Benchmarking District Heating in Hungary, Poland, Lithuania, Estonia and Finland

Presentation of benchmarking results –
a supplement to “Executive summary report”

20th April 2011
Pilot co-project between ERRA and Fortum

Contents

Summary – benchmarking (BM) benefits

- **BM enables implementation of necessary incentives in regulated industries as BM will help to assess the level of performance and as accurate measures will be created and agreed.**
- **BM should not be seen as one-off exercise but as a valuable consistent and long-term tool to develop the efficiency of an industry.**
- **BM can be implemented as a part of either ex-ante or ex-post regulatory review.**
- **BM can help to create a symmetric risk for the regulated industry i.e. that**
  - **Best performing companies will be rewarded for high efficiency and**
  - **Worst performing companies cannot be guaranteed to recoup the full cost of equity as long as their performance is not on an acceptable level.**
- **A limitation of BM can be the fact that within one country there don't exist well comparable DH companies with whom the relevant benchmarking could be done.**
  - **For example, in many countries there only are few major DH companies (e.g. Warsaw DH system) and it may be difficult to find similar companies in one country. Thus the regulators should look for cross-border BM co-operation with other countries having comparable DH companies for benchmarking purpose.**

Summary – benchmarking (BM) objectives

Question	Area
How to best promote district heating?	• Energy policy and regulatory frameworks: market regimes, evaluation of outcomes
What is DH's value for a typical customer?	• Heating costs: prices, specific heat consumption, average household income
How to incentivize for world-class efficiency?	• Cost efficiency of heating industry: production with different fuels, CHP vs. HOB and heat networks • Quality of operations
Is DH competitive with alternative solutions?	• Competitiveness of district heating with alternative space heating solutions
How to best promote sustainability and energy efficiency?	• Schemes to promote RES and CHP (market regimes, subsidies)

Summary – general conclusions

- BM should account for the possibility that DH companies may use different combinations of factors to deliver their heating services. Thus it is important not to look at any cost item in isolation but to consider company performance “as a whole” (total cost benchmarking; TOTEX).
- BM should also account for the effect of external factors that are beyond the control of management e.g. size of DH system, temperature, electricity price and subsidy schemes.
- Sufficient focus on data comparability and perhaps direct participation of individual DH companies should be considered. In this survey, the limited number of companies means that the results are not representative for whole heating industry. For example, the analysis of different fuel mixes and share of electricity production should be further improved.
- The regulatory objectives seem to narrow to the heat price as the key decision criteria. For a customer, the opportunity and motivation to influence on his heat consumption might be as important tool for increased satisfaction and image of DH. Coming from EU policy objectives, another important objective should be to encourage investments for new connections, higher efficiency of systems and optimizing electricity production utilizing existing heat demand.
- Without having transparent and well described regulatory objectives and related justification of selected methodologies, it is indeed difficult to evaluate how energy policy targets have been met or to establish cross-country benchmarking for that.
- There is a high degree of diversification in the regulatory methodologies of district heating/CHP between countries. Tariff approval process, justification of costs and assets have significant differences although established under basic framework called cost-plus regime.

Summary – benchmarking results

- The survey target has been to introduce a set of key performance indicators (KPIs) to pilot a cross-border benchmarking of district heating. These KPIs can also be utilized within a country.

- Regulatory regimes are either cost-plus (all surveyed countries) or alternative based approaches. In Finland, DH companies have the responsibility for tariff approval and have started to consider alternative based approach due to increasing competitive pressure coming from other space heating solutions. Cost-plus regimes do not lead to higher cost efficiency or lower tariffs. Instead, they may lead to lack of cost disciplines, inconsistency of investments and higher prices.

- There is a high degree of variance between heat prices between countries and companies using similar fuels. The main reasons are: price setting regime, fuel mix and prices and cost efficiency. Price setting is driven by national energy and competition policy, fuel strategy is driven by availability and investment possibilities. Cost efficiency is driven by several issues e.g. regulatory incentives and several company specific drivers.

- Profitability of DH companies is varying substantially. The poor results of some companies raise the question that how DH companies are able to serve their debt financiers if the volatility of profits is under continuous downward risk.

- An important heat price and efficiency driver is also share of electricity production. That impact has not been analyzed in-full and should be carried on within next steps.

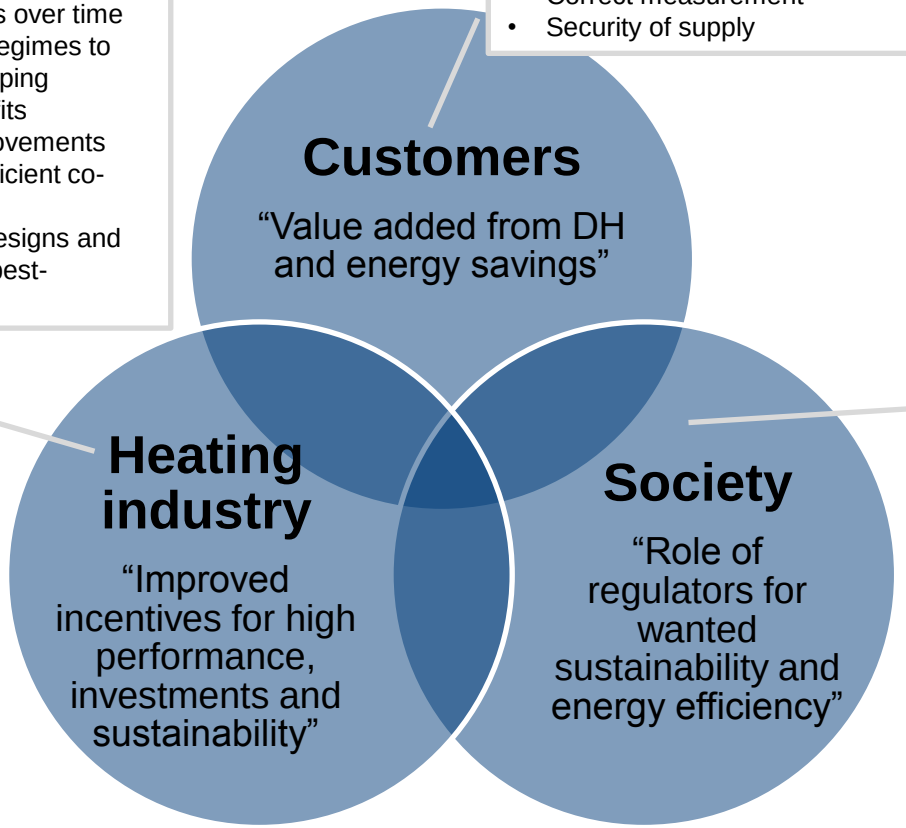
Summary – next step options (for discussion)

Basic objectives	**Develop an international benchmarking system based on how the district heating system fulfills and reaches the community values of district heating systems**		**Future price regulation frameworks must first define the local community values from district heating.**	
Basic options	**1) Widen the benchmarking scope for more companies and and/or countries; improve the quality of analysis**		**2) Issue papers for best practice market designs and price setting regimes for district heating/**	
Scope	**Increase number of sample companies in participated countries to create more representative samples**	**Increase number of countries to widen the DH/CHP outlook**	**Issue/discussion papers for best practice DH/CHP market regimes**	**Methodology paper for best practice DH/CHP price setting regimes**
Example of possible content	A representative number of companies in each category (min 4-5 companies)	Gas fuels: Latvia, Russia, Romania, Bulgaria, Netherlands, Slovakia and Moldova Solid fuels: Sweden, Denmark Other: Norway NOTE! Swe, Den and Nor not ERRA members	• Competition assessment • Single buyer model or access regimes in heat networks • Obligatory connection • RES and CHP subsidy schemes • Promotion of WtE	• Cost justifications • RAB/WACC -models • Alternative based heat pricing • Heat pricing from CHP • Regulatory incentives for efficiency (benchmarking)
Improvement areas	Selective focus on cost efficiency and prices (KPI definition and comparability and correctness of data).			
Time horizon	6-12 months	~¨12 months	4-8 months	4-8 months
Expected benefit	Verification of the pilot results presented in this survey	Widening of current scope into new countries – gaining commitment of other ERRA members	Creating a regulatory platform in district heating and CHP for EU wide, committed recommendations for further national modifications	
External project management and advisory will be required in all of these options. Detailed cost estimation should be prepared.				

Challenge of balancing interests of DH/CHP stakeholders

- Competitive heat prices over time
- Stable development of heat price
- Simplicity – easy to connect and use
- Environmentally benign heat product
- Equal treatment of customers
- Correct measurement
- Security of supply

- Sustainability as a success factor: sourcing of renewable fuels
- Competitive heat prices over time
- Consistent regulatory regimes to allow investment recouping
- Justified economic profits
- Energy efficiency improvements
- Strong promotion of efficient co-generation
- Unification of market designs and regulatory incentives (best-practises)



- DH/CHP is a technically ready solution
- Huge energy savings potential in buildings
- Redirecting energy policy and regulatory activities to save energy not just control prices
- Encouraging and subsidizing higher utilization of renewable energy sources
- Reasonable and stable prices
- Consistency and predictability of price regimes to attract long term investment commitments and continuous energy efficiency improvements

- Summary of conclusions and proposed next steps
- **Project introduction**
- DH markets and price setting frameworks
- Benchmarking results
- Appendix

Project background

- Energy Regulators Regional Association (later referred as “ERRA”) is a roof organization for national regulatory. Their scope of activity is electricity, gas and district heating. ERRA Secretariat headquarters is located in Budapest in Hungary. To date ERRA lists 24 Full, 2 Associate and 4 Affiliate Members. The Association was legally registered in Hungary in April 2001. NARUC and USAID have been providing continuous support for the operation of the Association.

- Fortum Power and Heat Oy (later referred as “Fortum”) is a subsidiary of Fortum Oyj, stock listed energy company. Finnish State is the majority owner of Fortum by 50,3 %. Fortum has four divisions: Power, Heat, Electricity Solutions and Distribution, and Russia. Fortum is one of leading DH and CHP operators in Europe having these operations in eight (8) countries including Sweden, Finland, Norway, Estonia, Latvia, Lithuania, Poland and Russia. District heating and CHP are one of Fortum’s core business area. Fortum is also a member in Euroheat & Power and COGEN Europe.

- ERRA and Fortum have initiated joint ambition for co-operation in piloting survey for benchmarking district heating and CHP since March 2009. The desire has been to analyze the conditions and effects of district heat supply regulation into operational cost efficiency and incentives for new investment in varying heat market conditions and regulatory regimes in jointly selected sample countries.

- ERRA and Fortum signed on 9th of December 2009 a Memorandum of Understanding (later referred as “MoU”) in order to jointly implement a pilot benchmarking survey for district heating and combined heat and power production (later referred as “CHP”).

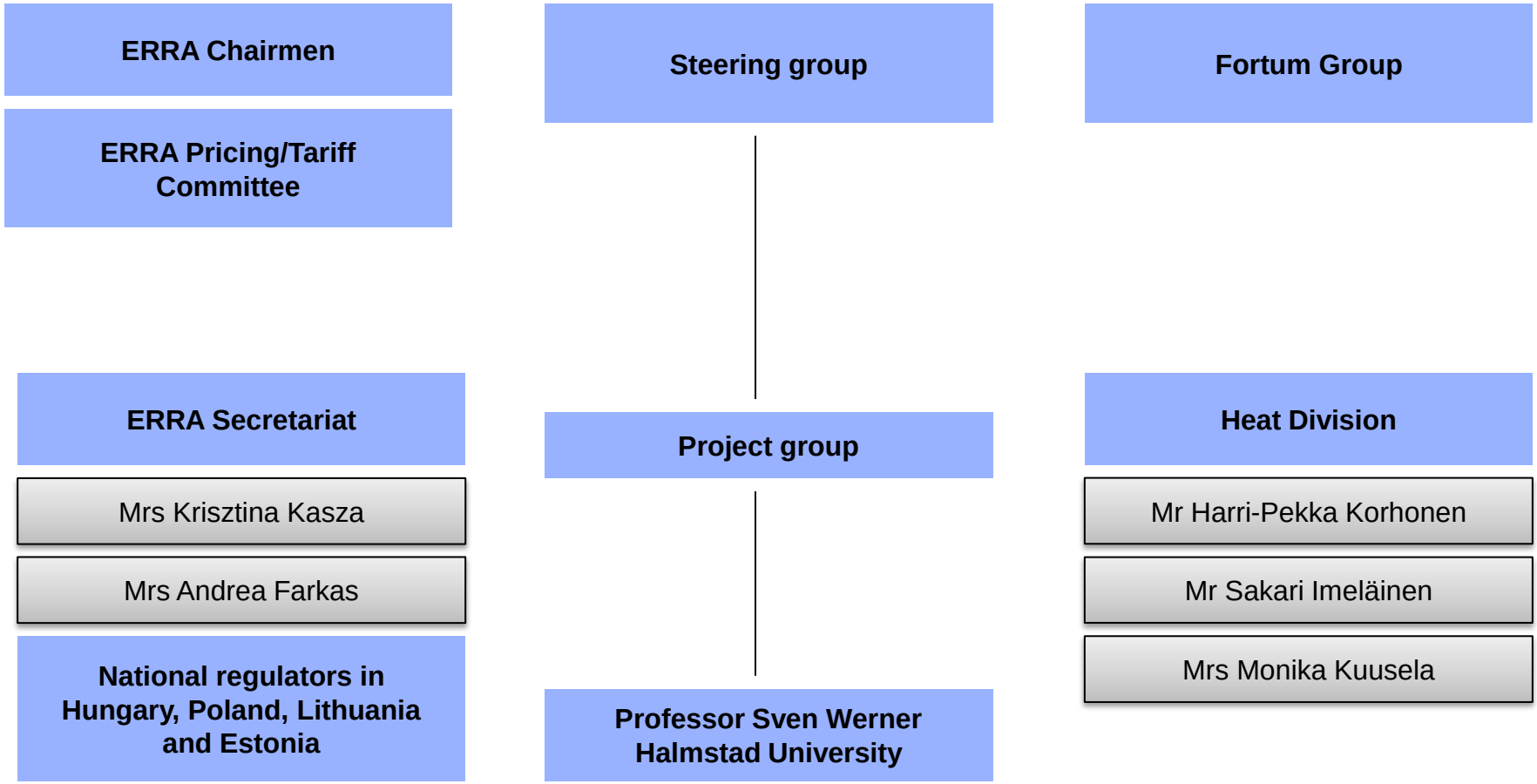
Key objectives

1. **Benchmark national district heating market characteristics and regulatory regimes.**
2. **Benchmark heat prices, cost efficiency, profitability and sustainability** (methodology pilot: limited number of companies).
3. **Multi-national in-depth understanding of the business environment for district heating and CHP**

Hungary, Poland, Lithuania, Estonia and Finland were selected as pilot countries in co-operation with local regulators Hungarian Energy Office ("HEO"), Energy Regulatory Office in Poland ("ERO"), National Commission for Prices and Energy in Lithuania ("NCCPE") and Estonian Competition Authority ("ECA") who are the regulatory bodies for district heating and CHP in each country. In Finland, data is based on public sources of information.

Establish an organized and constructive dialogue between ERRA, its members and Fortum who both have major interests in defining future best pricing regimes for district heating

Project organization



Key steps

- Memorandum of Understanding signed in 9th December 2009
- Data collection and validation January - August 2010
- Drafting conclusions and recommendations August - October 2010
- Draft report to ERRA chairmen October 2010
- Draft report to ERRA tariff/pricing committee October 2010
- Data validation with regulators December 2010 – January 2011
- Report finalization in December 2010 – January 2011

Benchmarking methodology

- National district heating characteristics and regulatory frameworks have been analyzed by jointly preparing a common set of questions to local regulators who have collected the requested information. We have summarized the information into this report.
- For each country, a sample of minimum eight (8) companies have been targeted. The group of companies should represent four (4) main categories: larger and smaller companies by size of heat supply volumes, and companies having either solid (coal, biomass) or liquid fuels (natural gas) as main fuel sources. Larger companies typically should have CHP as main heat production solution and smaller companies heat-only production. All companies were targeted to include vertically integrated operations from production to heat distribution and sales. It needs to be emphasized that only few companies have fully comparable fuel mixes. Companies have been selected by the regulators with a target to have at least 2 companies in each company category. In all countries this has not been possible due to local limitations in regard to fuel sources. In Hungary, certain data limitations have occurred and are noted within report. Data in Finland is collected from public sources (annual reports and energy statistics).
- Key performance indicators (KPI) were selected as metrics to benchmark selected areas: prices, efficiency, profitability and sustainability. The total number of KPIs has been thirteen (13).
- Scope of sample 35 DH companies. All company specific data has been collected on “no-name” basis (strictly confidential). Data collection has been done with Excel-worksheet and validation has been run during 2010.
- Pilot phase objective has also been to cost-effectively test the feasibility and acceptability of the methodology.
- We would emphasize that the target has not been in trying to make a dive-deep analysis and conclusions of the performance of individual companies in comparison to the other selected companies. In order to reach for dive-deep analysis, more comprehensive interviews of companies should be performed.
- Finally we have agreed to invite an independent expert, Professor Sven Werner from Halmstad University in Sweden to give his external opinion about European viewpoints of DH/CHP sector, used methodology and concluding remarks, and also a possibility to give his recommendations. They are presented in a separate chapter “External opinion”.

