



The case of Eastern Europe

4th Generation District Heating - First Annual Conference

3rd October 2012

Utzon Center, Slotspladsen 4, Aalborg

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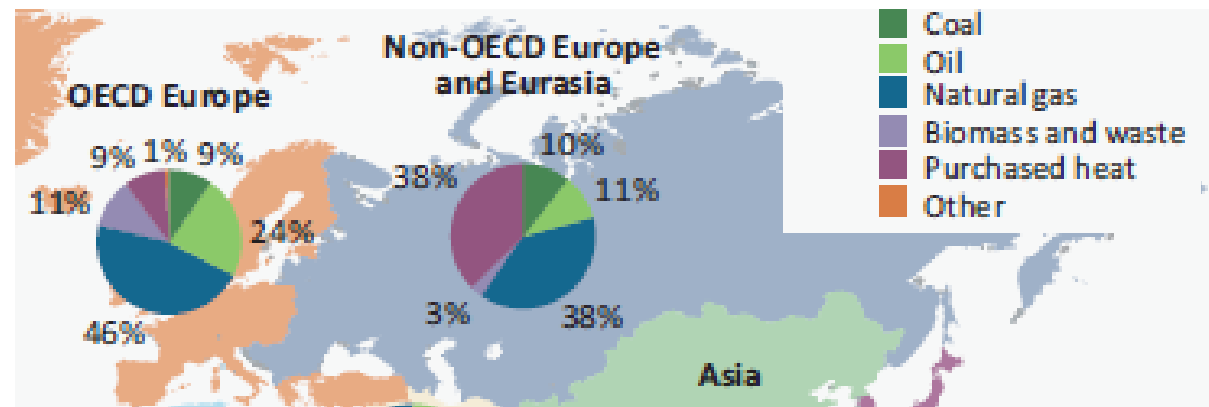
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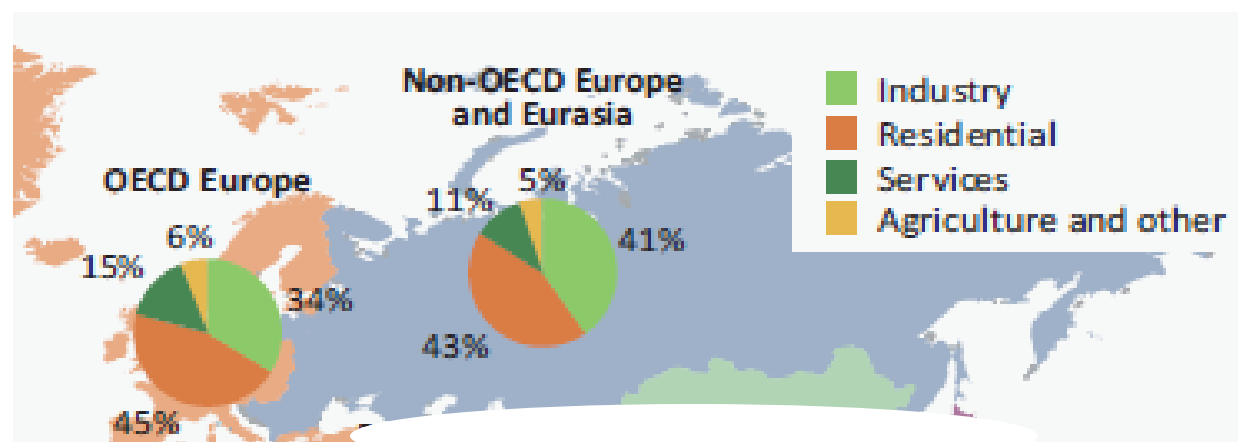
Introduction

- ◆ DH is widespread throughout Eastern Europe, but in transition countries face difficulties: inefficient heat production and high distribution losses, costs that exceed revenue and declining sales
- ◆ It used to be supplying high share of DH to industry
- ◆ High share of residential heating due to industry collapse
- ◆ High residential heat to hot water ratio – high winter/summer variability, usually no heat storage
- ◆ Usually subsidized or cross-subsidized, no incentive to increase efficiency
- ◆ Usually not metered but billed per m², or metered per building and billed per m²

Heat generation by region for different fuel types, IEA 2009

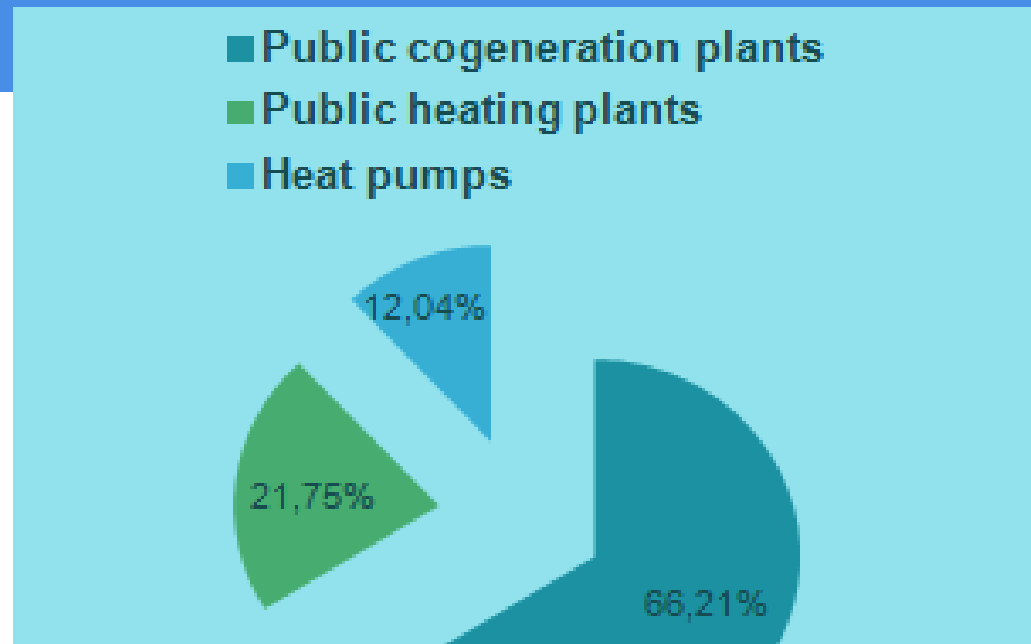


Heat consumption by region in various sectors, IEA 2009



Croatia

- ◆ DH systems exist in 17 towns; more than 155,000 customers
- ◆ Fuels: natural gas, fuel oil, light heating oil
- ◆ Distribution losses: ≈15%
- ◆ Heat production in 2010: 14,214 PJ



