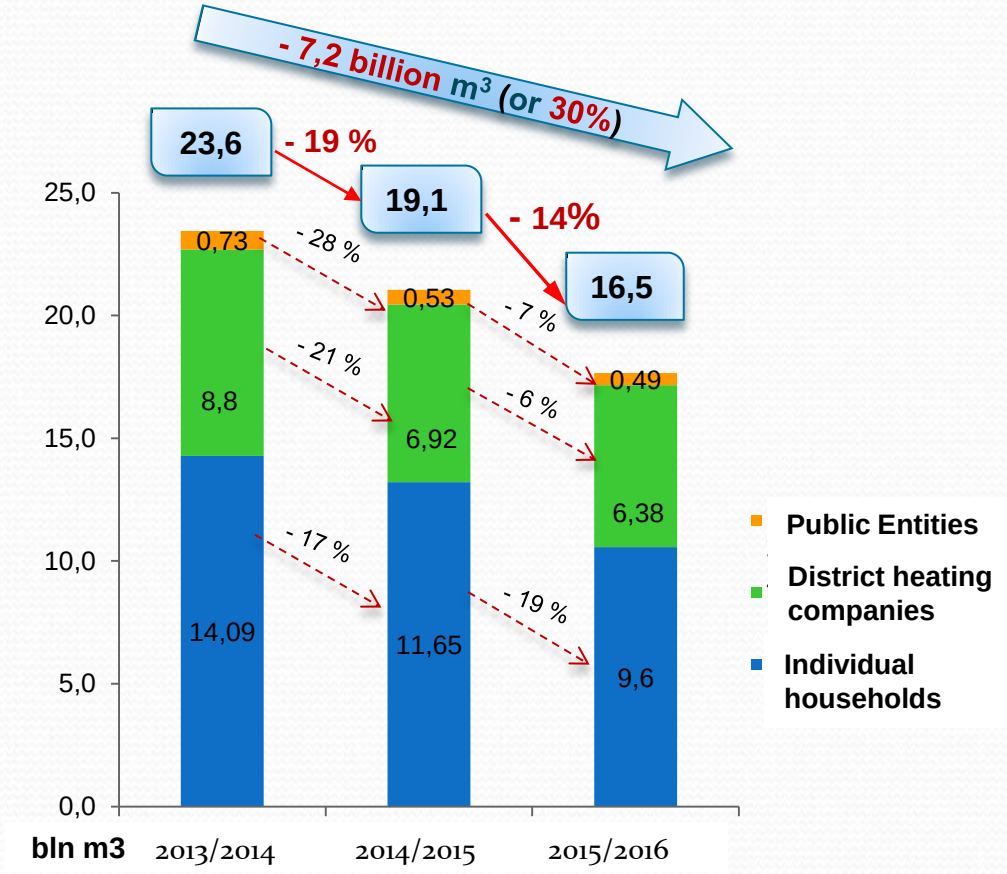
State Agency on Energy Efficiency and Energy Saving of Ukraine

Energy Efficiency and Renewable Energy: Status, Opportunities and Perspectives in Ukraine

Key priority: Substitution of Natural Gas

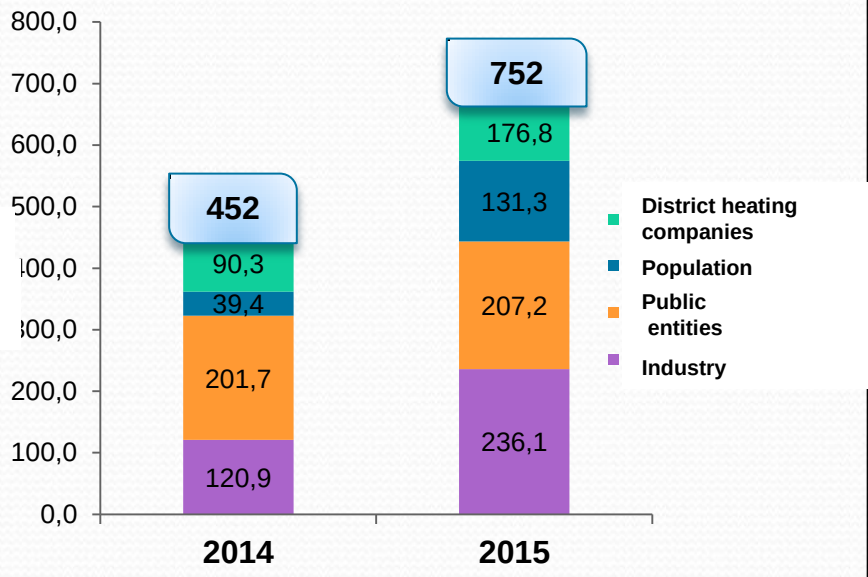
Reduction of gas consumption for the years 2013/2014/2015 *



Dynamics of natural gas replacement during 2014/2015 years **

Σ 1,204 MW

introduced during 2 years



*According to "Naftogaz Ukraine" (Excluding ARC, Luhansk and Donetsk regions).

