STATUS AND PERSPECTIVES OF DISTRICT HEATING SYSTEMS IN EASTERN EUROPE

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3RD INTERNATIONAL CONFERENCE ON

SMART ENERGY SYSTEMS AND 4TH GENERATION DISTRICT HEATING

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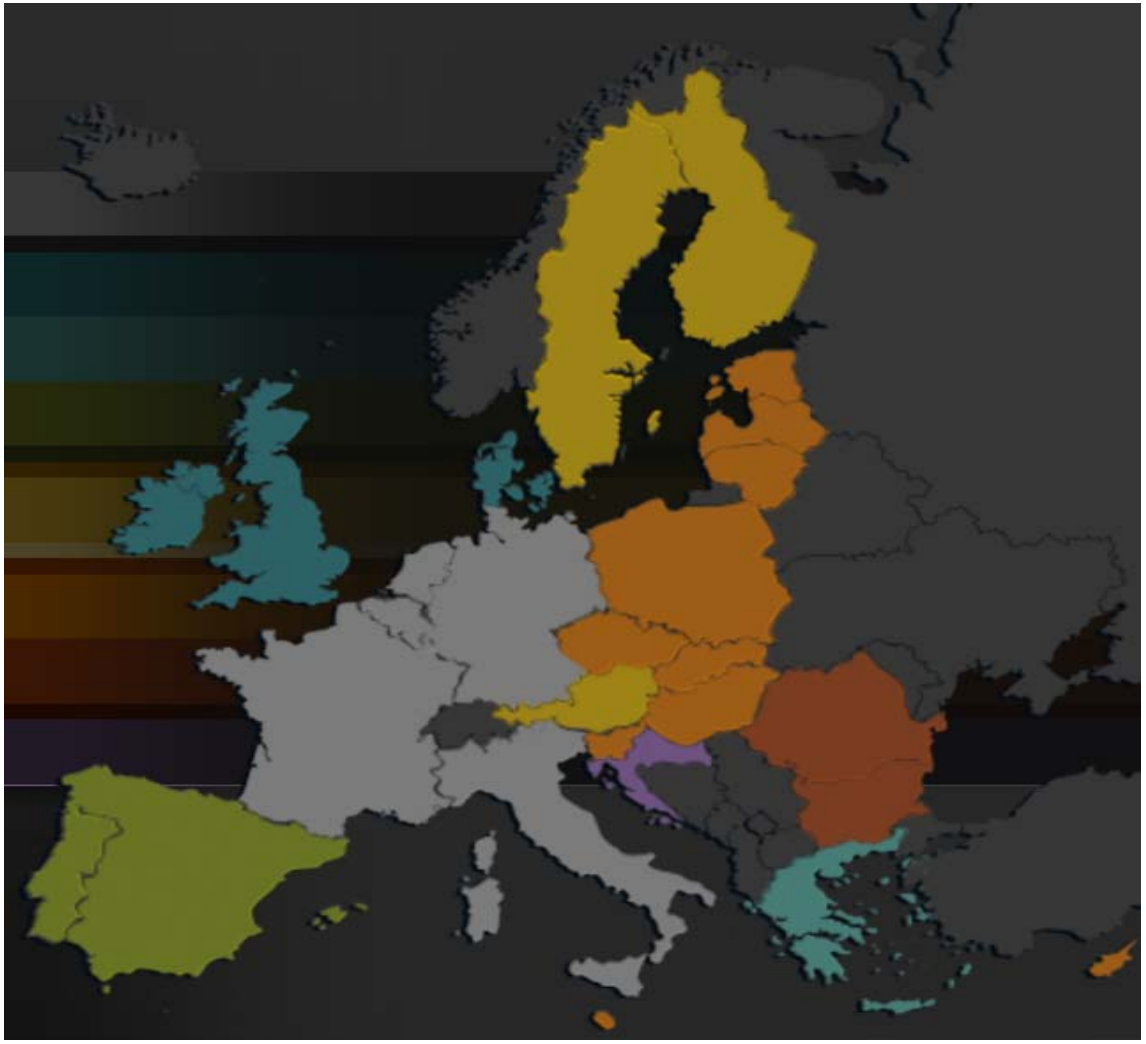
Introduction

- **District heating systems are currently available throughout Europe**
- **In EEC 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
  - declining sales
  - high heat losses
  - heat losses in production, distribution and end-use which are higher compared to Western Europe

Introduction

- **Other problems:**
  - high thermal and combined power plant operating and maintenance 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 Eastern Europe could be expanded and changed gradually towards more efficient systems such as 3rd or even 4th generation district heating systems

EU and non-EU members

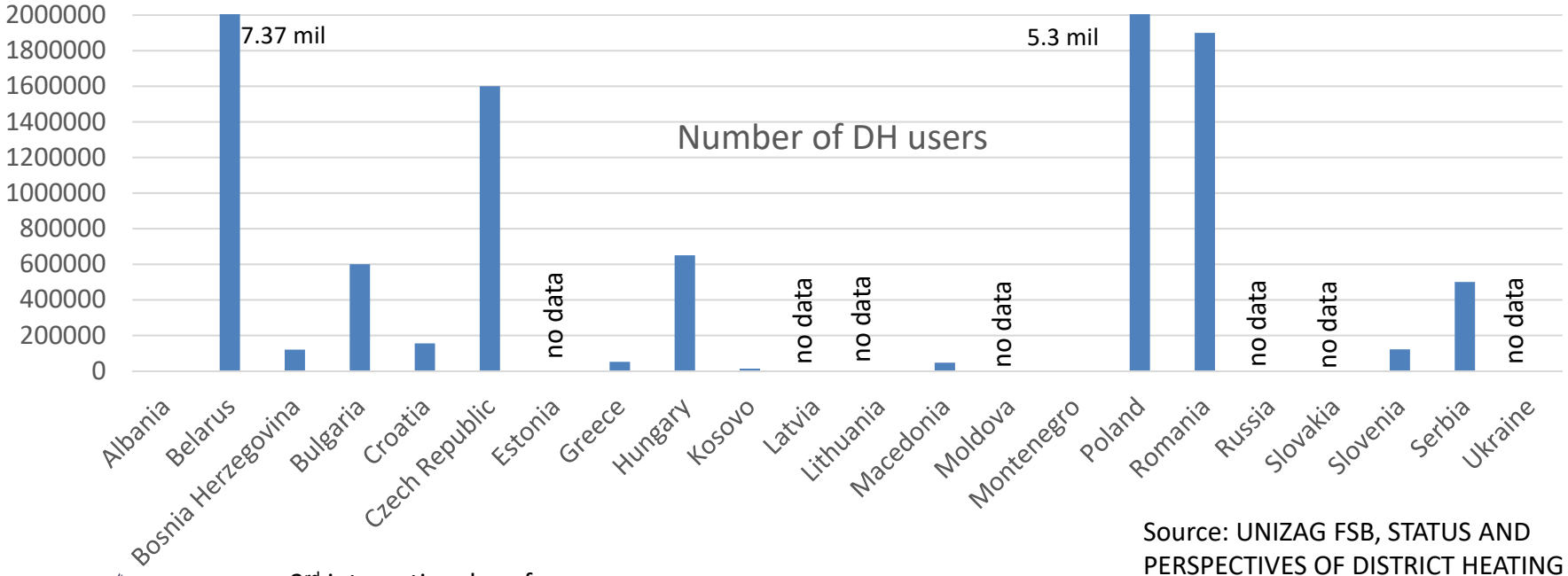


- Phases of entering after 1990s:
  - 1995 (Sweden, Finland, Austria)
  - 2004 (10 EEC)
  - 2007 (Romania and Bulgaria)
  - 2013 (Croatia)