Review period and company categories

- **DH company specific data is collected from years 2006-08**
  - High increase of natural gas and oil prices having gradual impact on heat prices
  - Lack of regulatory information in Hungary; data is mainly based on annual reports

- **Company specific data has been categorized in four (4) company categories**

1. Large and medium scale (over 700 GJ/a; ~200 GWh/a) DH companies using liquid fuels (natural gas, oil)

2. Large and medium scale (over 700 GJ/a; ~200 GWh/a) DH companies using solid fuels (coal, biomass, peat)

3. Small scale (under 700 GJ/a; ~200 GWh/a) DH companies using liquid fuels (natural gas, oil)

4. Small scale (under 700 GJ/a; ~200 GWh/a) DH companies using solid fuels (coal, biomass, peat)

   – Fuel category deemed in accordance with main fuel source, over 60 % of total fuel mix

Sample of 35 DH companies in 5 countries

Company #		1	2	3	4	5	6	7	8
Hungary - 6 DH companies									
Category 1)		LG	SS	LG	SG	SG	SG		
Heat sales	TJ	2 775	346	1 006	316	417	474	-	-
Heat sales	GWh	771	96	280	88	116	132	-	-
Electricity sales	GWh	184	1 522	487	20	42	49	-	-
Gas fuels 2)	%	100 %	0 %	100 %	100 %	100 %	100 %	-	-
Solid fuels 2)	%	0 %	99 %	0 %	0 %	0 %	0 %	-	-
Poland - 8 DH companies									
Category 1)		LG	LS	SS	SG	LG	SS	SG	LS
Heat sales	TJ	2 933	872	499	83	1 688	289	83	2 944
Heat sales	GWh	815	242	139	23	469	80	23	818
Electricity sales	GWh	1 085	2	0	0	500	0	0	0
Gas fuels 2)	%	95 %	0 %	0 %	96 %	82 %	0 %	100 %	1 %
Solid fuels 2)	%	5 %	100 %	100 %	0 %	18 %	100 %	0 %	99 %
Lithuania - 8 DH companies									
Category 1)		LG	LG	SS	SS	SS	SS	SG	SG
Heat sales	TJ	8 914	1 497	474	143	127	101	84	57
Heat sales	GWh	2 476	416	132	40	35	28	23	16
Electricity sales	GWh	589	7	0	0	0	0	0	0
Gas fuels 2)	%	90 %	100 %	39 %	11 %	20 %	0 %	90 %	95 %
Solid fuels 2)	%	5 %	0 %	60 %	81 %	80 %	99 %	9 %	0 %

Company #		1	2	3	4	5	6	7	8
Estonia - 6 DH companies									
Category 1)		SS	LG	SS	LS	SS	SS		
Heat sales	TJ	288	5 438	248	1 284	189	686	-	-
Heat sales	GWh	80	1 510	69	357	53	191	-	-
Electricity sales	GWh	0	0	0	0	0	18	-	-
Gas fuels 2)	%	15 %	100 %	0 %	40 %	0 %	0 %	-	-
Solid fuels 2)	%	85 %	0 %	76 %	60 %	93 %	100 %	-	-
Finland - 8 DH companies									
Category 1)			LS	SS	SG	LS	LG	SS	SG
Heat sales	TJ	-	5 879	542	407	2 920	6 966	188	478
Heat sales	GWh	-	1 633	151	113	811	1 935	52	133
Electricity sales	GWh	-	0	0	20	393	1 857	0	0
Gas fuels 2)	%	-	0 %	0 %	74 %	0 %	81 %	0 %	100 %
Solid fuels 2)	%	-	86 %	0 %	0 %	89 %	19 %	88 %	0 %

1) Four company categories

Large DH system with solid fuels (coal, biomass, peat, oil shale) as main fuel	**LS**	**4**	**- " -**
Large DH system with natural gas as main fuel source	**LG**	**9**	**- " -**
Small DH system with solid fuels (coal, biomass, peat, oil shale) as main fuel	**SS**	**13**	**- " -**
Small DH system with natural gas as main fuel	**SG**	**9**	**- " -**
		35	**DH companies**

2) HFO and LFO are not included in gas or solid fuels

Key performance indicators (KPIs)

- **Heat prices, margins and policies**
  - Average, nominal heat tariffs, EUR/MWh
  - Purchasing power parity (PPP) adjusted heat tariffs, EUR/MWh
  - Sales margin ratios, %
  - EBITDA margin ratios, % (Operating margin = Revenues ./. Fuel costs . /. OPEX)
  - EBIT margin ratios, % (Operating profit = EBITDA ./. Depreciation)

- **Cost efficiency**
  - Fuel and related (variable) costs per produced energy, EUR/MWh
  - Personnel and other operational (fixed) costs (OPEX) per produced energy, EUR/MWh
  - Production Cost Index (PCI), EUR/MWh. Total heat production costs when electricity revenues are considered as bi-product (negative cost) => *This KPI was finally excluded from the analysis as electricity revenues are dependent not only on amount of electricity produced but also on market and subsidized electricity prices and potential condensing production => Not sufficient comparability of PCI*

- **Profitability**
  - Return on equity, % (ROE)
  - Return on capital employed, % (ROCE)

- **Sustainability**
  - Share of renewable energy sources (RES) in heat production, %
  - Specific CO2 emissions, g/kWh

General limitations for findings and conclusions

- **Scope of sample companies ~35 DH companies** => results do not represent the whole industry and should be considered as indicative
- **Companies have been selected randomly** => they have not been selected to represent the best performing companies in each country
- **Different heating conditions (heating degree days)** => results of survey have not been adjusted according to varying climate conditions in each country
- **Data comparability** => we have defined detailed formula for data collection to calculate KPIs in similar way, however lack of sufficient data has created some limitations in comparability but this will be commented within each presented KPI
- **Cost efficiency of CHP based heat production**, KPIs (EUR/MWh) are calculated based on both heat and electricity volumes, **is expected to be better than HOB solutions.** We have included a separate benchmarking for this on page xx.

- **Summary of conclusions and proposed next steps**
- **Project introduction**
- **DH markets and price setting frameworks**
- **Benchmarking results**
- **Appendix**

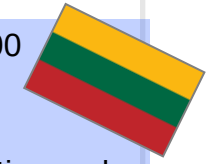
District heating market characteristics

- Heating degree days 3900-6400
- **DH sales 30 TWh (108 TJ)**
- DH market share 44 %
- CHP in heat production 73 %
- Average heat price 62 EUR/MWh
- Heat sales 2,8 GWh/km
- DH networks 11 000 km

- Heating degree days 3600-4000
- **DH sales 118 TWh (425 TJ)**
- DH market share 52 %
- CHP in heat production 62 %
- Heat sales 6,3 GWh/km
- DH networks 18 834 km

- Heating degree days 3000-3300
- **DH sales 12 TWh (44,8 TJ)**
- DH market share 10 % (higher for residential customers)
- CHP in heat production 70 %
- Average heat price 63 EUR/MWh
- Heat sales 3,7 GWh/km
- DH networks 3 500 km

- Heating degree days 3900-4300
- **DH sales 7,2 TWh (26 TJ)**
- DH market share 75 %
- CHP in heat production 8 %
- Heat sales 5,1 GWh/km
- DH networks 1 420 km

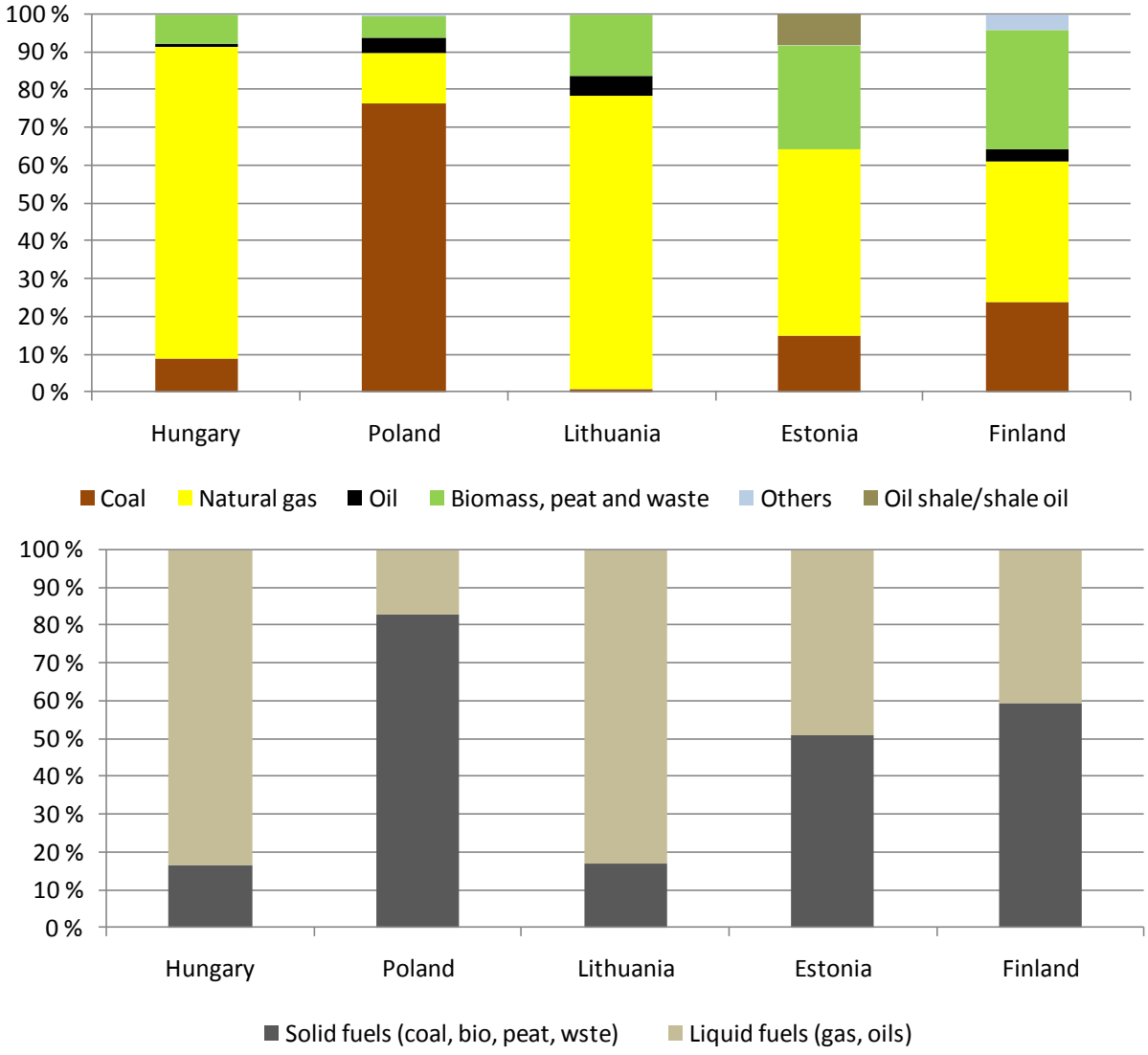


- Heating degree days 3400-4100
- **DH sales 8 TWh (28,7 TJ)**
- DH market share ~50 %
- CHP 14 % in electricity production and 49 % in heat production
- Heat sales 3,3 GWh/km
- DH networks 2 458 km

Source: Euro Heat & Power 2007 statistics and interviews with regulators

Fortum

Fuels in district heat production



Source: Euroheat & Power : District heating and cooling 2009 survey

Main differences between countries and companies

- **Heating degree days varying between 3,000 … 6,000 days**
- **Market share of district heating 10 % … 80 % of total space heating markets**
- **Regulatory regimes varying**
  - Non full-cost recovering heat pricing
  - Rate of return –based heat pricing
  - Alternative based heat pricing
- **Heat prices vary between countries and companies due to**
  - Availability and prices of fossil and renewable fuels
  - Efficiency of DH systems
  - Regulatory caps and costs
  - Company policies and practices
  - Profit or non-profit making nature of DH operations
- **Private and public ownership**
- **Share of average heating cost per GDP per capita has not been studied. Based on Fortum's preliminary analysis Average heating cost / GDP per capita varies between 3%...10%**

District heating price setting regimes

Light-touch regulation

- Prices set by DH companies based on costs and competition on local heating markets
- Competition Authority controls market dominance and reasonability of tariffs

Rate of return -model

- Regulatory authority ERO (URE)
- Justified costs and asset base
- Justified cost of equity under scrutiny
- Annual tariff setting process
- Reference price (CHP) introduced 2010
- Changes in heat pricing may evolve in new Energy law during 2011

Price cap -model

- Regulatory authority HEO/municipality
- Justified costs and profit
- Tariff review initiated by DH company
- Price caps defined for 5 categories
- Final price needs consent of the municipality

Rate of return –model

- Regulatory authority ECA approved all DH tariffs
- Justified costs and asset base
- Justified return WACC on RAB
- Tariff validity maximum 3 years
- New tariff application decided by company

Rate of return –model

- Regulatory authority NCCPE
- Justified costs and asset base
- Justified return WACC on RAB temporarily decreased to 5 %
- 3-year tariff s adjusted monthly and annually
- Resolution for a new tariff needed from municipality
- Benchmarking of efficiency within five DH company groups

Drivers for DH prices

Survey scope

Energy policy

- Legal principles for DH price setting: ex-ante vs. ex-post regulation, market mechanisms
- Regulatory objectives, their interpretation and guidelines
- Cross-subsidy between electricity and heat
- Energy (fuel) taxation

Ownership strategy

- Pricing strategy and objectives of the owner
- Investment plans and their financing needs

Fuel strategy and efficiency

- Fuel mix, prices and efficiency
- Technical concept in heat production (HOB, CHP)
- Cost efficiency of production and network operations

Local competition

- Price of other space heating alternatives (e.g. individual gas or coal boiler, heat pump, electrical heating)

Regulatory regimes

Cost efficiency: KPIs

Market position

Fortum

DH pricing within political and industry agendas

Political agenda

- High sustainability of community
- Profits from own utilities important source of revenues for municipal economy
- General level of energy prices

- Heat prices high on local political agenda
- Protection of customers against high one-off price increases
- Balancing long term incentive mechanisms to encourage DH/CHP infrastructure and RES investments
- Reaching EU emission reduction targets

Heat pricing

Market driven

Alternative based | **Cost plus based**

Regulatory driven

Cost based | **Rate of return**

Non-profit | **Justified profit**

Industry agenda

- Price competitiveness and transparency
- Stable heat price and profitability development
- Sustainability (taxation of fossil fuels)
- Sourcing of RES
- Reasonable profits for the owners

- Competition with natural gas
- Industry image and low-price expectations
- In-efficiency of DH systems
- Inability to fully recoup costs and investments
- Financing of productivity and RES investments
- Utilization of heat loads for co-generation

Fortum

Legal frameworks and regulatory objectives for DH/CHP

	Hungary	Poland	Lithuania	Estonia	Finland
Energy Policy and Acts	Energy Strategy till 2020 Energy Law Law on Price Setting (1990) DH Supply Law (2005)	Energy Policy (2009) Energy Act (1997)	Energy Strategy till 2020 Electricity Law (20xx) Law on Heat Sector (2003)	Energy Strategy till 2020 Electricity Market Act (RT I 2003, 25, 153) District Heating Act (RT I 2003, 25, 154)	Energy strategy till 2030 Energy Market Act (1995/386) No specific regulations for district heating in place.
Regulatory bodies	Hungarian Energy Office (HEO) and municipal consent for end-customer prices is needed	Polish Energy Regulatory Office (ERO)	National Commission for Prices and Energy (NCCPE). Municipal consent needed for 3-year tariff	Estonian Competition Authority (ECA)	DH company sets the prices. Finnish Competition Authority monitors generally the reasonability of DH price levels.
More info	www.eh.gov.hu	www.ure.pl	www.ncc.lt	www.konkurentsiamet.ee	www.et.fi
Regulatory objectives for DH/CHP and heat prices	Heat prices for residential customers and for heat production has to cover justified expenses and to provide coverage for operational profit. DH customers should enjoy the benefit from mandatory off-take of electricity produced in CHP. Heat price should create incentives for secure and cheapest DH production and supply, efficient use of capacities as well as enhance energy savings in DH consumption.	Tariffs should ensure coverage of justified costs of energy enterprises operations in the field of production, transportation and storage of fuels, transmission, distribution or trade, and the costs for modernization, development and environmental protection. Tariffs should protect interests of customer from unjustified level of DH prices.	To ensure (1) reliable and high quality supply of heat to heat customers at minimum costs; (2) effective competition in the heat sector; (3) to defend the rights and legitimate interests of heat customers; (4) to increase the efficiency of heat production, transmission and consumption; (5) when producing heat, to increase the use of indigenous fuel, bio fuel and renewable energy resources; (6) to reduce the negative impact of the heat sector on the environment .	The activities related to the production, distribution and sale of heat by way of district heating networks and connection to networks shall be coordinated and conform the principles of objectivity, equal treatment and transparency in order to secure, reliable and effective heat supply at a justified price in compliance with environmental requirements and the needs of final customer.	DH is regarded as a normal consumer product and is priced as any other product in competition. . Misuse of dominant market power is strictly prohibited. In competition legislation. Pricing is mostly dependent on company's own pricing policy, and this varies from cost plus based into alternative based price formation policies.