**According to regional state administrations

Renewable Energy

National Renewable Energy Action Plan Until 2020

- adopted in accordance with Directive 2009/28/EC on the promotion of the use of energy from renewable sources;
- approved by the Cabinet of Ministers of Ukraine Decree №902-p dated October 1, 2014.

11 %

- of RES in the end-use energy balance in 2020

12,4 %

- **Of RES in district heating and cooling systems**

11 %

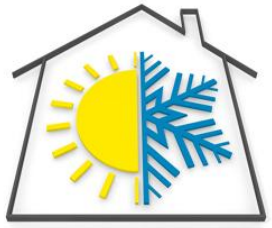
- **Of RES in electric power industry**

10 %

- **Of RES in transport sector**

Targets of the National Renewable Energy Action Plan

Power Production



Category of Electric Power Generation Facility	2015 Fact	2020 Planned	Required increase
	MW	*MW*	*MW*
Photovoltaic power plants	*432*	2 300	**1868**
Wind power plants	*426*	2 280	**1854**
Hydroelectric power plants, including:	*4 668*	5 350	**682**
< 10 MW	*87*	*150*	**63**
> 10 MW	*4 581*	*5 200*	**619**
Bioenergy plants	*52*	950	**898**
Geothermal power plants	*0*	20	**20**
Total:	**5 595**	**10 900**	**5305**