Length of distribution network (km)		Heating degree days Zagreb-Pleso				Number of households		
480		2,284				1,535,635		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings
	79.8	72.9	6.9	20.2	5.1	15.1	0	2,257,515

Pokupsko, Croatia – biomass DH system

- ◆ Municipality in southern part of Zagreb county - population ≈ 2.500
- ◆ Center of Pokupsko has 69 residential and commercial buildings - 2,100 MWh annually of heat needed
- ◆ The project is in planning stage with all main permits obtained
- ◆ Heating plant – 1 MW installed capacity
- ◆ 4,000 tones of wood chips available annually
- ◆ 80% - total efficiency in heat production
- ◆ Boiler losses 18%; network losses 8%
- ◆ Annual fuel demand – $2,100/0.74=2,800$ MWh

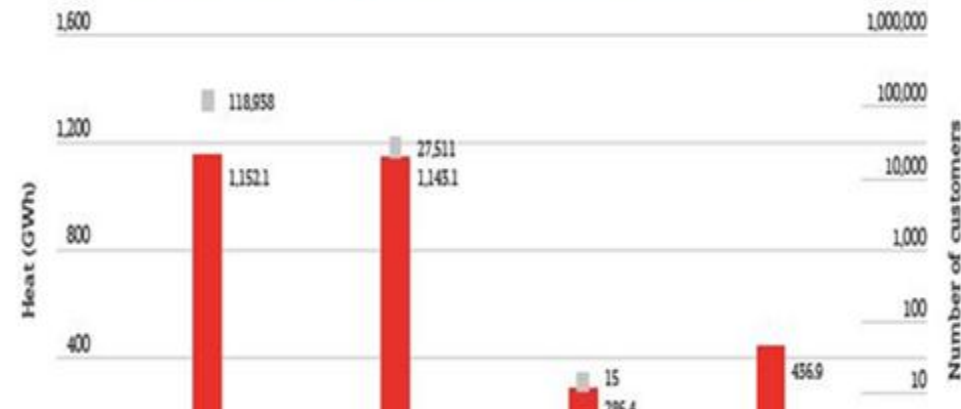


Source: Šegon, Velimir; Područno grijanje na biomasu

Slovenia

- ◆ DH systems exist in 48 of 210 Slovenian municipalities; ≈119,000 households customers
- ◆ Fuels: coal, natural gas, heating oils, renewables
- ◆ Distribution losses: ≈16%
- ◆ Produced heat energy from DH systems in 2010: ≈10.8 PJ

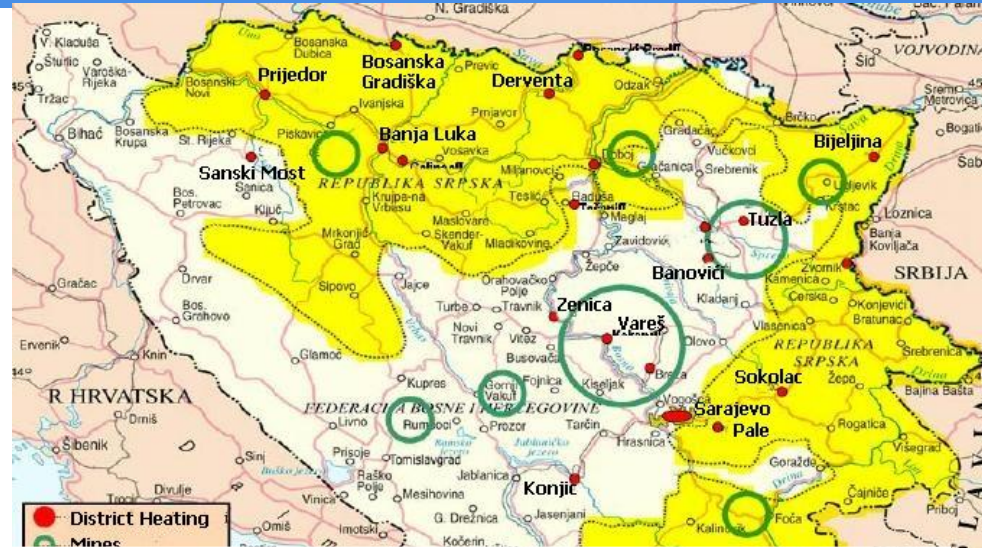
Heat consumption by type of customers and the customer number



Distribution network (km)		Heating degree days Ljubljana-Brnik				Number of households		
712.5		2,587				813,817		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings
	71.1	67.3	3.8	28.5	8	20.5	0.3	844,656