Basic framework for DH/CHP tariff setting - Hungary

DH tariff setting principle (heat-only)	• Based on justified costs and reasonable profit on invested capital (WACC) • Actual fuel and operating costs (OPEX) for production and supply • Reasonable profit necessary for efficient functioning of the business activities • Allowed return on equity is under development by HEO
DH tariff setting principle (co-generation)	• Co-generation benefit has to transferred to the benefit of DH end customers • Electricity from co-generation has a regulated/supported price when based on mandatory off-take • Return on equity for heat is regulated up to 7 % (HEO decision in 2009) • From practical point of view, also electricity income becomes this way regulated similarly
Regulatory bodies	• Hungarian Energy Office (HEO) reviews the legal conformity with an involvement of stakeholders • DH end-customer tariffs are approved by the local municipality • HEO approves the heat production tariffs between heat producer and DH supply company.

Standard Process scheme

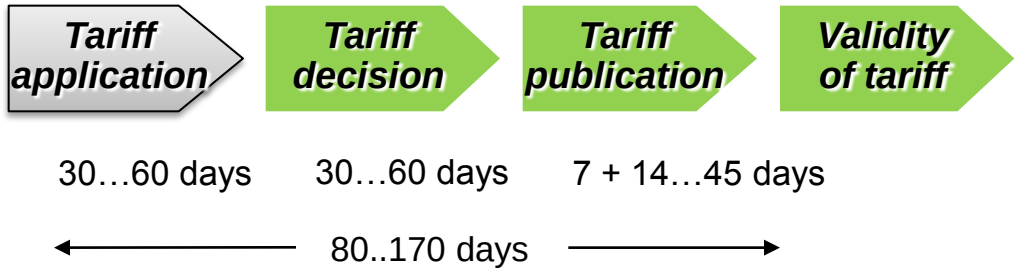
Tariff application rationale

- Change in inflation (CPI)
- Change in fuel costs
- Maintenance of competitiveness

Basic framework for DH/CHP tariff setting - Poland

DH tariff setting principle (heat-only)	• Based on justified costs and allowed return on justified asset base (price cap regulation) • Company specific WACC levels
Key elements	• Key objective is to minimize costs of DH companies. • Key task of ERO is to balance the interests of customers and energy companies. • Justified annual costs for heat production and distribution inflated by CPI • Justified annual costs for modernization and development, and environmental protection • Justified return on capital engaged in the heating activities
DH tariff setting (co-generation)	• Electricity income is deducted from the allowed revenue of heat (efficient co-generation > 70 %) • Heat price is set based on the cost of heat-only boiler (plants with efficiency below 70 %)
Key elements	• In efficient co-generation plants allowed heat revenue is calculated based on justified costs and allowed return of production, but reduced by estimated sales volume and price of electricity • In low efficient co-generation plants allowed heat revenue is calculated based on justified costs of comparable heat-only boiler plus impact of decrease of electricity production due to heat production multiplied by anticipated electricity price
Regulatory bodies	• Energy Regulatory Office (ERO/URE)
New Energy Law	• Currently, the process of changing Energy Law (district heating part) may have substantial impacts into above presented principles

Standard process scheme



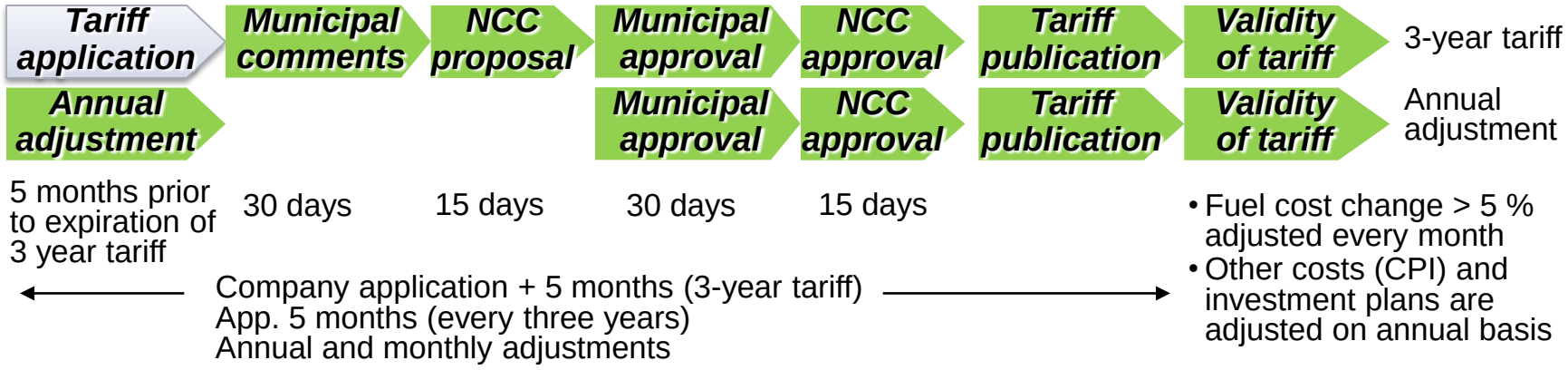
Tariff application rationale

- Binding request from ERO/URE
- Company initiative due to fuel and other cost developments, and annual investment plans
- Tariffs are normally valid for the time being

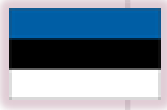
Basic framework for DH/CHP tariff setting - Lithuania

DH tariff setting principle (heat-only)	• Based on justified costs and allowed return on justified asset base (price cap regulation) • WACC level +/- 5 % (2006-08)
Key elements	• Tariff scheme set for 3-5 years at a time. Fuel costs are followed on monthly basis and can be changed by company decision when minimum criteria is met. • Annual adjustments due to heating volumes, inflation and investment plans. • Benchmarking is used to justify the general level of DH prices within five benchmarking groups. • Annual investments become justified along with having been approved by municipal council.
DH tariff setting principle (co-generation)	• Alternative cost of heat-only boiler • Limited cross-subsidy between heat and electricity (max 20 % of electricity profits)
Regulatory bodies	• National Control Commission for Prices and Energy (NCC) when DH sales > 5 GWh/a (app. 51 DH companies) • Municipal council when DH sales is < 5 GWh/a

Standard process scheme

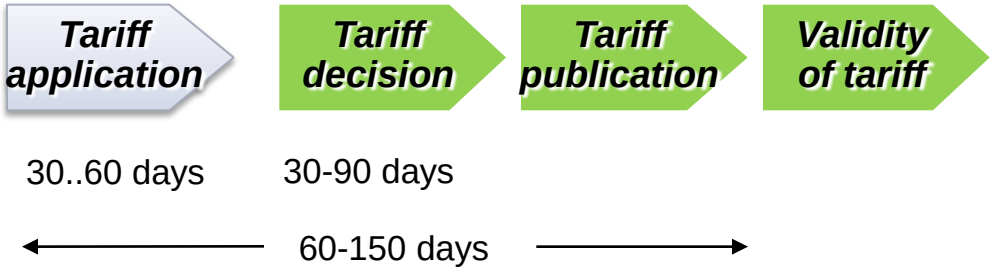


Basic framework for DH/CHP tariff setting - Estonia



DH tariff setting principle (heat-only)	• Based on justified costs and reasonable return on invested capital (WACC) • WACC levels 8-9 % (2006-08)
Key elements	• Necessary operating costs are covered. • Investments for operational performance are being made and that the development obligation of production and DH networks is met. • Justified profitability on historical asset base (minor differences with book value of assets) • Compliance with environmental requirements, quality and safety regulations
DH tariff setting principle (co-generation)	• Physical method or alternative heat-only boiler method to define the costs for heat production and networks • Electricity price is market based, not regulated as such
Key elements	• Main focus on splitting the costs and asset base between heat and electricity • Otherwise similar methodology as in heat-only situation • Scheme for CHP is being considered due to recent new investments
Regulatory bodies	• Since November 1st 2010 ECA has approved that all DH prices irrespective of heat volume (including local municipal prices) and ECA may extend the term for processing the application up to 90 days (formerly 60 days)

Standard Process scheme



Tariff application rationale

- Major changes in fuel costs
- Change in heat volumes
- New investments – major changes in production assets
- New application can be put whenever decided by DH operator

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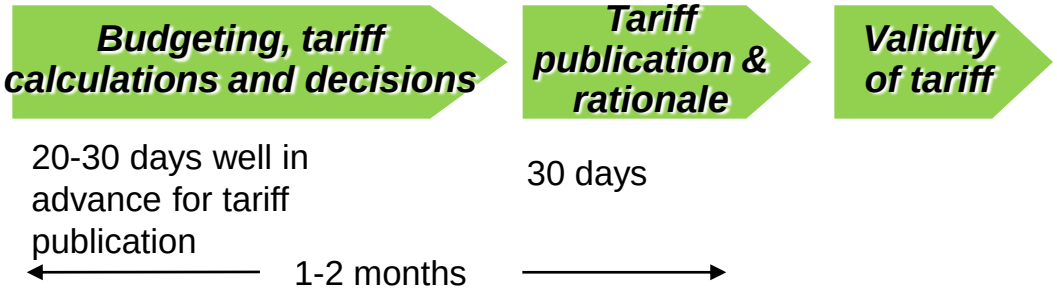
Basic framework for DH/CHP tariff setting - Finland

DH tariff setting principle (heat-only)	• High dependence on company's pricing policy (municipal and private owners) • Based on justified costs and reasonable return on invested capital • Comparisons with alternative heating solutions are being made but so far rather limited direct influence on individual tariff decisions. • DH tariff decisions are made by company's own risk • As DH companies are deemed to have a dominant market position, DH prices should be reasonable
Key elements	• Annual review of cost developments. Key focus on fuel cost developments. • Major one-off capacity investments need to be financed in advance according to business plans.
DH tariff setting principle (co-generation)	• Basically same method as in heat-only situation. • Benefits from CHP are shared between customers and DH company.
Key elements	• Annual review of cost developments. Key focus on fuel cost developments. • Major one-off capacity investments need to be financed in advance according to business plans.
Regulatory bodies	• Finnish Competition Authority monitors DH price development and potential abuse of dominant market power

Standard process scheme



Tariff change rationale

- Major changes in fuel costs
- Other cost developments
- Normally high one-off price change needs are adjusted downwards
- Tariff are normally valid for the time being

Reflections on development of DH price frameworks

Historical background

Due to historical status as low priced public utility service, regulatory focus has been on maintaining low heat prices and customer protection against one-off price increases

- When heat prices are artificially kept lower than actual costs, it does not genuinely motivate customers for energy savings in buildings, and may sustain energy inefficiency in the building stock
- When heat prices do not include consistent and sufficient economic profit, it does not motivate owners of DH systems to invest into higher efficiency, automation and new fuels

Continuous improvements adopted

- More straight forward and efficient tariff application and approval process
- Increased instructions, transparency and consistency
- Cost justifications being clarified e.g. cost of capital
- Economical justification - cost of equity gaining acceptance

Future development areas

Some imperfections remaining in regard to regulatory objectives

- Clarification of regulatory objectives and tools e.g. energy efficiency, CHP, RES and competitiveness of district heating as a long term customer benefit
- Effective regulatory or voluntary incentives for productivity investments and performance improvements for DH companies – balancing with other type of incentives e.g. feed-in tariffs, certificates, investment subsidies

Regulatory development into market based DH pricing

- District heating is politically regulated non-profit operations due to needs to protect low income customers

Non cost-reflective political regulation

Traditional rate of return - regulation

- District heating as enduring monopolistic position
- High expectation to realize significant, turn-rounding refurbishment investments
- Political preference to regulate prices
- Efficiency requirements are being implemented
- Profits allowed to attract improvements and new investments
- RAB/WACC-models
- Considering ex-ante versus ex-post

- Effective competition as realistic prospect
- Political and regulatory acceptance to market mechanisms and profit variability
- Competitive heat price to keep DH as preferred alternative

Alternative based heat pricing

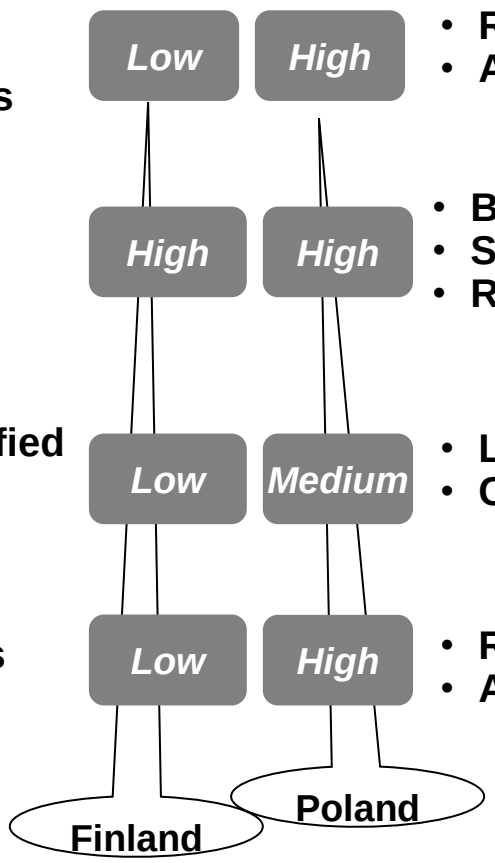
Selection of optimal regulatory regime for district heating

1. **Political acceptance to emphasize market mechanism**
2. **Well-defined regulatory goals**
3. **Economical evaluation and justification of regimes**
4. **Setting roles of regulatory bodies and companies**
5. **Effective and consistent implementation during 3-5 years**
6. **Evaluation and improvement**

Source: Fortum analysis

Example of check-list for regulatory goals in DH

Goal	Task	Short term priority	Solutions e.g.
System efficiency	• Encourage the management to operate in an efficient manner and to productivity investments	Low / High	• Regulatory incentives • Apply market mechanisms
Desired sustainability	• Guidelines for safety • Standards for high reliability, sustainability and quality	High / High	• Best practice solutions • Supporting schemes • Rewarding schemes
Equal treatment	• Economically and socially justified prices for different customer segments	Low / Medium	• Legislation • Customer differentiation
Economical viability	• Allow utility with a return that is justified by the level of risk	Low / High	• Rate of return -model • Alternative based pricing



Source: ERRA Tariff/Pricing committee: Economic issues related to tariff development. Issue paper. August 2008. Prepared by Pierce Atwood LLP. Presented model applied to district heating and CHP.