Source: http://www.europarl.europa.eu

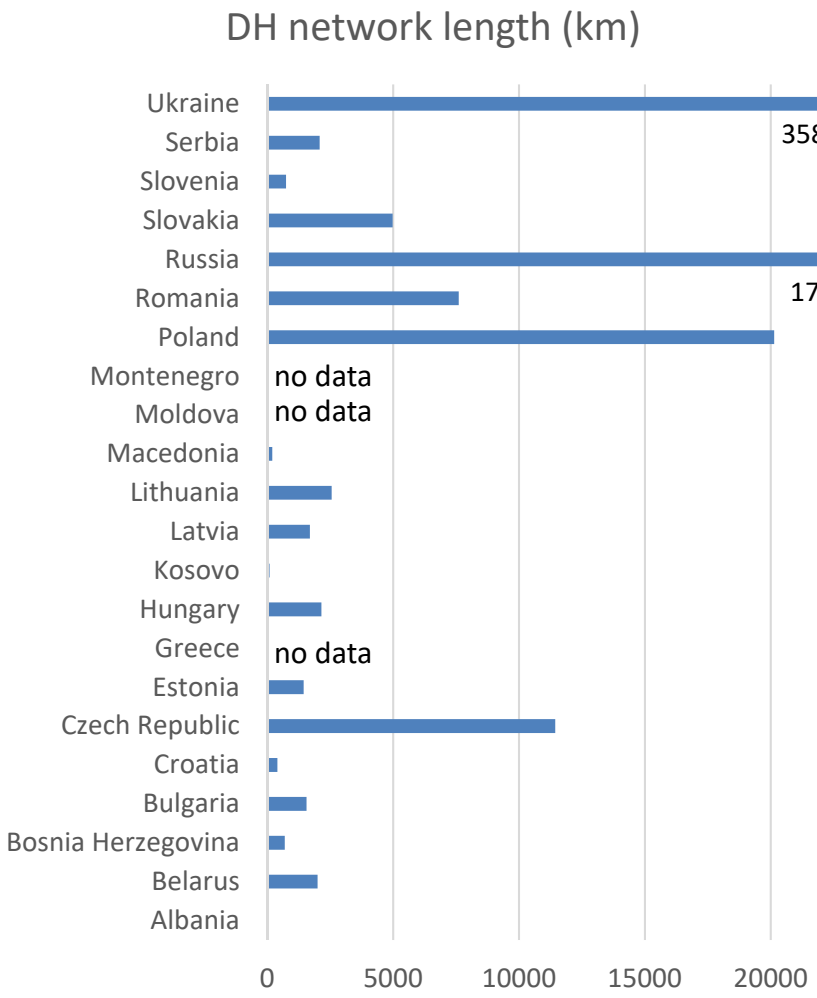
Status of district heating in Eastern Europe

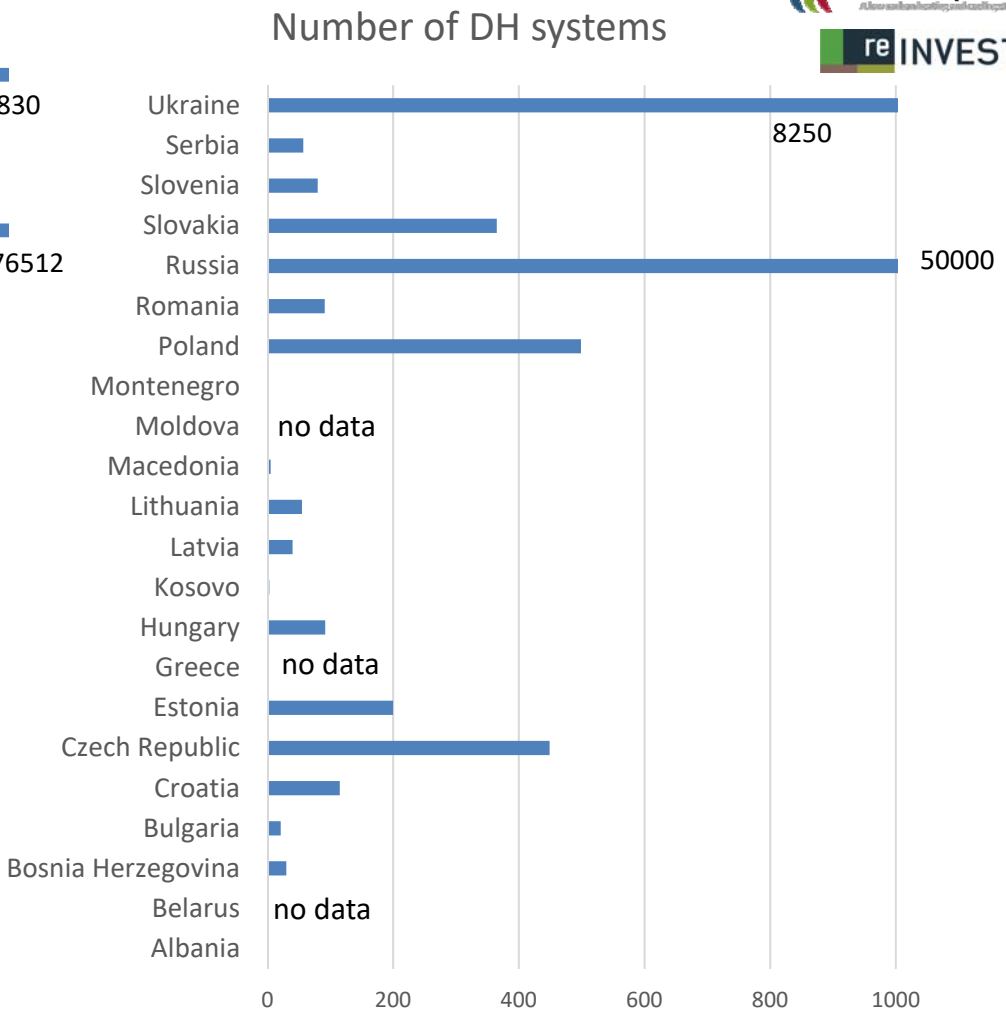
- District heating services are provided by utility companies via huge networks supplied by large centralized heat sources
- They were used during past decades to distribute heat to urban population using relatively cheap fuels
- Largest district heating systems in Russia (about 1700 TWh), Poland (just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