Bosnia&Herzegovina

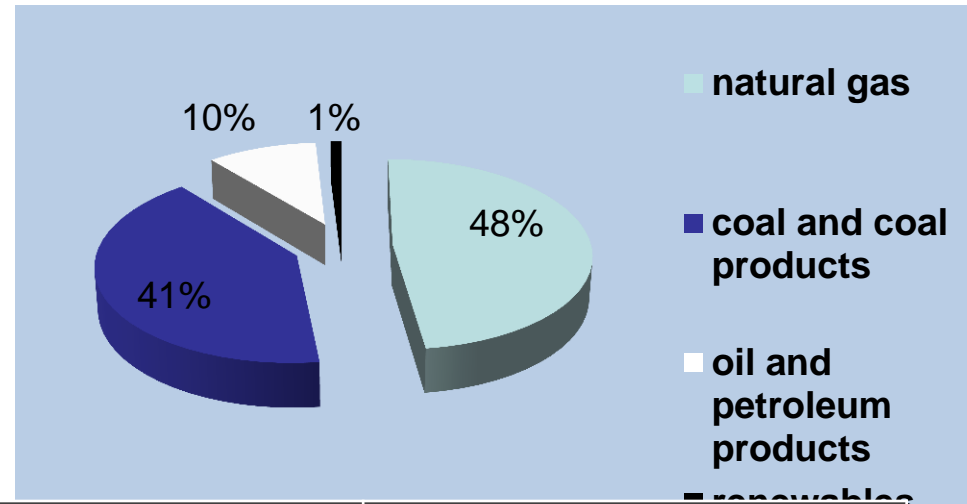
- ◆ DH systems exist in 22 towns
- ◆ 120,000 customers
- ◆ Fuels: natural gas (Sarajevo), heavy fuel oil, coal
- ◆ DH share in space heating and DHW in households and services is 12%; more than 4 PJ



Distribution network (km)			Heating degree days Sarajevo			Number of households		
N/D			2,932			1,054,613		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings
	78.5	71.1	7.4	19.6	N/D	N/D	0	N/D

Romania

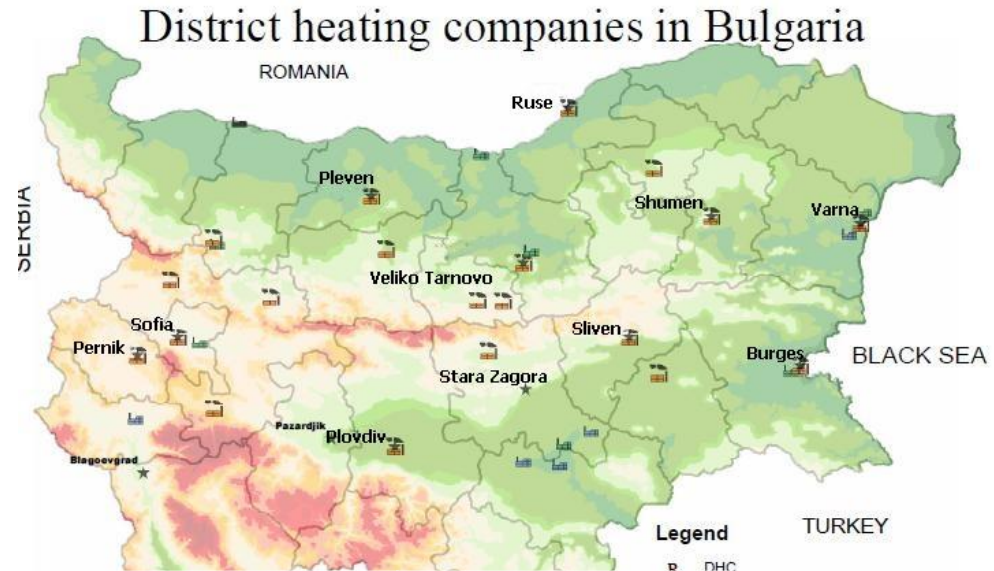
- ◆ DH systems operating in 92 towns; more than 1,900,000 users
- ◆ Fuels: natural gas, coal and coal products, oil and petroleum products, renewable sources
- ◆ Distribution losses: $\approx 19\%$
- ◆ Share of heat from DH systems



Distribution network (km)		Heating degree days Bucharest				Number of households		
7611		2,305				7,086,717		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings
	62.7	61	1.7	37.3	3	34.2	0	8,458,756

Bulgaria

- ◆ DH systems exist in 21 towns throughout Bulgaria; over 600,000 consumers
- ◆ Fuels: 1,4 billion m³ natural gas, 1 million tones of coal, 160,000 tones
- ◆ Distribution losses: 18%
- ◆ Production of DH systems was



Distribution network (km)		Heating degree days Sofia					Number of households		
2247		2,556					2,826,740		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings	
	56.8	47.1	9.7	42.7	5.7	37	0.5	3,898,688	

Macedonia

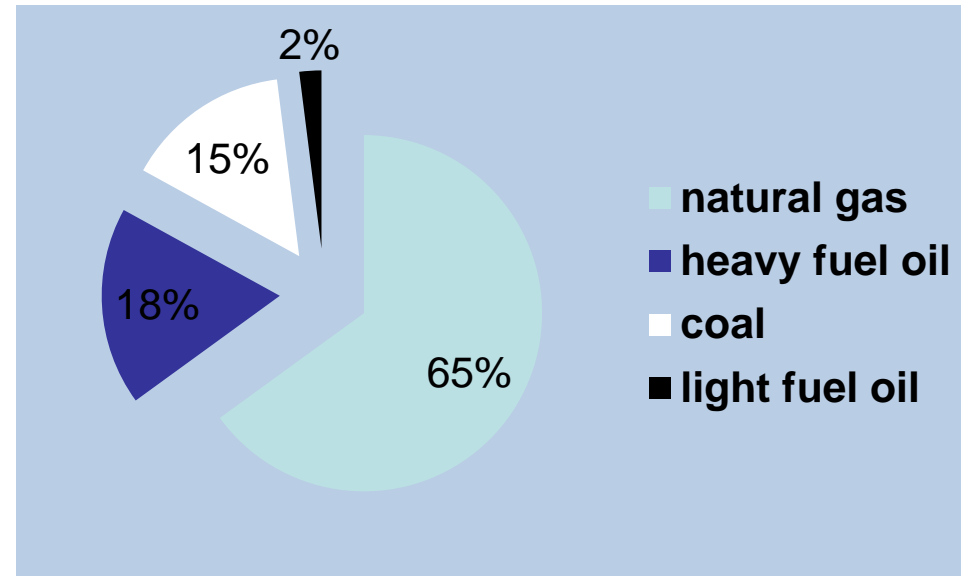
- ◆ DH systems are in Skopje, Bitola and Makedonska Kamenica
- ◆ 46,500 DH users
- ◆ 5 DH companies (3 in Skopje)
- ◆ Losses in distribution and transmission network: 6-12%
- ◆ Fuels: fuel oil, natural gas
- ◆ DH share – 9% of total heat



