UNIVERSITY OF ZAGREB
FACULTY OF MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE
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4DH
4th Generation District Heating Technologies and Systems

DISTRICT HEATING AND 4DH IN CENTRAL AND EASTERN EUROPE

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4th INTERNATIONAL CONFERENCE ON

SMART ENERGY SYSTEMS AND 4TH GENERATION DISTRICT HEATING

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AALBORG UNIVERSITY
DENMARK

Introduction

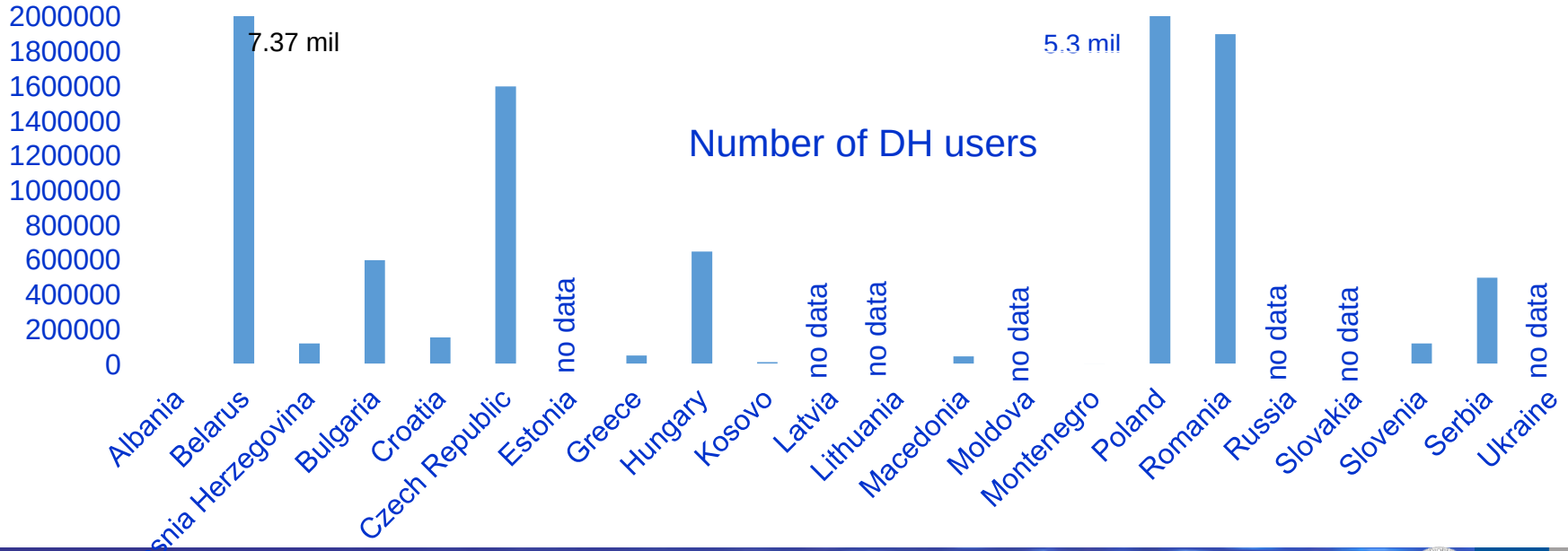
- **DH is legacy of centralized economic planning**
- **Traditionally most important source of heat for space heating in highly populated urban areas**
- **Necessary modernisation of district heating systems**
- **Main problems:**
  - inefficient heat production, often boilers, not CHP
  - declining sales due to competition
  - heat losses in production, distribution and end-use which are higher compared to Western Europe

Introduction

- **Other problems:**
  - high thermal and combined power plant O&M costs
  - Revenues (cost of heat for consumer) are under national tariff regulations which often give incentives to high-carbon heating methods instead of district heating
  - social problems and “energy poverty” (difficulty in paying the bills)
- future existing district heating networks in CEE could be expanded and changed gradually towards more efficient systems such as 3rd or even 4th generation district heating systems

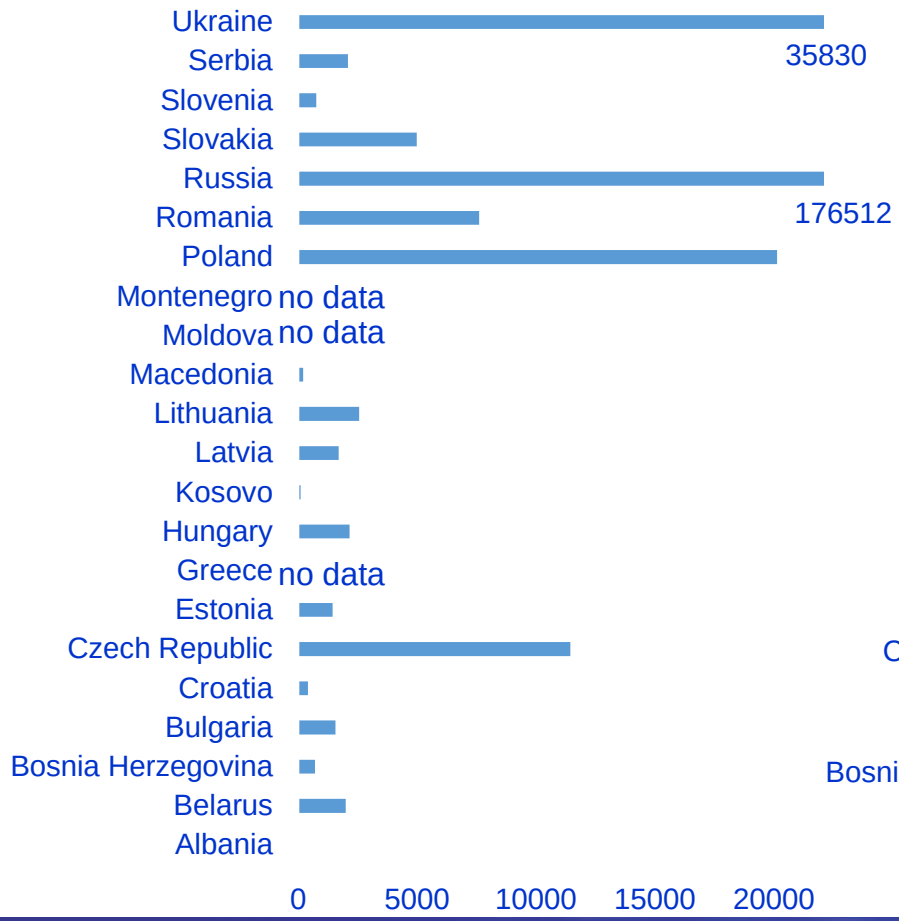
Status of district heating in Eastern Europe