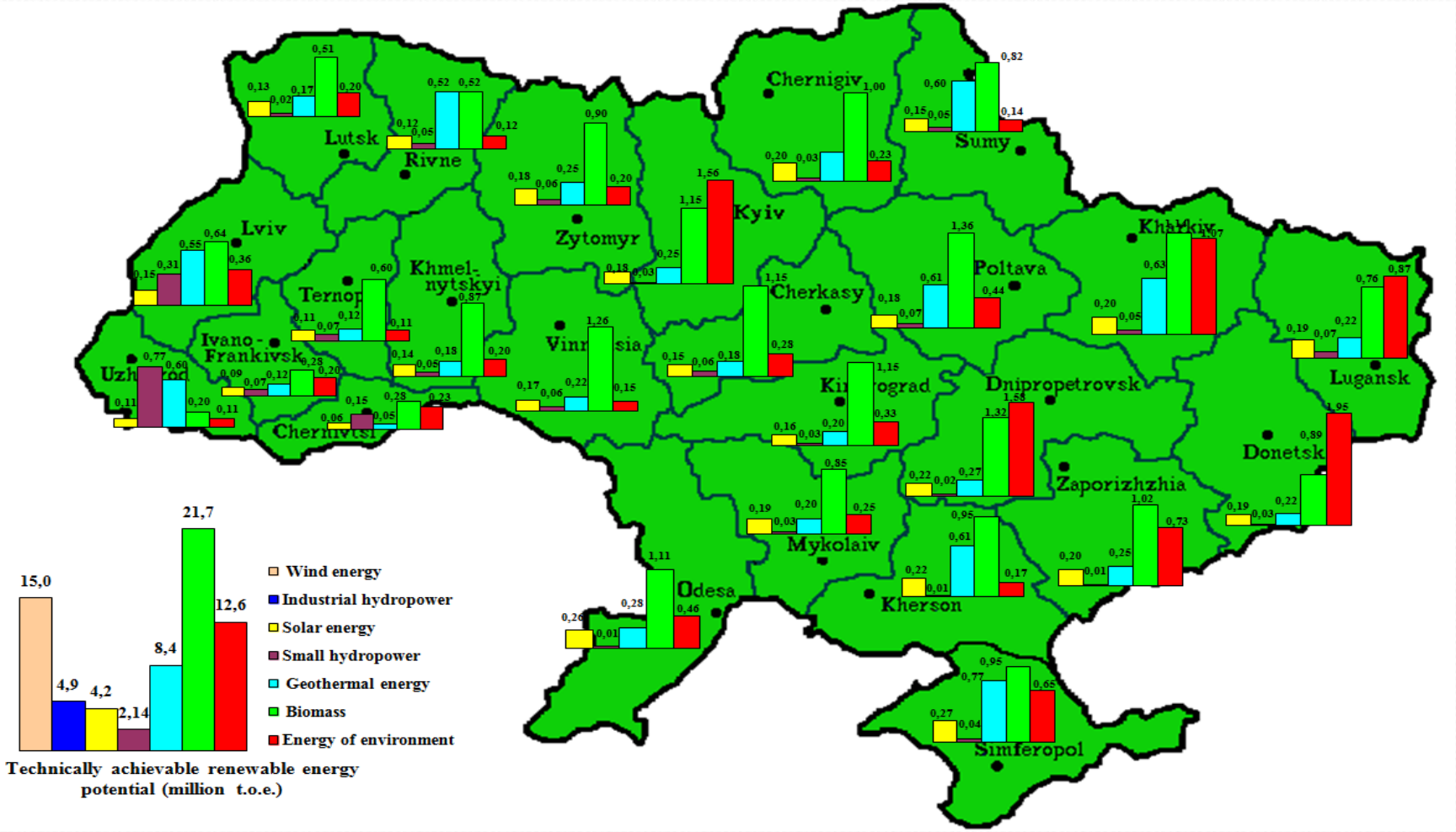
Heating and Cooling

Types of renewable energy sources	2014 Fact	2020 Planned	Required increase
	MW	*MW*	*MW*
Geothermal	5,5	2162	**2155**
Solar		1190	**1190**
Biomass	3650	11875	**8225**
TOTAL:	**3656,3**	**15227**	**11570**

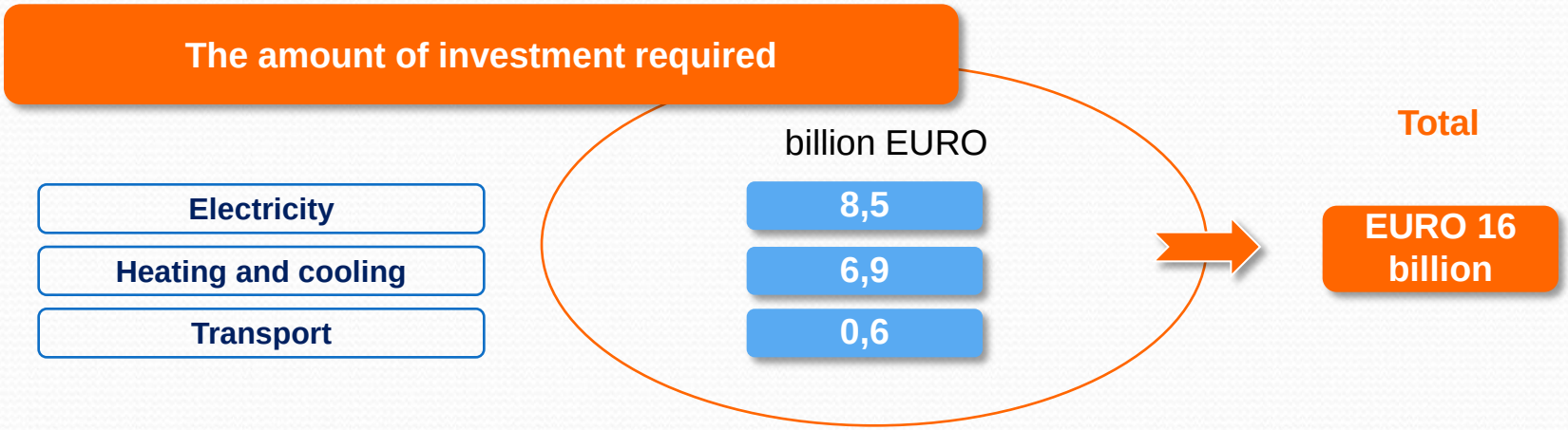
Transport

Types of renewable energy sources	2014 Fact	2020 Planned	Required increase
	MW	*MW*	*MW*
Electricity from RES	42	115	**73**
Bioethanol	41	320	**279**
Biodiesel	0	70	**70**
TOTAL:	**83**	**505**	**422**

Total technically recoverable energy potential of renewable energy sources of Ukraine



Required Investment for National Renewable Energy Action Plan Implementation



The Investment, inter alia, will be directed to the following measures:

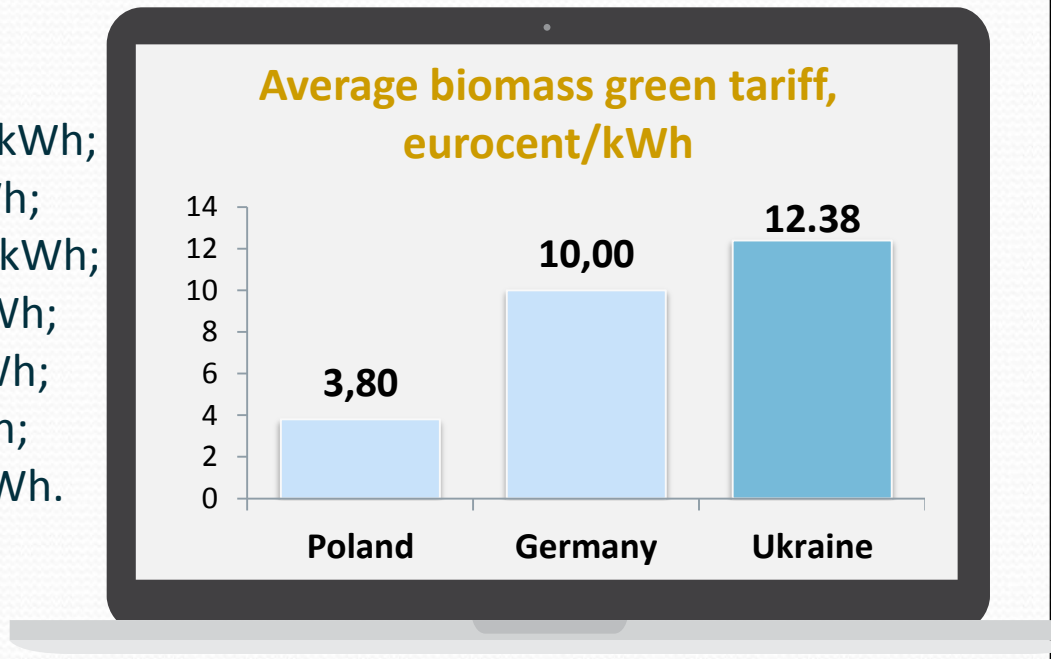
- Construction of plants for pellet production in Ukraine.
- Construction of plants for production of boilers (capacity from 7 kW up to 5 MW) that work on biofuel.
- Construction of second generation bioethanol plants.
- Energy crops production in Ukraine.
- Construction of cogeneration plants in Ukraine.
- Waste recycling plants.

