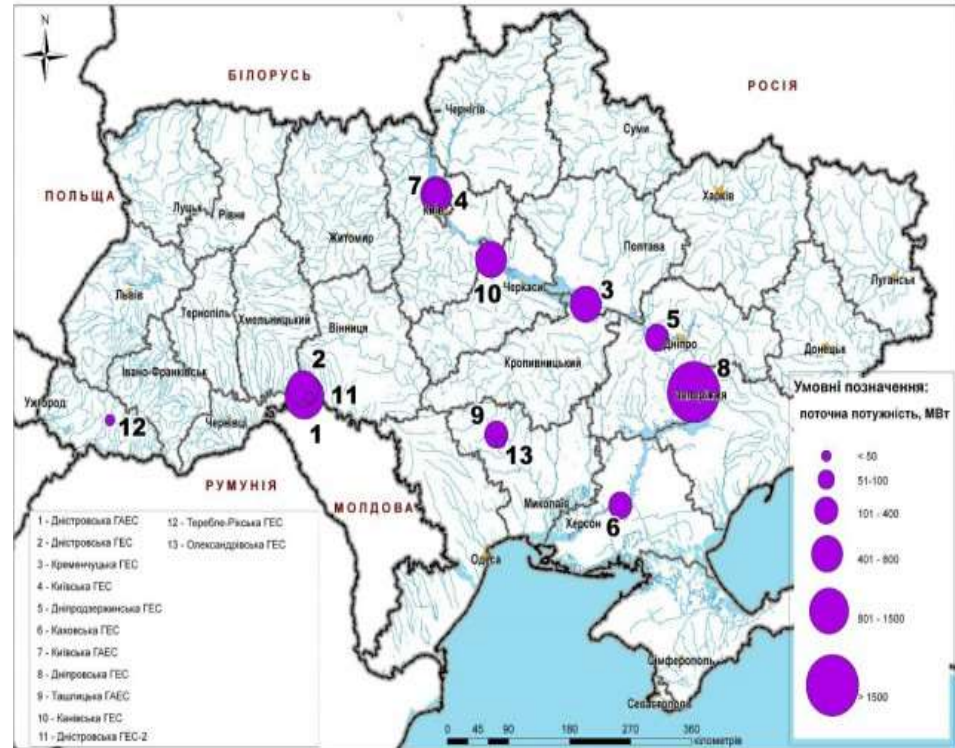
Name	River	Area, km2
Kiev reservoir	Dnipro	922
Kanev reservoir	Dnipro	582
Kremenchug reservoir	Dnipro	2250
Kamensk reservoir	Dnipro	567
Zaporozhye (Dnieper) reservoir	Dnipro	410
Kakhov reservoir	Dnipro	2155
Dniester reservoir	Dniester	142





## Large Hydropower Plants in Ukraine

№	Name of power station	Capacity, MW	Production, GW*h
1	Dniester Pumped Storage	972	1241
2	Dniester HES-1	702	672
3	Kremenchuk HES	636	1195
4	Kiev HES	440	698
5	Middle Dnieper (Dneprodzerzhinska HES)	388	1019
6	Kakhovka HES	335	1157
7	Kiev Pumped Storage	236	163
8	<b>Dnieper HES</b>	<b>1554</b>	<b>2982</b>
9	Tashlytzka Pumped Storage	302	181
10	Kaniv HES	483	841
11	Dniester HES-2	41	76
12	Tereblya-Ritska HES	27	99
13	Alexandrovka HES	12	28



