



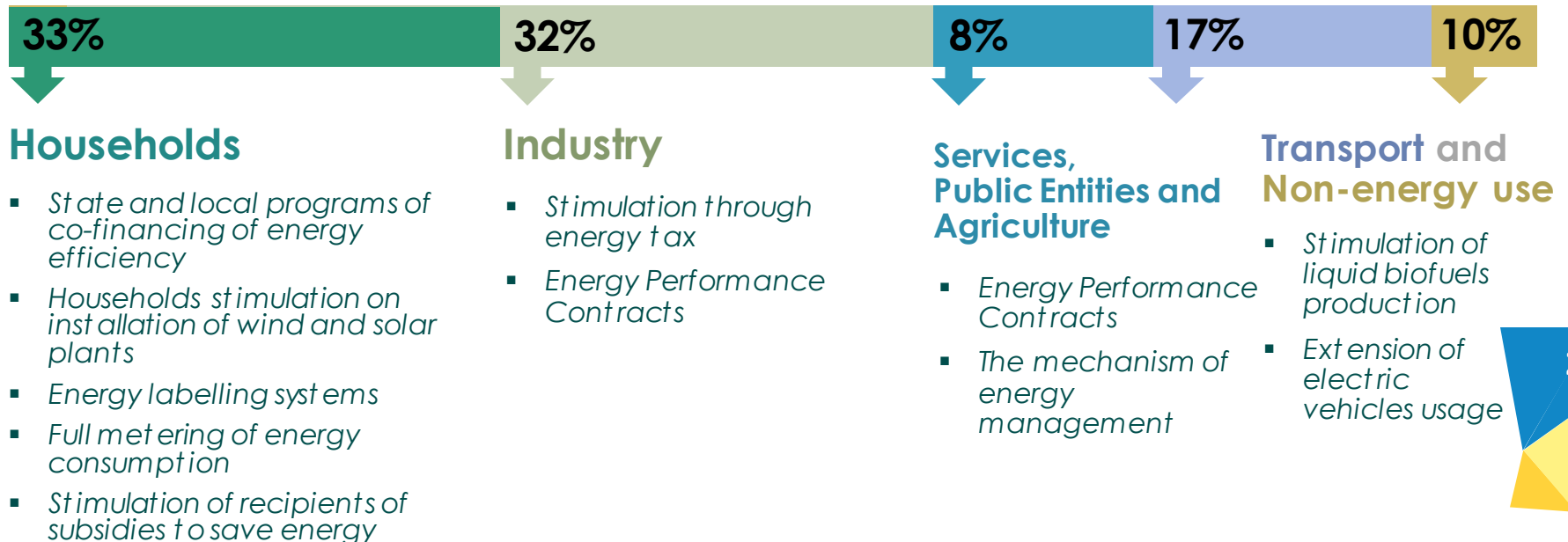
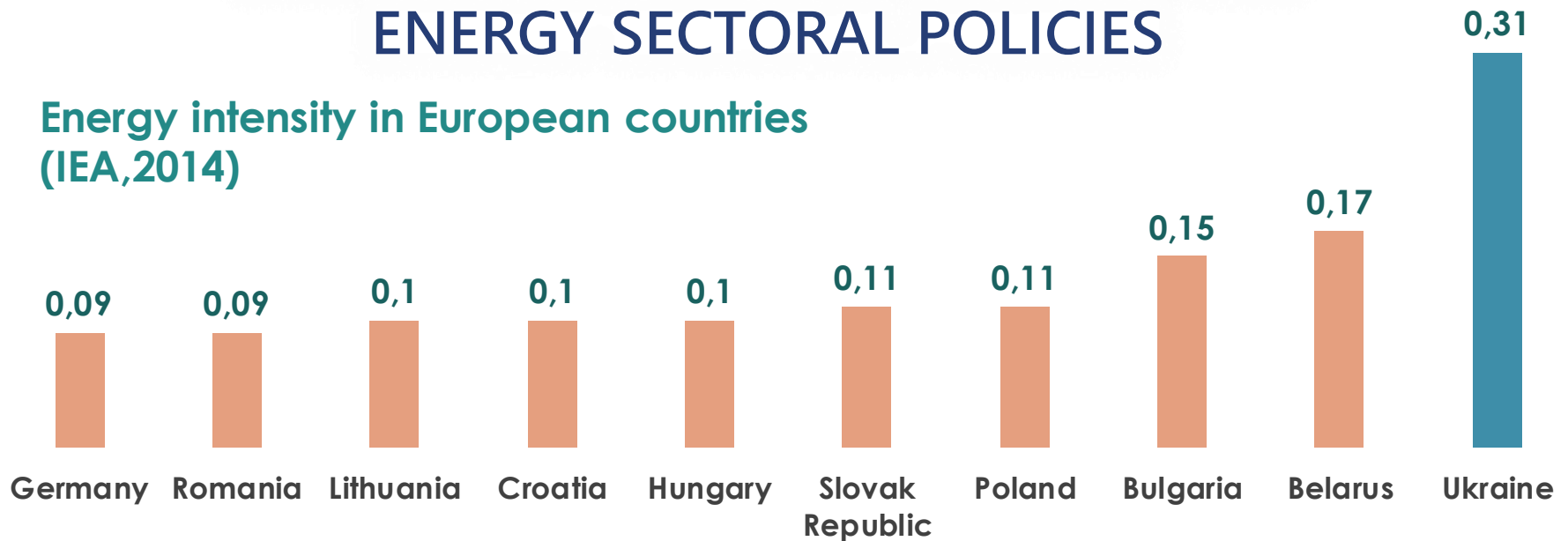
Investment attractiveness of renewable energy in Ukraine