Law of Ukraine on Renewable Energy Development*

1. Green tariff is fixed to EUR in order to avoid the risk of inflation.
2. The requirement on local equipment is cancelled.
3. Established green tariff for:
   - for geothermal electrical installations;
   - for private household solar and wind turbines up to 30 kW.

Introduced "green" tariff for:

- solar power stations: 16.00-17.23 €ct/kWh;
- wind power plants: 5.81-10.17 €ct/kWh;
- power stations on biomass: 12.39 €ct/kWh;
- small hydro plants: 10.45-17.44 €ct/kWh;
- geothermal installations: 15.02 €ct/kWh;
- household solar panels: 19.00 €ct/kWh;
- household wind turbines: 11.63 €ct/kWh.



Premium for usage of Ukrainian equipment is introduced (+10% for existing tariff)

*№514-VII of the 4th of June 2015

Botievska Wind Power Station

In 2015:

Installed capacity - **200 MW**

Electricity output to the United Energy System of Ukraine – **634 mln. kWh**

Ratio of equipment availability - **98,9%**

Ratio of capacity usage – **36,2 %**

Total investment - **340 mln EUR**

The level of "green" tariff – **11,3 €ct/kWh**

Successful examples of projects of thermal energy generation from biomass

Boiler for heating supply of population and public entities of Kamyanets-Podilskiy

Total capacity of boilers	7,6 MW
Producer of boiler	PE “Retro" (Ukraine)
Type of fuel	Straw pellets, miscanthus
Year of construction	2014

Universal Development Group Ltd. acted as the investor of the project, which will give an opportunity for city to save 20 mln. UAH a year. Heat power generated by a number of boilers is enough for spas, hospitals, clinics and medical college town.

Growing of energy poplar in Ukraine

Company: *"Bioproject"*
(founded by the French Republic, in Ukraine since 2011)

Plantations area: *400 ha, incl.:*
350 ha – Lviv region.
50 ha – Zhytomyr region.

Crop capacity: *40-60 t/ha (every 3-5 years)*

Annual growth: *16 000 t/year;*

Crop capacity cycle: *20-25 years;*

Heat of combustion : *18,0 MJ/kg;*

Substitution of gas: *3 000 th. m³/year of gas;*

Plans for the future: *6000 ha*

10 tons of wood chips from poplar substitute 2 500 m³ of gas

Growing of energy willow in Ukraine

Company: "Salix Energy"

Plantations area: 1 700 *ha*

Crop capacity: 20 *t/ha*

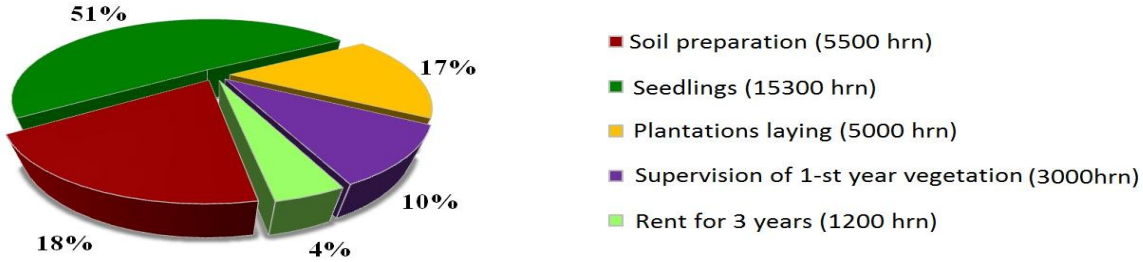
Annual growth: 34 000 *t/year* of chips

Crop capacity cycle: 25 *years*

Heat of combustion: 17,3-18,0 *MJ/kg*

Substitution of gas: 10 *mln m³/year of gas*

The cost of laying 1 hectare plantation with energy willow is 1,100 EUR



PJSC «Orel-Lieder» Biogas plant 5.5 MW

Construction: May 20, 2012 – Jan.16, 2013

Main tasks:
- Recycling 100% of chicken manure
- energy supply of poultry

Over the period of 2013-2015

Reduced: CO2 emissions - 270 000 *tonnes*

Disposed:
- Chicken manure - 100 000 *tonnes*
- Sorghum silage - 70 000 *tonnes*
- Other organic waste - 20 000 *tonnes*
- Sewage - 350 000 *m³*