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Market position of district heating

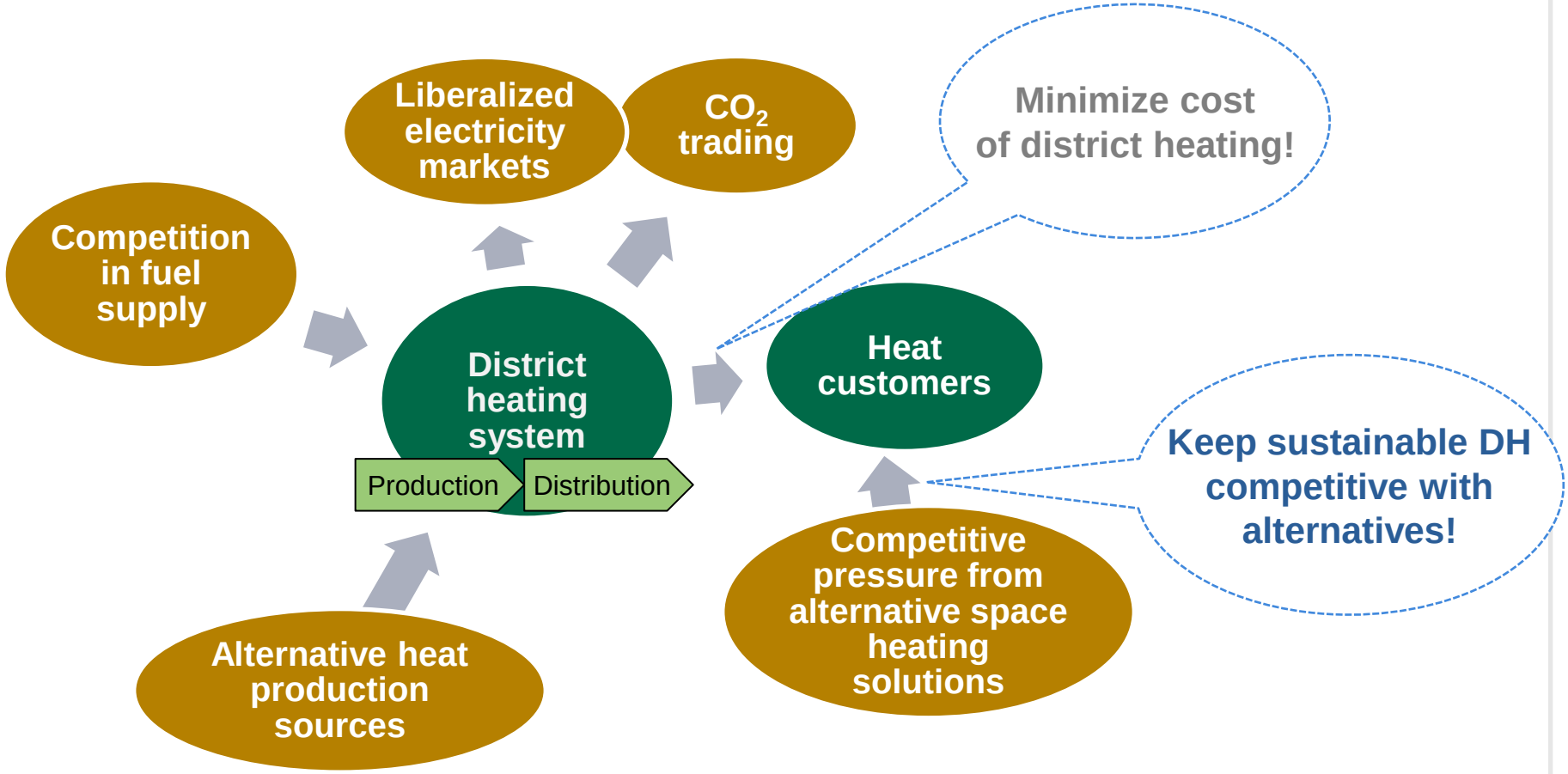
- **District heating is under competitive pressure in several frontiers**
  - Liberalized electricity and CO_2 trading markets
  - Competition of fuel sourcing
  - Alternative heat production sources e.g. industrial waste heat, third party heat suppliers
  - Competitive pressure from alternative space heating solutions

- **District heating is usually competing, to varying degree, with other space heating solutions for customers**
  - In some cases, customers have obligatory connection to DH system due to zoning policy which means that there is a strong limitation of competition (e.g. Estonia, Lithuania)
  - Obligatory connection may bring more reasoning for appropriate price regulation e.g. WACC/RAB- or alternative based -pricing models

- **When customer gets connected, district heating is having a strong market position**
  - Often it is unfeasible to change heating solution during economical life time of 10-20 years
  - It can be feasible to consider other alternatives when major refurbishments are needed
  - New technical solutions may increase the amount of economically justified alternatives

- **Claims for misusing strong market position over connected customers are avoided, when heat prices and profits remain**
  - Competitive with customer alternatives
  - Stable and reasonable when compared to consumer indexes and household income
  - Equally distributed between customer groups
  - Economically justified (risk adjusted cost of equity and debt)
  - Transparent in terms of comparability, understandable and openness

District heating under competitive pressure in several frontiers



Source: Fortum analysis

Views on market positions of district heating

	Hungary	Poland	Lithuania	Estonia	Finland
Market share of DH in the country	~10 %	~over 50 %	~50 %	~80 %	~over 50 %
DH connection	Voluntary	Voluntary	Mandatory (urban zoning)	Voluntary	Voluntary
DH disconnection	Easy	Easy	Difficult	Easy	Easy
House-owners' access to natural gas network	Common	Common	Common	Common	Generally rare (common in few regions)
Main heating solution in new developments	District heating and individual gas heating	District heating and individual gas heating	District heating and individual gas heating	District heating and individual gas heating	Mixture of district heating and heat pumps
Alternatives to district heating in urban areas	Individual natural gas boiler, electrical heating	Individual gas or coal boiler, electrical heating	Individual gas or oil boiler, electrical heating	Individual gas or pellet boiler, electrical heating	Ground heat pump, pellet boilers and electrical heating
Estimation of DH price competitiveness with best alternative; varies a lot due to different DH prices	N/A (individual boiler very competitive with gas as price difference between users is minor)	30 % … 50 %	10 % … 30 %	20 % … 40 %	10 % … 40 %
DH price data	Public data is available but longer term price series are not available	Statistical study "Heat energy in numbers" published annually since 2002. All company specific tariffs are public information.	DH price information that are authorized by NCCPE is constantly collected and published.	Currently valid DH prices are available on home page of ECA.	The branch organization of Finnish Energy Industry (ET) publishes price survey twice a year . Almost all of DH companies participate in that survey.
Price data on alternatives	Not available on national level				Not available on national level; ad-hoc surveys concluded
General remarks	Competitiveness of natural gas depends on pricing policy between different customer segments within each country. Customers often compare only the energy costs of alternatives, not investment costs. Energy price of electrical heating is not competitive but it is favoured due to simplicity and low investment needs.				

Source: Oxera Consulting Ltd, UK: Assessment of DH market regimes in 8 countries, February 2011 (Fortum)

Fortum

- **Summary of conclusions and proposed next steps**
- **Project introduction**
- **DH markets and price setting frameworks**
- **Benchmarking results**
- **Appendix**

Benchmarking results

A. Calculation principles

B. Nominal and PPP adjusted heat prices

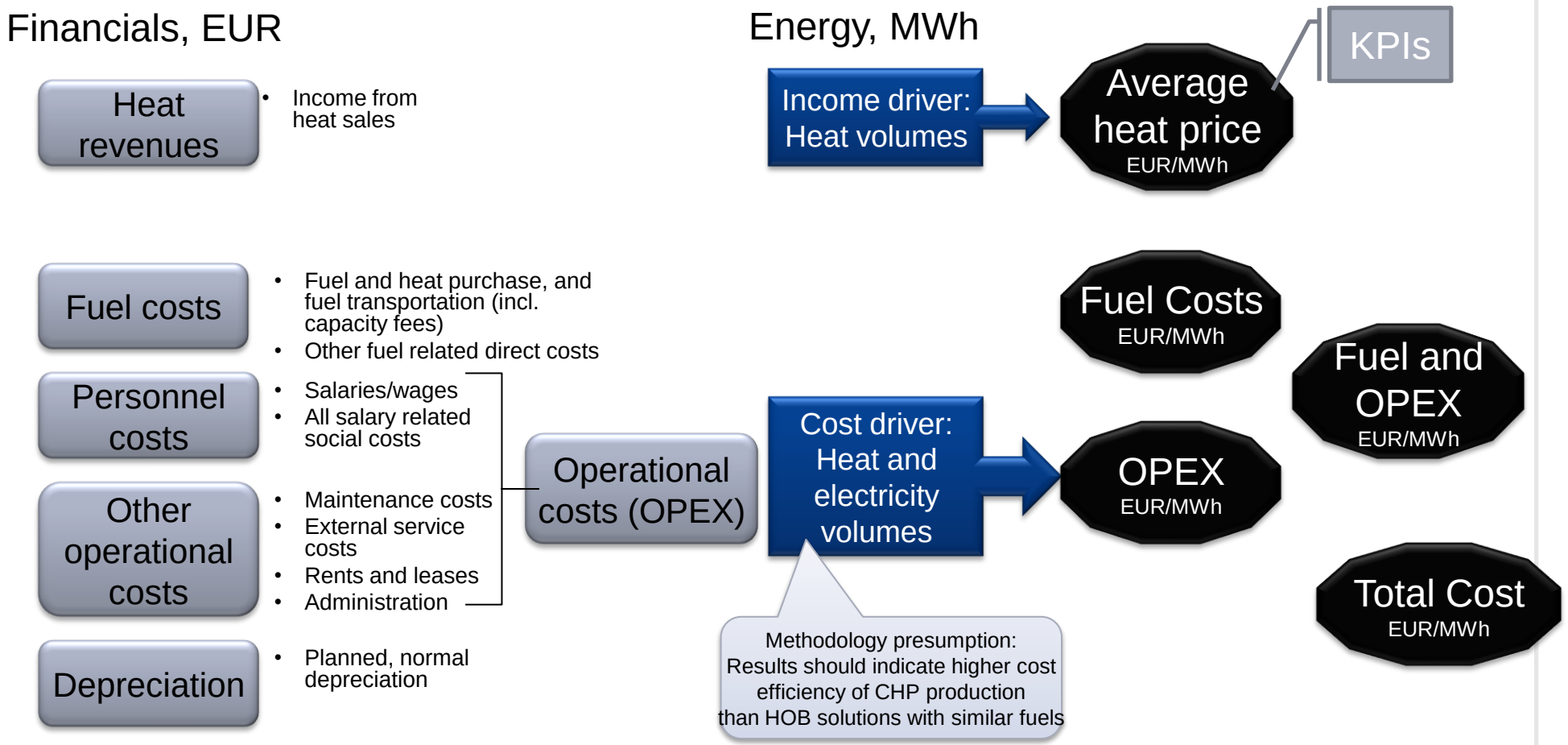
C. Margin analysis

D. Cost efficiency analysis – key performance indicators

E. Profitability – ROCE, ROE

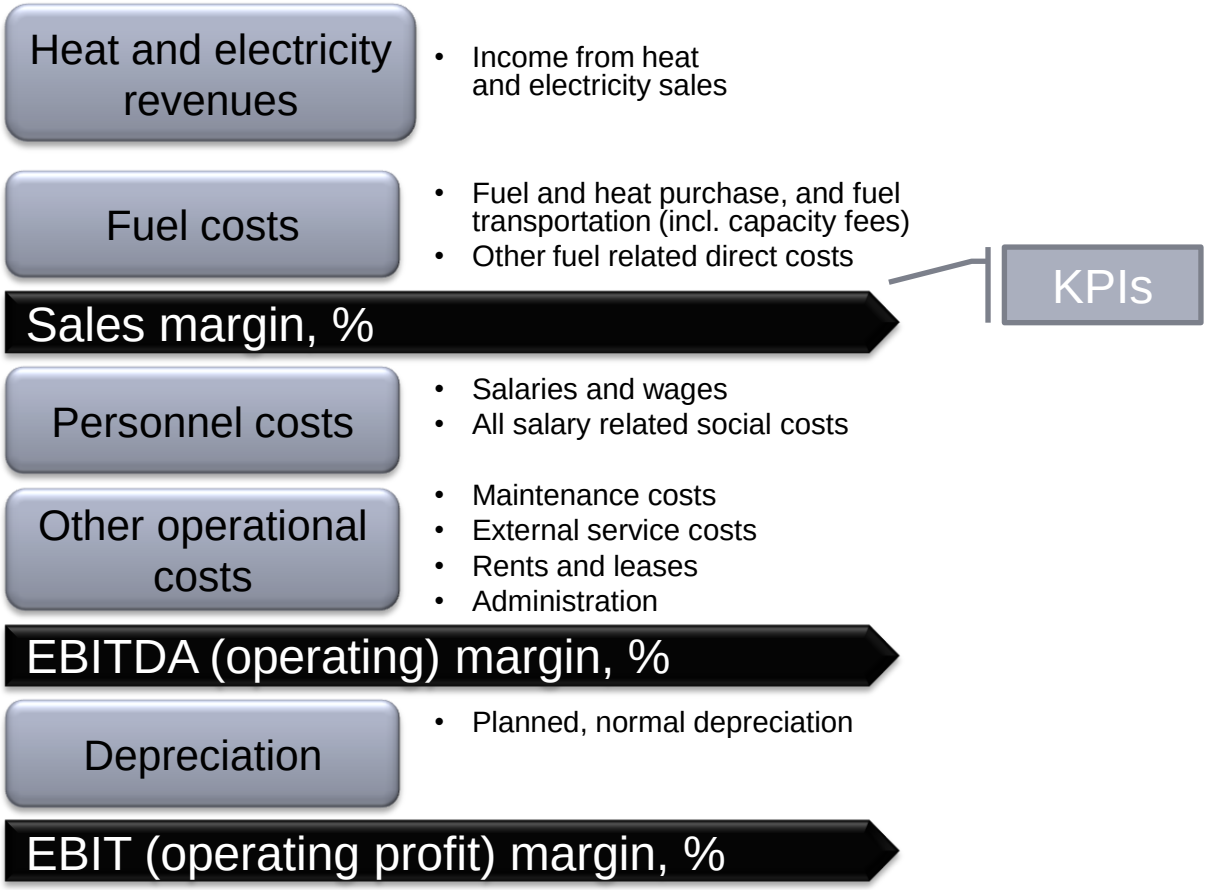
F. Sustainability

A1. Heat prices and cost efficiency – KPI calculations



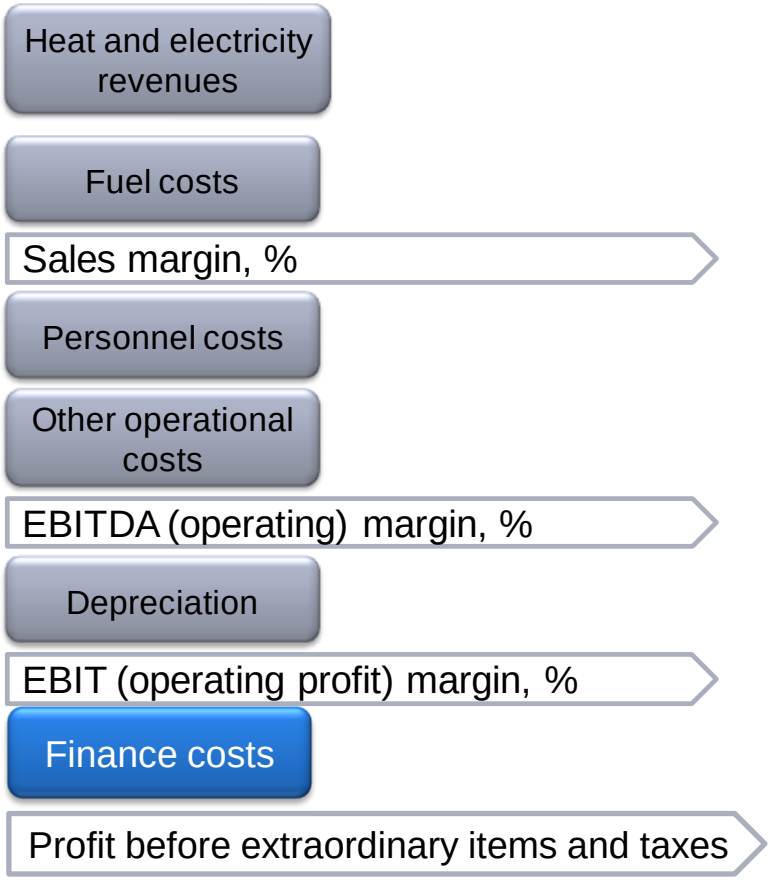
NOTE! Extraordinary items, CO2 income and costs, financing income and costs, and taxes are excluded from price and cost KPI analysis

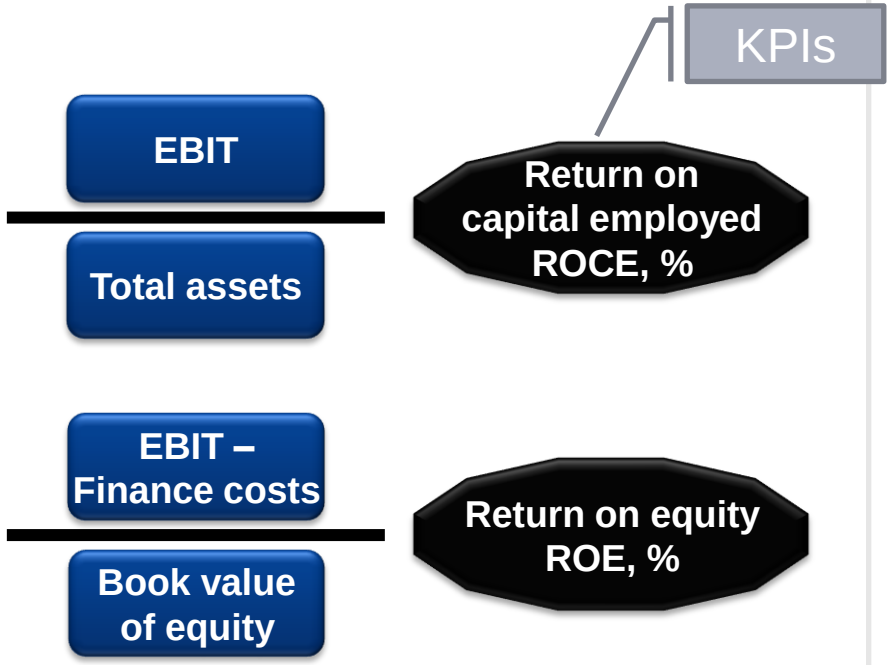
A2. Calculation of margins – KPI calculations



NOTE! Extraordinary items, CO2 income and costs, financing income and costs, and taxes are excluded from margin analysis

A3. Calculation of profitability - ROCE, ROE



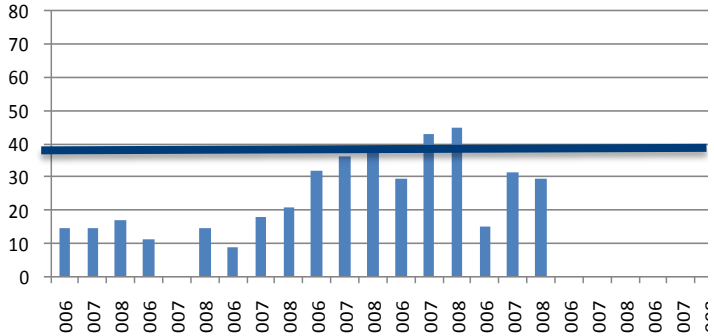


NOTE!
1) Capital employed ~ Net assets at book value
2) Interest income is included in ROE calculation