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ENERGY EFFICIENCY AND RENEWABLE ENERGY SECTORAL POLICIES

Energy intensity in European countries (IEA, 2014)



Households

- State and local programs of co-financing of energy efficiency
- Households stimulation on installation of wind and solar plants
- Energy labelling systems
- Full metering of energy consumption
- Stimulation of recipients of subsidies to save energy

Industry

- Stimulation through energy tax
- Energy Performance Contracts

Services, Public Entities and Agriculture

- Energy Performance Contracts
- The mechanism of energy management

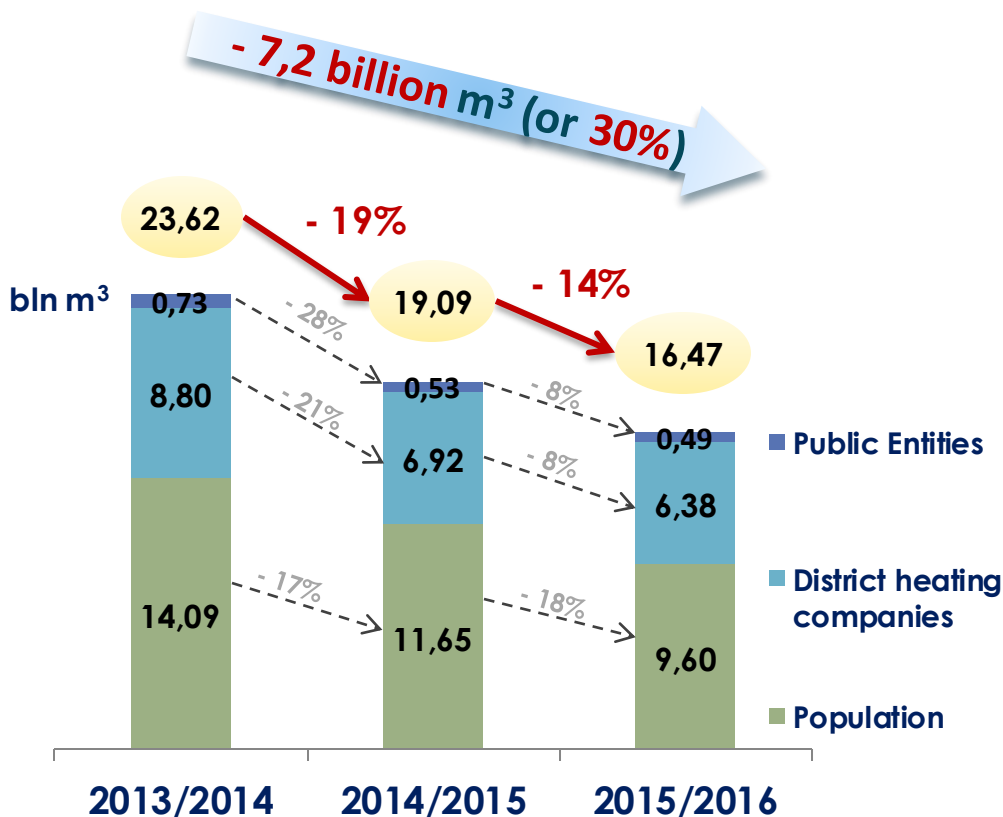
Transport and Non-energy use

- Stimulation of liquid biofuels production
- Extension of electric vehicles usage