- District heating services are provided by utility companies via large networks supplied by large centralized heat sources
- They were used during past decades to distribute heat to urban population using relatively cheap fuels
- Largest district heating systems in Russia (about 1700 TWh), Poland (just under 100 TWh) and Ukraine (just under 200 TWh)

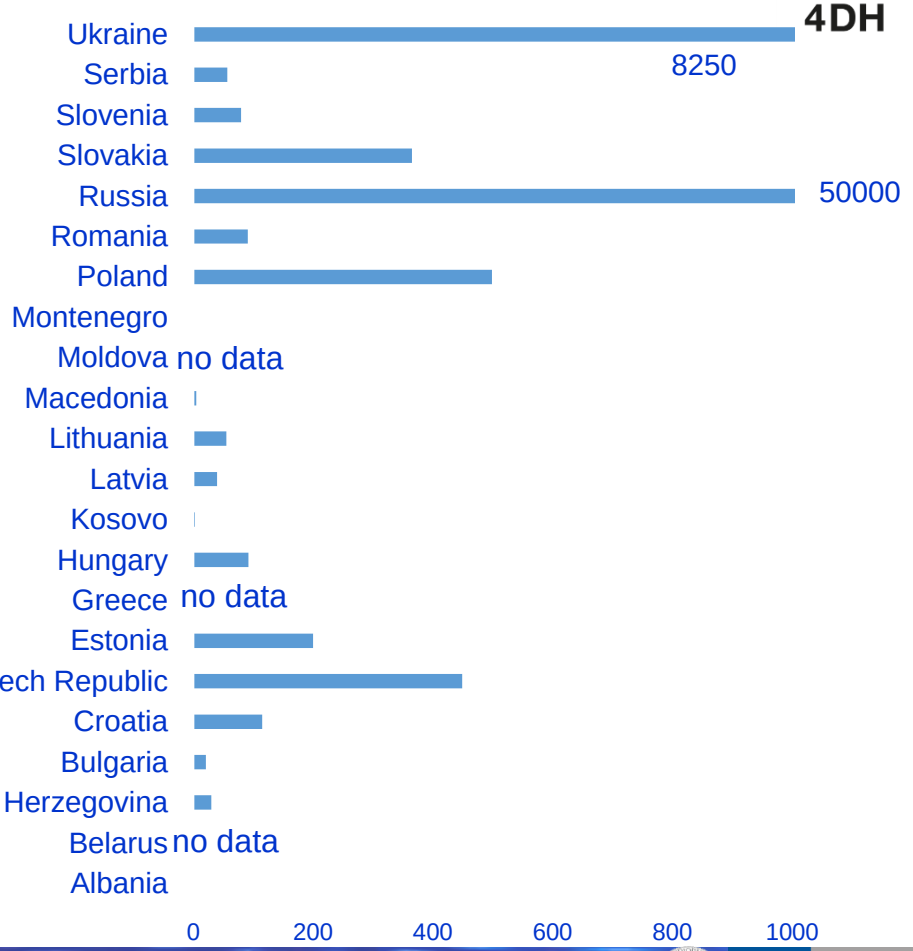


Status of district heating in Eastern Europe

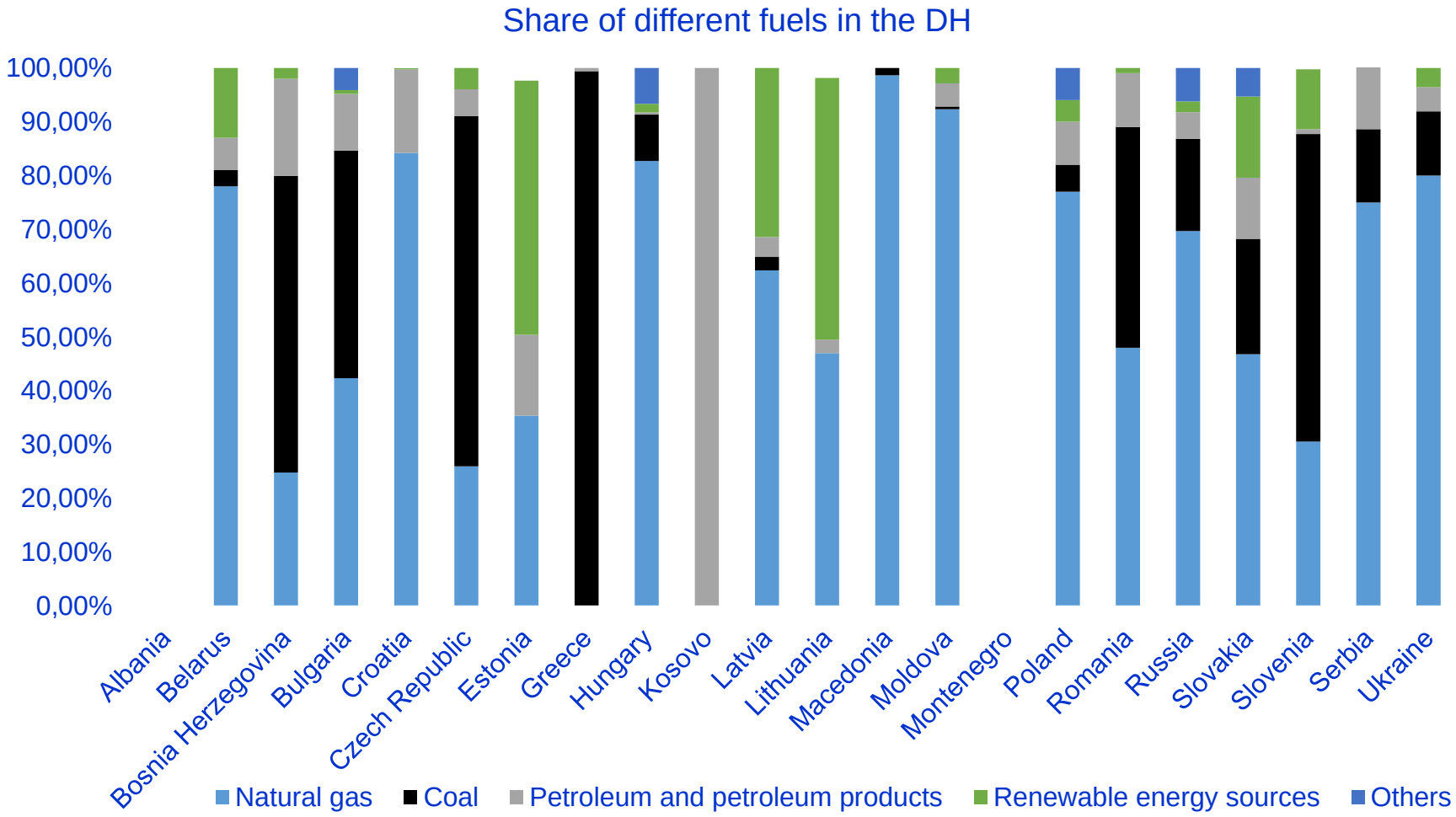
DH network length (km)