Source: UNIZAG FSB, STATUS AND PERSPECTIVES OF DISTRICT HEATING SYSTEMS IN EASTERN EUROPE, Report, 4DH

Status of district heating in Eastern Europe





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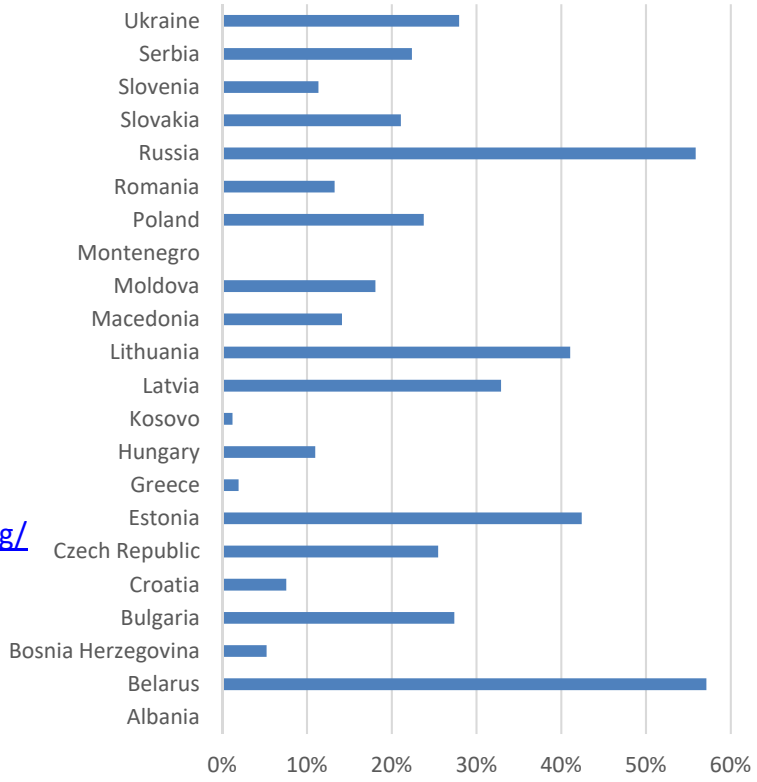
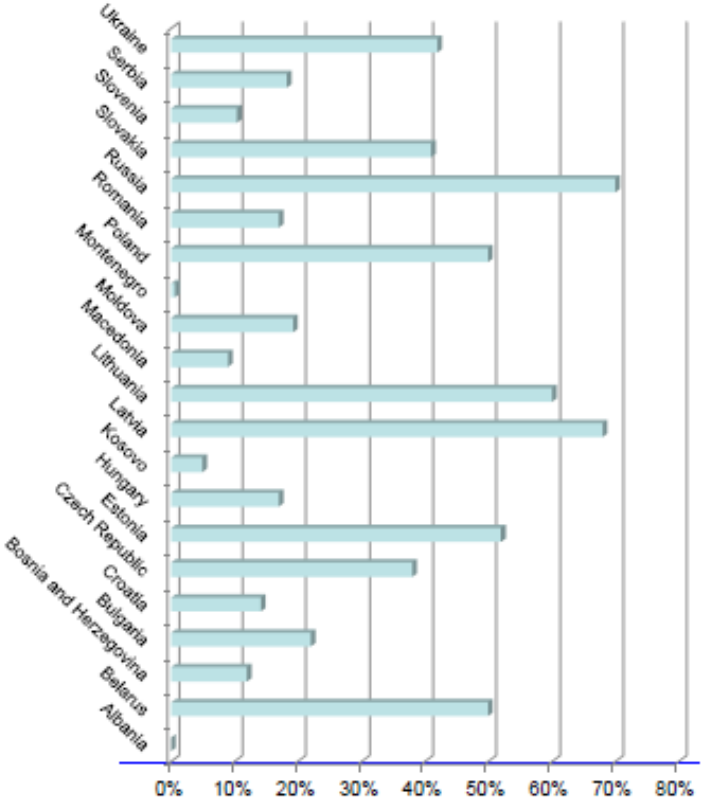
Source: UNIZAG FSB, STATUS AND PERSPECTIVES OF DISTRICT HEATING SYSTEMS IN EASTERN EUROPE, Report, 4DH