Distribution network (km)		Heating degree days Skopje-Petrovec				Number of households		
211.5		2,348				564,296		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings
	N/D	N/D	N/D	N/D	N/D	N/D	N/D	698,143

Serbia

- ◆ DH systems are in 55 towns operated by 55 DH companies
- ◆ 500,000 users
- ◆ Fuels: natural gas, heavy fuel oil, coal, light fuel oil
- ◆ Old dated and deteriorated distribution network
- ◆ DH share - ≈18% of total heat demands in households and



Distribution network (km)		Heating degree days Belgrade-Surčin					Number of households		
N/D		2,138					2,497,187		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings	
	N/D	N/D	N/D	N/D	N/D	N/D	N/D	3,243,587	

Montenegro

- ◆ There is (was) one DH system in Montenegro (town of Pljevlja)
- ◆ 470 users
- ◆ Fuel: coal
- ◆ Share of DH is 0,7% of total heat demands during one year
- ◆ There is ongoing project of building DH system on biomass



Distribution network (km)		Heating degree days Podgorica				Number of households		
N/D		1,381				194,795		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings
	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D

Kosovo

- ◆ DH systems are in 3 towns: Prishtina, Gjakova and Mitrovica
- ◆ 13,260 users
- ◆ Fuels: mostly heavy fuel oil, some light fuel oil
- ◆ Great thermal losses
- ◆ Installed thermal capacity: 183.5 MWth
- ◆ Share of DH is 5% in total heat demands; more than 0.5 PJ

Distribution network (km)		Heating degree days				Number of households		
92.5		2,377				295,070		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings
	90	N/D	N/D	10	N/D	N/D	N/D	403,459

Albania

- ◆ Albania doesn't have DH systems (source IEA)
- ◆ 20 DH systems in Albania (presentation of Dr. Edmund M. Hido)
- ◆ 2/3 of electricity consumption is used for space heating and water heating
- ◆ electricity covers half of the heating energy demand
- ◆ There are some researches about possibility of building DH system on geothermal energy (Elbasan project)

Distribution network (km)		Heating degree days Tirane				Number of households		
N/D		1,300				740,256		
Distribution of population by dwelling type	Houses (% of total)	Detached houses (% of total)	Semi-detached houses (% of total)	Flats (% of total)	Flats in a building with less than 10 dwellings (% of total)	Flats in a building with more than 10 dwellings (% of total)	Others (% of total)	Absolute number of dwellings
	70	N/D	N/D	30	N/D	N/D	N/D	1,075,881

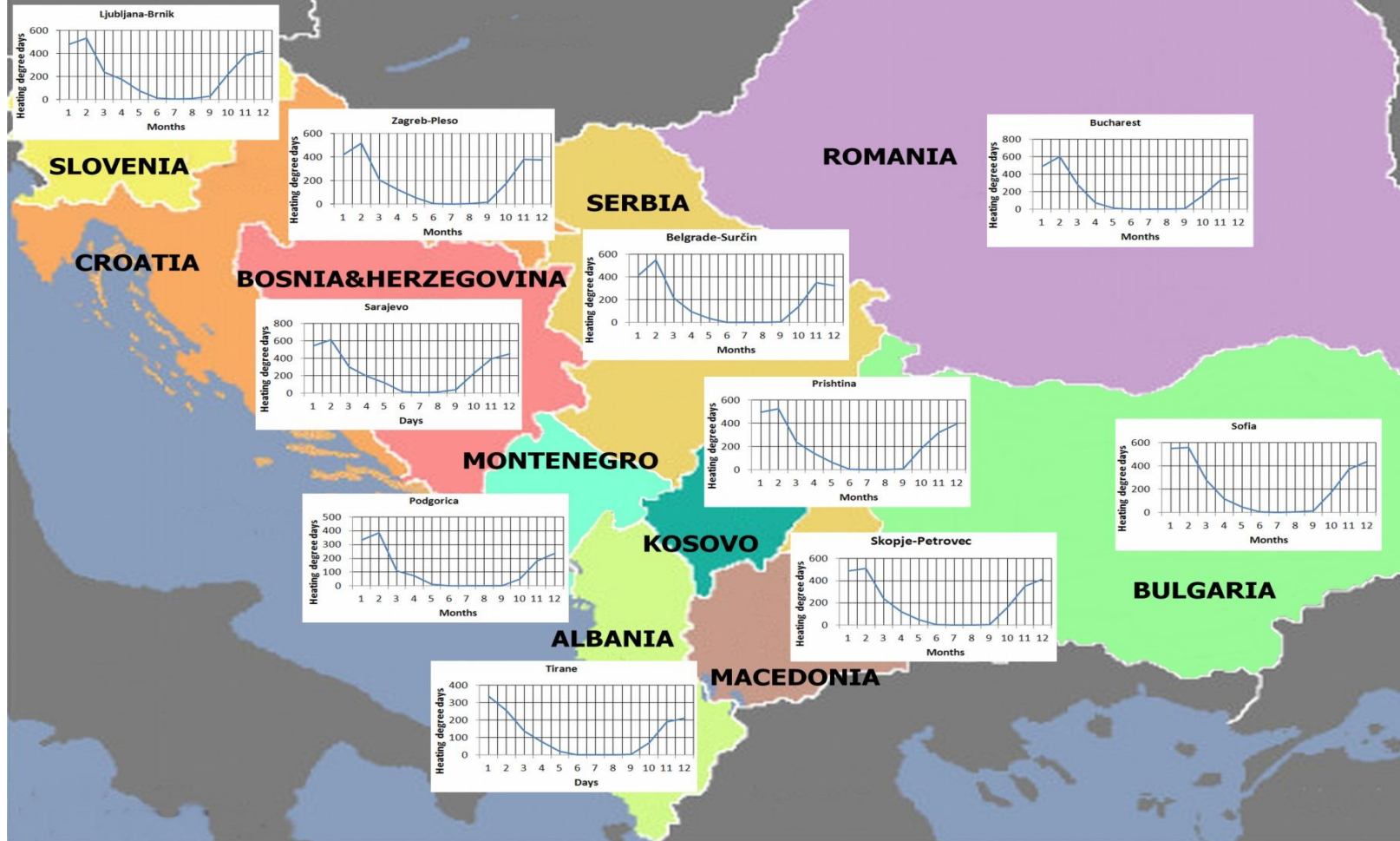
Geothermal district heating project in Elbasan City, Albania

