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**UNDP/Ministry of Economy Project  
Supporting Uzbekistan in transition to a low-emission  
development path"**

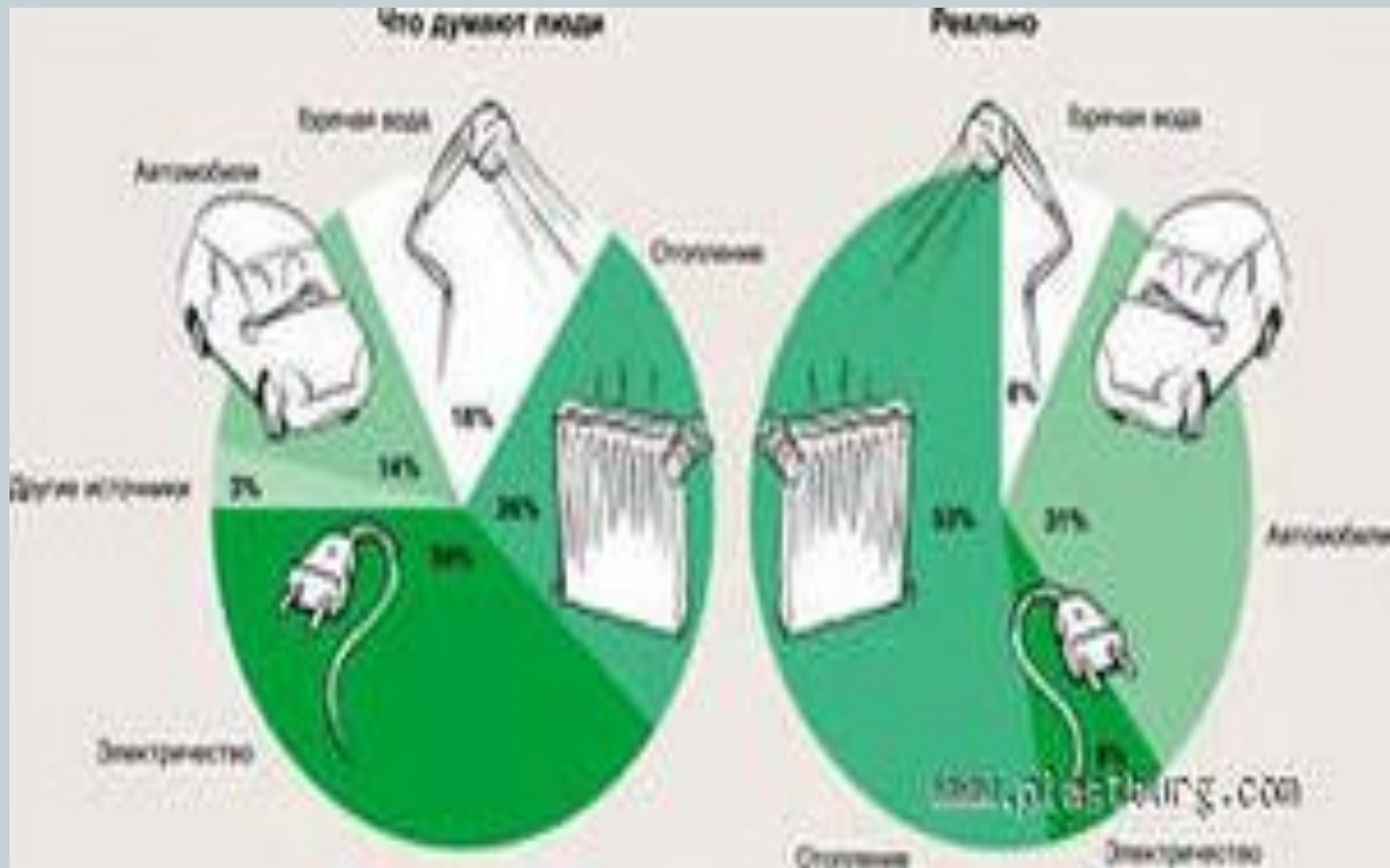


# **ENERGY EFFICIENCY IN THE BUILDINGS: HIDDEN CAPACITY FOR SUSTAINABLE DEVELOPMENT IN UZBEKISTAN**

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# Nearly half of primary energy is spent for energy supply of the buildings in Uzbekistan



# Energy consumption in the buildings (2011 )



In 2011, all buildings consumed as much energy :

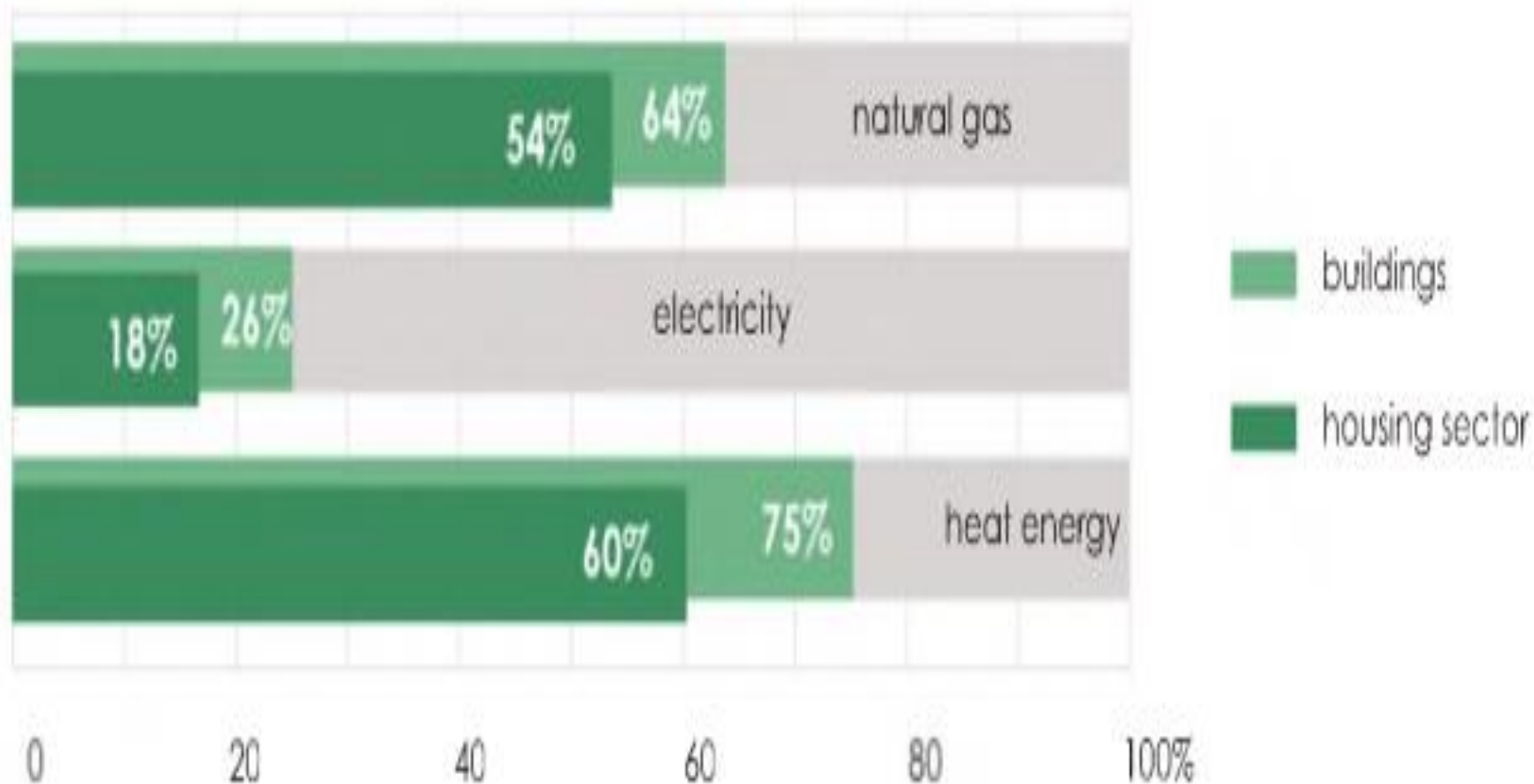
- Primary energy- around **50%**
- Final energy – **55%**

including energy saving in **residential** buildings:

- Primary energy – **41%**
- Final Energy – **46%**



# Final consumption of the energy in buildings (2011)



# Energy consumption in buildings



Given electricity generation and heat generation, **56%** of all natural gas consumption in the country falls upon buildings' needs

Natural gas makes **84%** in the energy consumption mix in the residential buildings

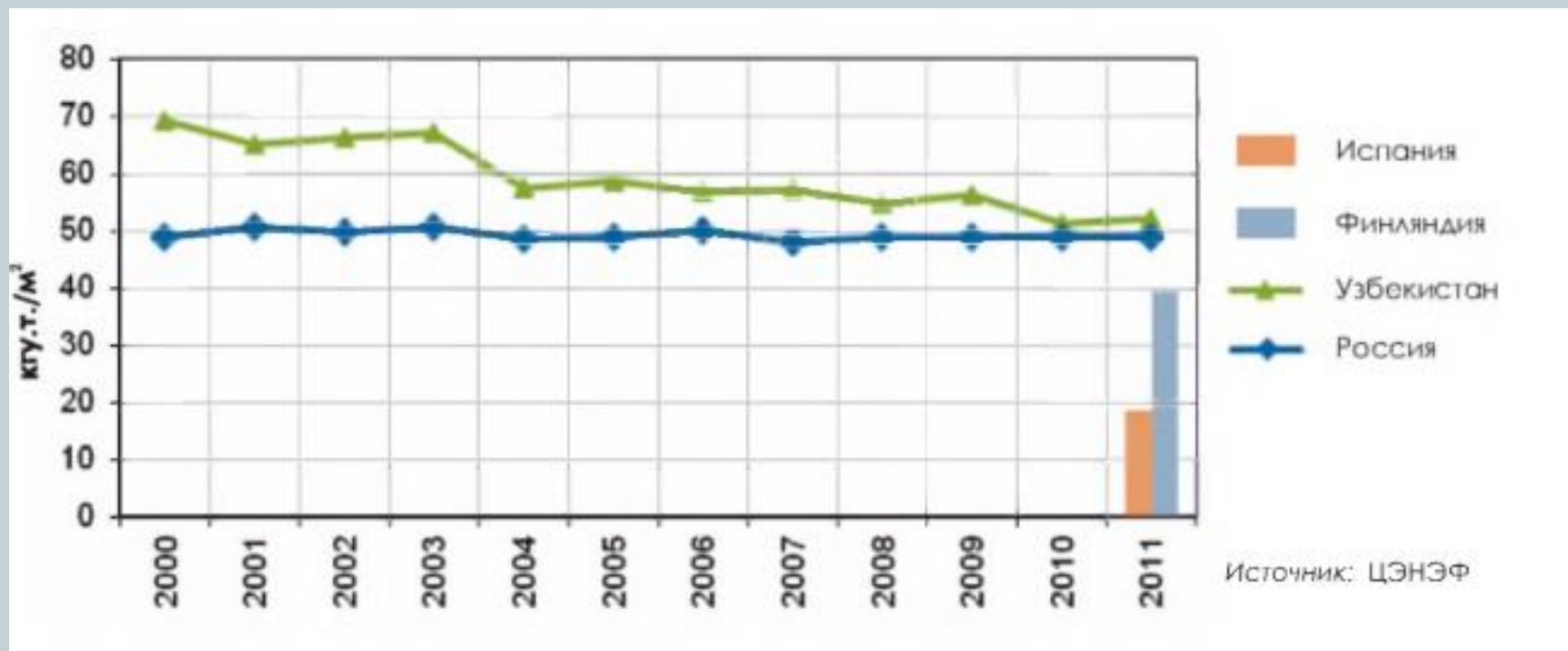
**Population's total energy consumption equals to 15-16 mln tons of oil equivalent**



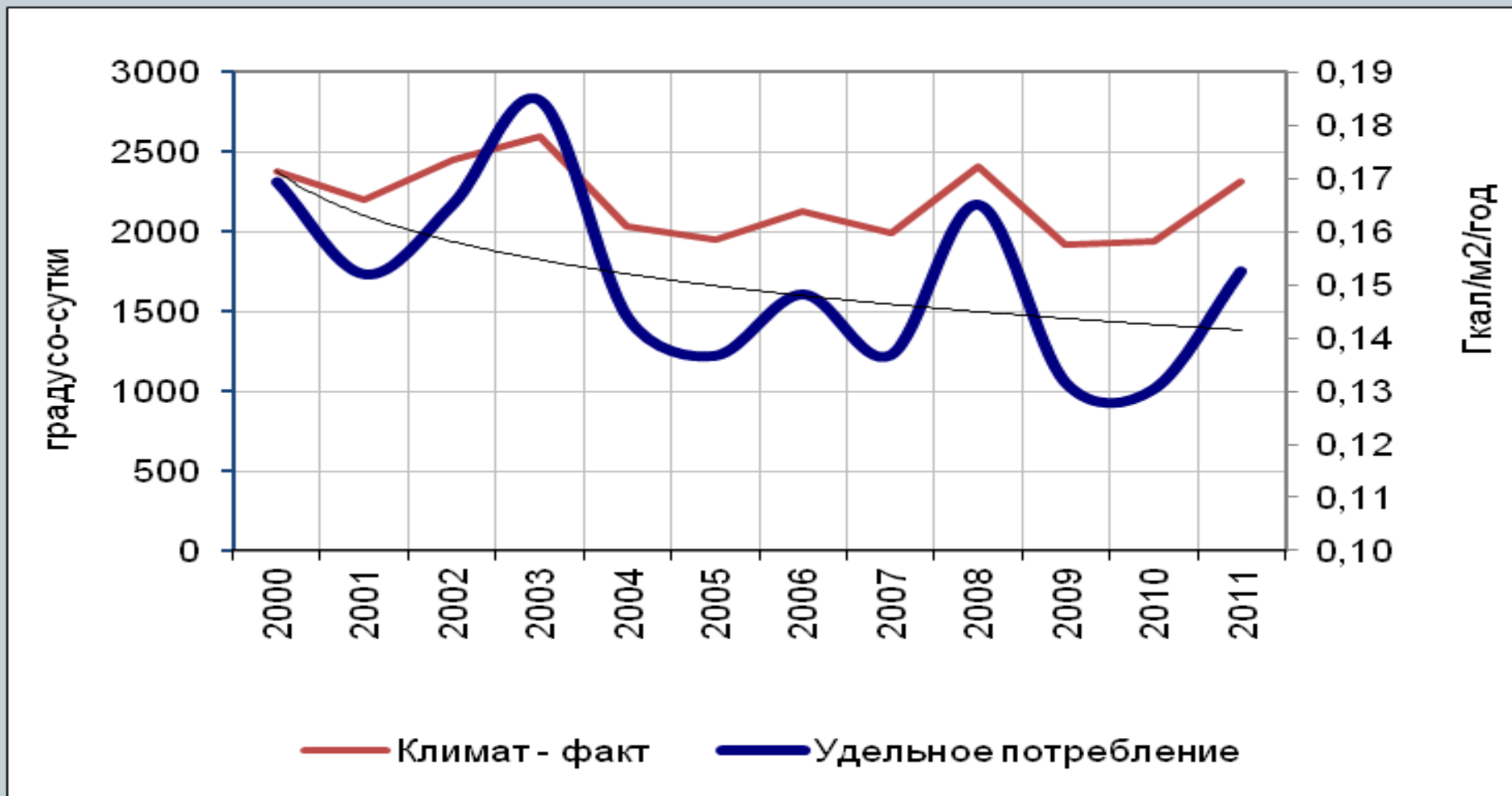
# Energy consumption in the buildings (2011)