Number of DH systems



Status of district heating in Eastern Europe



Status of district heating in Eastern Europe

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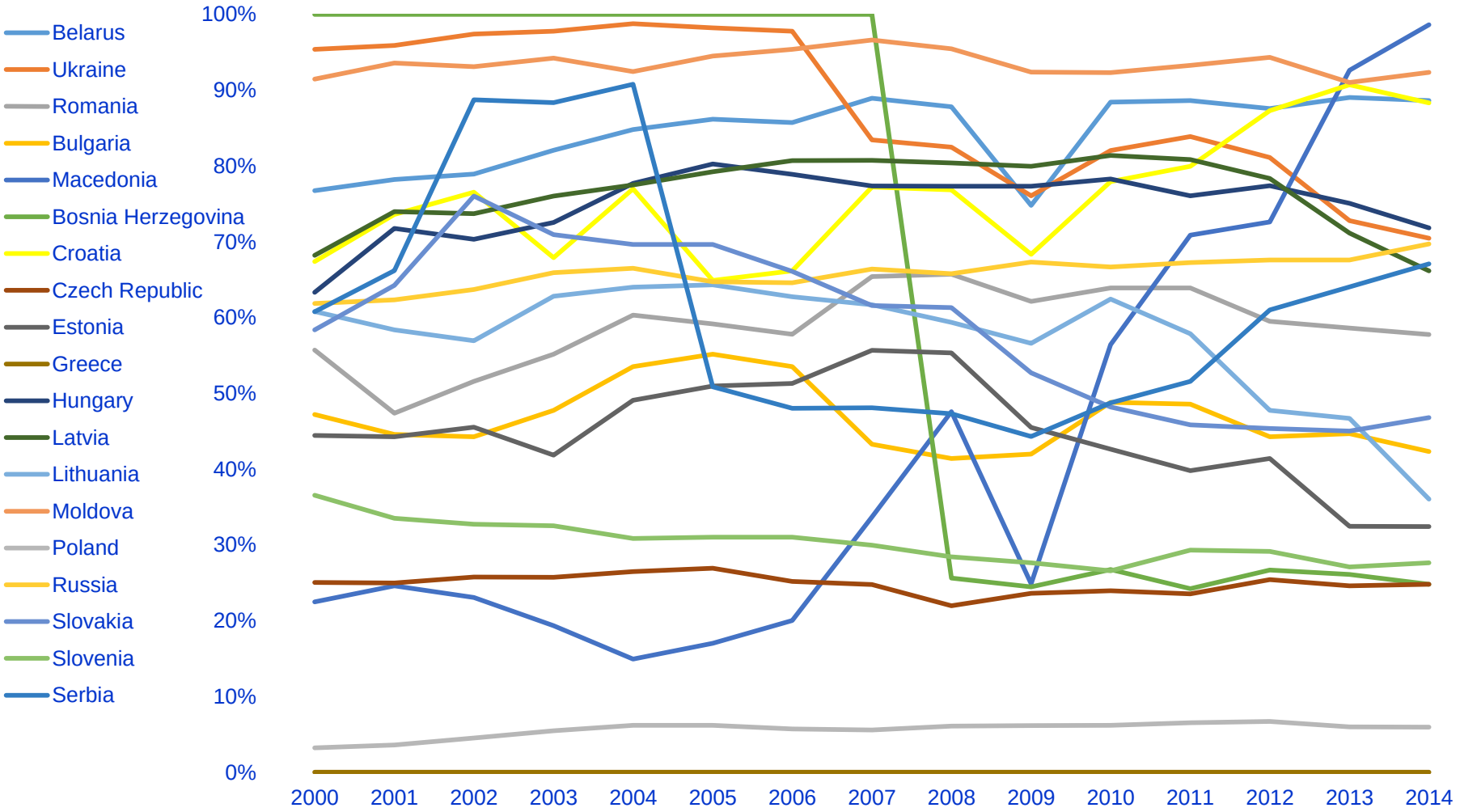
Heat Roadmap Europe 2050
A low-carbon heating and cooling strategy