**By the end 2017**

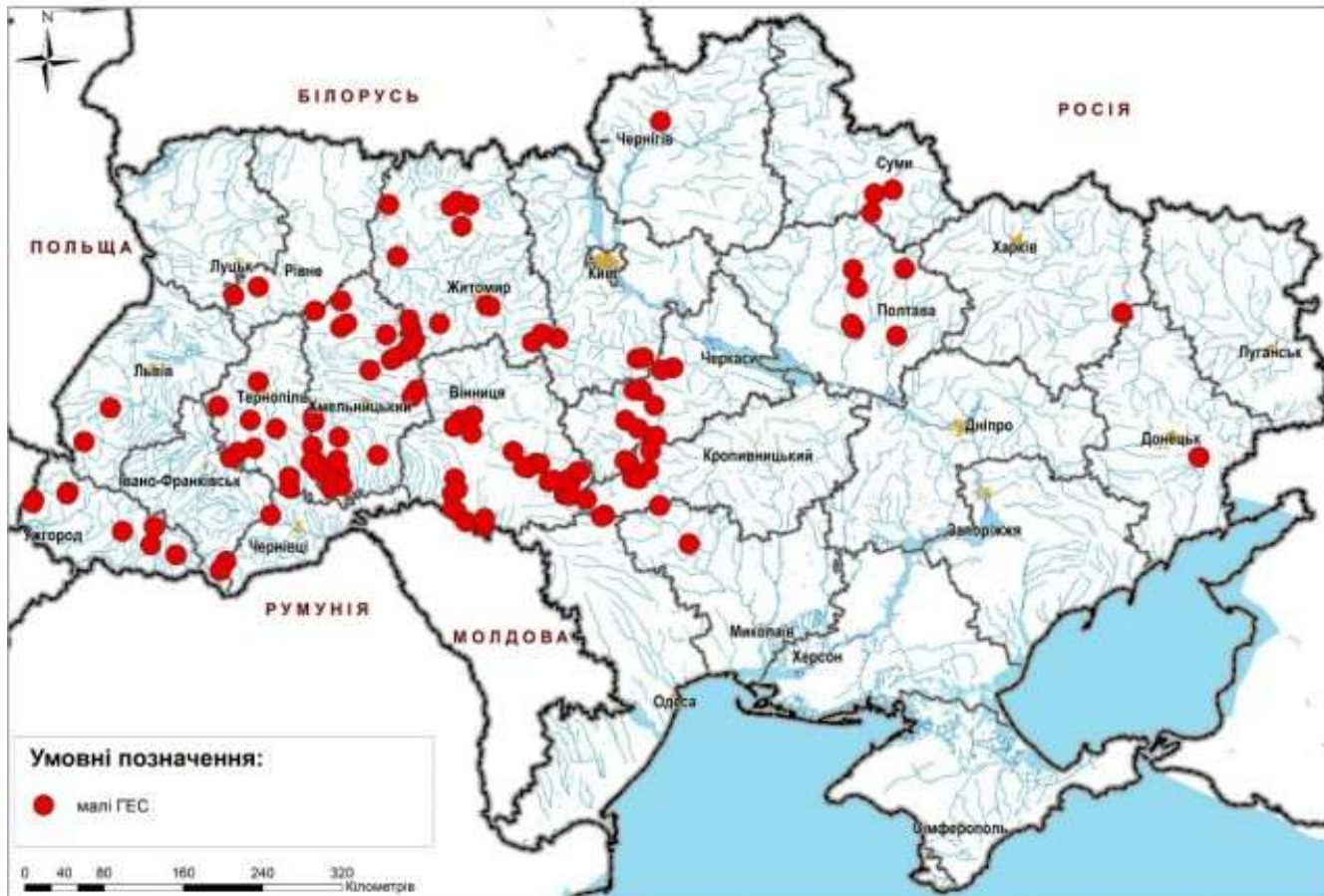
**- Total capacity of HES - 4 617 MW,  
production – 8 768 GW\*h**