Specific rate of energy consumption per 1 m<sup>2</sup> of residential area equals to 52 kg of reference fuel or 423 kWh/year



# Specific rate of energy consumption to heat residential buildings and changes in degree-day



# Energy consumption in buildings (2011)

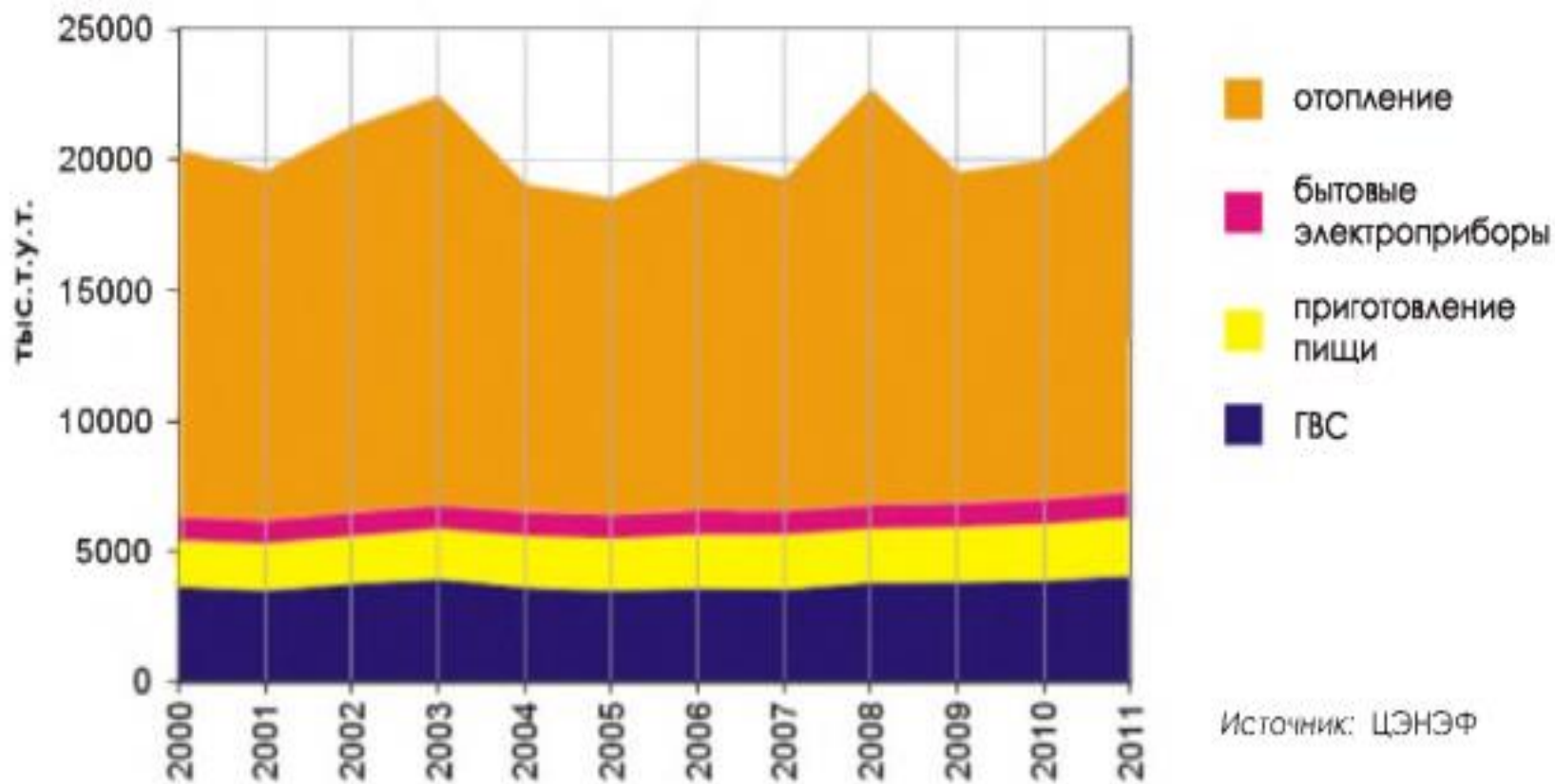


**Two third of energy consumed by the population is used to heat home**

<b>Average consumption of energy to heat all buildings</b>	<b>0,121 Wh/m<sup>2</sup>/degree-day</b>
<b>Average consumption rate to heat apartment buildings</b>	<b>0,035-0,065 watt-hour/m<sup>2</sup>/degree-day</b>
<b>Average consumption rate to heat individual houses</b>	<b>0,136 watt-hour/m<sup>2</sup>/degree-day</b>
<b>For EU countries</b>	<b>0,035-0,06 watt-hour/m<sup>2</sup>/degree-day</b>



# Energy consumption in buildings (2011)



Источник: ЦЭНЭФ

# Potential to save energy in buildings' sector



# Main definition of the energy saving potential



**Technical** (technological) potential

**Economic** potential – part of technical potential, that is economically attractive for applying public criteria to make investment decisions .

**Market** potential – part of economic potential. It is used when applying private criteria to make investment decisions in real market conditions

# Technical potential to save energy in housing sector (thousands of tons of reference fuel)

Approach	Heat energy	Electricity	Natural gas	Coal	Other solid fuels	Total
Passive houses	871,4	-15,9	16724,8	50,0	5,7	17636
New construction codes	871,4	662,1	12156,8	33,06	4,6	13728

# Potential to save energy in housing sector

## Housing sector

### Technical potential

- 17,6 mln t.r.f. (77%);
- 13,8 mln t.r.f. (61%,).

### Economic potential

- 14,9 mln t.r.f.
- 13,8 mln t.r.f.

### Market potential

- 4,1 mln t.r.f.
- 0,3 mln t.r.f.

## Public and social buildings

### Technical potential

-

- 2,4 mln t.r.f. (70%);
- 2,9 млн. t.r.f. (84%,).