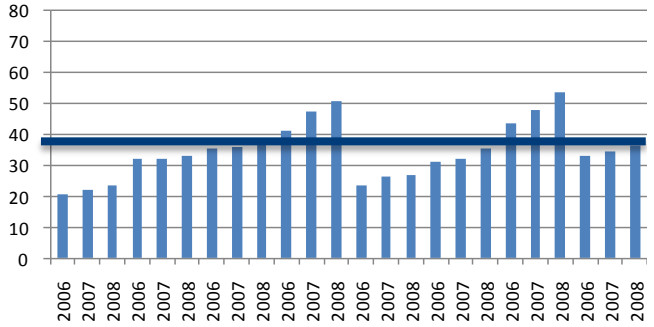
NOTE! Extraordinary items, CO2 income and costs, and taxes are excluded from profitability analysis

B1. Average heat prices (EUR/MWh) per company 2006-08

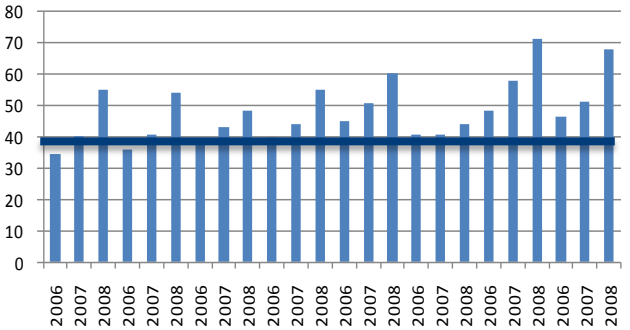
Hungary (6 DH companies)



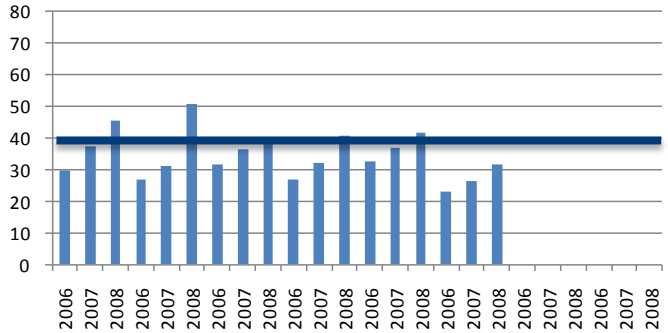
Poland (8 DH companies)



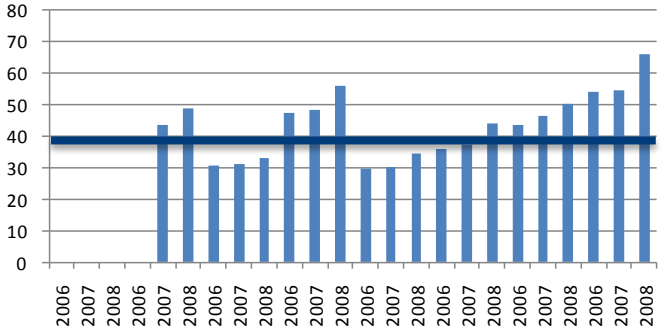
Lithuania (8 DH companies)



Estonia (6 DH companies)



Finland (7 DH companies)



- **High range of nominal heat prices between 15…80 EUR/MWh during 2006-08 => Different cost of heating for customers**
  - Hungary 15…40 EUR/MWh, Poland 20…50 EUR/MWh, Lithuania 40…70 EUR/MWh, Estonia 30…50 EUR/MWh and Finland 30…60 EUR/MWh
  - Natural gas as main fuel an indicator for higher heat prices
  - Local solid fuels (coal, peat, biomass, waste) as an indicator for lower heat prices
- **Rather substantial price increases have occurred during 2006-08 in all countries**
  - Main reason is a hike of oil and natural gas prices
- **Benchmark heat price at 40 EUR/MWh** (for comparison purpose; average price of sample companies in 2008 is 41 EUR/MWh)

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B2. Purchasing power parities (PPPs)

Purchasing Power Parities (PPPs) are currency conversion rates that both convert to a common currency and equalize the purchasing power of different currencies. In other words, they eliminate the differences in price levels between countries in the process of conversion.

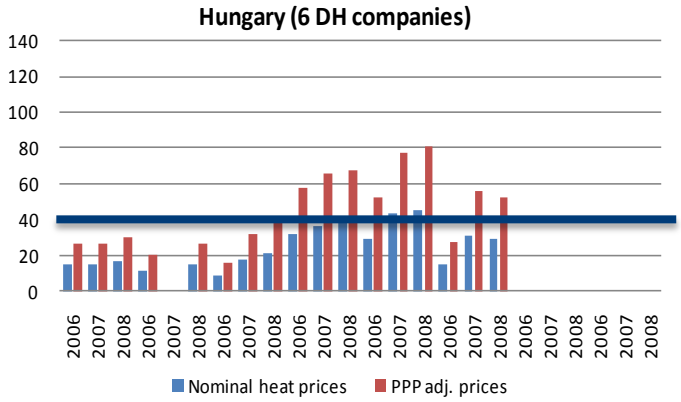
Currency exchange rates and purchasing power parities have been based on average figures calculated for 2006-08.

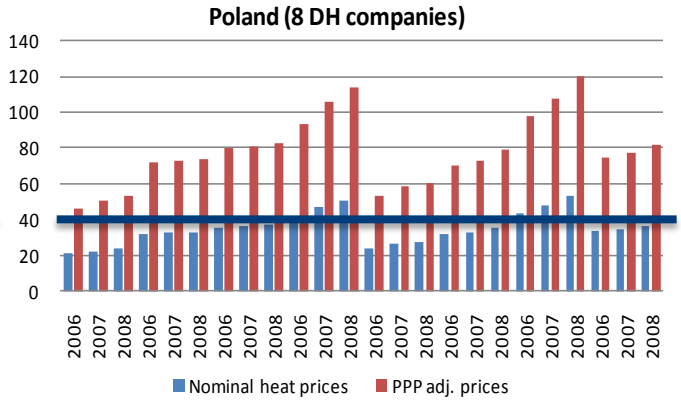
	Hungary (HUF)	Poland (PLN)	Lithuania (LTL)	Estonia (EEK)	Finland (EUR)
Average exchange rate	**270.0000**	**4.0000**	**3.4500**	**15.6500**	**1.0000**
Purchasing power parity	**1.80**	**2.24**	**2.16**	**1.83**	**1.00**

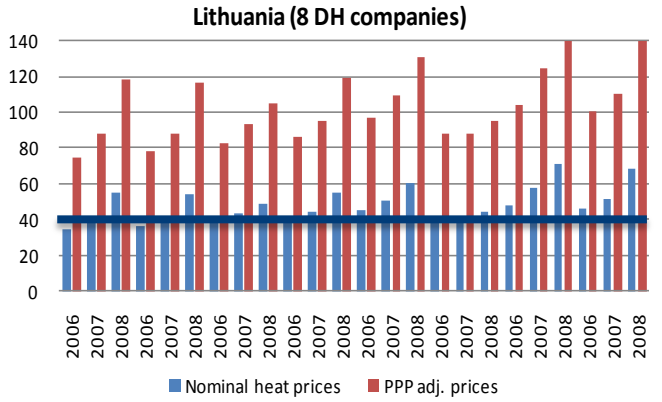
Why PPP adjusted heat prices? PPP adjusted heat prices better provide an answer to the question how high or low heat prices are in a multi-national benchmarking as they measure heat price level in respect to local purchasing power in each country.

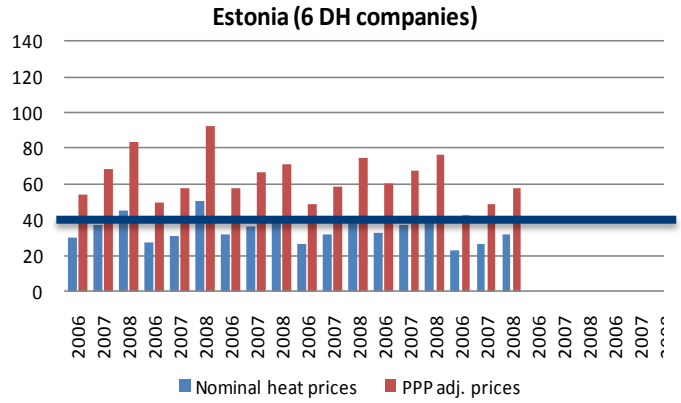
Data source: xxxx

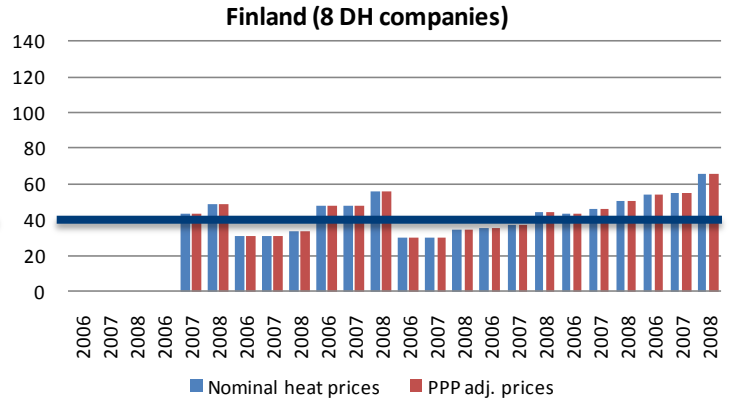
B3. PPP adjusted heat prices (EUR/MWh) 2006-08





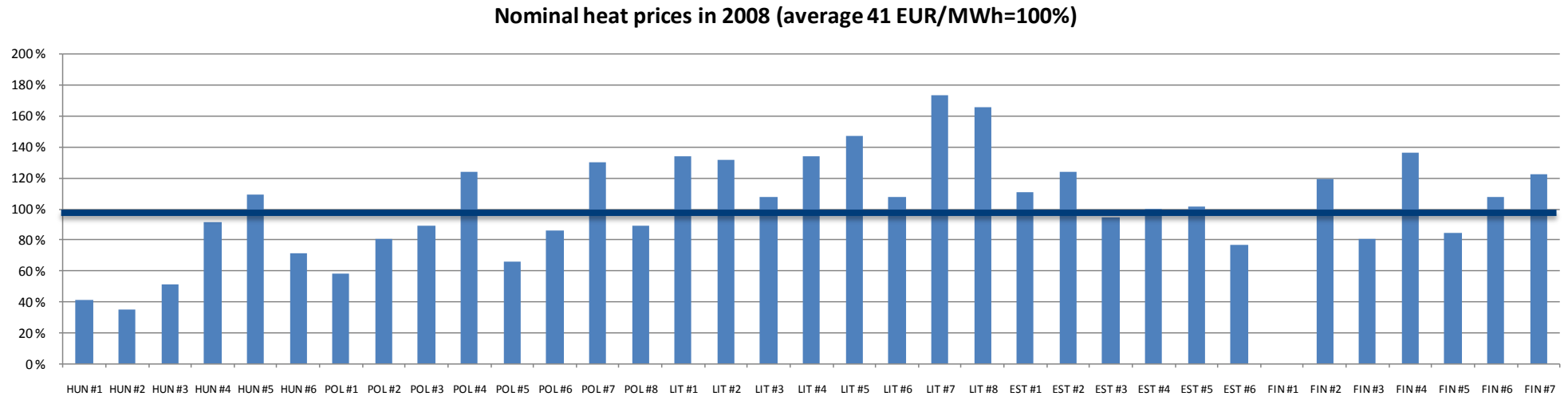


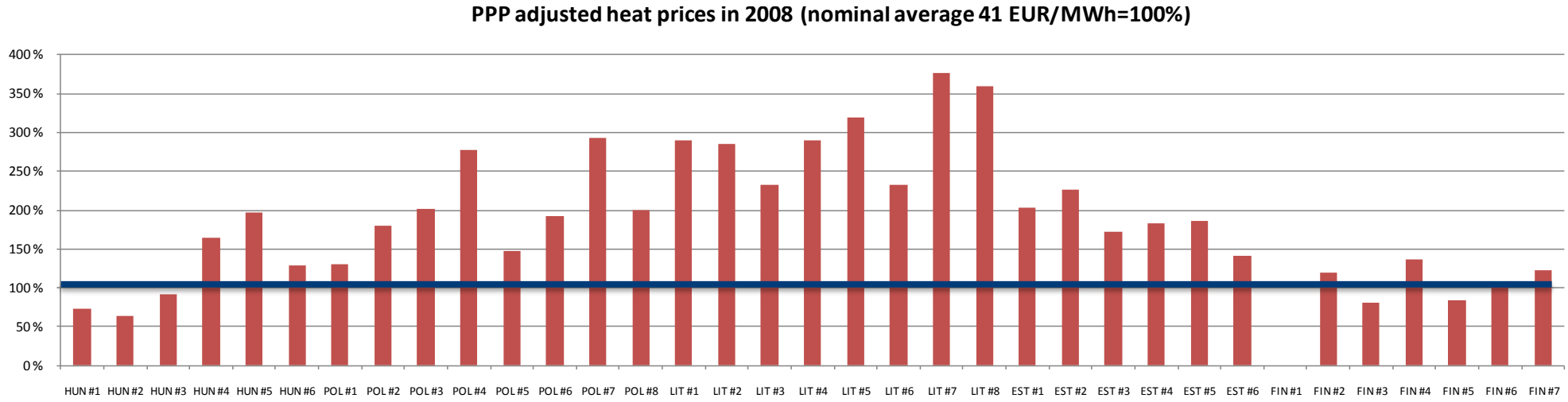




- **High range of PPP adjusted heat prices between 40…140 EUR/MWh during 2006-08 => Different cost of heating for customers**
  - Hungary 30…80 EUR/MWh, Poland 45…120 EUR/MWh, Lithuania 80…140 EUR/MWh, Estonia 50…90 EUR/MWh and Finland 30…60 EUR/MWh
  - Income adjusted price of heating is over 200 % higher
- **Benchmark heat price at 40 EUR/MWh**
  - Average nominal price in 2008 is 41 EUR/MWh
  - Average PPP adjusted price in 2008 is 76 EUR/MWh

B4. Nominal and PPP adjusted heat prices (EUR/MWh) in 2008





Hungary	Poland	Lithuania	Estonia	Finland

B5. Concluding remarks on heat prices and pricing policies (1)

Energy policy

- Heat prices based on historical costs do not fully reflect the necessary cost of developing DH systems into world-class.
- Specific heat consumption is an important driver for total heating cost for a customer. This is not included in this survey. Average consumption varies between 150…250 kWh/m2.
- In Hungary, one important driver for lower heat prices is full cross-subsidy from electricity revenues.
- In other countries, benefits of CHP are practically shared between both products (heat and electricity). Detailed regulatory rules in place in Poland, Lithuania and Estonia.