KEY PRIORITY: SUBSTITUTION OF NATURAL GAS

Reduction of gas consumption

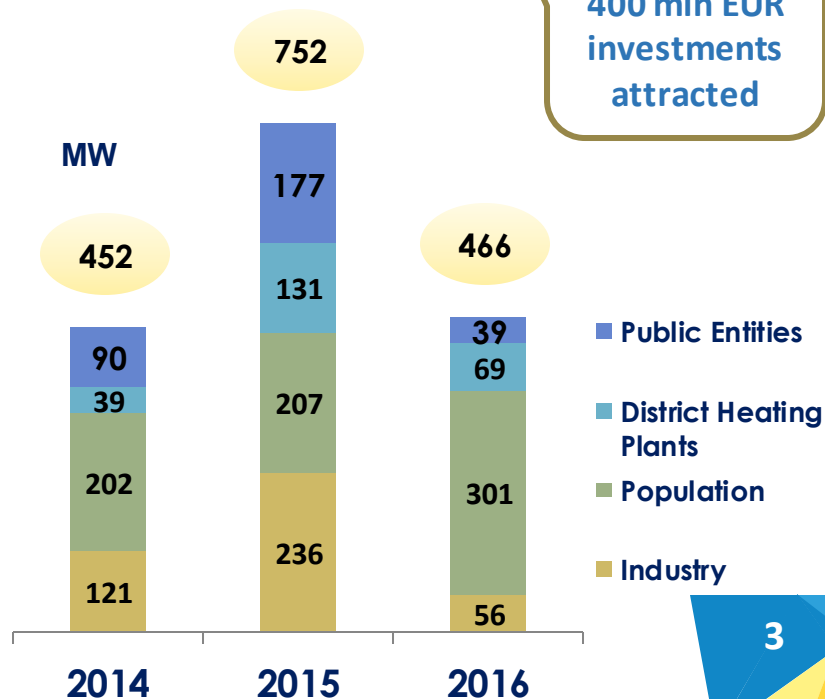
during heating periods 2013 / 2014, 2014 / 2015 and 2015 / 2016*



New biomass heat generation facilities

launched in 2014, 2015, 2016 **

Σ 1 670 MW



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

**According to regional state administrations.



NATIONAL TARGETS ON ENERGY EFFICIENCY AND RENEWABLES

National Renewable Energy Action Plan-2020

as of Oct.1, 2014, № 902-p

11%

of Renewables in final
energy consumption

National Energy Efficiency Action Plan-2020

as of Nov.25, 2015, № 1228-p

-9 % (6,5 mln t.o.e.)

of energy saving comparing
to the average final energy
consumption in 2005-2009

Ukraine was the 20th country to ratify the Paris Agreement

**The share of renewables in primary energy supply should be 25%
according to New Energy Strategy till 2035**

TARGETS OF NATIONAL RENEWABLE ENERGY ACTION PLAN TILL 2020 (NREAP)

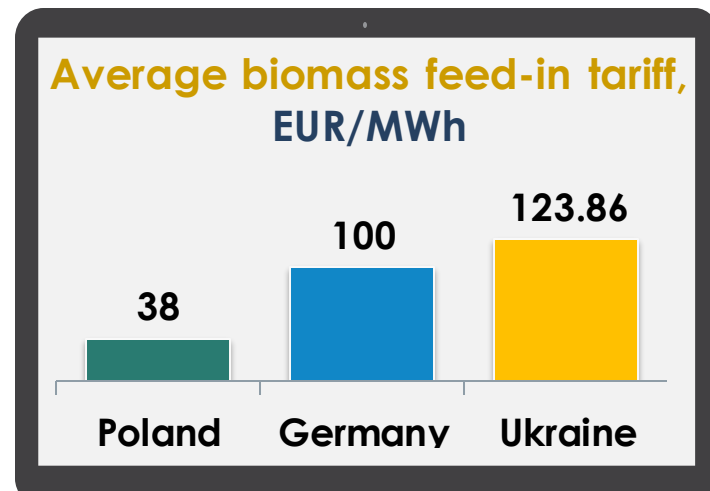
	2009	2016	2020
Power plants installed capacity	4 625 MW	7 977 MW	10 900 MW
Power generation	11 471 GWh	18 726 GWh	26 000 GWh
Heat and Cooling	1 473 thou. toe	3 576 thou. toe	5 850 thou. toe
	14 730 thou. Gcal	35 760 thou. Gcal	58 500 thou. Gcal
Transport	52 thou. toe	298 thou. toe	505 thou. toe