Share of natural gas in DH



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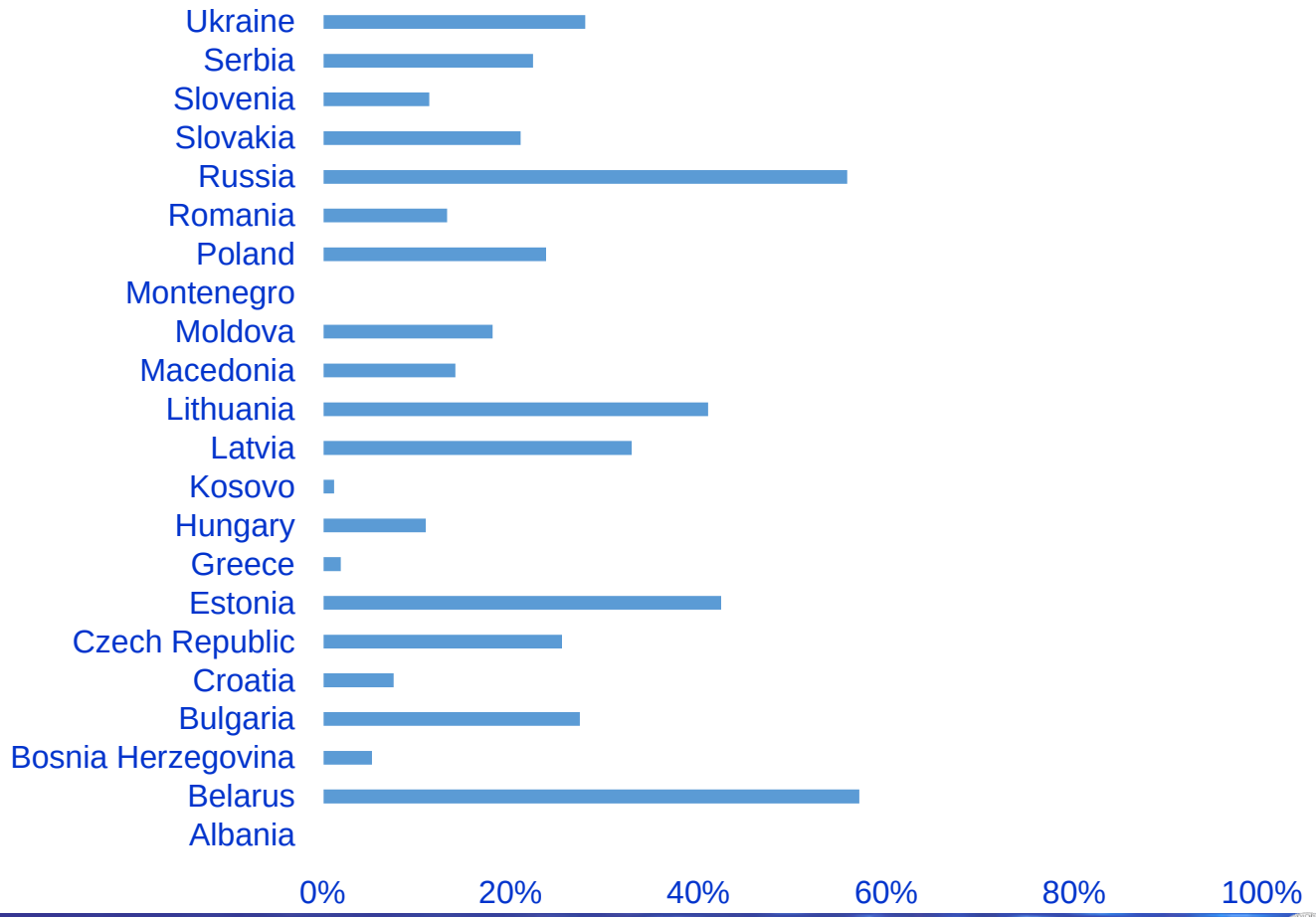
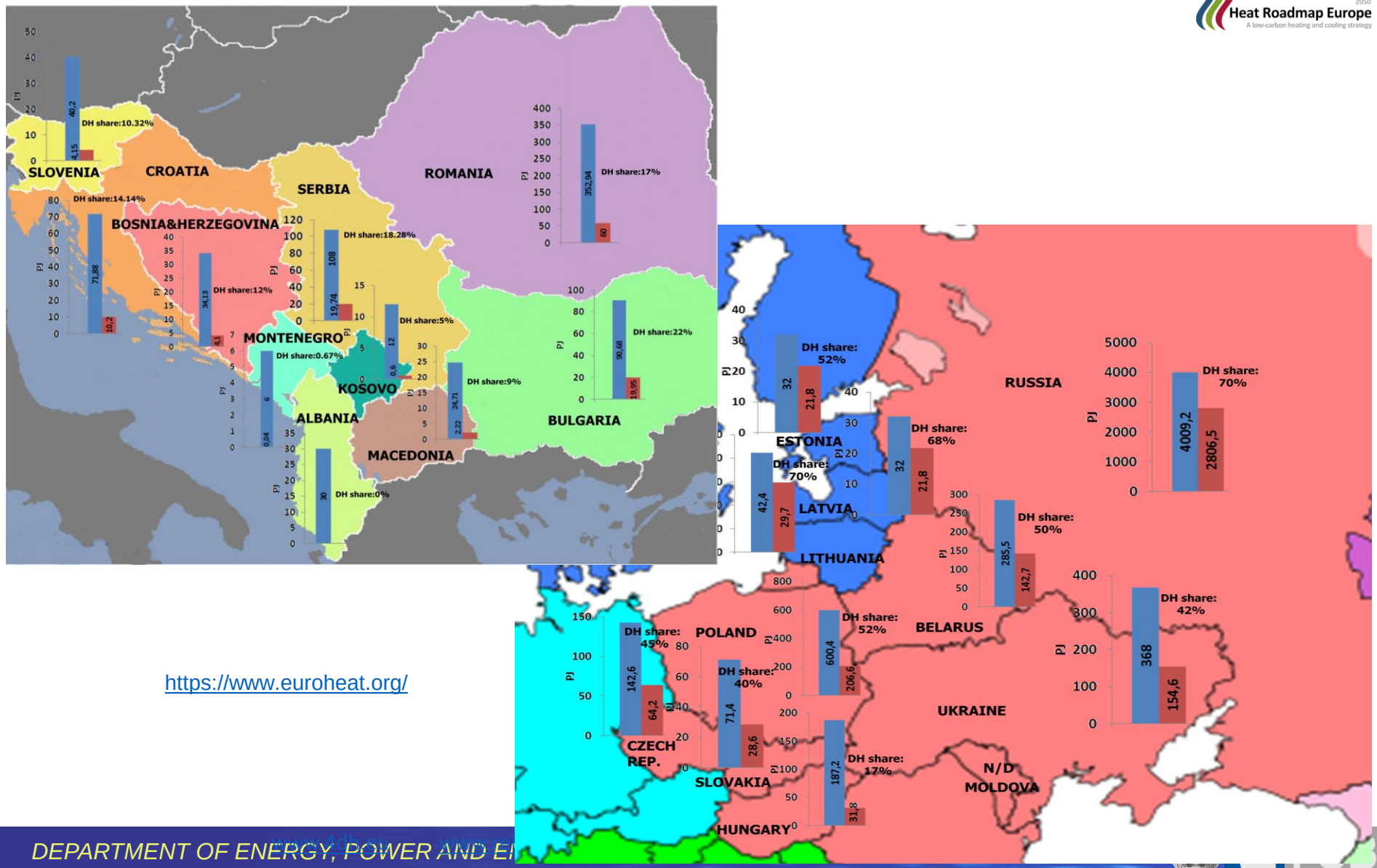
Status of district heating in Eastern Europe