Ownership strategy

- Low heat prices have high local political interest (Hungary, Lithuania) which often seems to lead to under recouping of costs and investments
- Low heat prices have some local political interest (Poland, Estonia, some municipalities in Finland)
- Local utilities are seen as income source for municipal economy (Finland) which often means that the owners expect to receive regular profits (dividends)

B6. Concluding remarks on heat prices and pricing policies (2)

Fuel strategy and cost efficiency

- Main fuel is the most important driver for heat prices: gas or local solid fuel
- Finland can be considered as world-class reference of DH/CHP in terms of heat prices and cost efficiency. Heat prices in Finland are not higher than in other benchmarked countries due to efficiency benefits and high utilization of more stable priced local fuels.
- In cost-plus regimes, level of operational costs between companies varies substantially and can therefore have major price impact
- Cost-plus pricing regime may lead to demotivation for targeting for world-class cost efficiency
- Cost efficiency will be analyzed in section D

Local competition

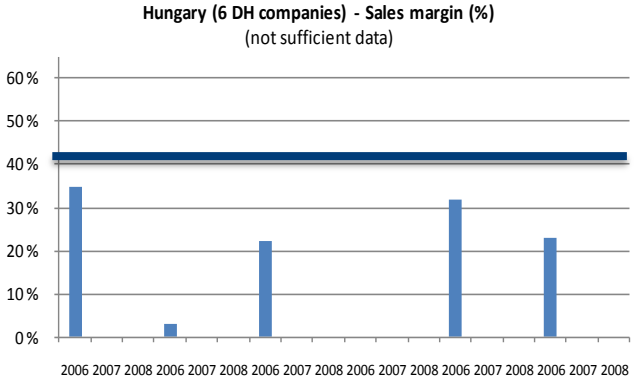
This has been analyzed on pages 28-29 in respect to DH market position

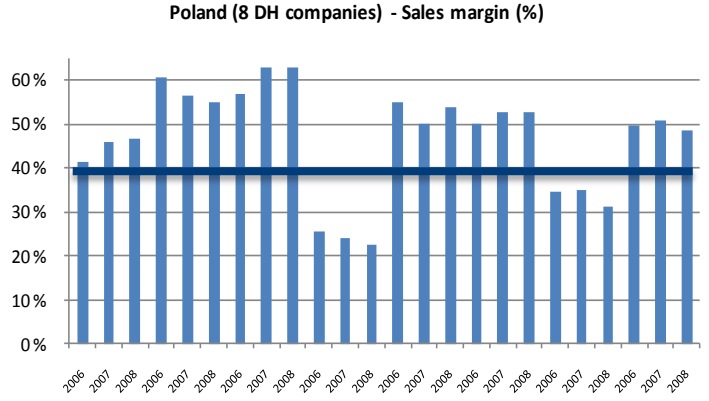
- DH is clearly competitive against alternative space heating solutions in Poland, Estonia and Finland
- Challenges in competitiveness in Hungary and Lithuania
- Potential area for more in-depth analysis

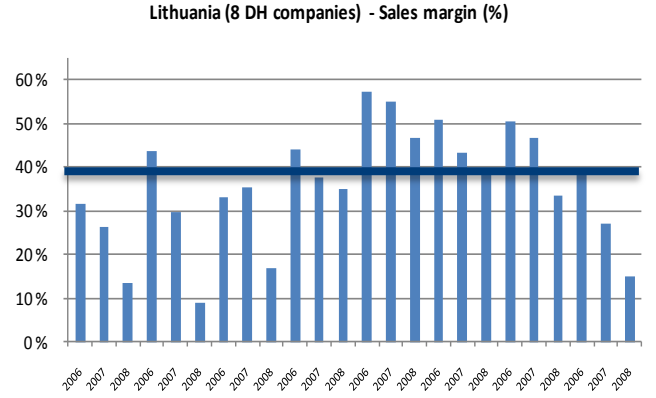
C1. Profitability - sales, EBITDA and EBIT margins (%)

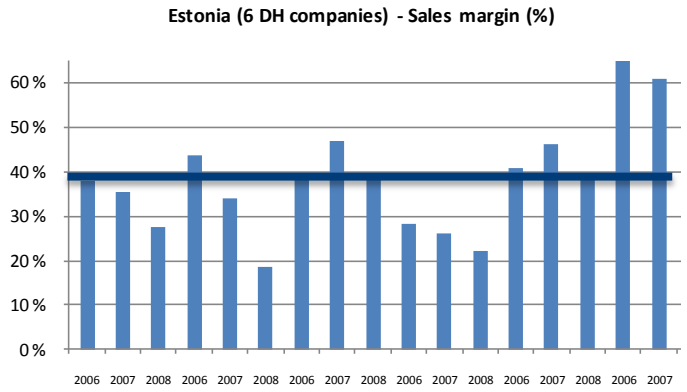
- **All company categories have been combined in presenting these margins as they should be rather comparable despite of company size and main fuels, and can therefore give a more comprehensive overall outlook**
- **In short term perspective, negative or too low margins reflect that DH companies are not able to cover all costs and may become insolvent. In longer term perspective, negative or too low margins will jeopardize proper motivation of private investors in investing into DH operations.**
- **Sales margin, %**
  - Sales margin = Revenues - Variable costs (mainly fuel)
- **EBITDA (operating) margin, %**
  - EBITDA = Revenues - Variable costs - OPEX
  - Cash flow from operations; before taxes, financing and investments
- **EBIT margin (operating profit), %**
  - EBIT = EBITDA - Planned depreciation
  - Profit before extraordinary items, financing and taxes

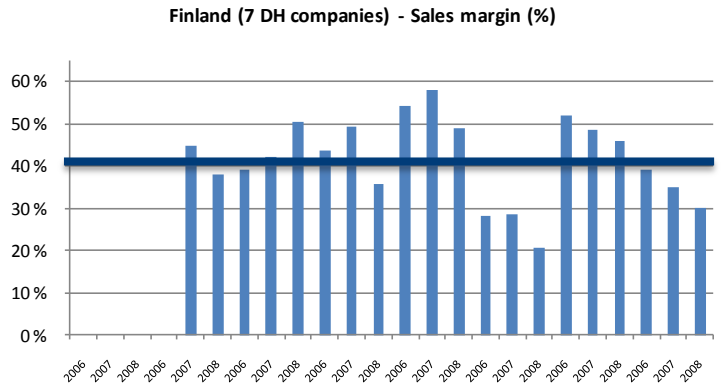
C2. Sales margins (%) in 2006-08 – all companies





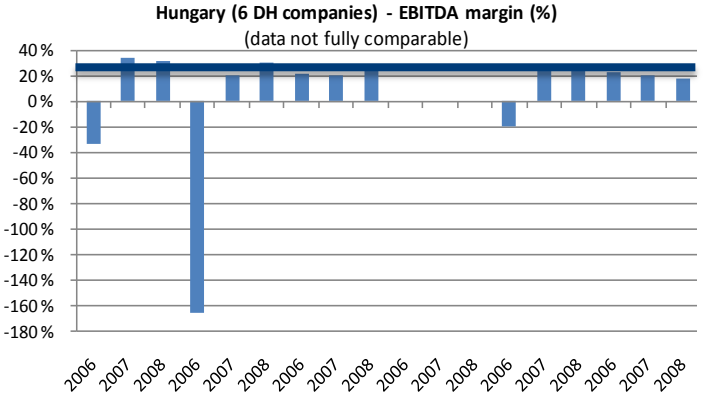


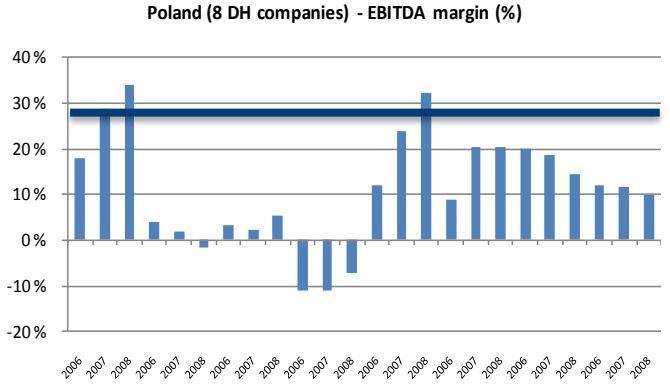


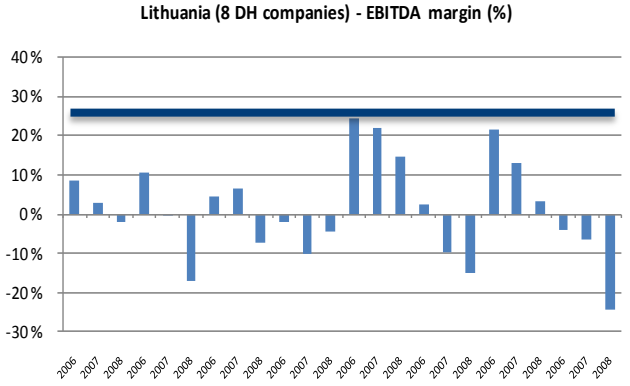


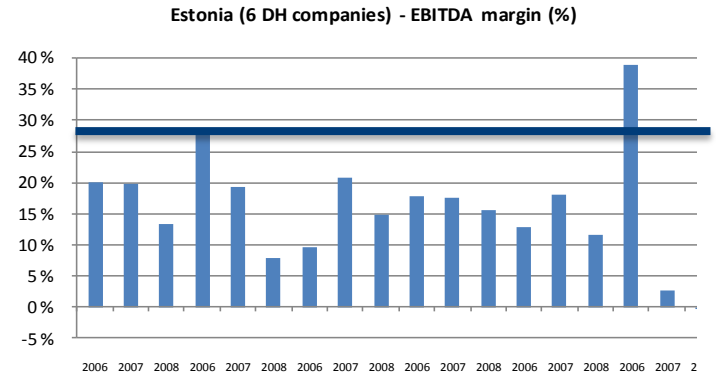
- **Sales margin targets to cover operational expenses (OPEX), depreciation, financing expenses and taxes**
- **Average sales margin in Finland ~40 % represents rather stable margin level (benchmark sales margin)**
- **Sales margins vary between 0%...60%**
  - Declining margins during benchmarking period in all countries; main reason is increase of fuel prices

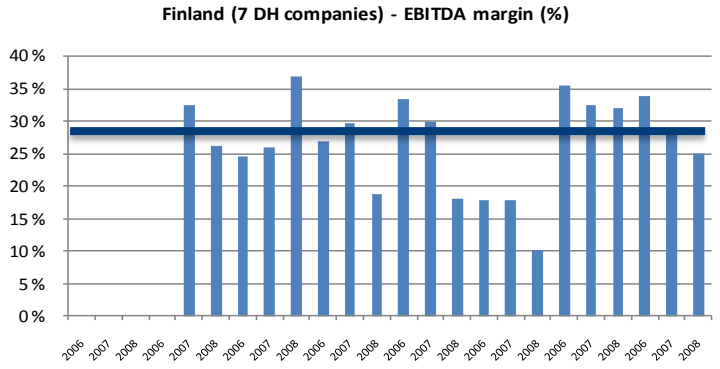
C3. EBITDA margins (%) in 2006-08 – all companies





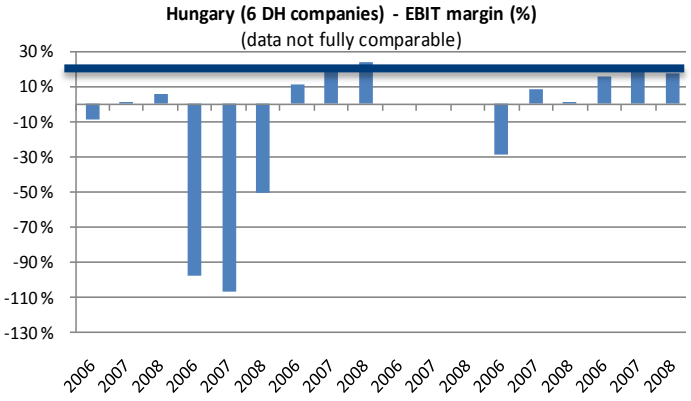


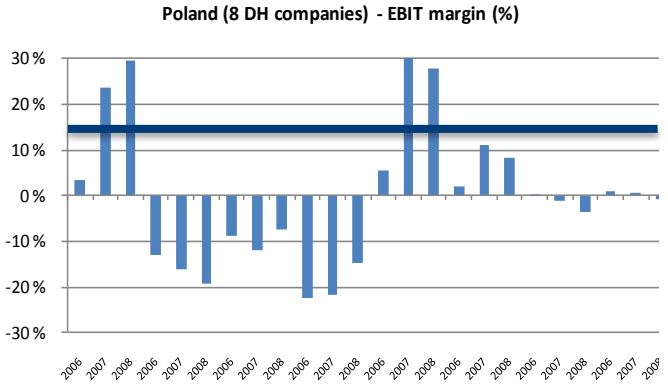


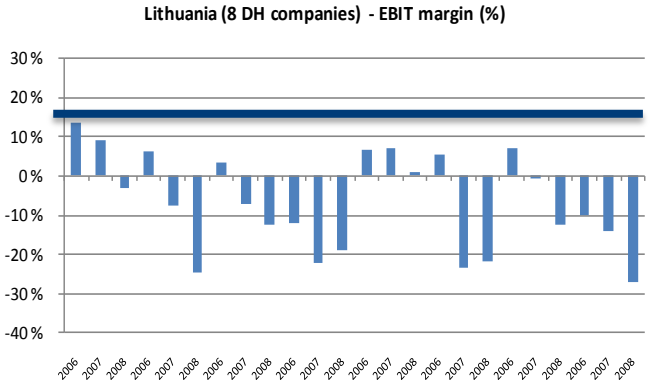


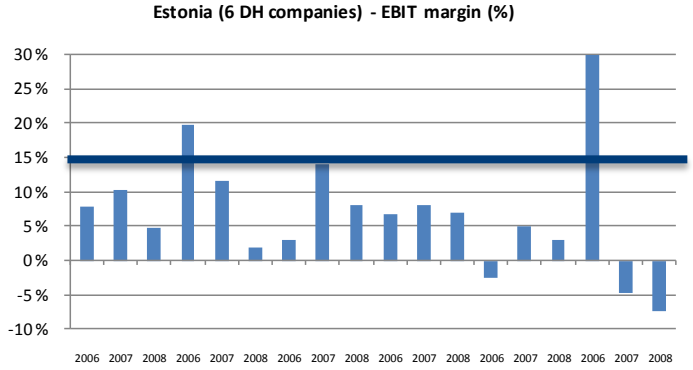
- **Positive EBITDA margins illustrate that a DH company is able to recoup all fuel and operational (OPEX) costs (all costs needed to run the operations)**
- **Average EBITDA margin in Finland ~28 % represents rather stable margin level** (benchmark EBITDA margin)
- **EBITDA margins vary between negative up to 35%; substantially high variance**
  - In Poland and Lithuania, high company specific and annual differences; some even negative
  - In Estonia, margins vary between 5%...40%, and are rather stable
  - In Finland, most stable level of EBIT margins
  - In Hungary, seriously negative margins could be found by some companies (data not fully comparable)
  - High EBIT margin of Estonian DH company due to other sales income in one year

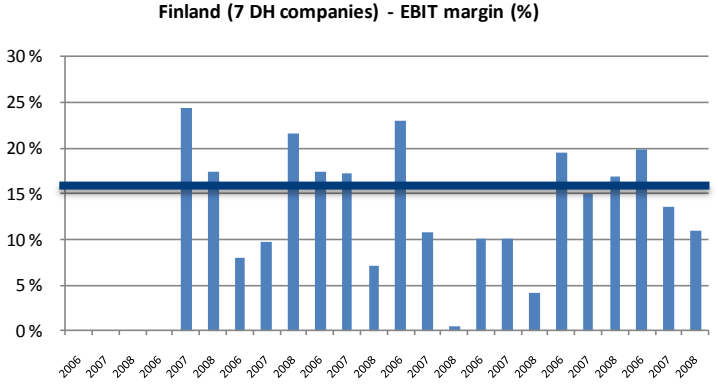
C4. EBIT margins (%) in 2006-08 – all companies