- ◆ Planned for new small residential part of Elbasan, indoor area 119,000 m²
- ◆ Total heating capacity 5.954 MWth
- ◆ The system consists of 2 elements: the geothermal production system from 3 wells and the peak load boiler
- ◆ Flow rate of 30 l/s with a water temperature of 65.5 °C
- ◆ Possible geothermal capacity is 2.77 MWth and utilisation of 3473 FLH
- ◆ Annual energy needed for space heating and DHW is 15,374 MWh; geothermal share 74 %

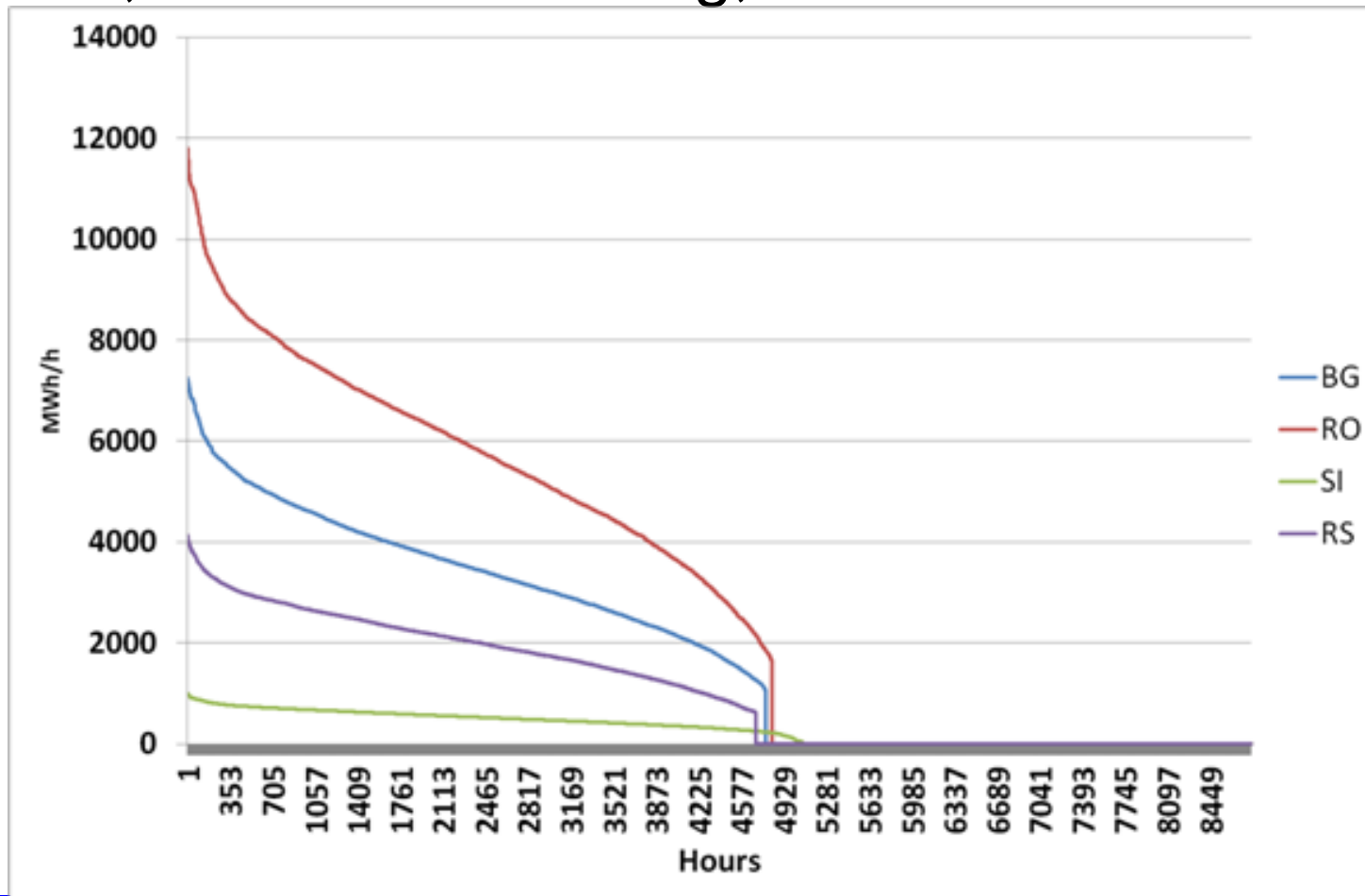


Source: Kurti, Armond: Geothermal District Heating in a Part of Elbasan City, Albania