Produced:
- Biogas - 35 *million m³*
- "Green" electricity - 70 *million kWh*
- "Green" heat - 10000 *Gcal*
- Replaced of natural gas - 1.2 *million m³*

Biofertilizers:
- Liquid - 350 000 *m³*
- Solid - 30 000 *tonnes*

Boiler Plant on Alternative Fuel

City: Vinnitsa
Start of operation: 2016
Capacity: 23.2 MW
(5.2 MW on wood chips, 18 MW on gas)
Type of fuel: wood chips
Investments: 3,6 mln EUR
Producer: VIESSMANN (Germany)

Boiler Plant supplies with hot water and thermal energy:

- ✓ **48 multi-flat buildings**
- ✓ **2 kindergartens**
- ✓ **1 school**

Potential volumes of replaced gas:
5,2 *million* m^3 *per annum*

Typical construction model of BioCHPP

Capacity: **5,3** *MW* – electricity
13 *MW* – heat power

Efficiency: **87%** (chips 1970 Kcal/kg)

Fuel: **chips, pellets**

Cost: **0.09** *EUR/kW*h*
23,8 *EUR/Gcal*

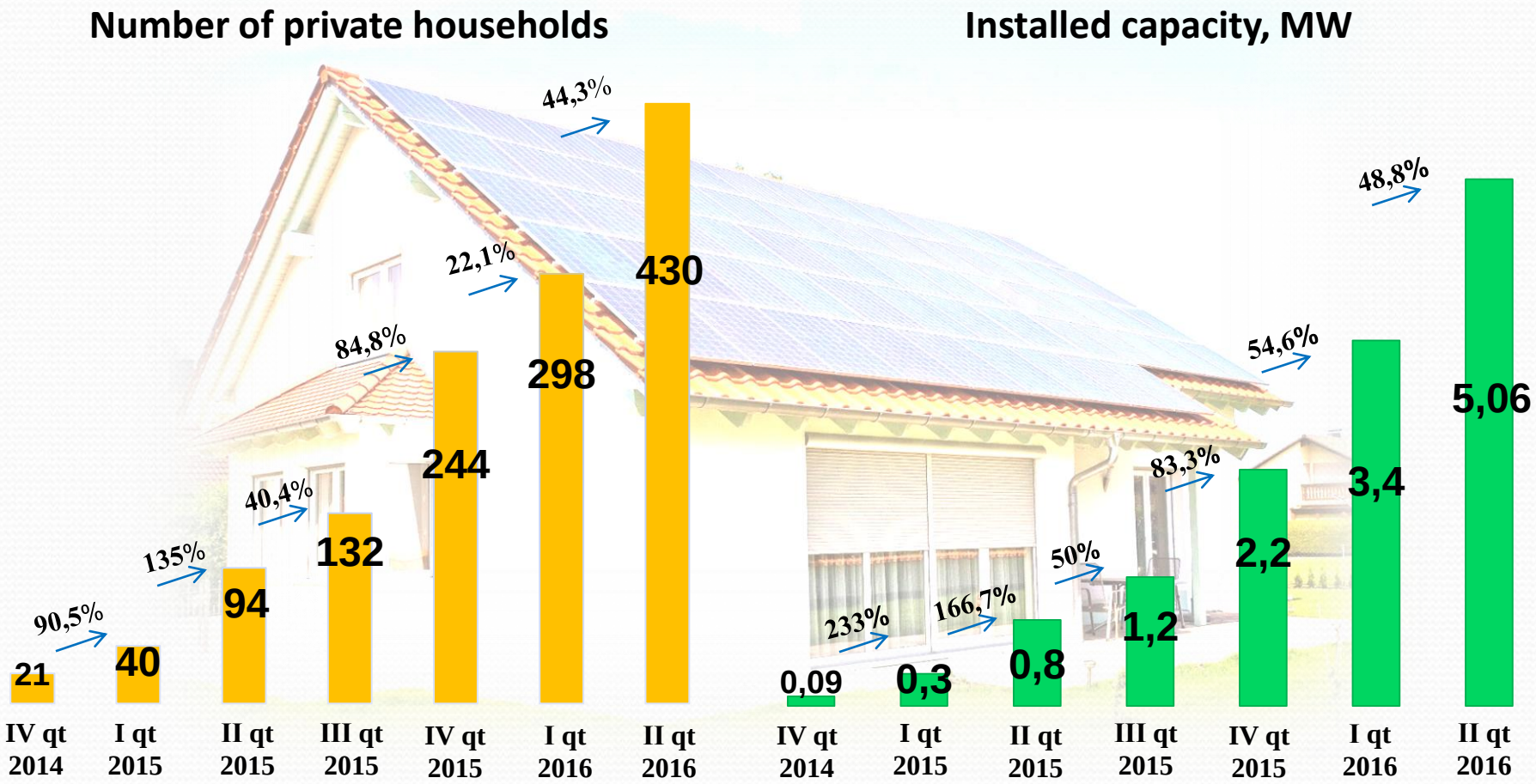
Rates: **0,12** *EUR/kW*h*
44 *EUR/Gcal*