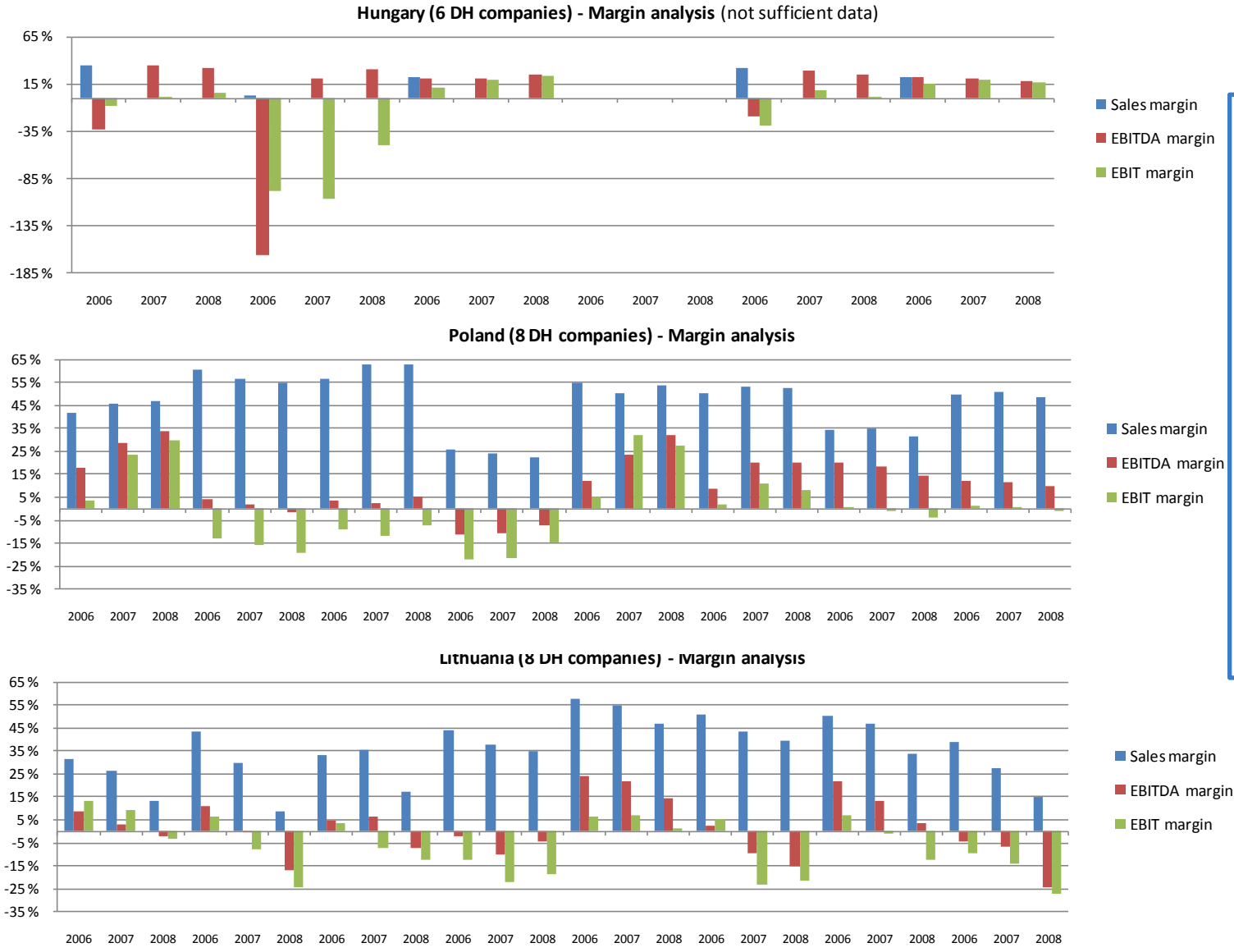






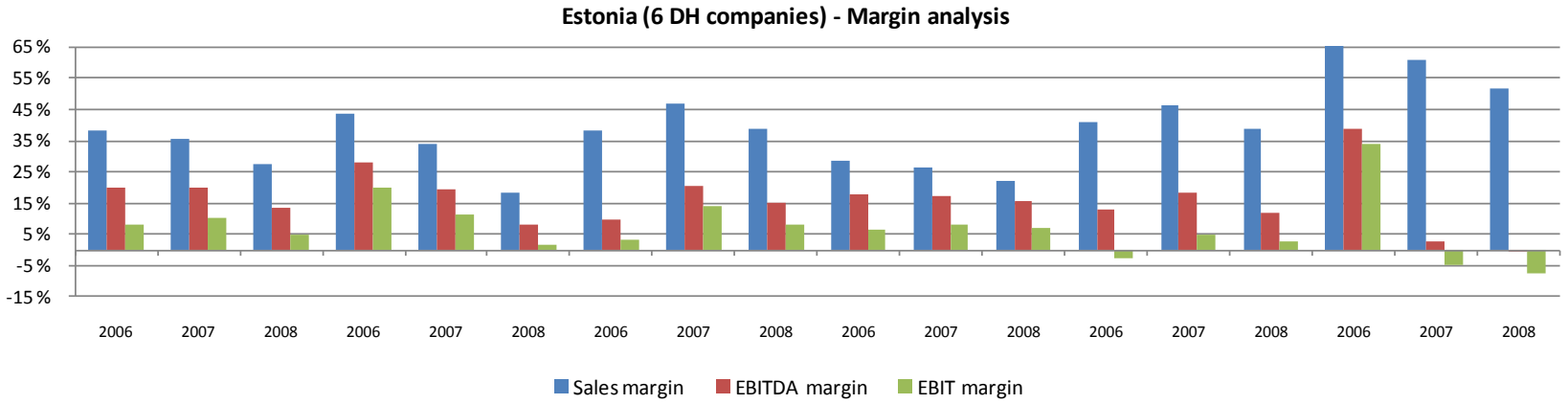
- **Positive EBIT margins illustrate that a DH company is able to recoup all fuel and operational (OPEX) costs and depreciation**
- **Average EBIT margin in Finland ~15 % represents rather stable margin level** (benchmark EBIT margin)
- **EBIT margins vary between negative up to 30%; substantially high variance**
  - In Poland and Lithuania, high company specific and annual differences; some even negative
  - In Estonia, margins vary between 5%...40%
  - In Finland, most stable level of EBIT margins; certain declining trend
  - In Hungary, seriously negative margins could be found by some companies (data not fully comparable)
  - High EBIT margin of Estonian DH company due to other sales income in one year

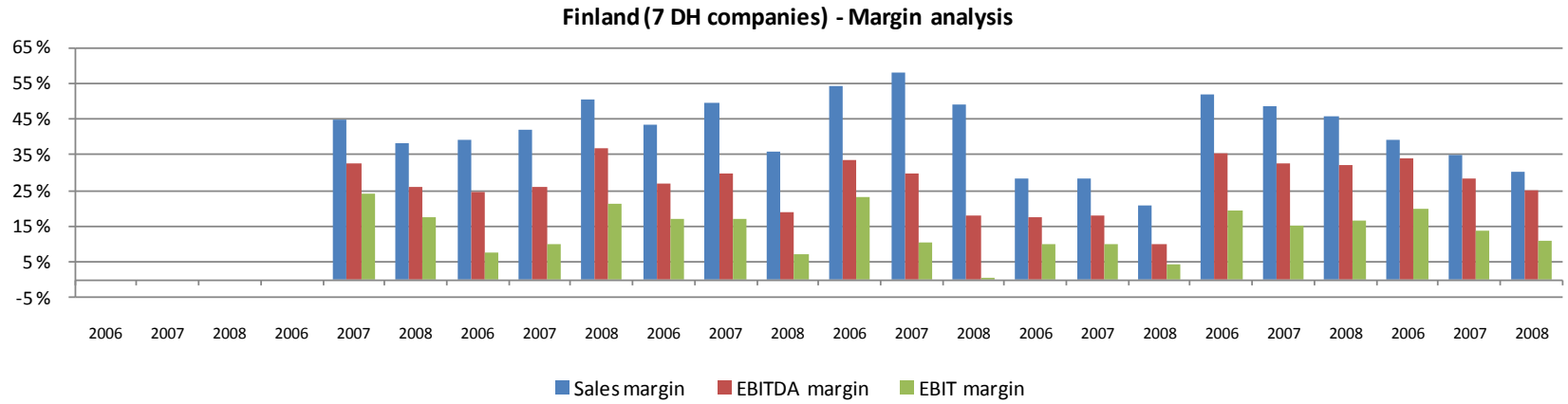
C5. Margin summary in 2006-08 – Hungary, Poland and Lithuania



- **Quite high range of margin levels and unstable development during 2006-08**
- **Negative EBITDA and EBIT margins in rather many cases in Hungary and Lithuania**
- **Some negative EBIT margins in Poland**

C6. Margin summary in 2006-08 – Estonia and Finland





- **Solid margin levels and development during 2006-08**

C7. Concluding remarks on margin analysis

- **Justification of stable profitability margins over time**
  - Sustaining stable solidity and cash liquidity
  - Enable consistent investment planning, implementation and financing
  - Solid positive development of financial service for both debt and equity

- **According to benchmarking analysis of limited number of DH companies, margin development has been negative during 2006-08 in Poland, Lithuania and Estonia**
  - Main reason has been delayed pass through of substantial gas and oil price increases into heat prices
  - Furthermore it is assumed that also other cost increases have not been passed through effectively into heat prices
  - Ability of DH companies to recoup full costs and depreciation has been negative in surprisingly many cases (EBIT margin analysis)
  - NOTE! Data in Hungary not sufficient

D1. Cost efficiency of DH operations depends on

Regulatory incentives

- **How DH companies are rewarded for higher cost efficiency?**
- Are there voluntary mechanisms for management to seek for most cost efficient solutions?
- Appreciation of investments vs. costs in regulatory practices
- Regulatory requirements for continuous cost efficiency improvements

Investment policy and possibilities

- **How DH companies find competitive financing for their investment plans?**
- Financial liquidity: equity and debt financing capability
- Owner strategy: investments vs. dividends vs. low tariffs
- Return expectations of financiers for investments

Asset mgmt strategy and competences

- **What are the asset management strategy and competences?**
- Maintenance policy and requirements
- Competences of personnel and outsourcing policy for operations and maintenance
- Balance between short and long term cost appreciations

Age and condition of assets

- **What is the age and condition of assets?**
- Higher maintenance costs of old production and network assets
- Pre-insulation and quality of network assets
- Degree of automation

Cost scrutiny by management

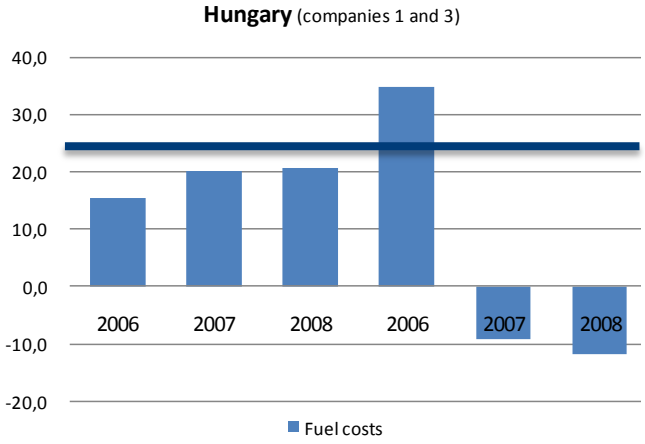
- **How DH company culture and management is in favor for cost scrutiny?**
- Return expectations and profile of the owner
- Cost awareness culture and ambition
- Quality of investment profitability calculations and decisions
- Investment prioritization limitations

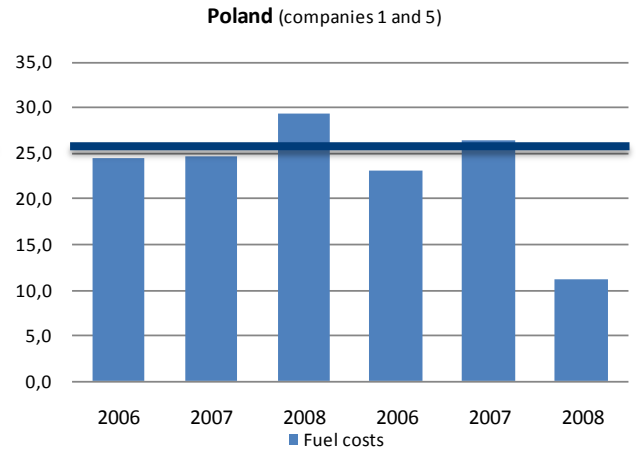
D2. Issues that have not been included in KPI cost efficiency analysis

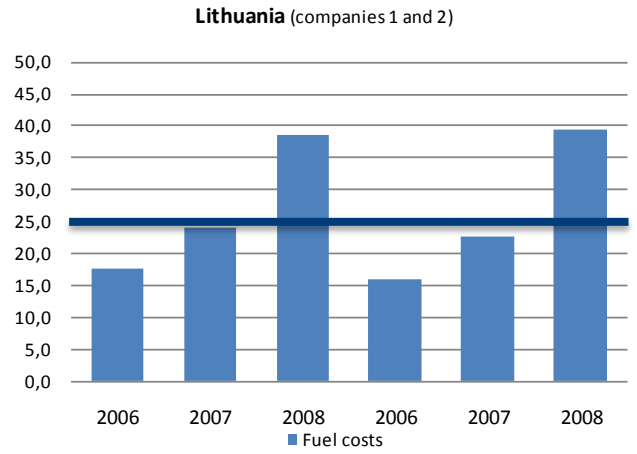
- Impact of annual temperature, heat demand and fuel price variations
- Impact of annual variations in electricity – in case of condensing production
- Impact of customer non-payment on heat prices
- Customer structures (residential, public, commercial, industrial)
- Structures of heat tariffs (variable and fixed components)
- Level of outsourcing – typically some maintenance costs can be included within personnel costs (own maintenance personnel) or within other operational costs (outsourced maintenance) – this is mainly eliminated by using OPEX/MWh as KPI
- Accounting differences between countries and companies may cause part of reported differences because of different accounting treatment for allocating asset maintenance
  - Maintenance as annual expenses or investments into assets (depreciation as annual cost)

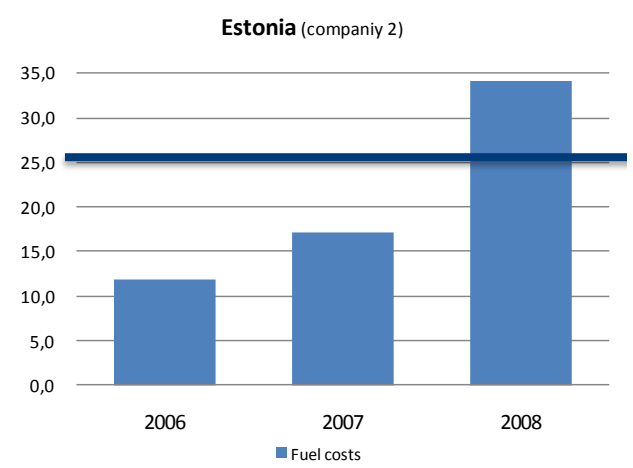
Cost Efficiency: Large natural gas DH companies in Hungary, Poland, Lithuania, Estonia and Finland

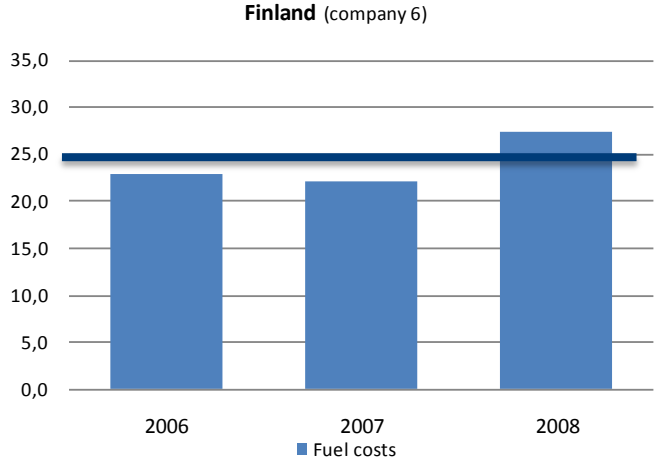
Fuel Costs (EUR/MWh) – large natural gas DH companies









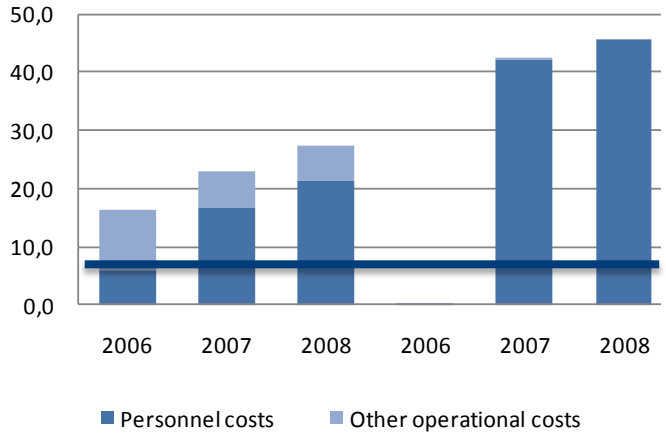


- **High increase during 2006-08**
- **Fuel costs between 20…40 EUR/MWh**
  - Price level of natural gas in different countries has not been analyzed in detail
  - Some own gas sources in Poland
  - Gas transportation cost has limited impact on presented price levels
- **Benchmark line at 25 EUR/MWh to reflect currently valid price levels**
  - Highest gas fuel costs in Hungary and Lithuania due to recent increase of prices

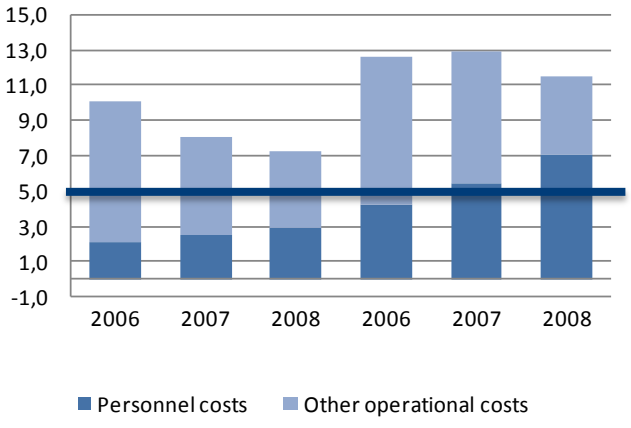
NOTE! Cost allocation in Hungary indicative as detailed data not available.