Status of district heating in Eastern Europe

Share of DH in household and commercial heating demand

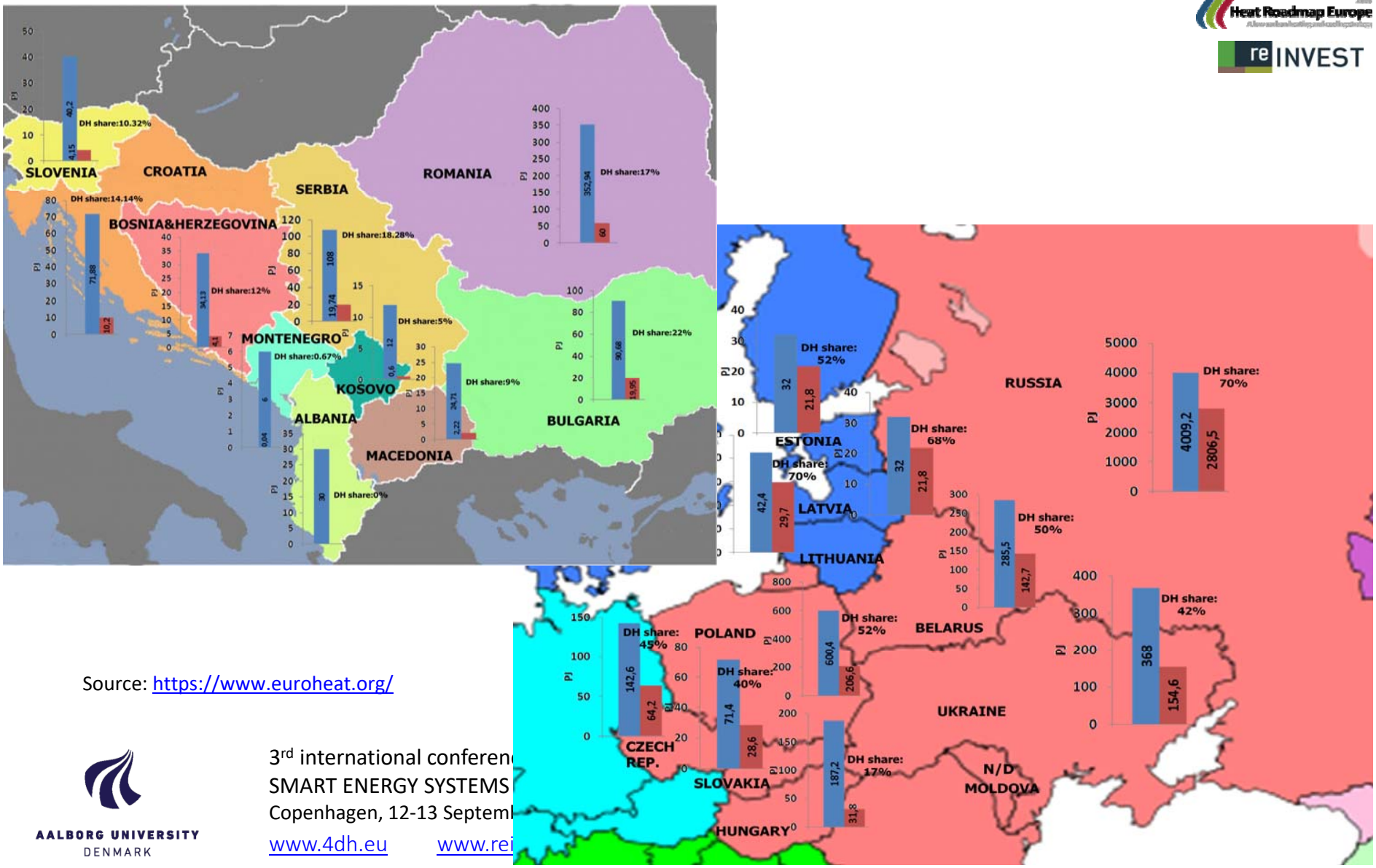




Source: IEA, statistics, 2014 http://www.iea.org/statistics

Source: Robert Mikulandrić, Goran Krajačić, Neven Duić, Zoran Pranjić, Gennadii Khavin, Henrik Lund, Brian Vad Mathiensen, Perspectives of district heating systems in Eastern Europe, Presentation, 2013, Portorož

Status of district heating in Eastern Europe



Source: https://www.euroheat.org/

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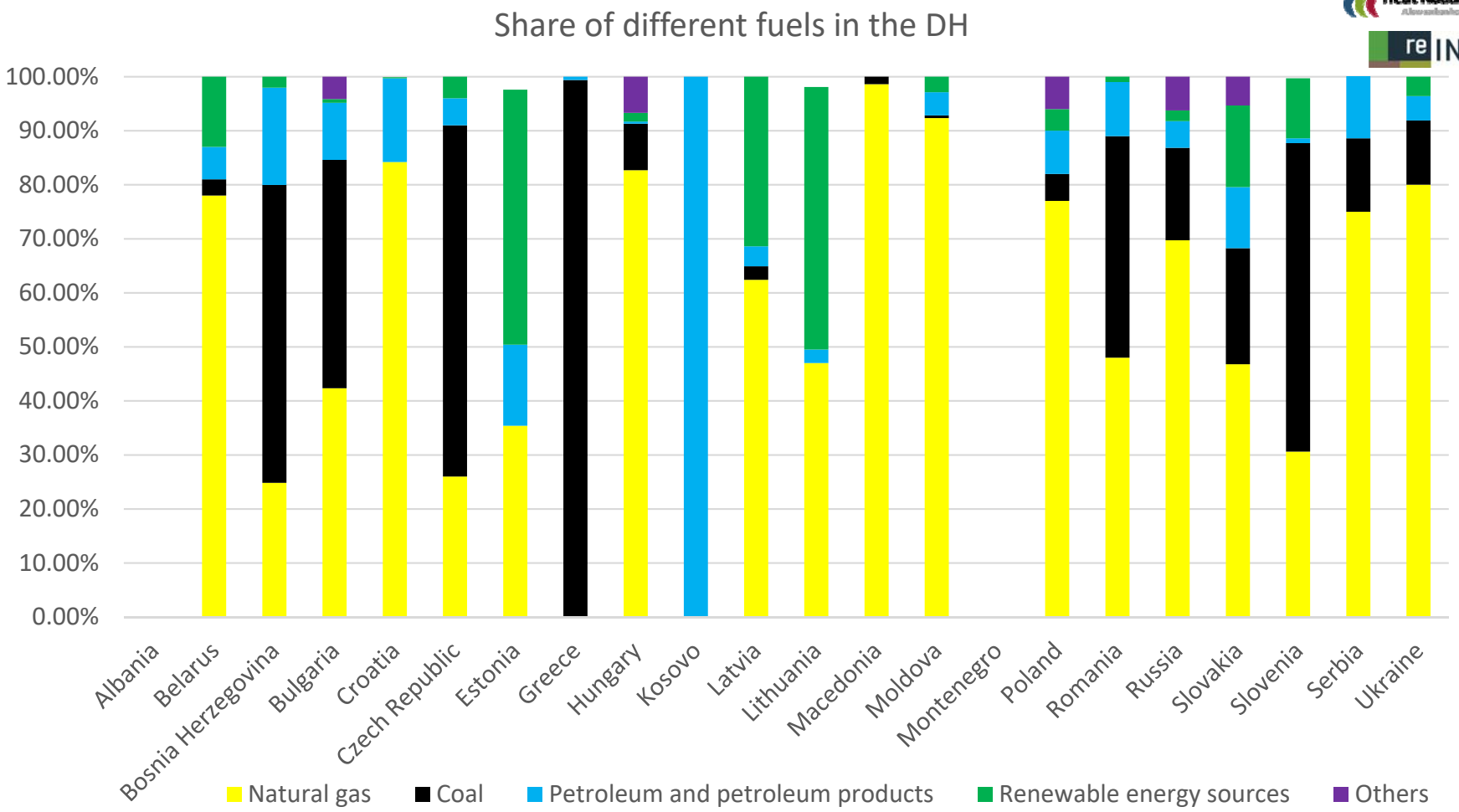
Status of district heating in Eastern Europe