Share of DH in household and commercial heating demand



Source: IEA, statistics http://www.iea.org/statistics

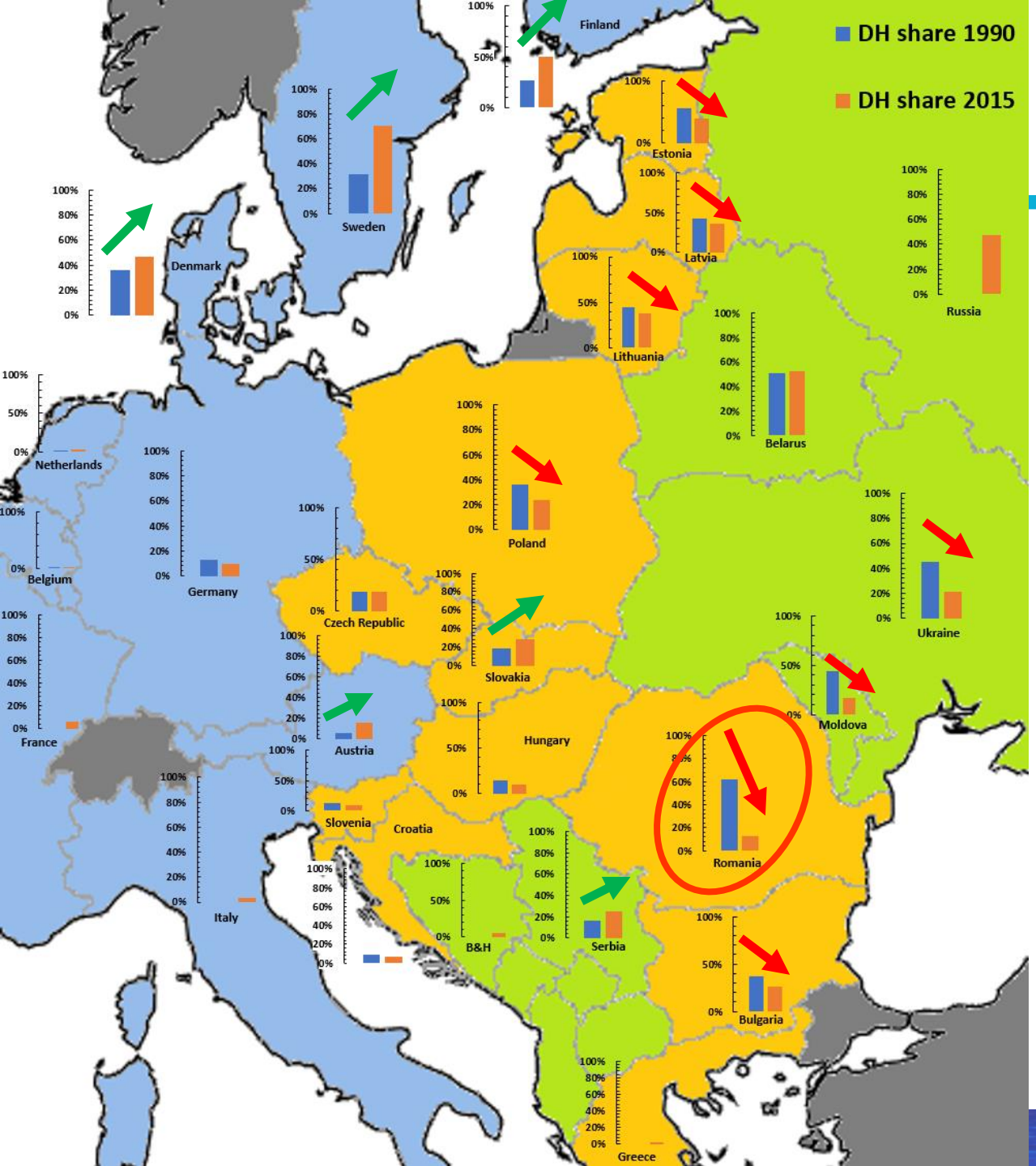
Status of district heating in Eastern Europe



https://www.euroheat.org/

Residential heat supplied by DH

- Falling due to increase in energy efficiency, but also due to competition from natural gas
- Romania lost most of DH