# Potential to save energy at the heat supply sources



## Technical potential to save :

- Natural gas – 7 bln. m<sup>3</sup> (8,1 t.r.f.).
- Coal – 1,6 mln tons (499,7 thousand t.r.f.).
- Electricity – 646,9 mln kWh (79,6 thousand t.r.f.).
- Additional power generation by turbo expander machines at TPP and by co-generation units at boiler-rooms – 1,2 bln kWh (145,0 thousand t.r.f.).

**Totally: 8,8 mln t.r.f., or 39,8%.**

# Potential to save energy at the heat supply sources



**Technical potential** - 8,8 mln. t.r.f. (39,8%);

**Economic potential** - 5,4 mln. t.r.f.

**Market potential** - 97 thousand t.r.f.

# Costs of energy saved at heat supply sources when implementing energy saving measures and energy efficiency measures





# Raise potential of energy saving in buildings' sector



Technical potential of energy saving can be raised through addressing the following priority issues:

- Reduce, gradually, cross-subsidizing between population and other groups of consumers;
- Encourage local producers of energy efficient materials, products and equipment;
- Encourage households, thorough subsidies and other mechanisms, to implement energy efficient measures;
- Introduce “white” and “green” certifications.

## **Raise energy saving potential in boiler-rooms and Central heating and power plants (CHPP)**

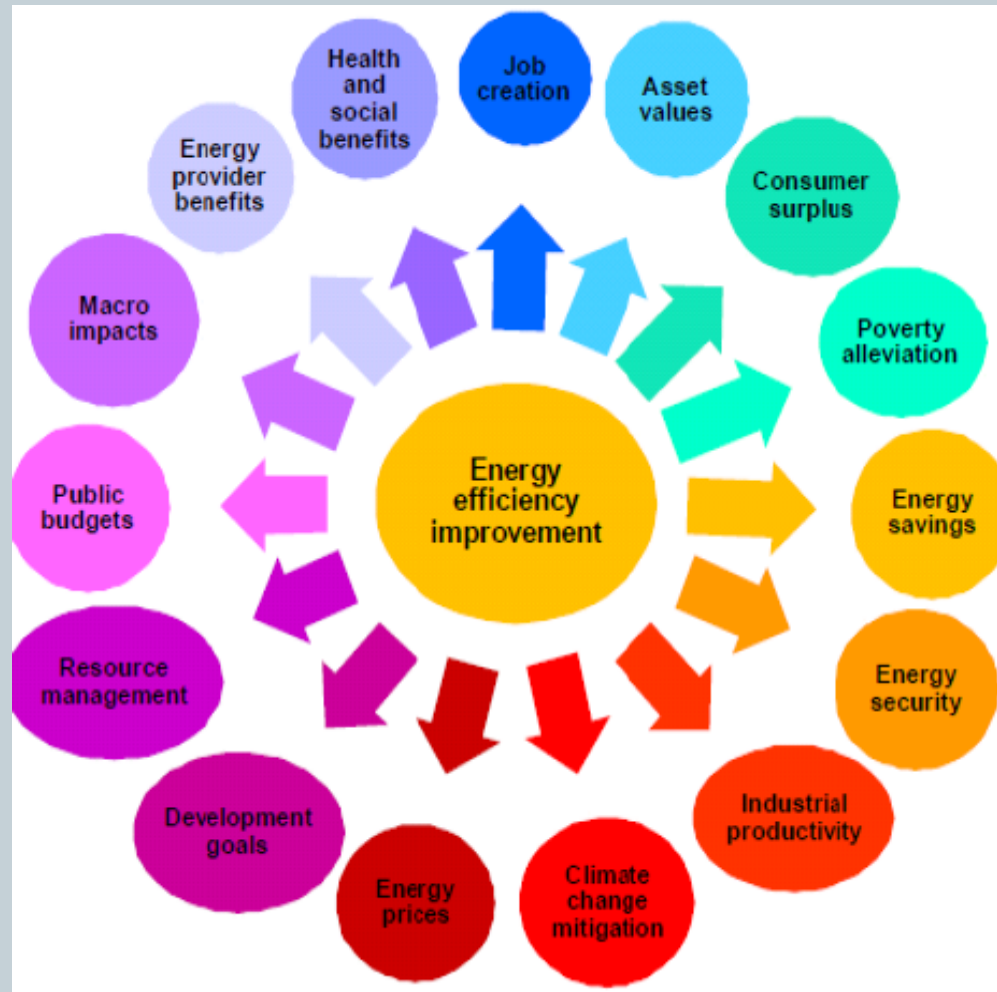


**The following energy saving and energy efficient actions/technologies are advisable both economically and financially :**

- Commission unit-based shaft turning gear in boiler-rooms;**
- Introduce turbo expander machines at CHPP and TPP**

**Costs of saved energy will not exceed \$157/t.r.f.  
(CSE<\$157/t.r.f.).for these energy saving activities**

# Costs and socio-economic benefits



# Baseline scenario (till 2050)



## Main assumptions:

Existing Construction codes will not be revised up to **2050**

Share of apartment buildings commissioning will stay at **2%**

Renewable energy in hot water supply will not exceed **6,5%** till **2050 r.**

Housing stock will reach **949-987 m<sup>2</sup>**. Housing per capita will reach **26 m<sup>2</sup>/person**.

## Main results:

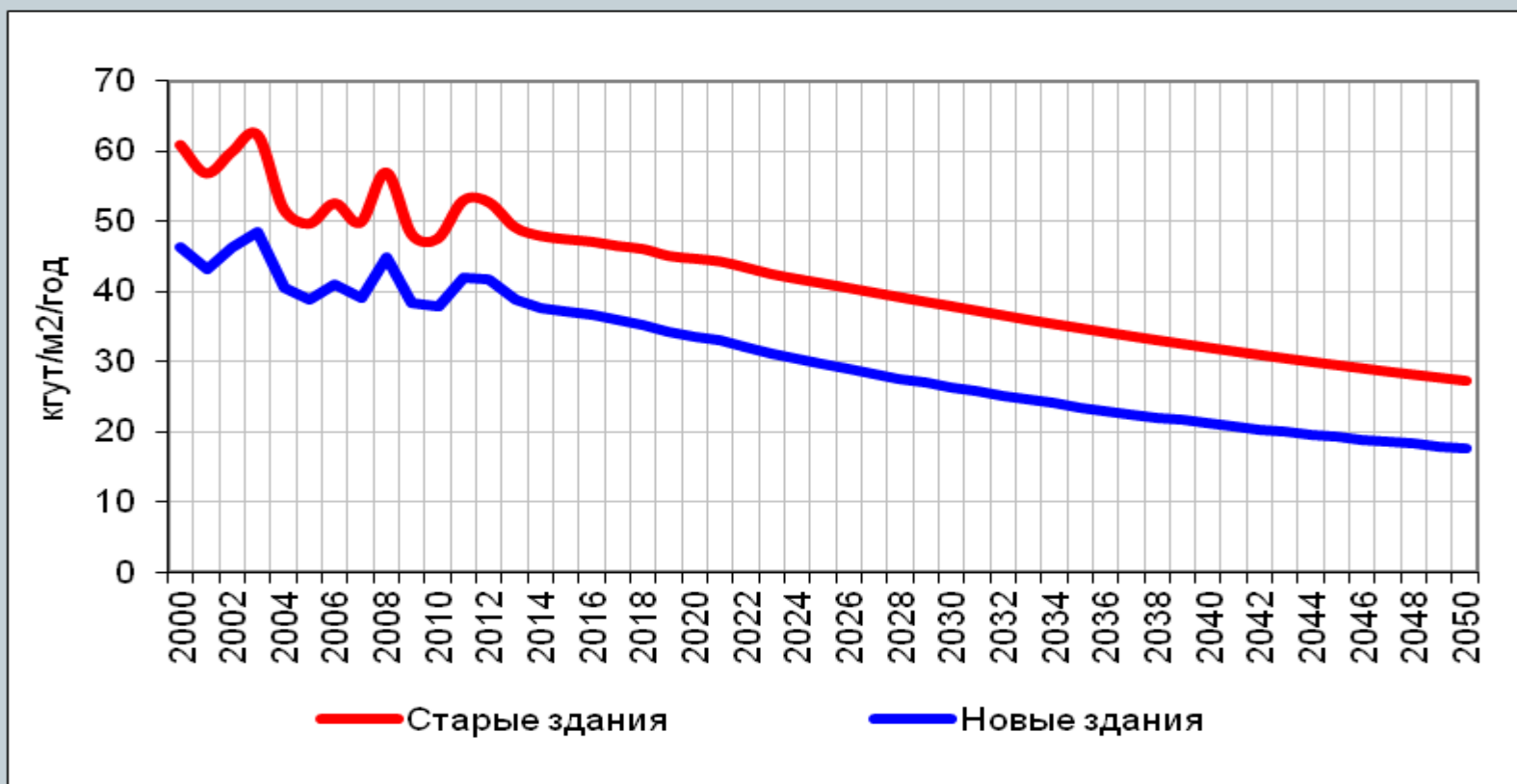
Specific energy consumption (SEC) will be nearly **twice** as low