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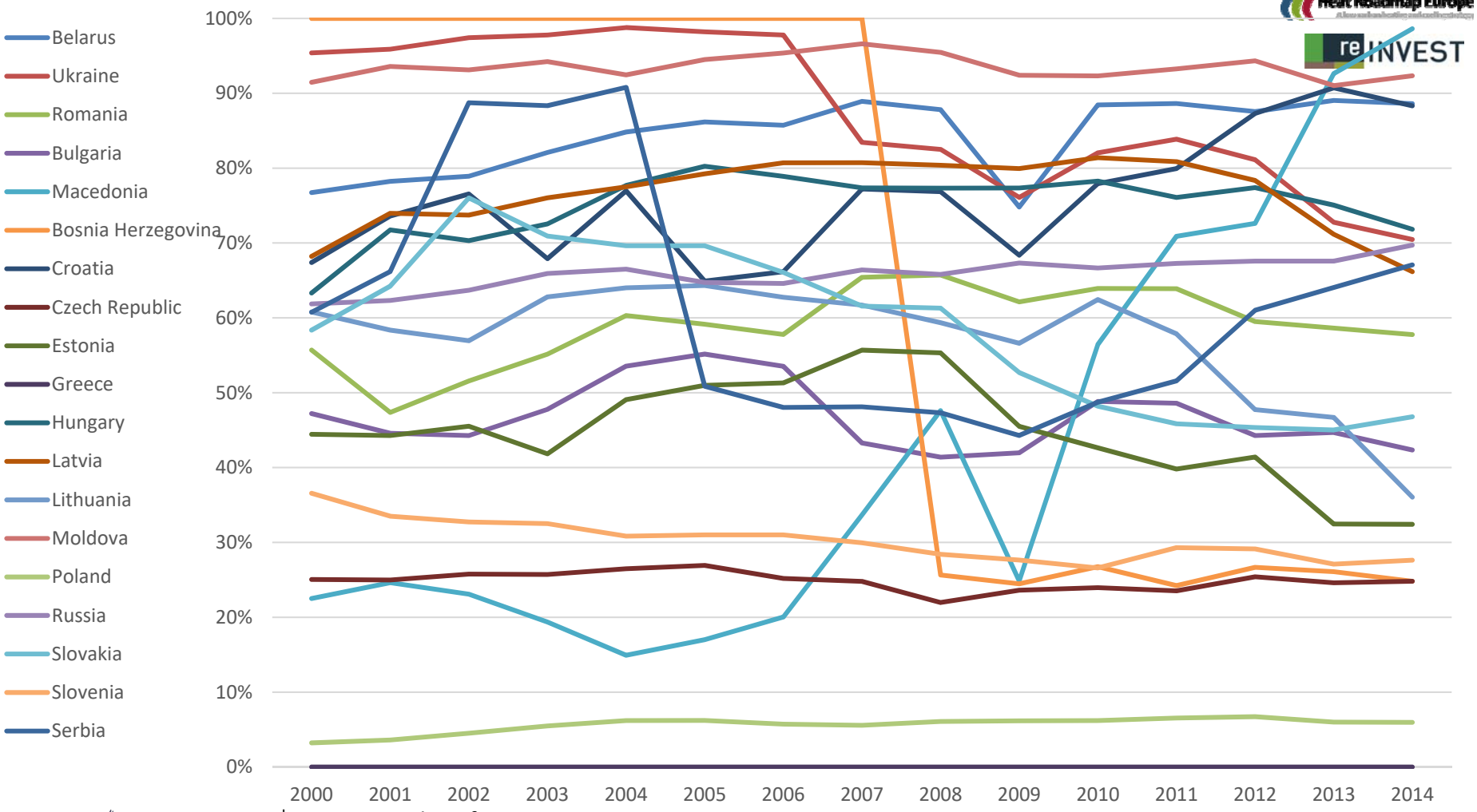
Source: UNIZAG FSB, STATUS AND PERSPECTIVES OF DISTRICT HEATING SYSTEMS IN EASTERN EUROPE, Report, 4DH and IEA, statistics, 2014, http://www.iea.org/statistics

Status of district heating in Eastern Europe



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Source: IEA, statistics, 2014
http://www.iea.org/statistics

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%
  - no open district heating market, 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

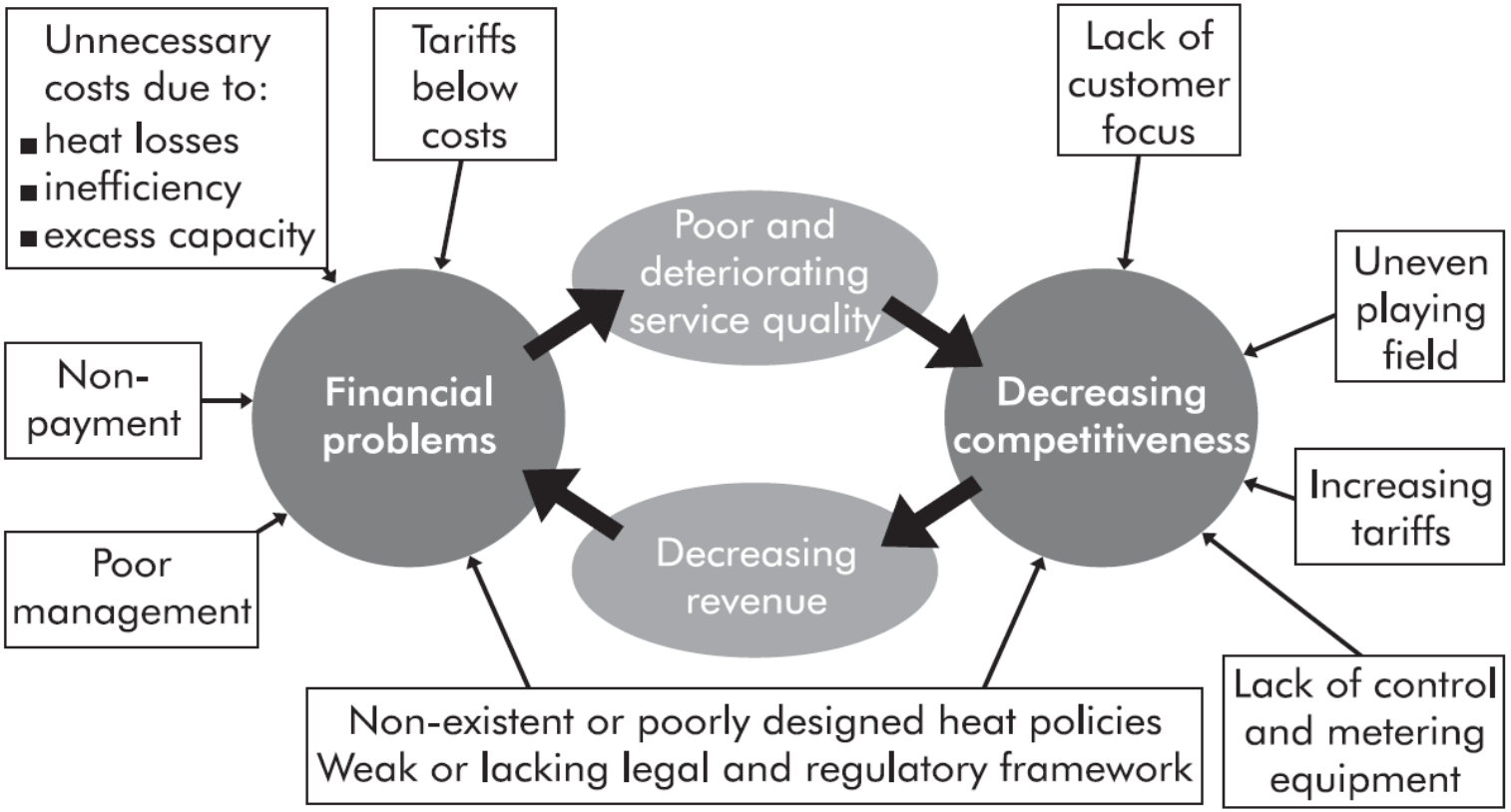
Main characteristics of DH systems in Eastern Europe

- 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

Source: UNIZAG FSB, STATUS AND PERSPECTIVES OF DISTRICT HEATING SYSTEMS IN EASTERN EUROPE, Report, 4DH, and Meyer and Mostert (2000), IEA/OECD, (2004).

Key challenges of DH systems in Eastern Europe



Source: IEA/OECD, 'Coming in from the Cold – Improving District Heating Policy in Transition Economies', (2004).