Heat degree days of the capitals in SEE



LDC, residential heating, SEE



Existing geothermal district heating systems in Southeastern Europe

- ◆ Slovenia (Murska Sobota, Lendava), Romania (Oradea, Beius), Macedonia (Kocani)
- ◆ 300 dwellings in Murska Sobota and school, kindergarten, dwellings in Lendava are heated from GDH systems; total 12,200 MWh/yr
- ◆ Oradea – city DH and university DH system
 - ◆ City DH system – supply of DHW to 3000 apartments and 8000 people (present capacity of 2.2 MWth producing 21,000 MWh/yr)
 - ◆ University DH system – DHW and space heating for campus and 3 apartment blocks in vicinity (capacity of 3.4 MWth)
- ◆ Beius – 1000 apartments, public and commercial buildings
- ◆ Kocani – geothermal heating for 2 greenhouse complexes and the town
 - ◆ Nominal capacity – 60 MWth; water capacity production – 400 l/s

Overview of existing and planned biomass DH systems in SE Europe

- ◆ Slovenia – the biggest progress; biomass is the most important renewable energy source with a more than 50% share
- ◆ There is about 20 biomass DH systems (Vransko, Kočevje, Črnomelj...) and 6 biomass based CHP systems (the biggest one is Merkscha)
- ◆ Romania – the Intorsura Buzaului DH system uses sawdust as fuel (capacity 7 MW, produced energy 8.05 GWh/year)
- ◆ Bulgaria – DHS in Bansko using wood chip, two boilers with capacity of 5 MW each, producing more than 15 MWh heat energy
- ◆ Croatia – in Pokupsko i Žakanje municipality ongoing projects
- ◆ Montenegro – Pljevlja project financed with loan by EBRD
- ◆ In Bosnia and Herzegovina, Serbia, Macedonia, Kosovo and Albania there is no DH systems on biomass

Development strategies of DHS in SEE

- ◆ **Slovenia** – almost 70% of primary energy is imported; the main goal is increasing the use of RES (30.8% of energy for heating and cooling from RES until 2020), big investments in biomass DHS (almost 20 of them were built from 2004),
- ◆ **Croatia** – HEP invests in modernization of its existing DHS, decreasing distribution losses, improving infrastructure, etc. There are plans for new DHS on biomass in small towns where wood biomass is easily available
- ◆ **Bosnia and Herzegovina** - plans for rehabilitation of existing DHS (improving heat network infrastructure, rehabilitation and construction of boiler rooms, improvement of distribution and transmission network, etc). Some studies about possibility of biomass DHS are conducted (Donji Vakuf, Pale, Vitez)
- ◆ **Serbia** – priority in DH sector is decreasing heat losses, modernization of network and substations, emissions reduction and increasing use of biomass. There is KfW project for rehabilitation of DHS in major towns which is financed by loans
- ◆ **Montenegro** – the new DHS on biomass in Pljevlja is the main project concerningng DH and will include use of biomass (finalization in 2013)

- ◆ **Romania** – DH and CHPs need urgent modernization because of very high energy losses and very poor quality of delivery; required great investment in this area
- ◆ There is project to modernize DHS of Bucharest which is the largest in the country and has great losses in distribution network, there are also plans for use of biomass in DHS
- ◆ **Bulgaria** – rehabilitation of DHS is required (modernization of substations, heat transmission network, heat sources in order to guarantee a safe and reliable operation, etc.) Plans for future of DHS: use of alternative fuels (waste, biomass), high efficient cogeneration, automation of the heating grid
- ◆ **Macedonia** – there is desire for revitalization of geothermal DHS in Kocani
- ◆ **Kosovo** – DHS are fired with heavy fuel oil (pollution problems), plans to switch to natural gas when pipeline is completed, increase efficiency of existing DHS and to introduce meter-based billing system and to increase number of users
- ◆ **Albania** – studies to use geothermal potential of some Albanian regions and biomass in DHS

Russian Federation

- ◆ Russia has the largest and oldest DH system in the world
- ◆ DH is widely used form of heating (more than 200,000 km of DH pipeline system, but more than half is passed its life expectancy)
- ◆ 91% of all buildings in large cities and 60% in small towns are connected to DH
- ◆ 50,000 DH systems
- ◆ 2,806.5 PJ of heat is consumed in household and service sector
- ◆ CHP plants are predominately fuelled by natural gas (82-83%) in European part of Russia, and with coal (81-86%) in Siberia and Far East
- ◆ DH share: 70%
- ◆ Since 2000 heat consumption in residential sector dropped by 38%
- ◆ Most of network needs urgent rehabilitation (great heat losses)
- ◆ It is estimated that a minimum of 10-12% of pipes need to be changed every year (only 1% is changed, lack of investments)

Poland

- ◆ 499 DH systems in all major towns, DH capacity is 59,260 MW (19,400 km of pipeline systems)
- ◆ 500 companies operated in this sector income of about €4.1 billion in 2010
- ◆ Fuels: coal, oil, natural gas, biomass (7% RES share in 2009)
- ◆ About 207 PJ of heat is delivered to households and services
- ◆ DH share in total heating needs 52%
- ◆ The largest DH system in Poland and in EU is Warsaw
- ◆ 38,000,000 GJ/yr of heat delivered, supplying million citizens (19,000 buildings)