For new buildings, SEC will be below **20 kg r.f./m<sup>2</sup>/year** or **163 kWh/m<sup>2</sup>/year**

Growth rate in energy consumption in public and social buildings - **37%**

# Baseline scenario (till 2050)

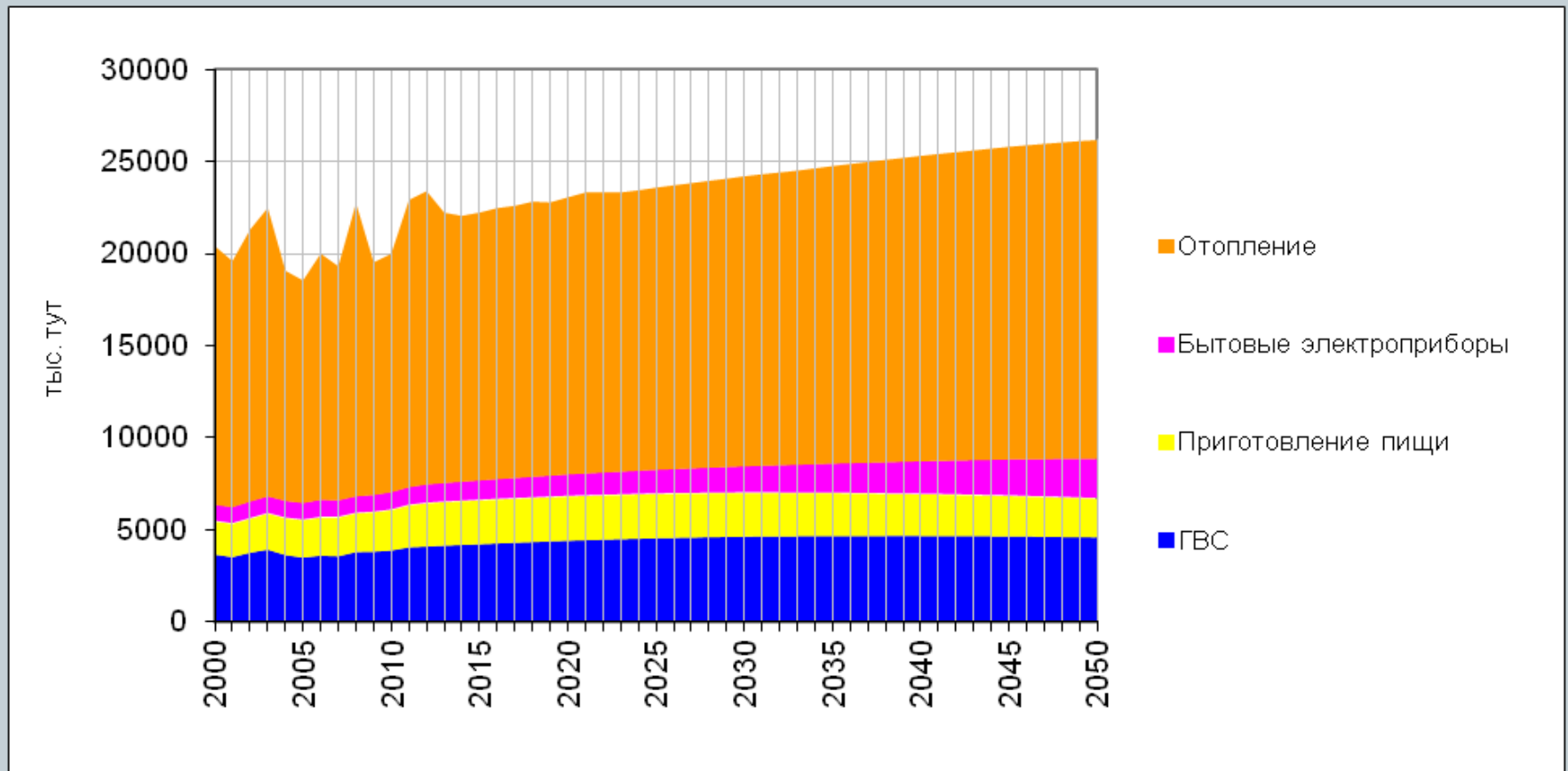
## Specific energy consumption by groups of buildings