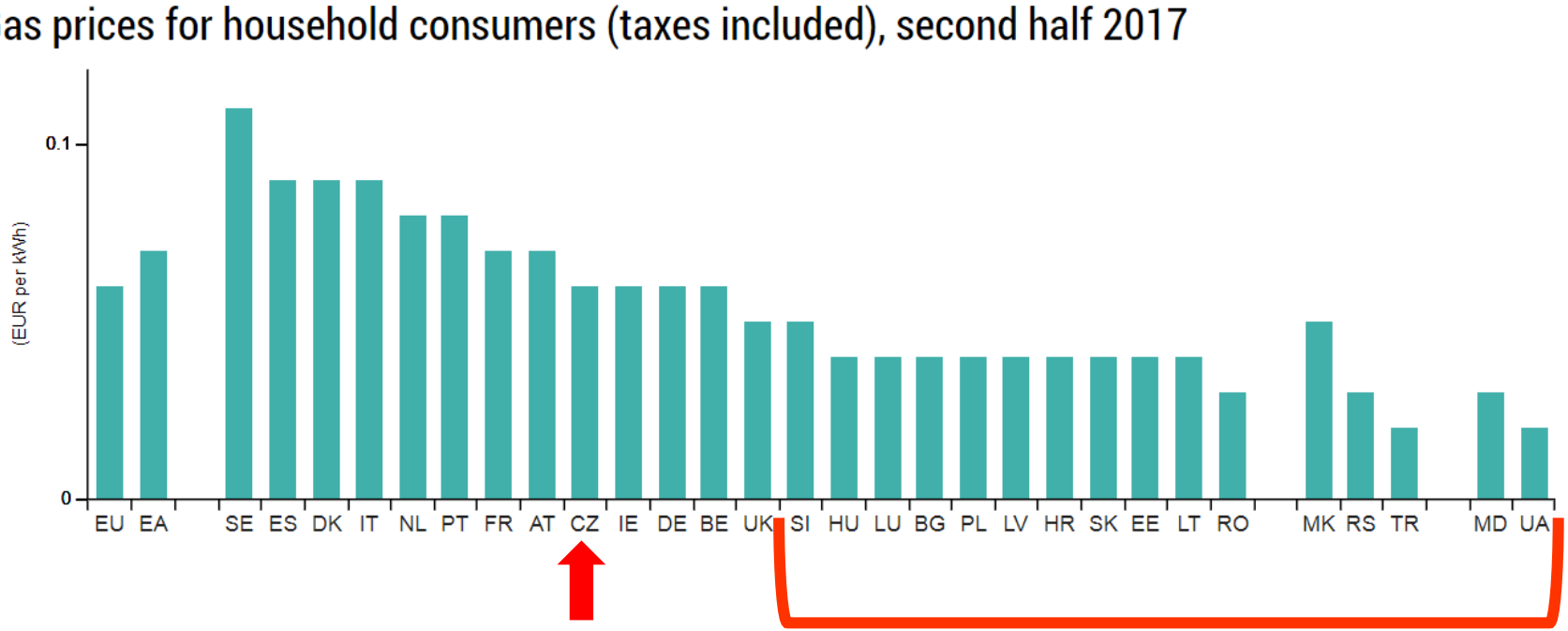
Residential DH share

- Falling due to competition from natural gas
- Romania lost most of DH to gas

How Romania lost DH?

- DH was municipal ownership
- -> Clientilistic employment in DH
- -> Cost balloons
- National gas monopoly steps in and offers to finance conversion to gas
- Nearly 90% of DH network was lost

Gas prices for households



Source: Eurostat (online data codes: nrg_pc_202)

eurostat

Status of district heating in Eastern Europe – Belarus example

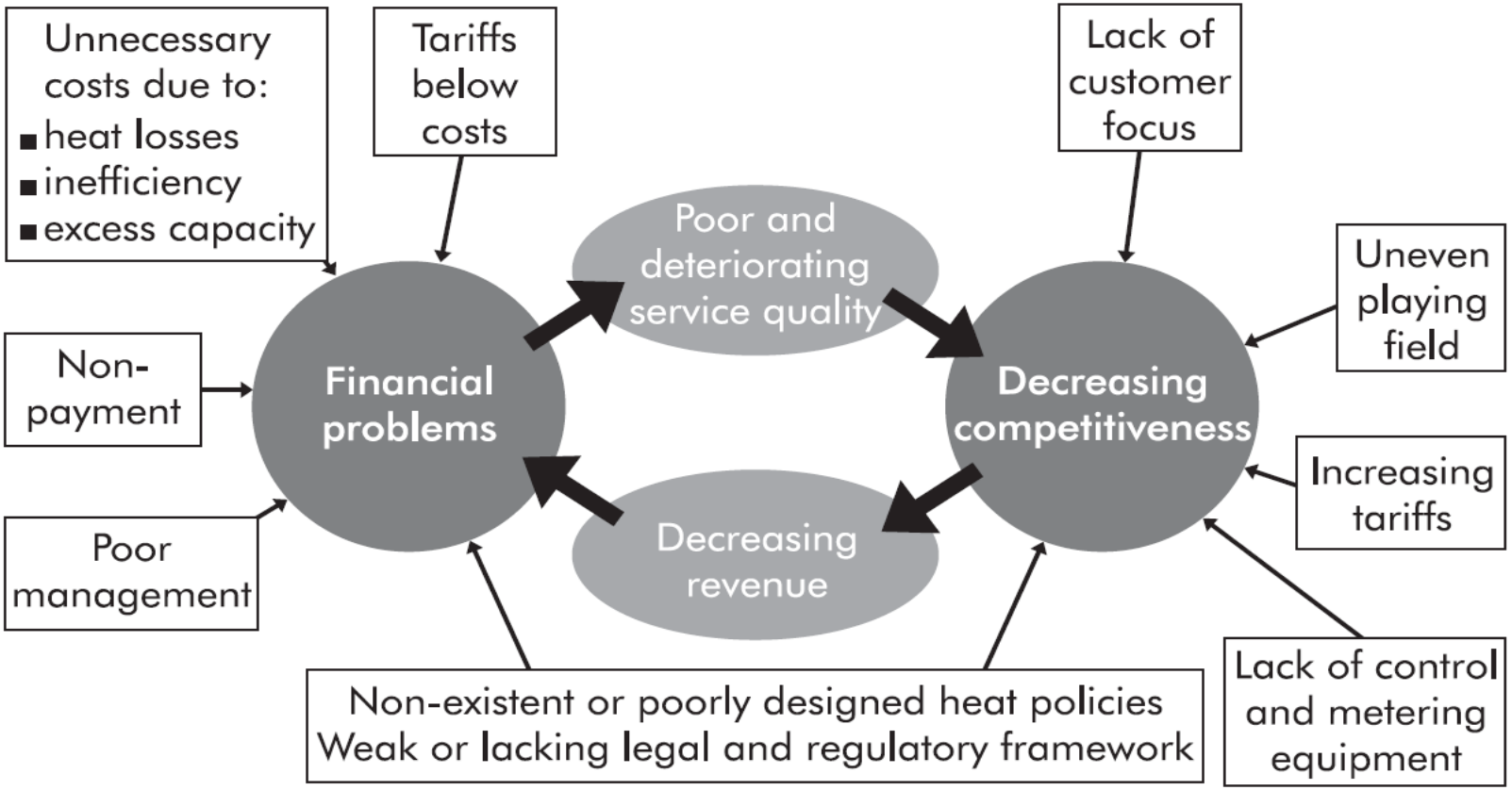
- 70% of the population is served by district heating where the network capacity is high enough to provide thermal energy to almost all the inhabitants of cities
- Problems:
  - high share of thermal energy generated by using natural gas imported from Russia, 80%
  - state monopoly for the production and distribution of thermal energy
  - The Ministry of Economics establishes **the same tariffs for heating, cold and hot water for all regions**, independent of the kind of equipment and fuel used for the generation of thermal energy.
- The CHP development in Belarus between 2010 and 2015 had a significant impact on the increase of electricity and thermal energy generation
- In Belarus 89.8% of the urban housing stock are covered by DH system and 38.3% of rural housing stock are covered by DH system