**€ 12 BLN– REQUIRED INVESTMENTS TILL 2020
FOR NREAP IMPLEMENTATION**

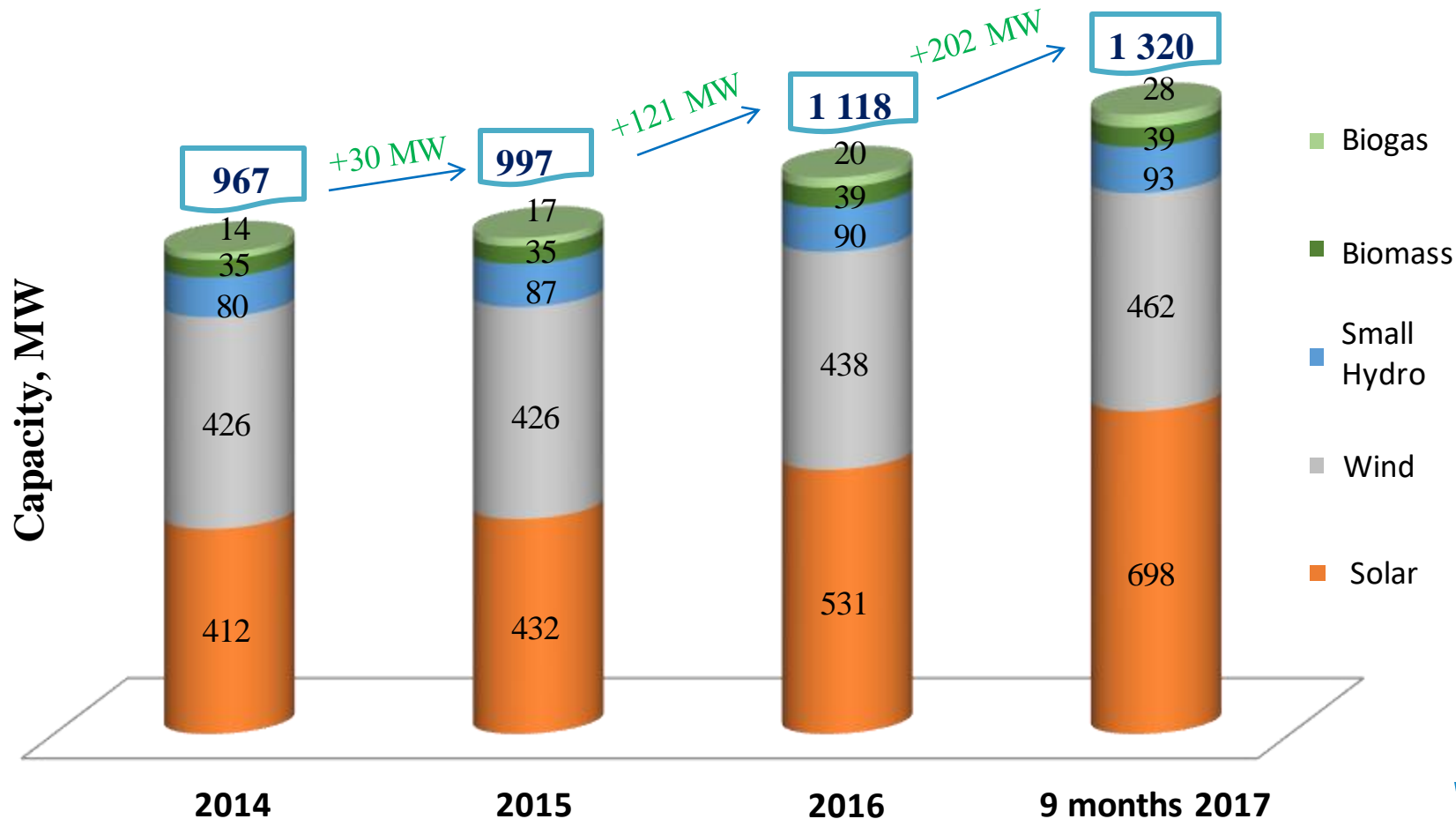
LAW OF UKRAINE «ON FOSTERING RENEWABLE ENERGY DEVELOPMENT»