# Baseline scenario(till 2050)

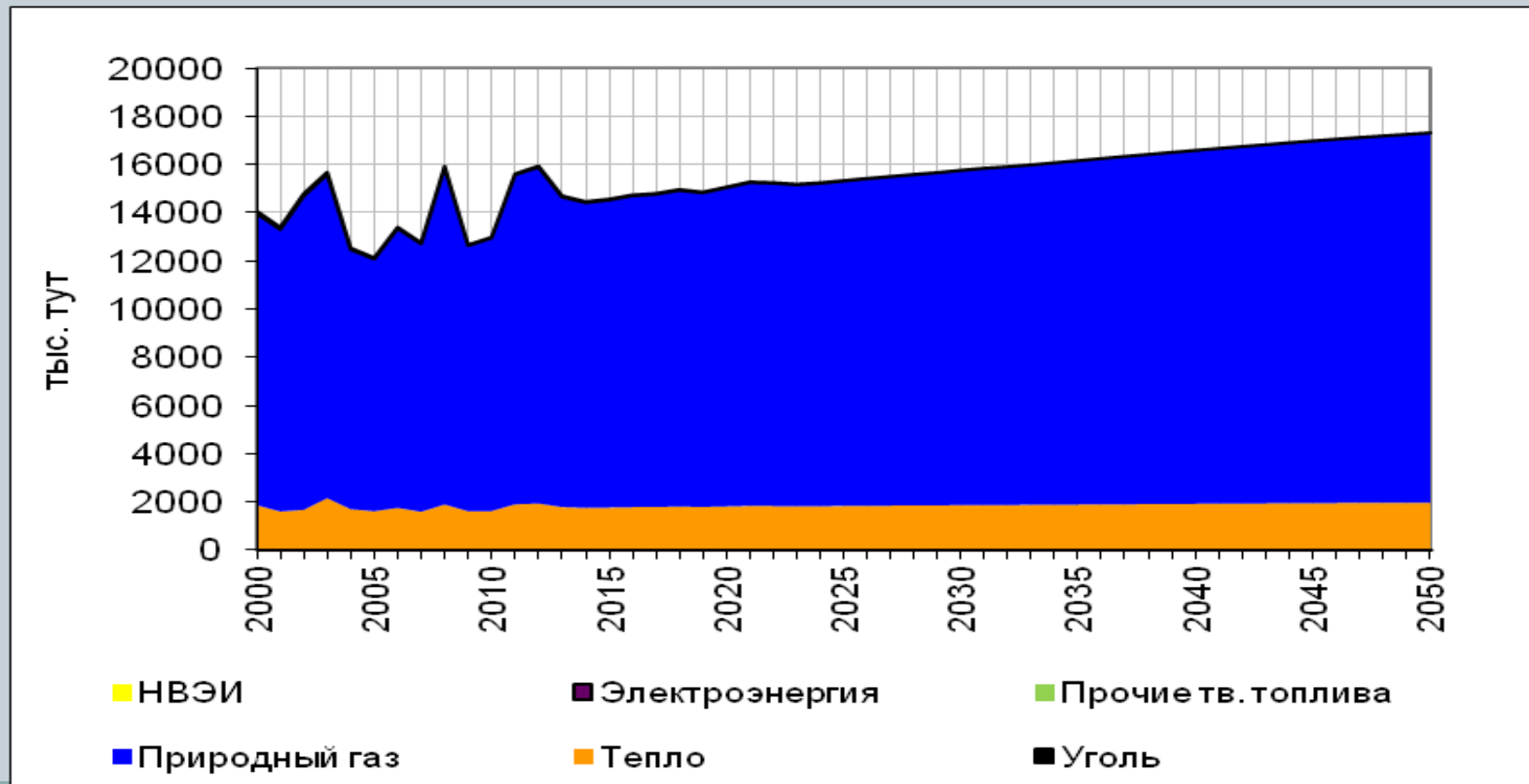


## Energy consumption by usage



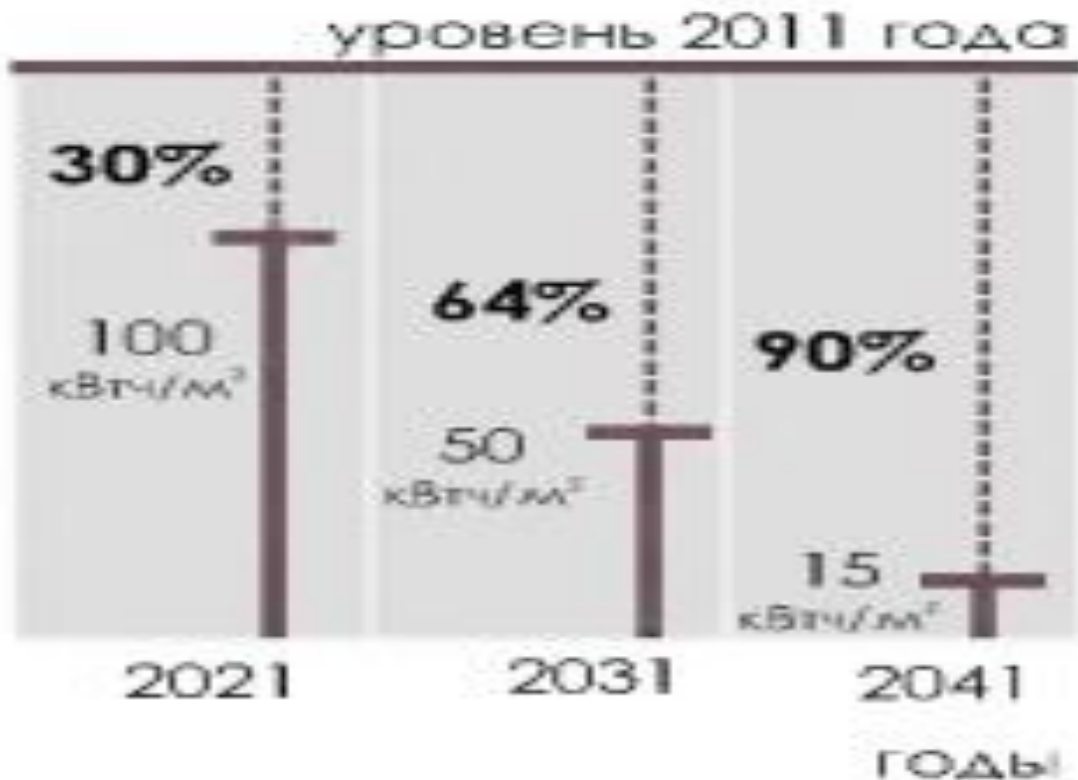
# Baseline scenario(till 2050)