Necessary investments about 16 million EUR

The payback period is 3.5 years from the date of commissioning

(construction time - 1 year)

Dynamics of solar installations in private households growth



The number of private houses applicable for solar panels installation is **6.5 million**

Energy Efficiency

Developed National Action Plan on Energy Efficiency for 2020

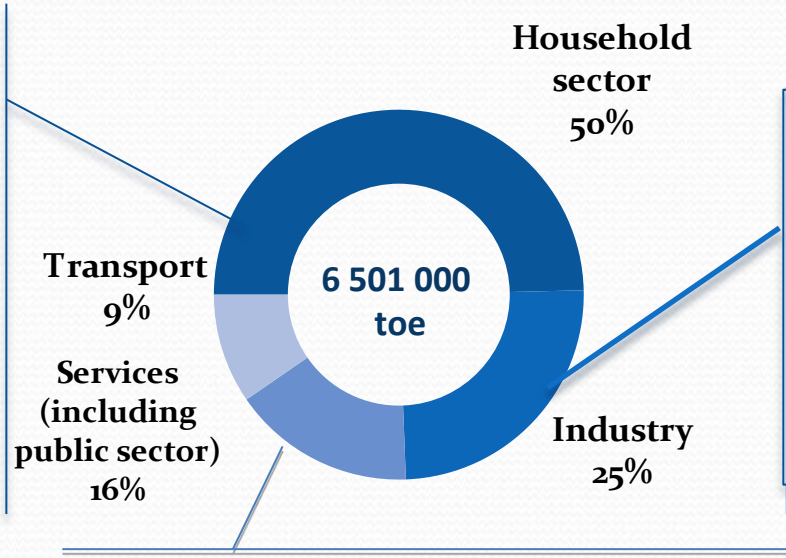
(Implementation of Directive 2006/32/EU)

Investments under NAPEE for years 2015-2020: 35 billion €

NEAP goal - 9% savings from the average final domestic consumption or 6 501 000 toe in 2020

Tools:

- ✓ adoption of 100-percent commercial accounting of energy use;
- ✓ institutionalization of buildings energy audit;
- ✓ state support (subsidizing the cost of thermal modernization);
- ✓ adaptation of building regulations and standards according to the requirements of the European legislation;
- ✓ the creation of an Energy Efficiency Fund.



Tools:

- ✓ energy labelling;
- ✓ eco-design;
- ✓ adoption of incentive tariff (RAB-regulation);
- ✓ unbundling of natural monopolies in the heat supply.

Tools:

- ✓ thermal modernization of 20% of the public sector;
- ✓ involvement of energy service companies (performance contracts);
- ✓ implementation of energy monitoring and energy management.

The volume of necessary investments to energy efficiency in buildings

Residential buildings (more than 5 floors)		Public entities
Multi flats	Individual	
Number of buildings		
≈ 80 thousand	≈ 6,5 million	≈ 100 thousand
Investment needs		
≈ from 48.5 to 86.9 bln. dollars. USA*		≈ from 4.2 to 8.5 bln. dollars. USA*
POTENTIAL ANNUAL GAS SAVINGS		
8 bln m3		700 mln m3