Technology/Comm. Year	2015	2016	2017-2019	2020-2024	2025-2029
Biomass	123.86	123.86	123.86	111.48	99.09
Biogas	123.86	123.86	123.86	111.48	99.09
Geothermal	150.25	150.25	150.25	135.17	120.09
Small Hydro (0.2-1MW)	139.48	139.48	139.48	125.48	111.48
Small Hydro (1-10MW)	104.47	104.47	104.47	94.24	83.47
Solar (ground based)	169.64	159.94	150.25	135.17	120.09
Solar (roof based)	180.41	172.33	163.71	147.56	130.86
Wind (>2MW)	101.78	101.78	101.78	90.47	79.16
Solar (private households)	200.32	190.09	180.94	162.63	144.86
Wind (private households)	116.06	116.06	116.06	104.47	93.16

- Premium for Ukrainian equipment usage is provided – 5-10% to existing tariff;
- Signing of bankable long-term Power Purchase Agreement (PPA) with feed-in tariff till 2030;
- Stimulating tariffs for heat produced from alternative sources envisaged.



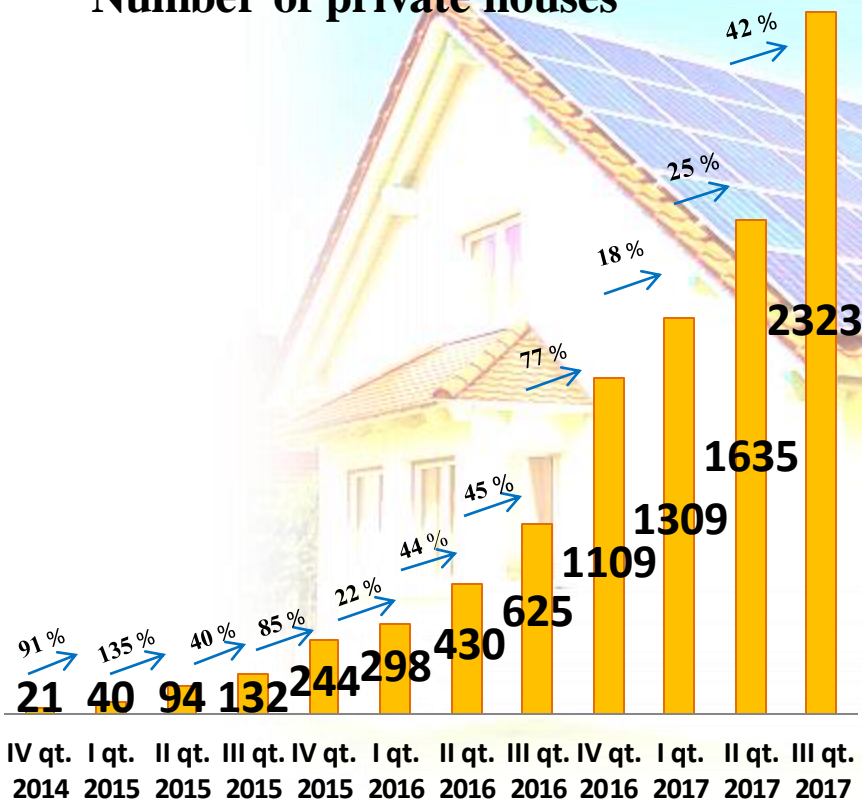
INSTALLED CAPACITY OF RENEWABLE ENERGY OBJECTS WORKING UNDER THE "GREEN" TARIFF



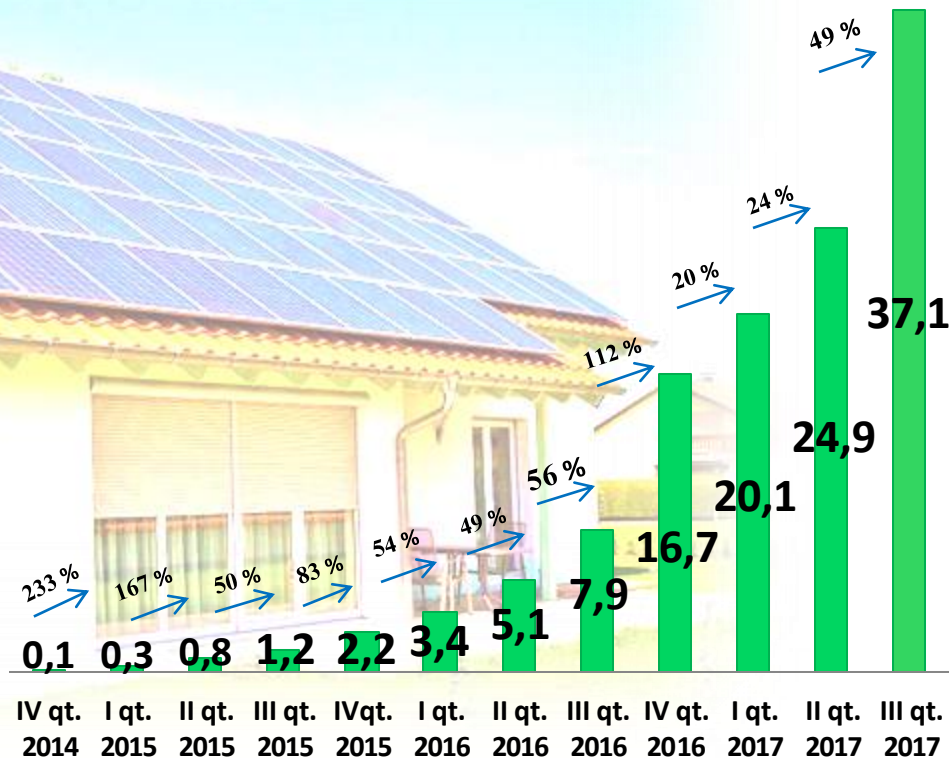
From the beginning of 2015, 353 MW were introduced and more than € 345 mln were invested.

DYNAMICS OF SOLAR INSTALLATIONS IN PRIVATE HOUSES

Number of private houses



Installed capacity, MW



€ 34,7 mln investments attracted

The number of private houses eligible for solar panels installation is 6,5 mln

EXAMPLES OF SUCCESSFUL RENEWABLE PROJECTS

Biogas plant 5.5 MW (PJSC "Orel-Lieder")



Recycling 100% of chicken manure for energy generation

Produced **Biogas:**

35 million m³/year

Produced "Green" electricity:

70 million kWh/year

Produced "Green" heat:

10000 Gcal/year

Energy willow (SALIX energy)



Company: «**SALIX energy**»

Plantations area: **1 700 ha**

Crop capacity: **20 t/ha**

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

Crop capacity cycle: **25 years**

Heat of combustion:

17,3-18,0 MJ/kg

Boiler station on renewable fuels



The boiler station provides heat and hot water for 4 municipal medical institutions