## Breakdown of energy carriers use to heat residential buildings



# Scenario “Step to the 21<sup>st</sup> century” (till 2050)

Higher requirements to specific heat consumption for heating and ventilation





# Scenario “Step to the 21<sup>st</sup> century” (till 2050)



**Higher requirements to specific heat consumption for heating and ventilation in case of complete repair of buildings**

**2016 – 30% reduction of specific energy consumption against the baseline level**

**From 2016. – complete repair of residential buildings by 2% a year; out of them, 50% are apartment buildings**

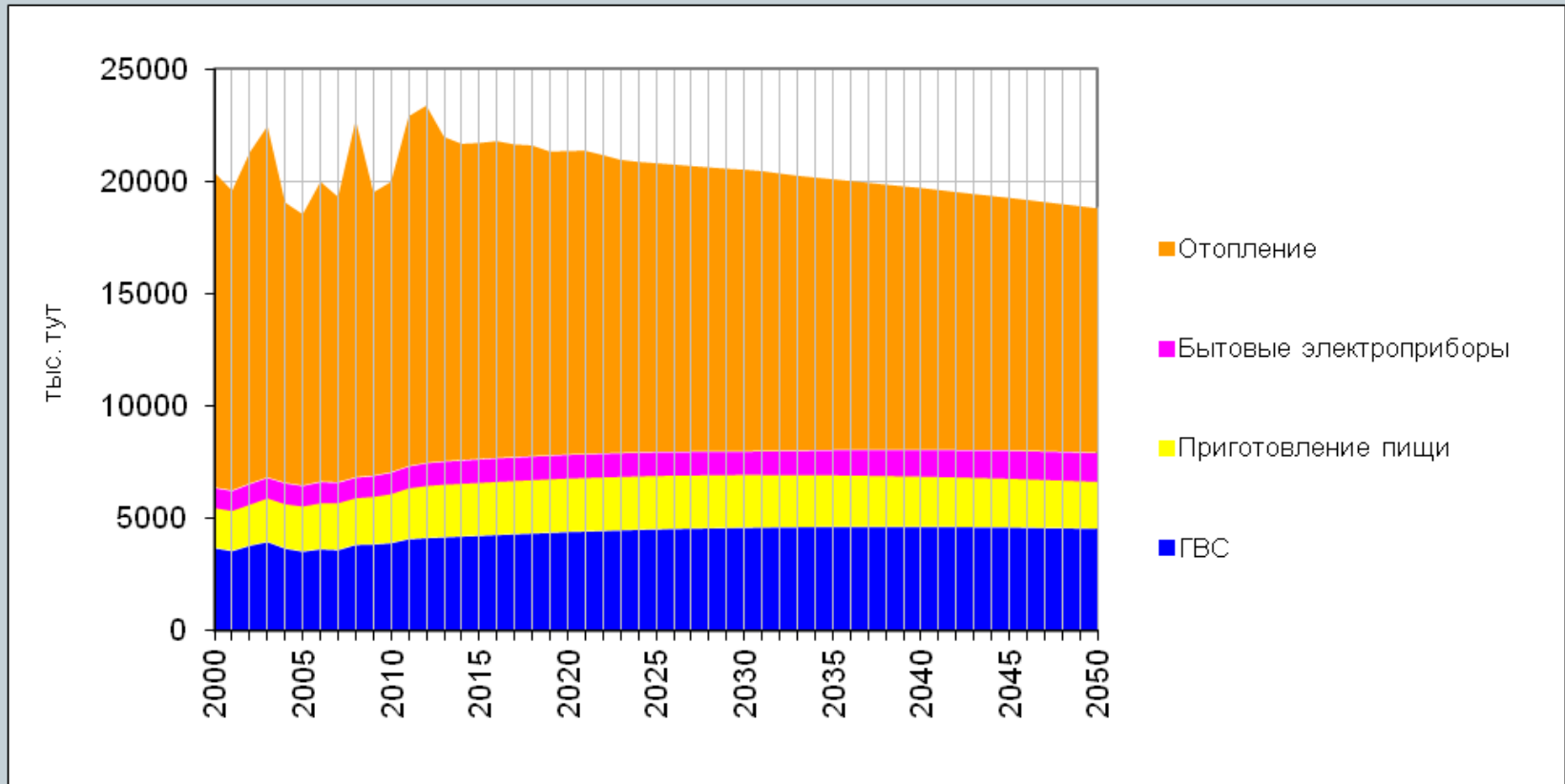
**From 2031 r. - 50% reduction of specific energy consumption against the baseline level**

**From 2041 – reduction of specific energy consumption by 90% against the baseline level (15 kWh/m<sup>2</sup>/year)**



# Scenario “Step to the 21<sup>st</sup> century” (till 2050)

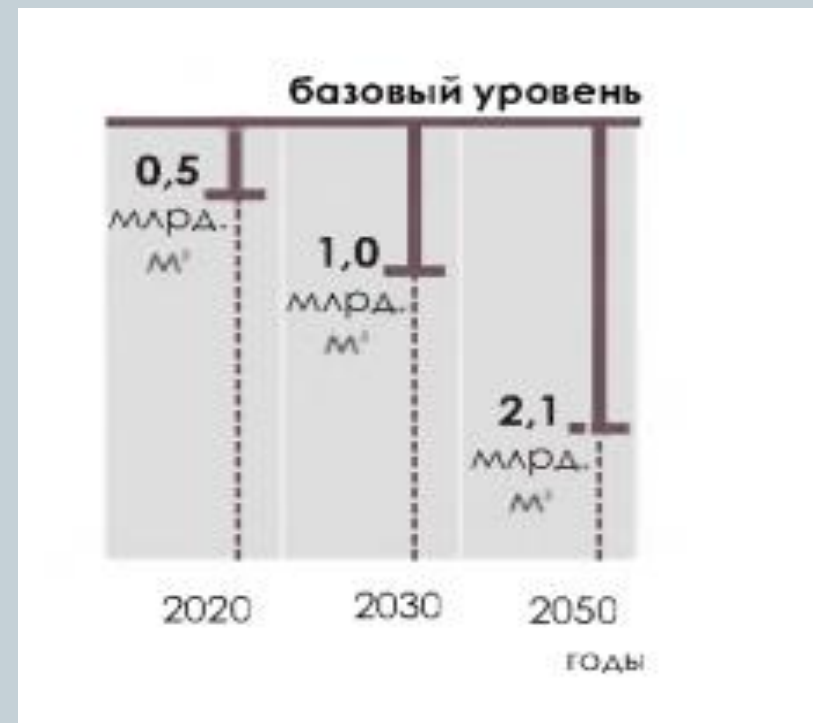
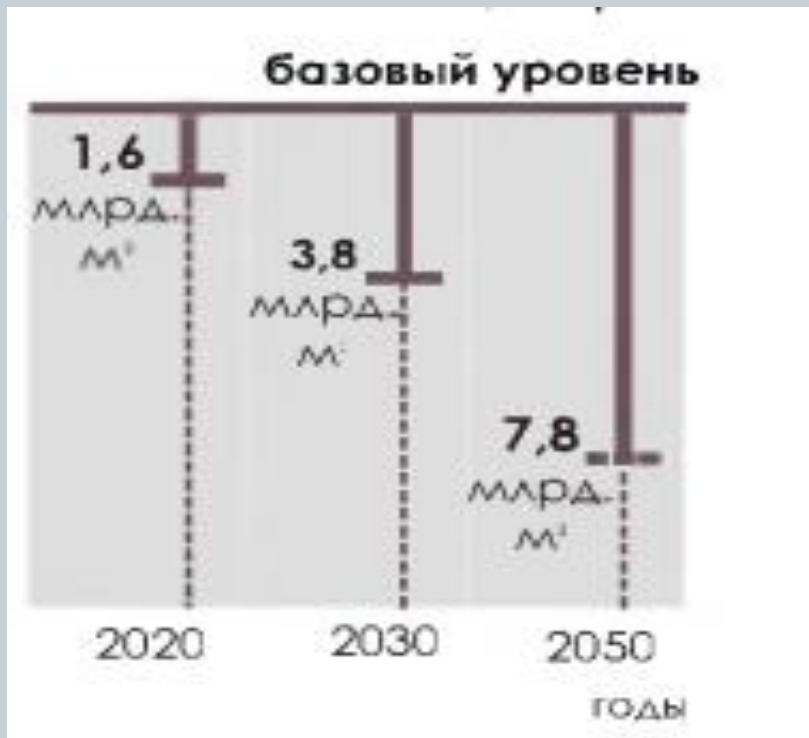
## Population’s consumption of energy by usage



# Scenario “Step to the 21<sup>st</sup> century” (till 2050)



## Saving natural gas in fuel balance of the buildings' sector



# Scenario “Step to the 21<sup>st</sup> century” (till 2050)



## What is needed for practical implementation:

Raise requirements of Construction Codes to specific consumption of heat for heating and ventilation (**15 kWh/m<sup>2</sup>/year**) by **2041**

Increase, and make **2%/year**, a share of buildings under repair; requirements must be introduced regarding reduction of specific energy consumption by **30%**, and then by **50%**.