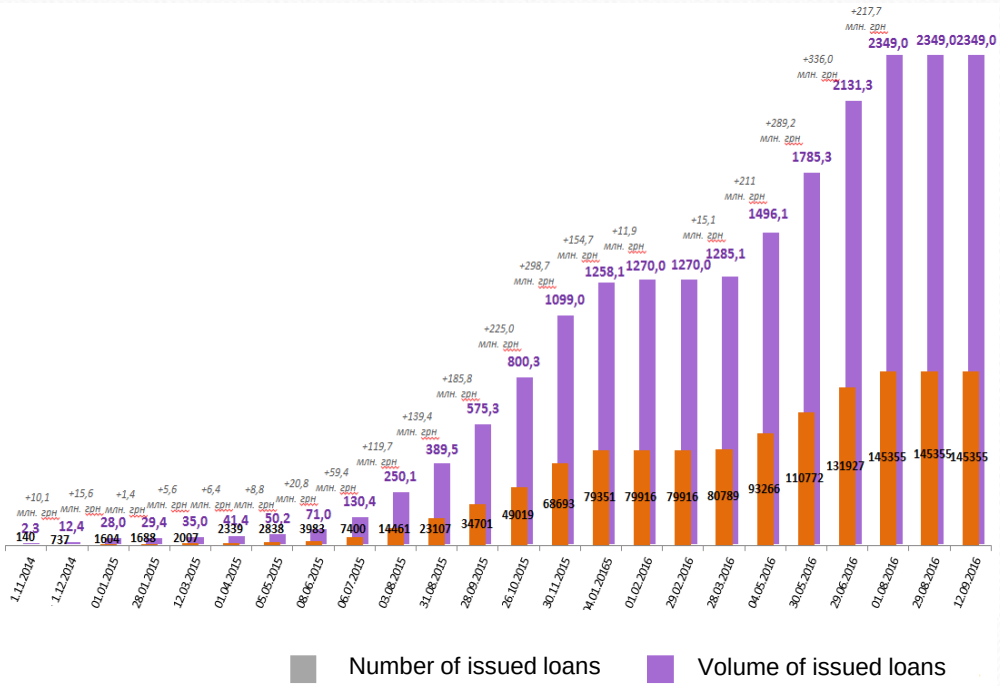
*Depending on the level of thermomodernization

Road Map to Introduce the Mechanisms of Energy Efficiency Stimulation

Mechanism

reimbursing the part of the principal of loans for energy efficiency measures*

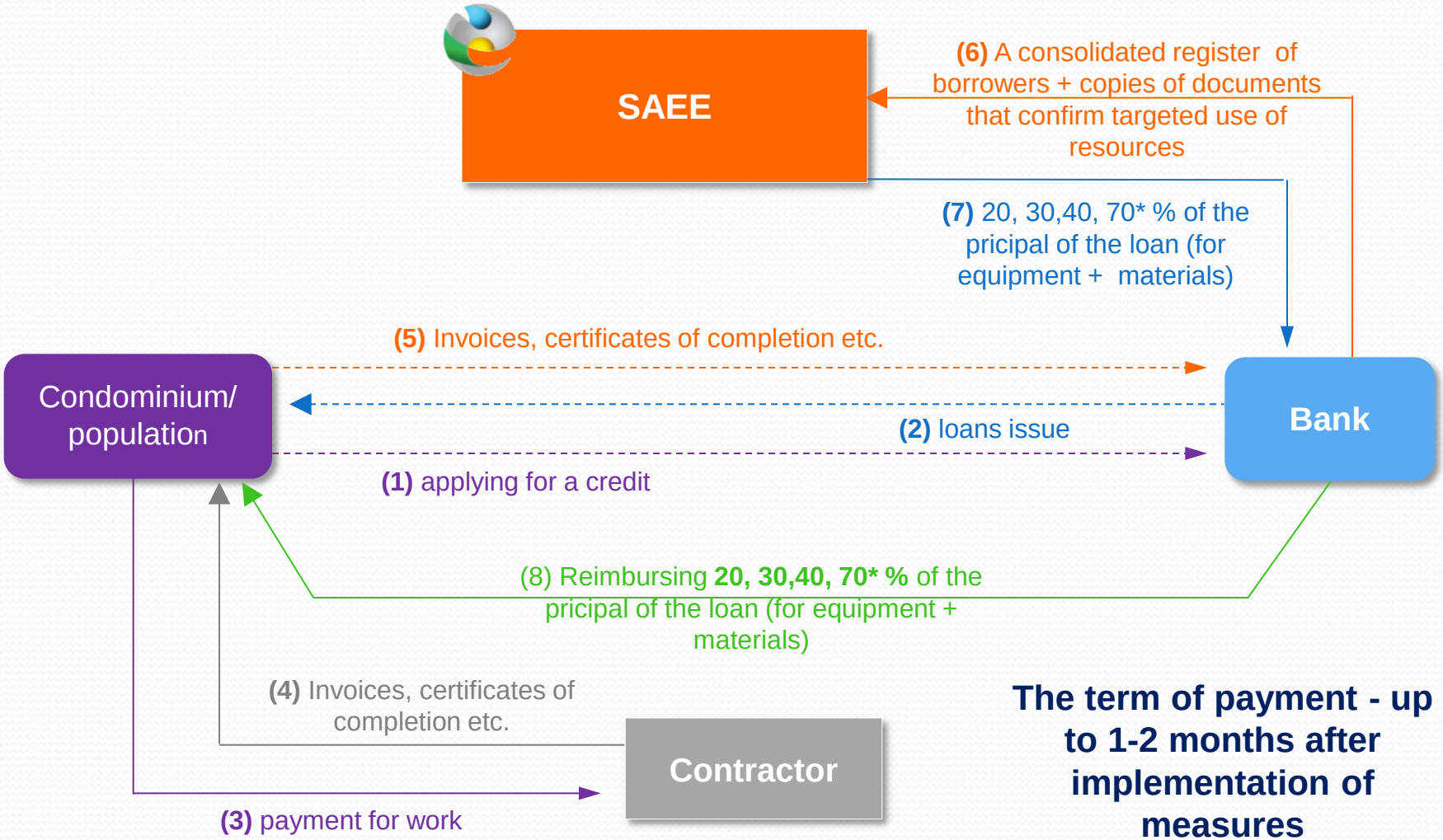
Monthly dynamics of demand for state support by individuals, condominiums, building co-operatives (replacement of gas boilers and purchase of energy-efficient equipment / materials)