Installed capacity: **10,5 MW**

Type of fuel: **pellets**

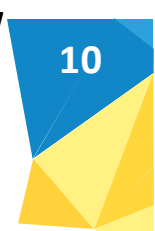
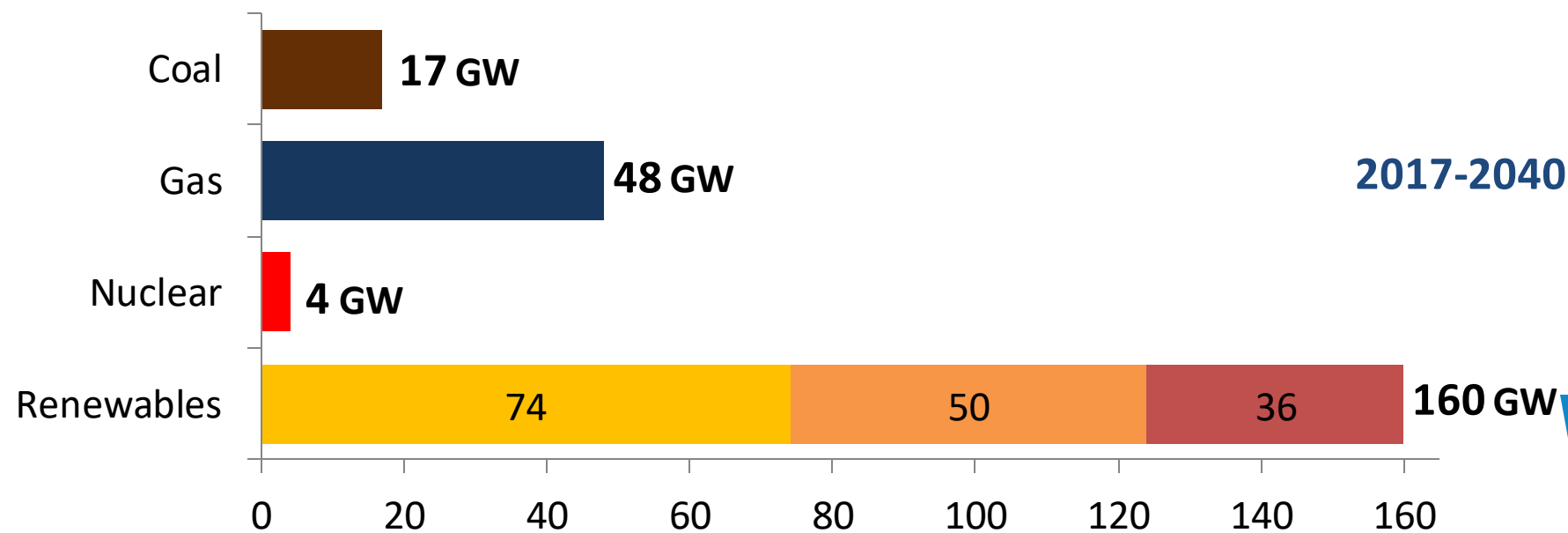
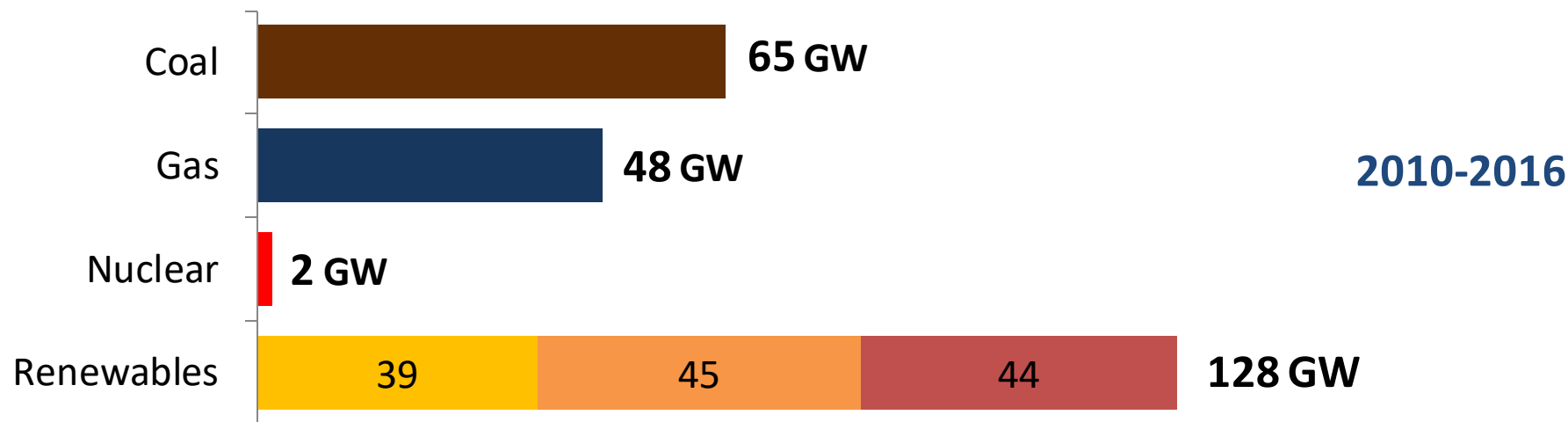
Investments: **€ 1,5 mln**

Put into operation: **2015 year**

Investor:

APS Power Technology

GLOBAL AVERAGE ANNUAL NET CAPACITY ADDITIONS BY TYPE



CURRENT SITUATION ON WASTE IN UKRAINE

Status: 93% of waste are sent to landfills

Aim: more than 90% of waste to be sent to “waste to energy” plants



6 148
landfills



32 984
unauthorized
landfills

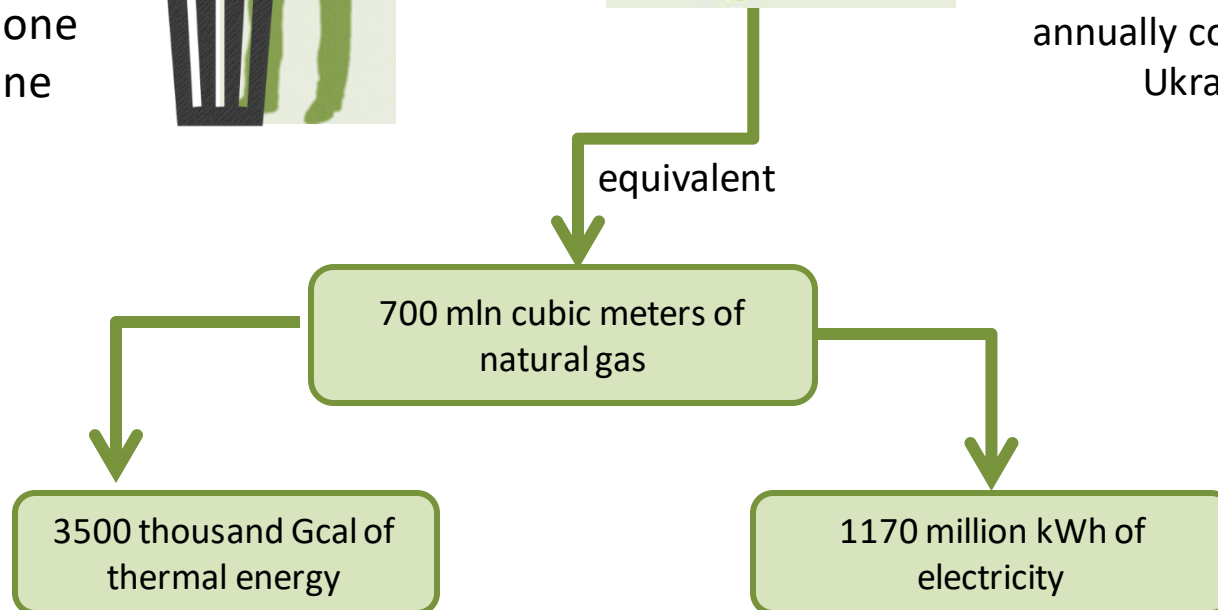
300 – 350 kg

of household waste
is produced by one
person in Ukraine



10 mln tonnes

of generated
household waste is
annually collected in
Ukraine

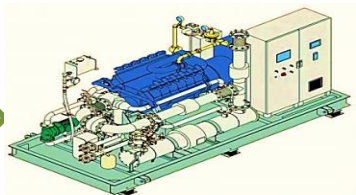


MODEL OF COMPLEX WASTE PROCESSING



Biogas

III. 600 million cubic meters



Cogeneration unit

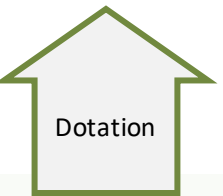
IV. Electricity
1170 million kWh *
(16.17 ¢ / kWh)



«Feed – in tariff»



Condominiums



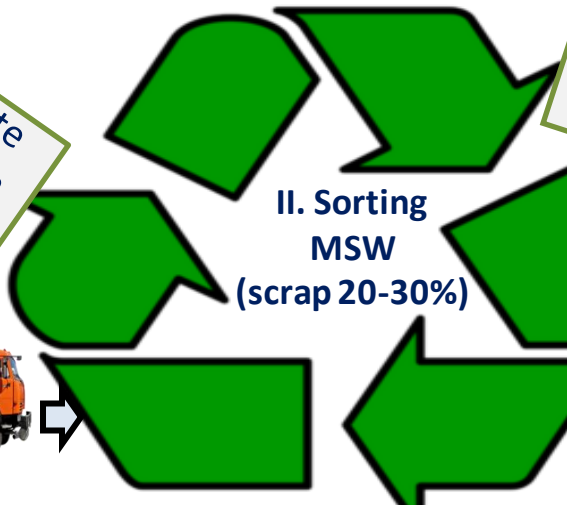
Dotation



Municipalities

V. Residue (biologically inactive) 80% (4.0 million tons)

Food waste (50%) (5 mln tonnes)



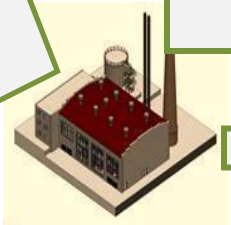
II. Sorting MSW (scrap 20-30%)

IV. Heat - 1300 mln Gcal



IV. Heat - 2,200 mln Gcal

III. RDF 10-15% (1,0 mln tonnes)



Boiler station



Ash

I. MSW landfilling (10 mln. t)

Residues (Biologically inactive) 10-15% (1,5 mln. t)

Landfill (5,7 mln. t)

V. MSW residues (20% from RDF) (0.2 million tons)



Example of Khmelnitsky city:

- produced **80 thsd tonnes. Solid waste/annually**
- Investments into recycling complex – **12 mln EURO;**
- **1,2 MW** electricity;
- **10 MW** heat power;
- recouptment **from 6 years.**





INVEST in UKRAINE!

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