**- Total capacity of pumped storage – 1 510 MW,  
production - 1585 GW\*h**





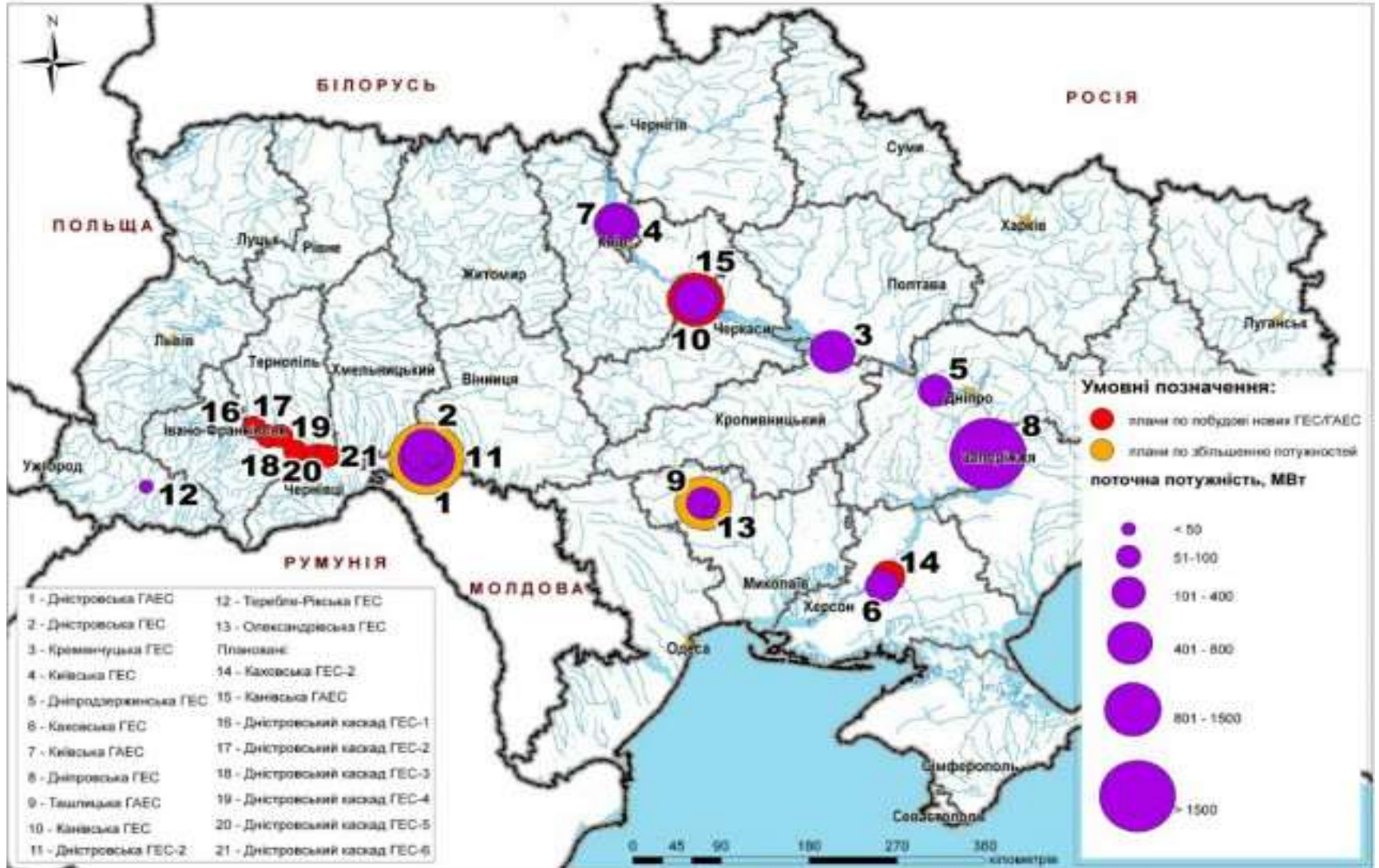
# Small Hydropower Stations



**136 small hydropower stations with total capacity of 95 MW  
are operating by «green» tariff (as of the end 2017)**



# Hydropower development program for the period up to 2026





## Hydropower development program for the period up to 2026

Project's name	Added capacity, MW	Total cost, mln €
Dniester pumped storage - first stage	972	530
Dniester pumped storage - second stage	324	100
Dniester pumped storage - third stage	972	300
Kaniv pumped storage	1000	430
Tashlytzka Pumped Storage	604	530
Kakhovka HES-2	250	415
Reconstruction of 34 units	307	800
Cascade of upper Dniester river	390	720
<b>Total</b>	<b>4819</b> <b>(Pump- 3872 /HES- 947)</b>	<b>3 825</b> <b>(Pump -1890 / HES - 1935)</b>



## Problems and urgent steps for small hydropower development in Ukraine

For further and faster hydropower development in Ukraine it is important:

- to update legislation on design, construction and operation of hydropower plants taking into account the best world experience;
- to study technical condition of hydrotechnical objects;
- to develop a standard for assessing technical condition of the hydropower plants' main equipment in view of the current requirements;
- to develop modern schemes for regulating water regimes of natural rivers and artificial reservoirs of hydropower stations in Ukraine;
- to develop software to optimize water loss control from a buffer reservoir;
- to study water and energy potential of medium and small rivers;
- to develop a "Water Utilization and Hydropower Use Scheme for Small Rivers of Ukraine, taking into account environmental criteria", first of all in the Carpathian region;
- to use low-power turbines (up to 100 kW micro hydropower stations), in particular on industrial drains and existing plain-water reservoirs, for locally distributed electricity supply to households, farms, tourist, recreational and educational institutions combining other renewable energy facilities.





# Thank you for attention!

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