FSB

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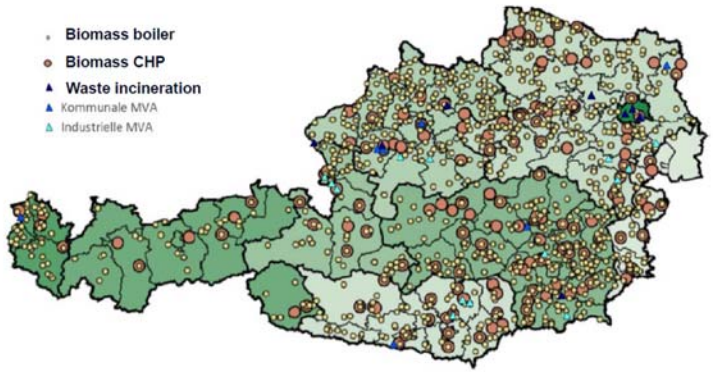
Heat Roadmap Europe

reINVEST

Stratego



In Austria, more that 2.400 heat networks are existing (among them a large number of small biomass networks). DH market share is about 24%. District cooling has only a minor role limited to some cities.

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Two CHP biomass plants in two EU member states:

	Velika Gorica (Croatia, 63,517 ppl.)	Jelgava (Latvia, 64 279 ppl.)
Heat capacity	35 MWt	45 MWt
Electricity capacity	20 MWe	23 MWe
Fuel consumption	210,000 t biomass	400,000 MWh biomass, 6,000 trucks
Heat production	125,000 MWh	220,000 MWh
Electricity production	150,000 MWh	110,000 MWh
Combustion	Circulating fluidized bed	Bubbling fluidized bed
Biomass type	Wood chips, wood residuals	Wood chips and agricultural residuals
Steam boiler capacity	55 MW	76 MW
Steam production	19.44 kg/s	26 kg/s
Steam temperature	522 °C	527 °C
Steam pressure	124 bar	117 bar

NOT BUILT
NIMBY

BUILT
NO NIMBY

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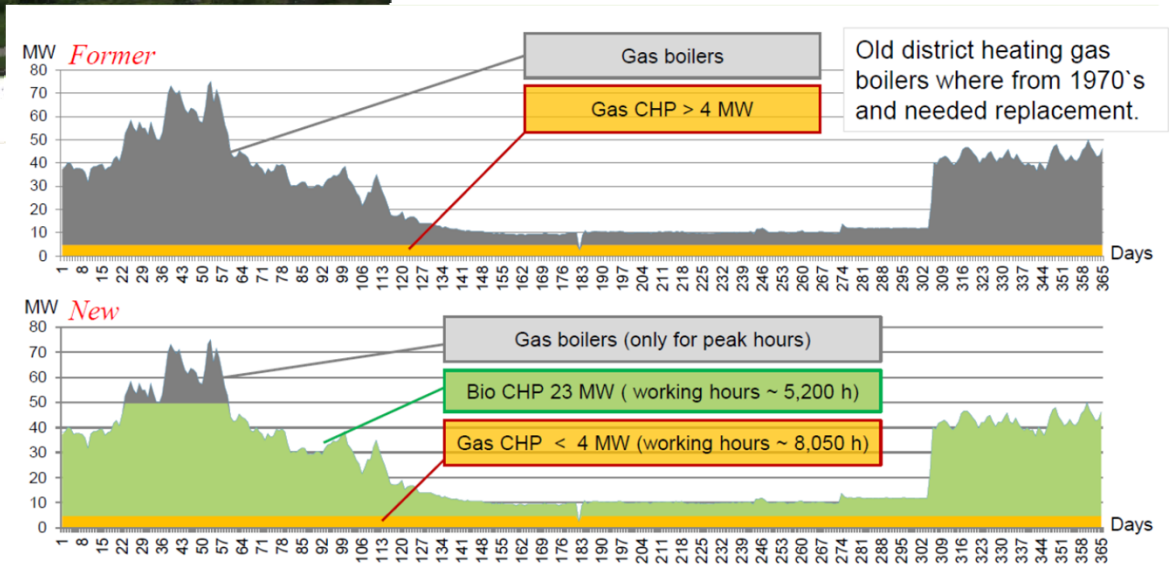
Savings, security of supply, cleaner environment, local jobs, investments, SEAP….. are not enough?

Fortum's biomass CHP plant in Jelgava

See video about Jelgava Bio CHP at:
http://youtu.be/J35wleC3dy0

Next generation energy company | Fortum



Key challenges of DH systems in Eastern Europe

- Ukraine
  - imperfect tariff setting system
  - imperfect system of payments between consumers and suppliers in the heat energy market
  - imperfect subsidy system
  - lack of investment in thermal upgrade of buildings and DH systems
- Romania
  - transmission & distribution networks rehabilitation for increasing technical performance and delivering a cost-efficient DH-supply service, thus enhancing end-user's acceptance
  - metering systems implementation for a reliable and transparent end-user consumption measurement
  - increasing the energy performances in public buildings thus enhancing DH supplying service efficiency

Solutions: Individual heating substation for heating and hot water supply on the basis of reliable and highly efficient plate heat exchangers, Ukraine

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National Technical University „Kharkiv Polytechnical Institute", Department of Integrated Processes and Chemical Engineering
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- **Energy saving 15-20%;**
- **Payback period less than 1,5 year;**
- **There are more than 400 IHS and 4,000 plate heat exchangers in 18 regions of Ukraine;**
- **Reconstruction of systems of hot water supply with the use of energy-saving technologies and installation of IHS in 34 buildings allowed to reach energy savings equivalent to 240 000 $ per year;**
- **IHS are equipped with automatic devices, pumping equipment and reliable reinforcement.**