Source: Surma, Tomasz: District Heating in Poland

Ukraine

- ◆ In Ukraine main consumers of thermal energy are: households 44%, industry 35%, rest of the economy 21%
- ◆ Heat production is carried out by 250 CHP plants and more than 7000 heat only boilers
- ◆ Fuels: natural gas (76-80%), oil (15-18%), coal (5-6%)
- ◆ The cost structure of thermal energy: natural gas 55%, power costs 11-15%, water cost 8%
- ◆ Almost 155 PJ of energy from DH is consumed by households
- ◆ The share of DH in total heat is about 42%
- ◆ The heat network length is 34,625.5 km, including 5491.4 km in emergency and end-of-life pipelines
- ◆ Problems: very poor technical condition of heat generators and distribution networks, inefficient system of distribution of heat (great heat losses), problem of financial nature (lack of investments, people do not pay for consumed heat)

Czech Republic

- ◆ 449 DH systems
- ◆ Over 7,500 km of DH network
- ◆ 64 PJ – heat energy consumed by households and services
- ◆ 142 PJ – total consumption of heat
- ◆ DH share: 45%
- ◆ The largest DH system is in Prague serving 265,000 households and selling 13 PJ of heat annually

Slovakia

- ◆ 365 DH systems
- ◆ 3,471 km of DH network
- ◆ 28,6 PJ – heat energy consumed by households and services
- ◆ 71 PJ – total consumption of heat
- ◆ DH share: 68%

Estonia

- ◆ DH systems 200
- ◆ 18,82 PJ – heat energy consumed by households and services
- ◆ 36,2 PJ – total consumption of heat
- ◆ DH share: 52%

Latvia

- ◆ 40 DH systems
- ◆ 21,7 PJ – heat energy consumed by households and services
- ◆ 32 PJ – total consumption of heat
- ◆ DH share:40%

Lithuania

- ◆ DH systems 30
- ◆ 29,7 PJ – heat energy consumed by households and services
- ◆ 42,4 PJ – total consumption of heat
- ◆ DH share: 70%
- ◆ new waste to energy CHP plant in the City of Klaipeda will start operation in 2013 (270 000 tons of municipal and industrial waste will be expected to produce around 150 GWh of electricity and 400 GWh of heat annually)

Moldova

- ◆ DH systems: N/D
- ◆ 7,4 PJ – heat energy consumed by households and services from DH
- ◆ N/D – total consumption of heat
- ◆ DH share:N/D

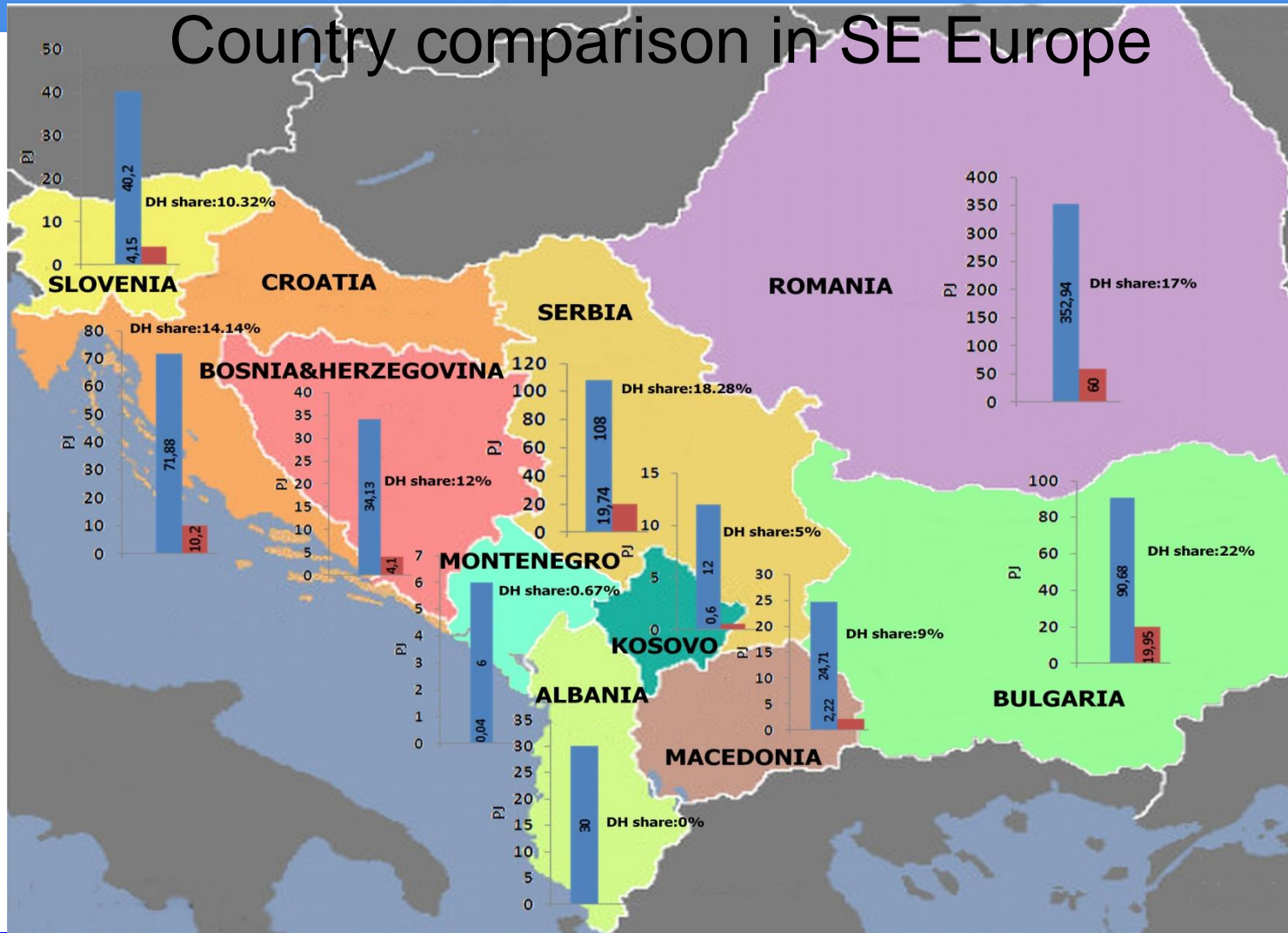
Hungary

- ◆ 92 DH systems in all major towns
- ◆ 650,000 users of DH
- ◆ Households receive about 32 PJ from DHS
- ◆ Total consumption of heat in households is about 187 PJ
- ◆ DH share is about 17%
- ◆ there are around 16 geothermal district heating projects in operation with over 500 MWth of installed capacity and this number will double by 2014.