Main characteristics of DH systems in Eastern Europe

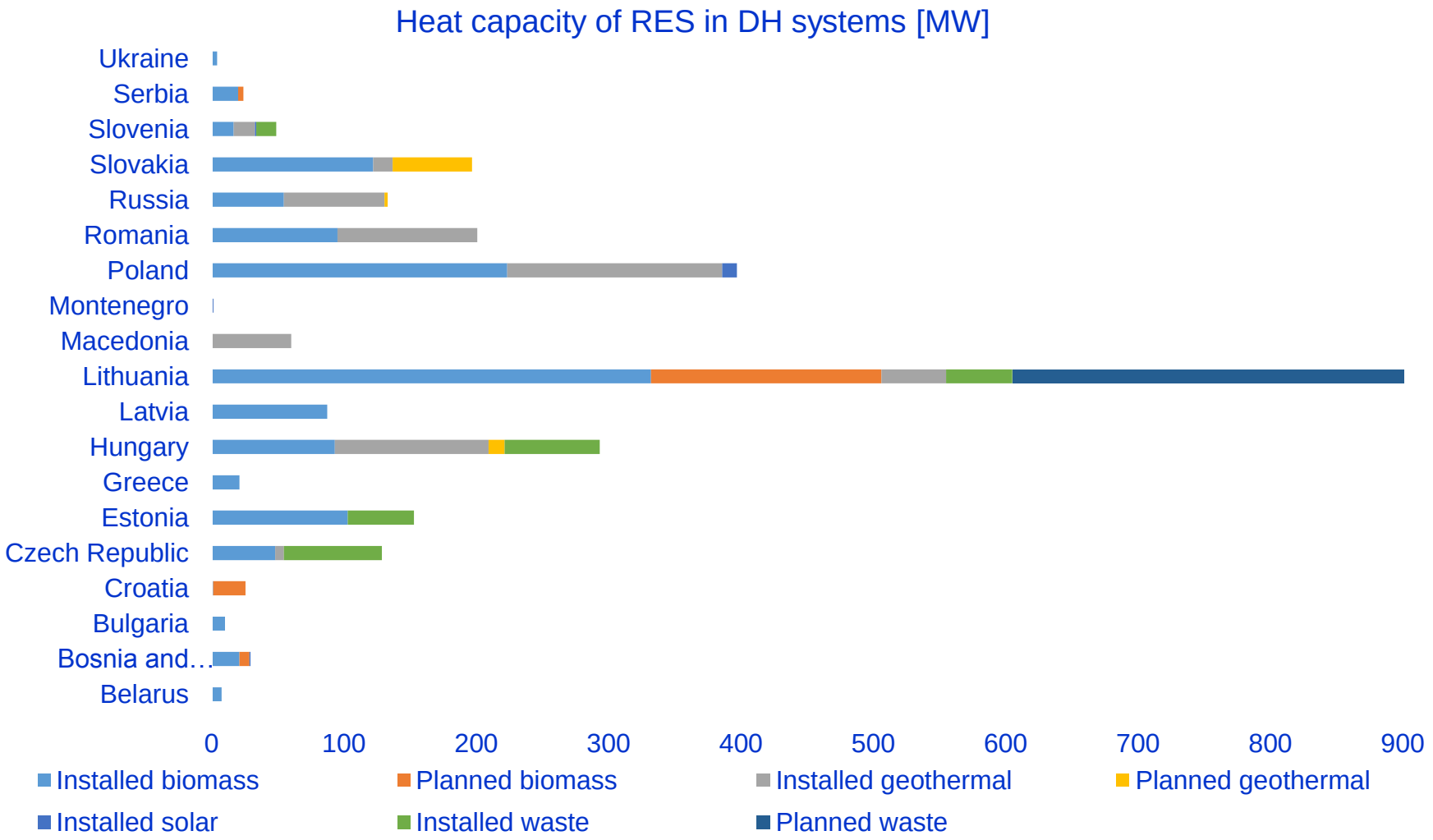
- inefficient heat production
- high emissions
- fossil fuel dependence
- declining sales
- old technology
- poor maintenance
- worn out equipment
- over dimensioned systems
- lack of controls
- insufficient insulation on heat pipelines

COMPARISON OF PERFORMANCE INDICATORS FOR DISTRICT HEATING DISTRIBUTION SYSTEMS	Unit	CEE and former Soviet Union	Western Europe
Customer heat consumption (annual energy use/space heated)	kWh/m^3	70-90	45-50
Distribution losses	% of heat supply	15-25	5-10
Change of circulation water (annual make-up water volume/network water volume)	Refills per year	10-30	1-5
Production losses	% of fuel energy	15-40	5-15