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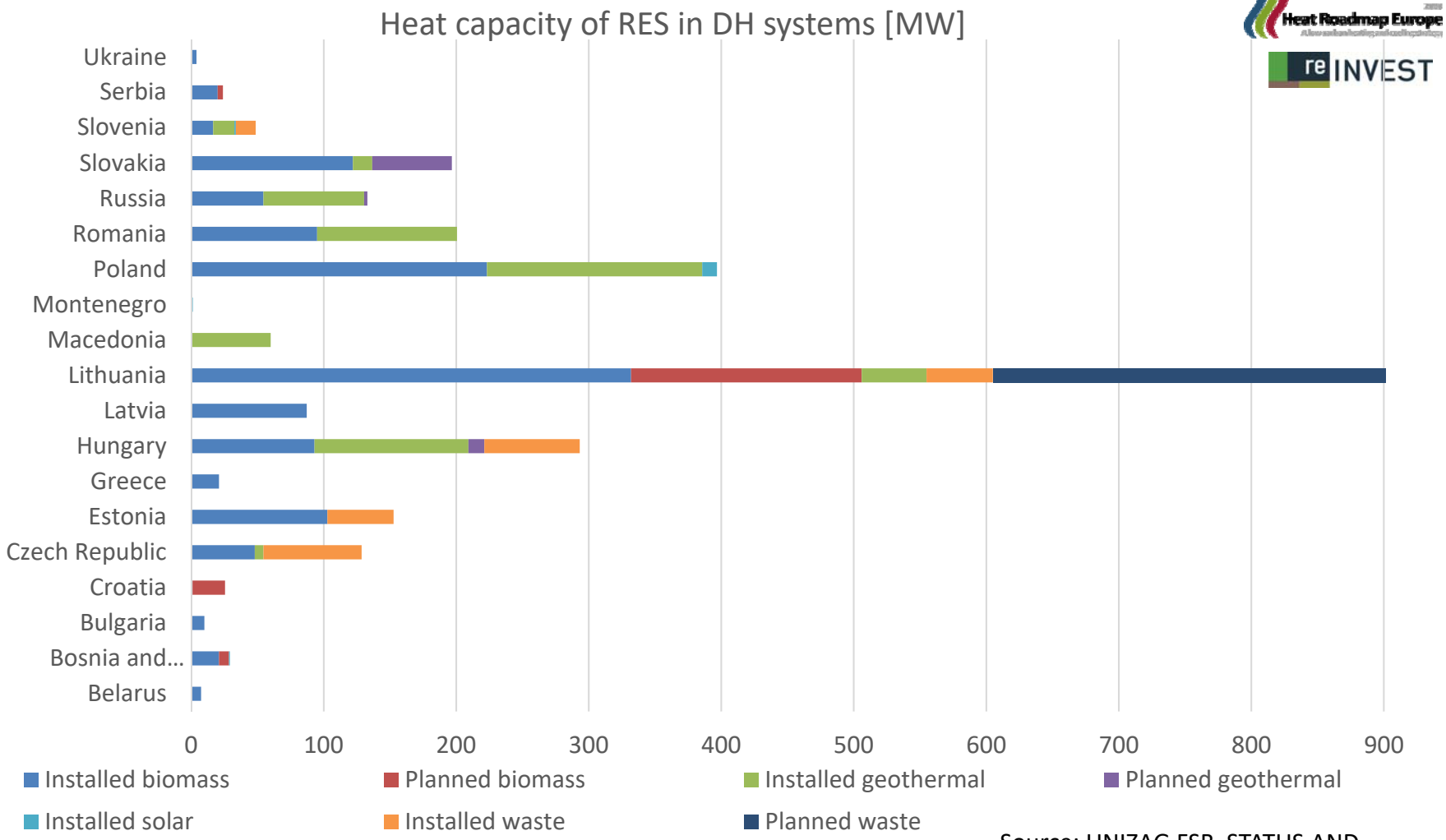
Use of locally available fuels in DH systems



Source: UNIZAG FSB, STATUS AND PERSPECTIVES OF DISTRICT HEATING SYSTEMS IN EASTERN EUROPE, Report, 4DH

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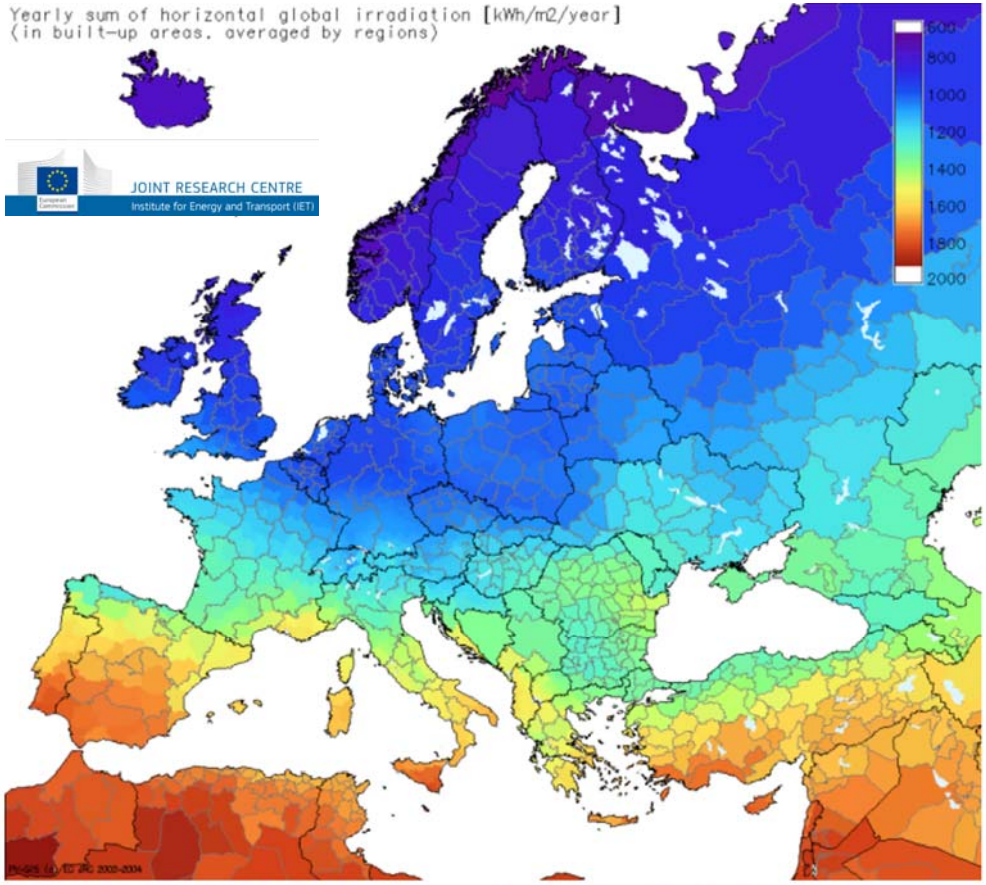
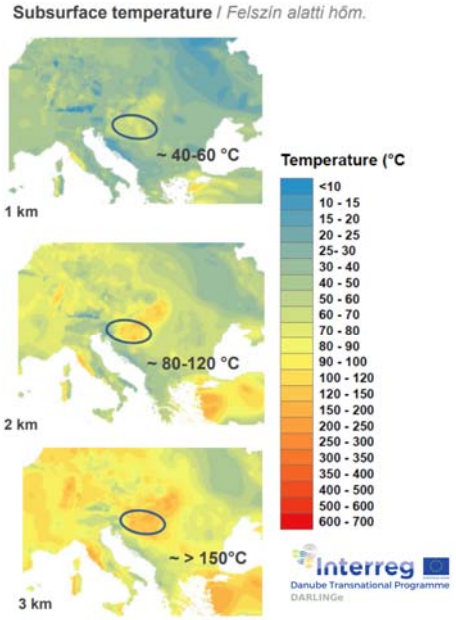
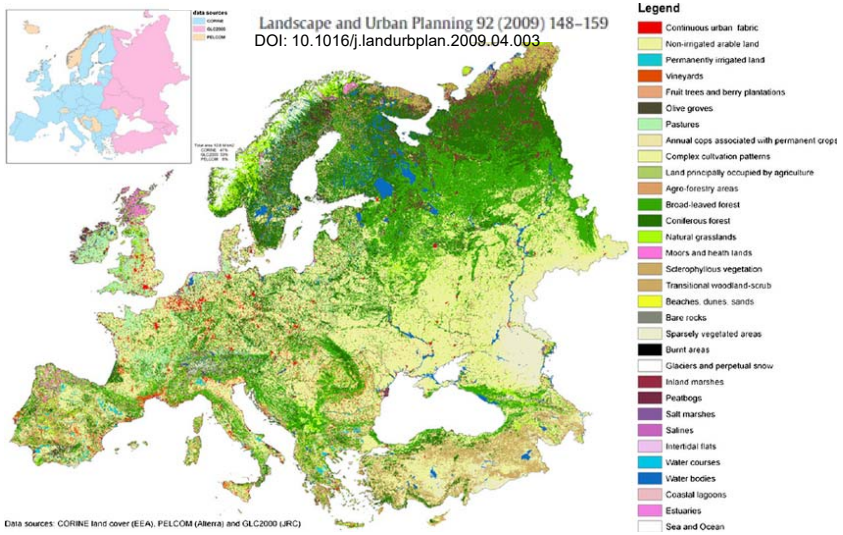
Renewable heating sources?