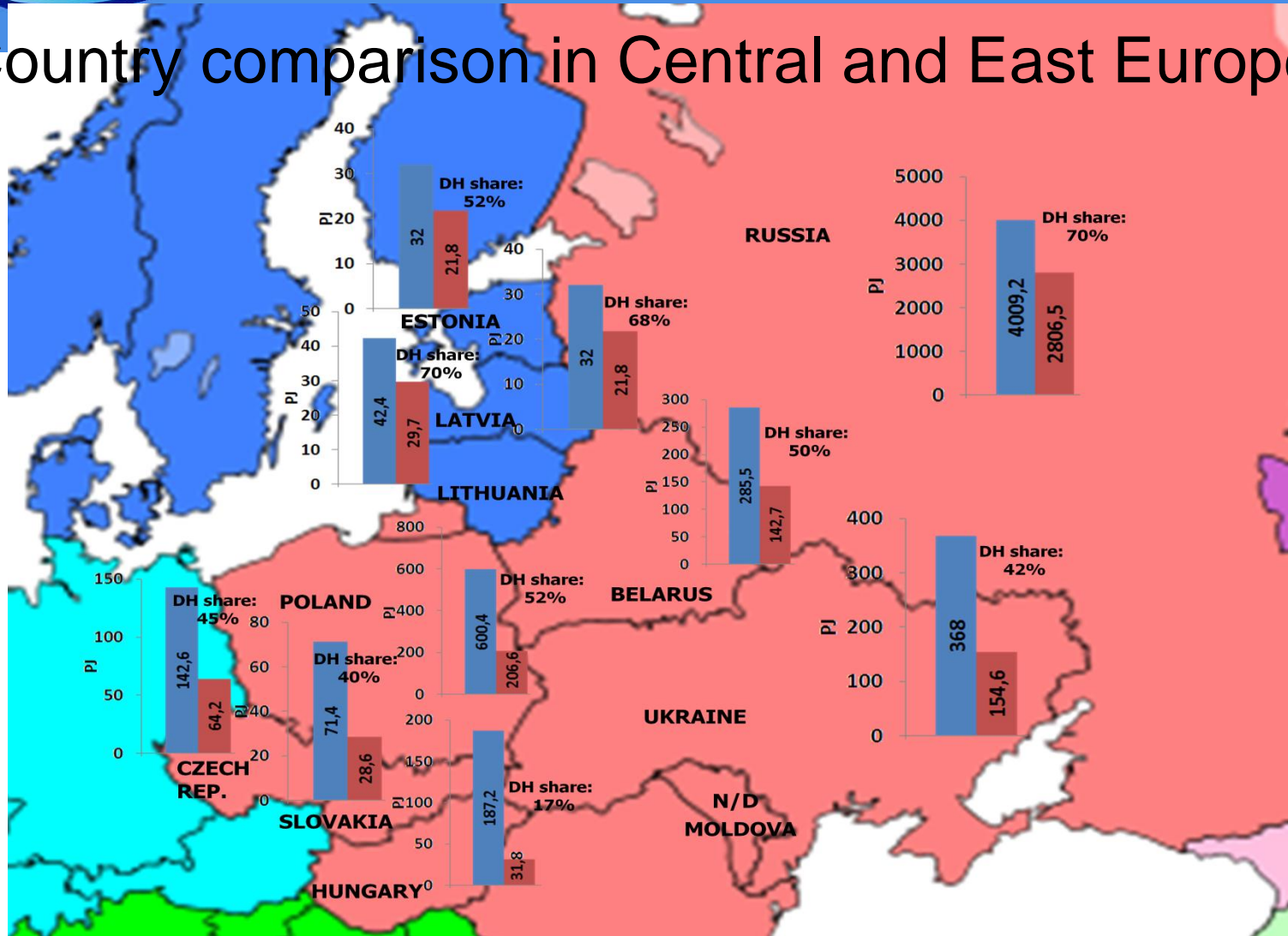
Belarus

- ◆ DH systems: N/D
- ◆ 142,7 PJ – heat energy consumed by households and services from DH
- ◆ 285,5 – total consumption of heat
- ◆ DH share: 50%

Country comparison in SE Europe



Country comparison in Central and East Europe



Conclusions

- ◆ Problem is that majority of equipment is in very bad condition or at the end of its lifetime
- ◆ Investments are needed in rehabilitation of existing DHS
- ◆ District heating and cooling are marginalized areas of energy policy and technology, energy policy makers do not see the potential of DHS
- ◆ DHS could significantly contribute to the achievement of national energy policy objectives in Eastern Europe as well as shift to low carbon heating system
- ◆ They can secure efficient use of energy and allow large-scale integration of renewable energy sources in urban areas
- ◆ Biomass fired DHS are becoming more popular as this is very effective way to increase use of renewable energy sources
- ◆ EU - Member States must complete a “comprehensive assessment” by December 2015 of the potential of high-efficiency cogeneration and efficient district heating/cooling, set their own targets and present national efficiency action plans in 2014, 2017 and 2020. (New Energy Efficiency Directive -EED)



Thank you for your attention!

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