Key challenges of DH systems in Eastern Europe



Use of locally available fuels in DH systems



Stratego

Heat Roadmap Europe 2050

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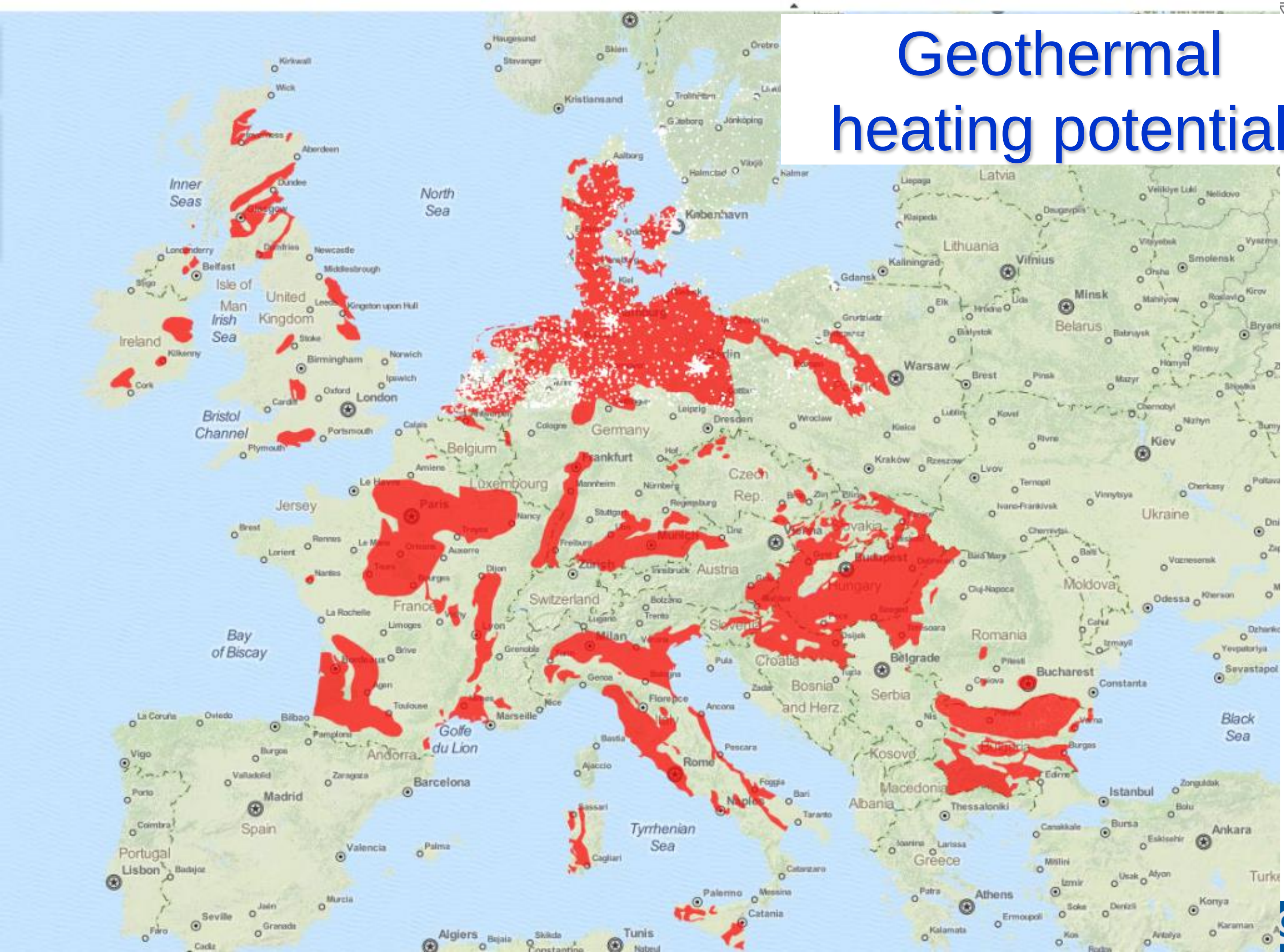
Peta, the Pan-European Thermal Atlas: renewable energy

Disclaimer: The data provided on this website is indicative and for research purposes ... responsibility is taken for the accuracy of included figures or for using them for uninter...

Geothermal heating potential



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Solar DH in CEE

Plant	Operation start	Owner	Country	City	Apert. area in m2	Capacity in kWth
Incel	2009	Municipality Banja Luka	Bosnia and Herzegovina	Banja Luka	1030	721
Aldemar (Cretan Village)	2000		Greece	Aldemar	2785	1950
Sarantis	1998	Sarantis S.A.	Greece	Sarantis	2700	1890
Greta Candia Maris	2002		Greece	Greta Candia Maris	2538	1777
Rodos Place	2000		Greece	Rodos Place	1115	781
Gomfoi	1999	Tyras S.A.	Greece	Gomfoi	1040	728
Budva	2014	Budvanska Riviera	Montenegro	Budva	1770	1200
Łódź	2008	SM Radogoszcz	Poland	Łódź	7368	5100
Zamość	2012	SM im. Jana Zamoyskiego	Poland	Zamość	2500	1750
Goldap	2011		Poland	Goldap	2140	1500
Czestochowa	2006	WSzS w Czestochowie	Poland	Czestochowa	1500	1050
Poddębice	2004	Gmina Poddębice	Poland	Poddębice	1287	901
Bartoszyce	2012	Szpital Powiatowy	Poland	Bartoszyce	1100	770

Use of heat storage and waste

- MSW heating plants are not so common in Eastern Europe, with few examples in:
  - Czechia (Prague, Brno, Liberec)
  - Estonia
  - Hungary
  - Lithuania
  - Slovenia
- Lock-in effect?
- Heat storage is not commonly used in the district heating systems in EE, but arriving – barriers to implementation

Wind share in electricity demand 2017

Romania – 13%
EU – 12%
Lithuania – 11%
Estonia, Poland – 9%
Greece – 8%
Croatia – 7%
Bulgaria – 4%
Hungary, Latvia, Macedonia, Norway – 2%
Czechia, Ukraine – 1%

National perspectives for DH systems in Central and Eastern Europe

- DH systems are supported in national energy plans, strategies and recommendations, but …
- Decarbonisation of heating – EU top down legislation probably needed
- Why not RES-gas targets?
- Why not taxing unused excess heat
- Proper gas pricing, too high wholesale, too low retail
- Why not go Dutch and ban gas?

Conclusion

- Ageing of energy generation infrastructure requires large investments in rehabilitation of existing district heating systems
- Low DH efficiency and high emissions
- Negative media coverage
- Customer dissatisfaction with heat distribution systems which reduces total heat demand from DH systems and revenue
- Biomass is the most ready for district heating, while readiness of geothermal and solar energy is limited
- Natural gas better organised competitor using hidden subsidies
- Orientation to local resources leads to job creation in local communities

Thank you for your attention!

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