The yearly sum of global irradiation on a horizontal surface is considered only for built-up areas, then averaged for regions (NUTS level 3 for the EU).



Limberger and van Wees 2013

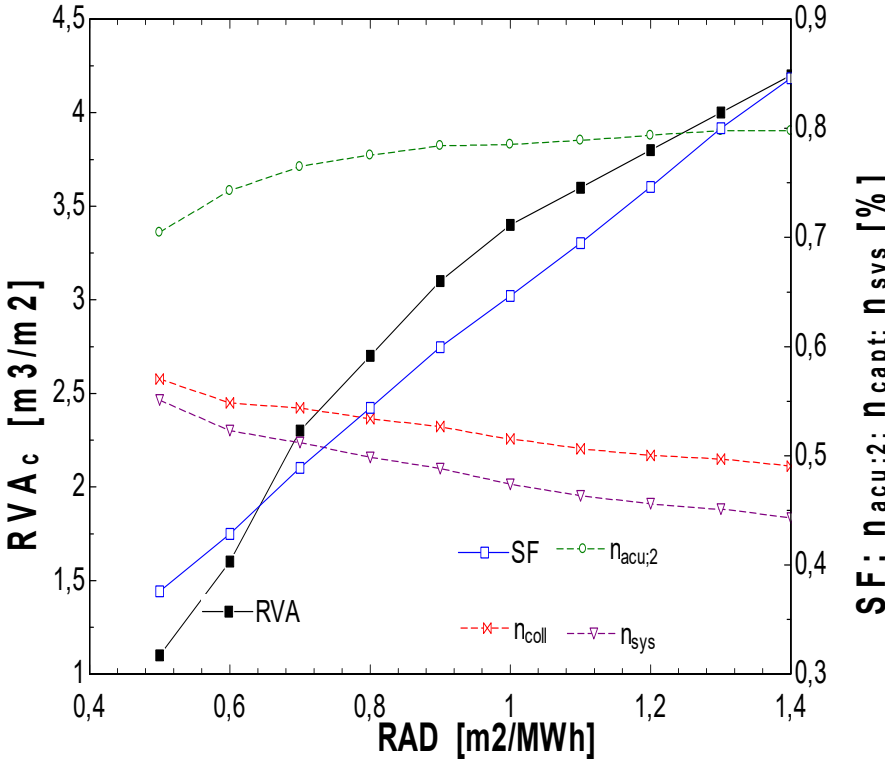


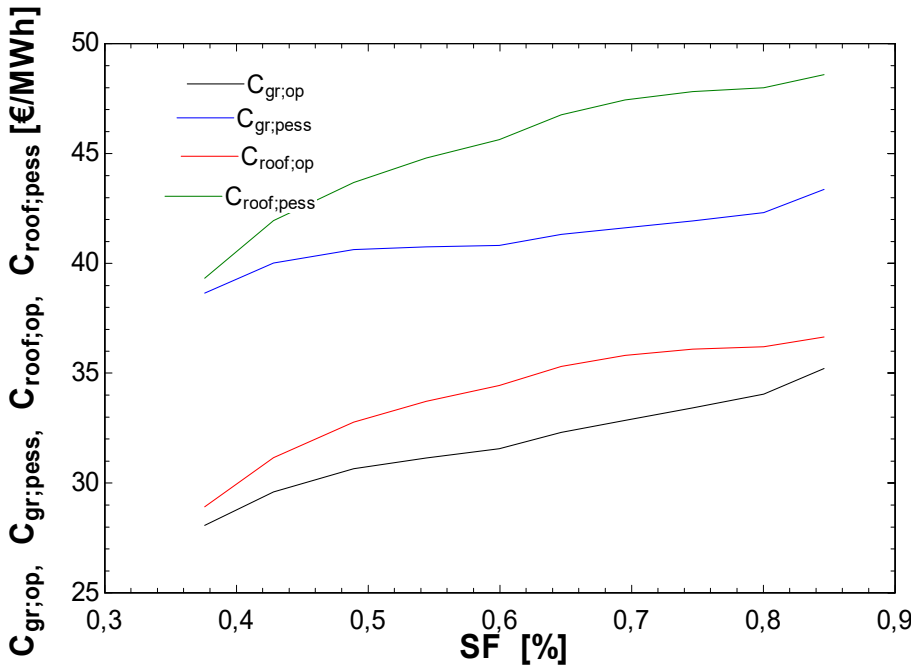
Seasonal storage Velika Gorica, Croatia – results

Felipe Andreu Javier, Schneider Daniel Rolph, Krajačić Goran:
Evaluation of integration of solar energy into the district heating system of the city of Velika Gorica, Thermal Science 2016 Volume 20, Issue 4, Pages: 1049-1060
https://doi.org/10.2298/TSCI151106106A

Critical volume criteria

- do not reject any heat produced
- reach the maximum usage of the accumulation





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Use of heat storage and waste

- MSW incineration plant are not so common in EEC
- Few examples in:
  - Czech Republic (Prague, Brno, Liberec)
  - Estonia
  - Hungary
  - Lithuania
  - Slovenia
- Heat storage is not commonly used in the district heating systems in EEC

National perspectives for DH systems in EEC

- DH systems are supported in national energy plans, strategies and recommendations
- Suggestions:
  - heat market liberalisation, new business models
  - improvement of financial stability of the district heating companies
  - reliability and efficiency improvement of the DHS
  - better DH regulation (heat metering, energy plans, demand forecasts)
  - reduction of operation and production costs
  - reduction of heat energy quantity used from the households
  - reduction of the households heating expenditures

Conclusion

- ageing of energy generation infrastructure which requires large investments in rehabilitation of existing district heating systems
- low DH efficiency and high emissions
- customer dissatisfaction with heat distribution systems which reduces total heat demand from DH systems and revenue
- DH system refurbishment will increase overall system efficiency, reduce emissions and improve quality of DH service
- in general biomass is the most available for district heating, while availability of geothermal and solar energy is limited
- substitution of fossil fuels with renewable energy sources will considerably reduce emissions and increase security of supply
- orientation to own resources is going to lead to job creation in local communities

CROATIAN ENERGY TRANSITION

www.het.hr

4dh

STRATEGO

CoolHeating

BEAST

HRE

Bin2Grid

AGROCYCLE

fosterREG

PlanHeat

Thank you for your attention!

Any questions?

goran.krajacic@fsb.hr

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