Replace heating equipment

Increase the share of energy efficient light sources till **Повышение 50% in 2020 and 100% by 2030**

Introduce a set of measures to replace current domestic appliances with EE models and set up their manufacturing in Uzbekistan

# Scenario “Soft way” (till 2050)



## Main assumptions:

By **2021**, monitoring system is set up to ensure compliance of residential buildings construction with Constructing Codes

From **2021**, incentives scheme is launched to encourage construction of low-energy consumption buildings (**50 kWh/m<sup>2</sup>/year**) and “passive” buildings (**15 kWh/m<sup>2</sup>/year**)

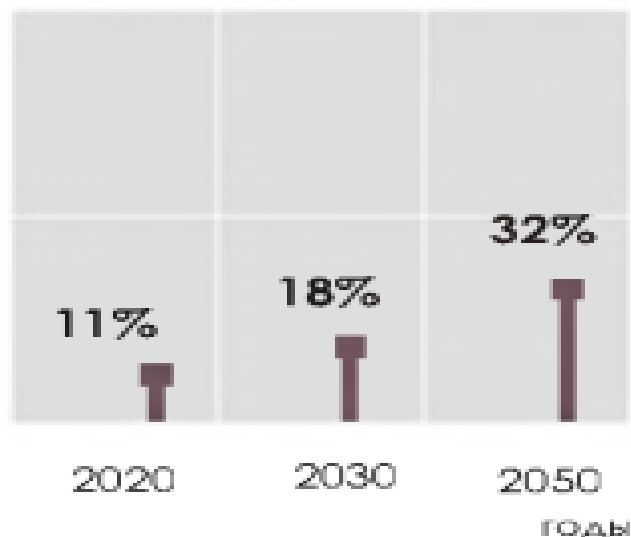
Share of new residential buildings with low energy consumption and “passive” buildings will increase by **1%** and **in 2050**, each of them will reach **30%**.

By 2050- **15%** of energy consumption in residential buildings from renewable energy sources

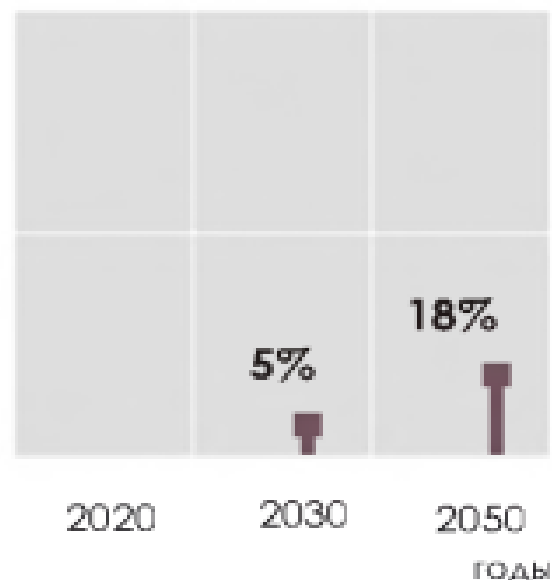
# Scenario “Soft way”(till 2050 г.)



Доля жилых зданий,  
оборудованных  
солнечными  
водонагревателями

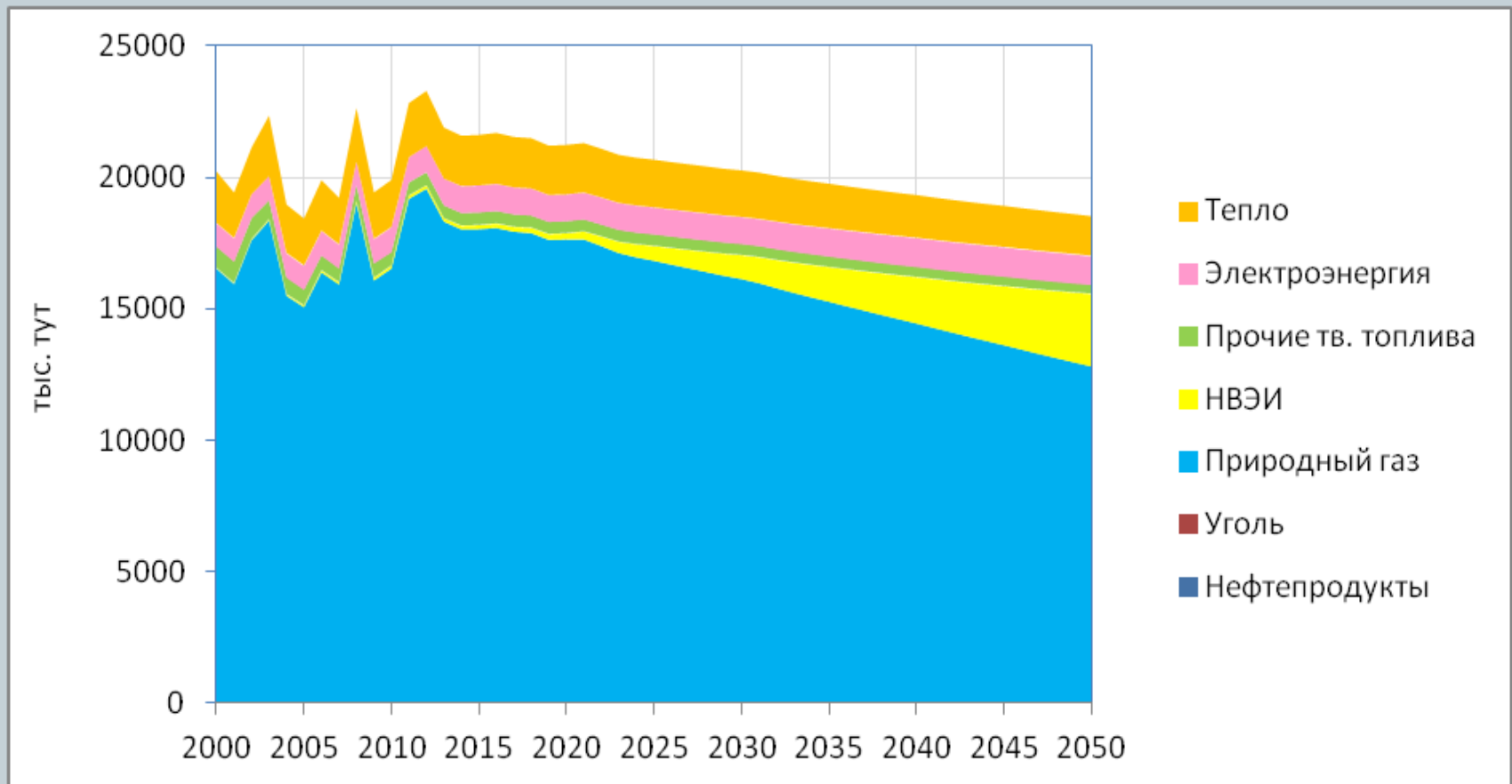


Доля жилых зданий,  
оборудованных тепло-  
выми насосами



# Scenario “Soft way”(till 2050)

## Breakdown of energy resources consumption by housing sector





# Scenario “Soft way” (till 2050)



Экономия  
природного газа  
в 2013-2050 г.г.  
по результатам  
сценария «Мягкий путь»

**50,6 млрд. м<sup>3</sup>**



от потребления  
природного газа  
в 2050 г.  
по базовому сценарию

# Scenario “Soft way”(till 2050)



## **What is needed form practical implementation:**

- Encourage use of thermal pump; 5% of individual houses will have them by 2030 and 17% by 2050
- Encourage use of solar water heater; 11% of individual houses will have them by 2020 and 18% by 2050
- Encourage use of photo power plant; 1% of individuals will use them by 2030 and 5% by 2050.

# Costs and benefits analysis of “Step to the 21<sup>st</sup> century “and “Soft way