Implementation Stages

1. Stimulating people to introduce biomass boilers (since 15.10.2014)
2. Application of the mechanism for condominiums and private houses for thermal modernization of houses (since 06.05.2015)
3. Increasing the amount of compensation for recipients of subsidies on utilities, expanding the list of energy efficiency equipment and materials (since 27.08.2015)
4. Continued implementation of the program in 2016 (the decision of the Government on 11.11.2015 №929)

State Support for Energy Saving Measures



The term of payment - up to 1-2 months after implementation of measures

*Since 27.08.2015 the amount of compensation for resipients of subsidies on utilities is increased up to 70%

State support is provided for the following energy-efficient equipment and materials:

For borrowers – individuals (single-family houses, two-family houses)

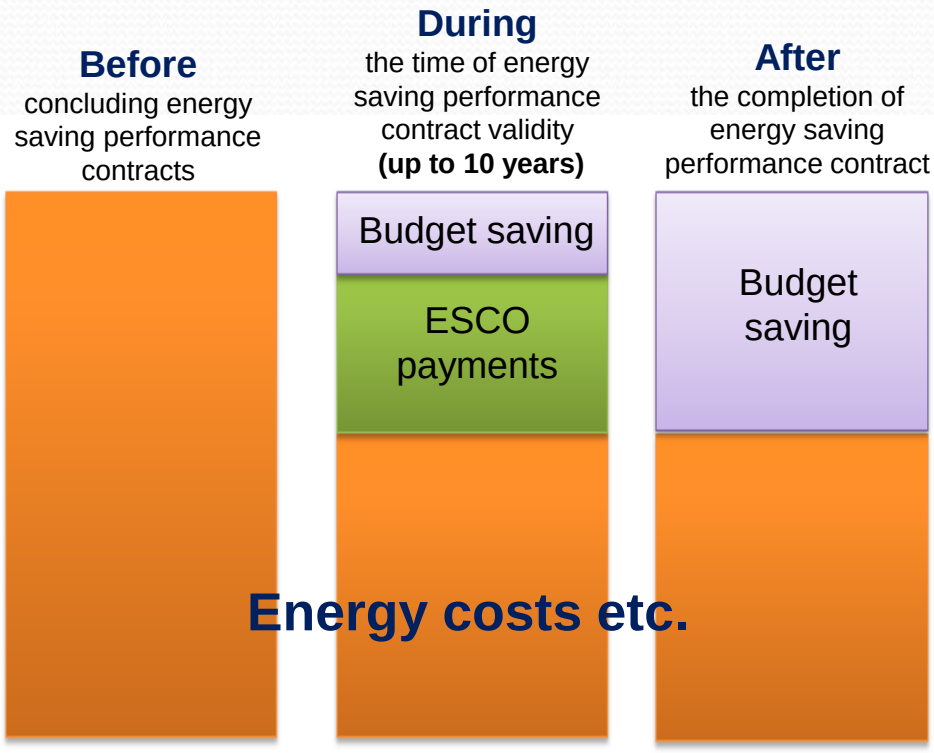
For condominiums (apartment buildings)

- materials for thermal insulation/modernization of the external walls of the residential building, basements, attics and roof
- energy efficiency windows and balcony doors
- heat and water meters, multizone (multiple-tariff) electricity meters
- **heat pumps**
- **solar thermal collectors**

- heat recovery ventilation
- heating radiators with thermostats
- Non-gas boilers (including solid fuel, heat-accumulating)
- individual heat point
- doors in public places
- materials and equipment for modernization of lighting systems, thermal modernization of internal heating systems, hot water supply (in public places)

Adopted Legal Framework for Energy Saving Performance Contracts in Public Buildings

ESCO-mechanism
(investment return from the achieved energy savings)



Result:

Creation of new ESCO-market with expected volume of
€4,4 billion

Development of market of energy efficient equipment and technologies

New jobs creation

Sample Energy Saving Performance Contract was adopted by the government on Oct 21, 2015

Next steps:

- **Developing of guidelines for Contracting Parties (on public purchasing procedures etc.)**
- **Creation of incentives for ESCO-market development**
- **Information campaign**

THANK YOU FOR YOUR ATTENTION!

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