OPEX (EUR/MWh) – large natural gas DH companies

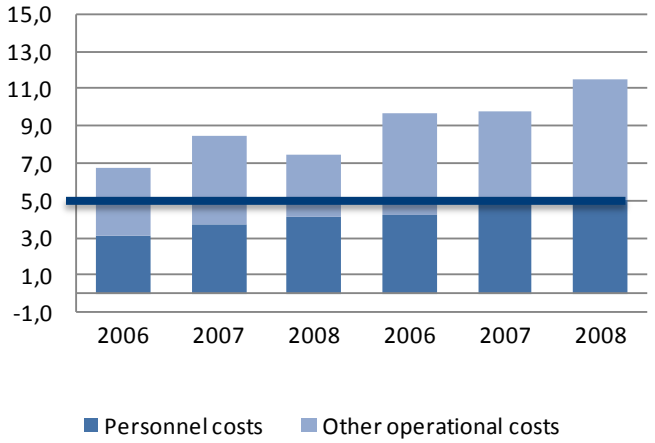
Hungary (companies 1 and 3)



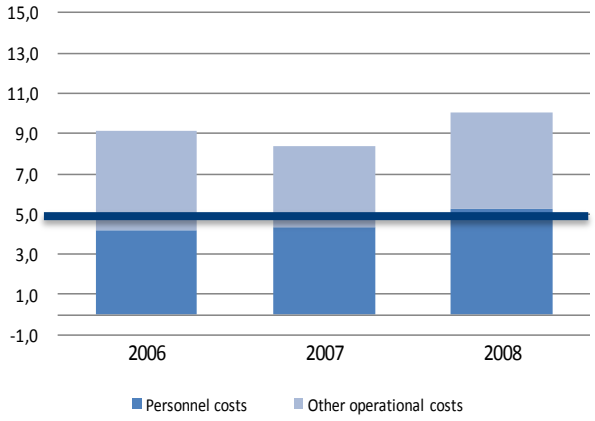
Poland (companies 1 and 5)



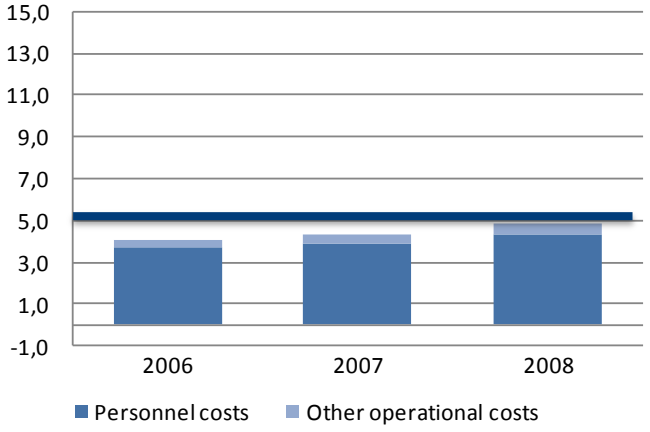
Lithuania (companies 1 and 2)



Estonia (company 2)



Finland (company 6)

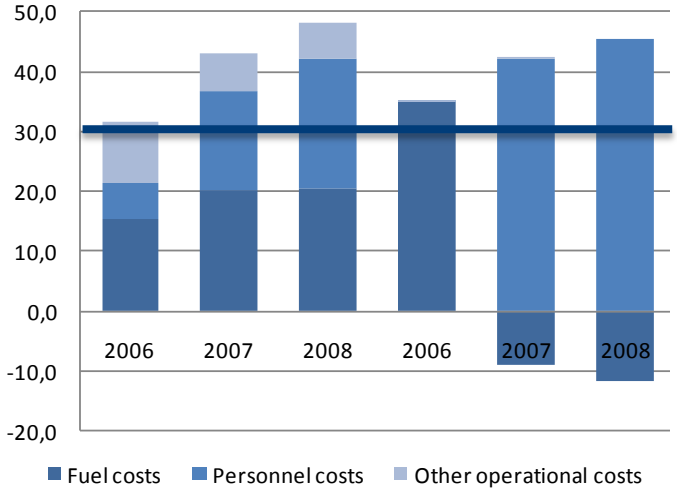


- **OPEX vary between 4…over 10 EUR/MWh**
- **Benchmark level 3…5 EUR/MWh in Estonia and Finland**
- **Worst companies have 9…13 EUR/MWh**
  - Poland
  - Lithuania
  - Hungary

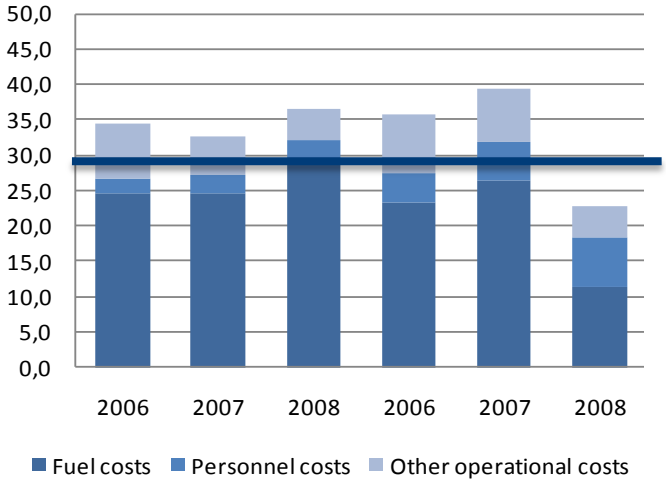
NOTE! Cost allocation in Hungary indicative as detailed data not available.

Fuel and OPEX (EUR/MWh) – large natural gas DH companies

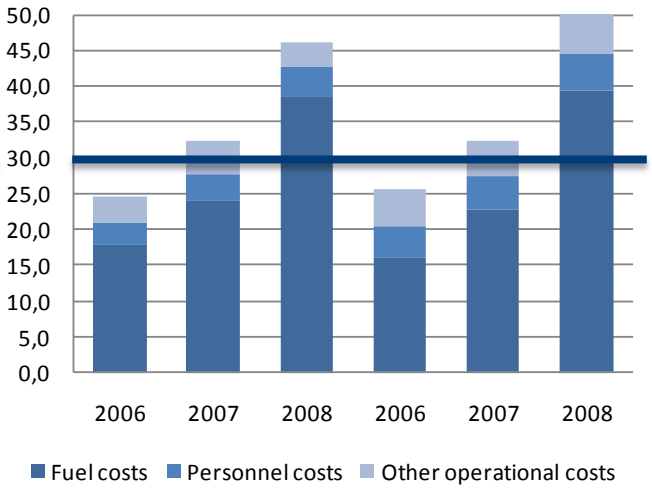
Hungary (companies 1 and 3)



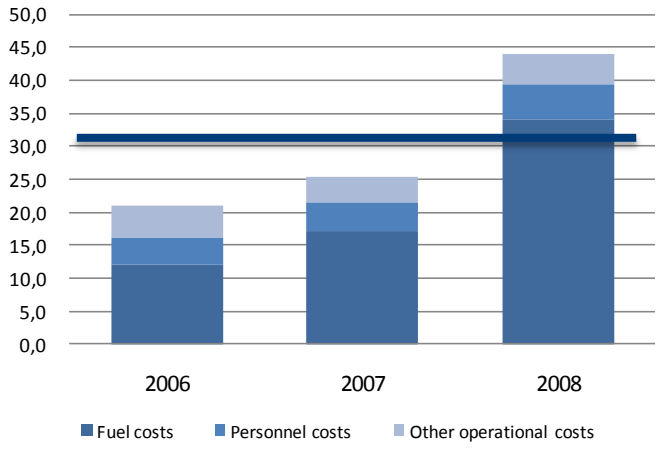
Poland (companies 1 and 5)



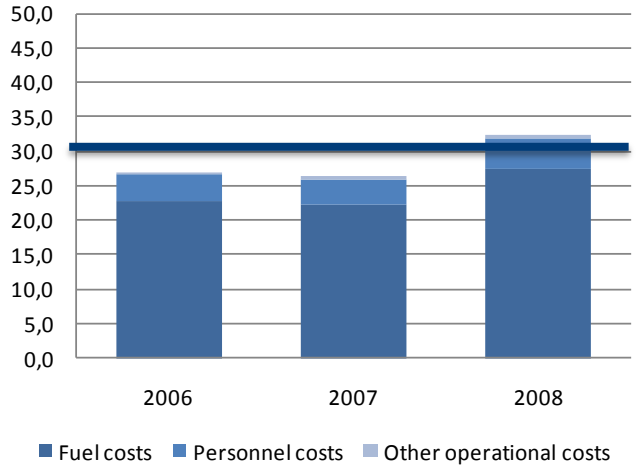
Lithuania (companies 1 and 2)



Estonia (company 2)



Finland (company 6)



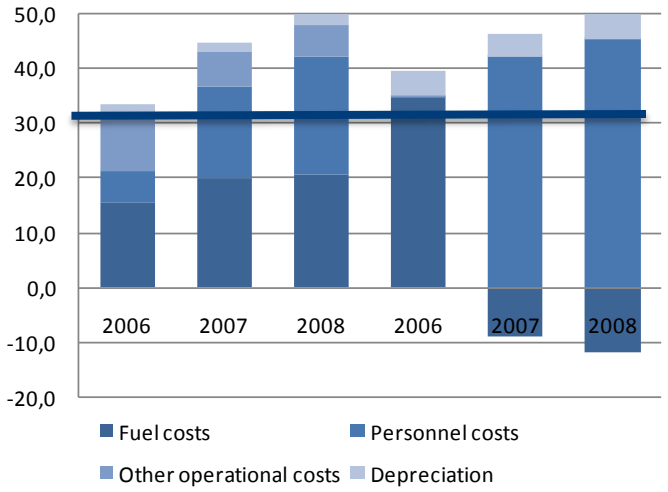
- **Fuel and OPEX between 30…50 EUR/MWh**
- **Benchmark level 30 EUR/MWh in Estonia and Finland**

NOTE! Cost allocation in Hungary indicative as detailed data not available.

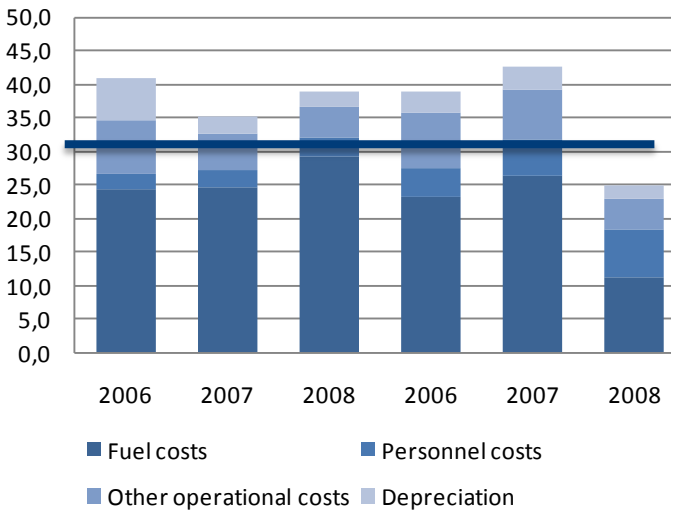
Fortum

Total Costs (EUR/MWh) – large natural gas DH companies

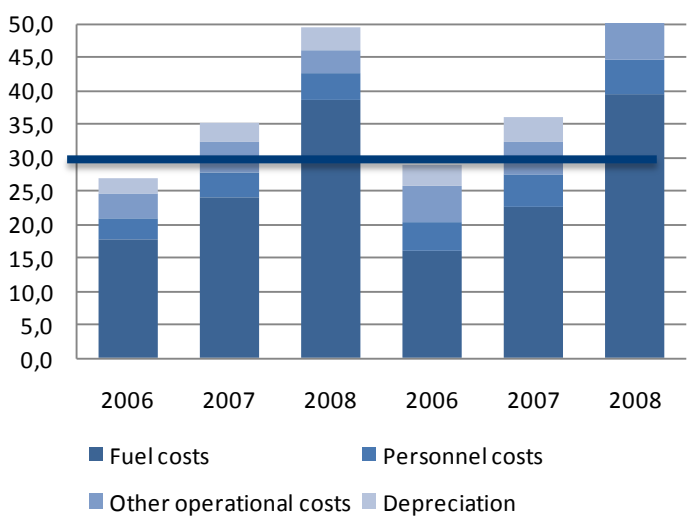
Hungary (companies 1 and 3)



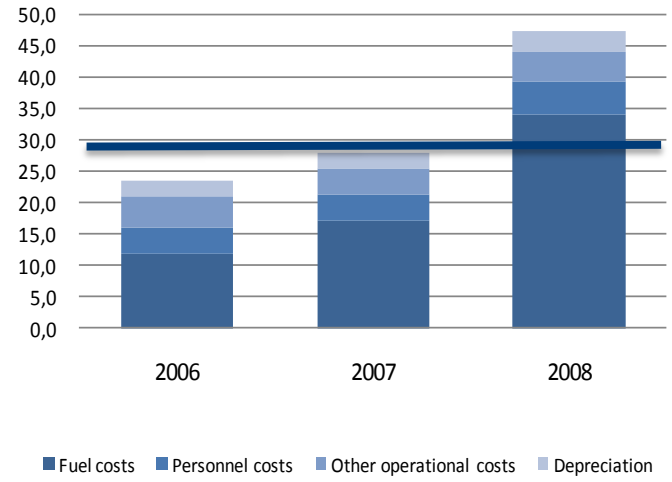
Poland (companies 1 and 5)



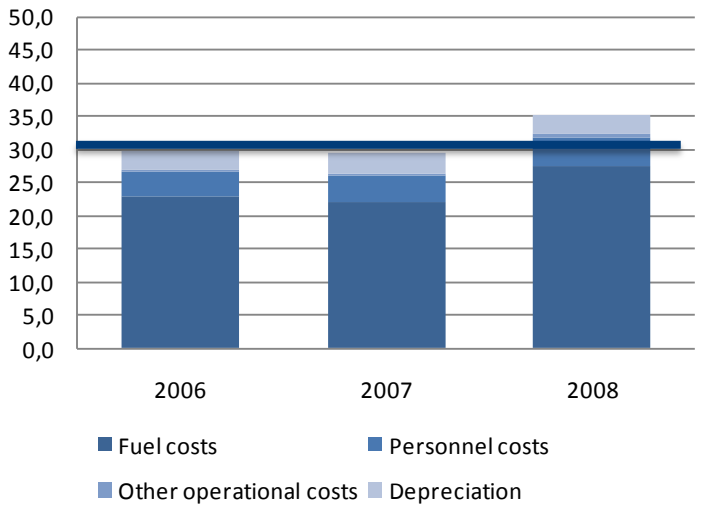
Lithuania (companies 1 and 2)



Estonia (company 2)



Finland (company 6)



- **Total costs between 30…50 EUR/MWh**
- **Benchmark level 30 EUR/MWh in Estonia and Finland**

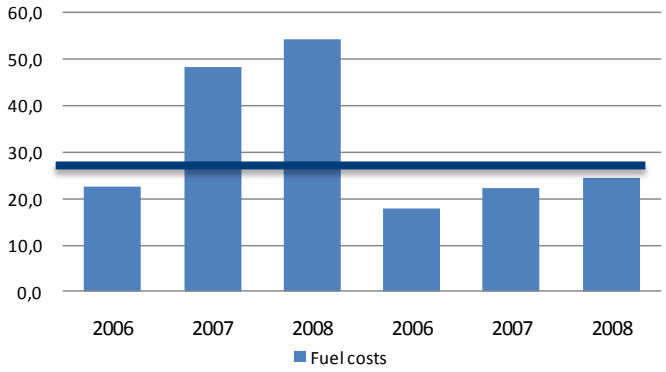
NOTE! Cost allocation in Hungary indicative as detailed data not available.

Fortum

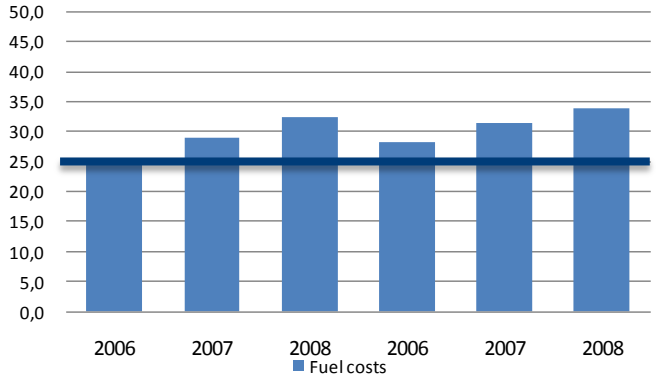
Cost Efficiency: Small natural gas DH companies in Hungary, Poland, Lithuania and Finland

Fuel Costs (EUR/MWh) – small natural gas DH companies

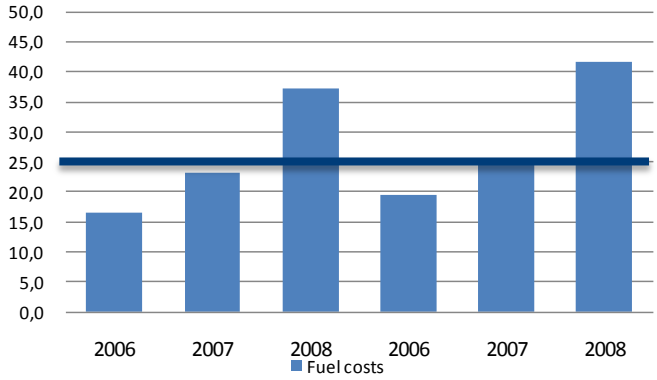
Hungary (companies 5-6)



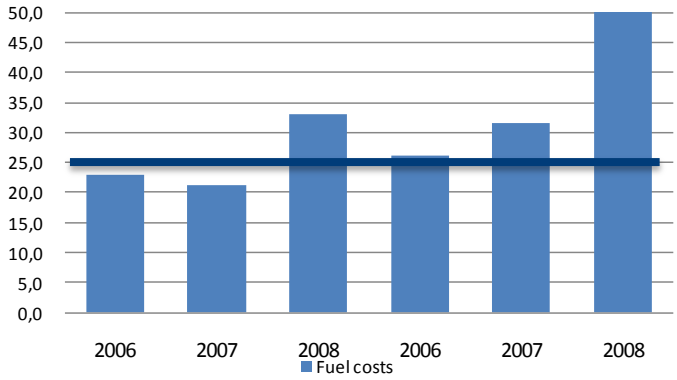
Poland (companies 4 and 7)



Lithuania (companies 7 and 8)



Finland (companies 4 and 8)



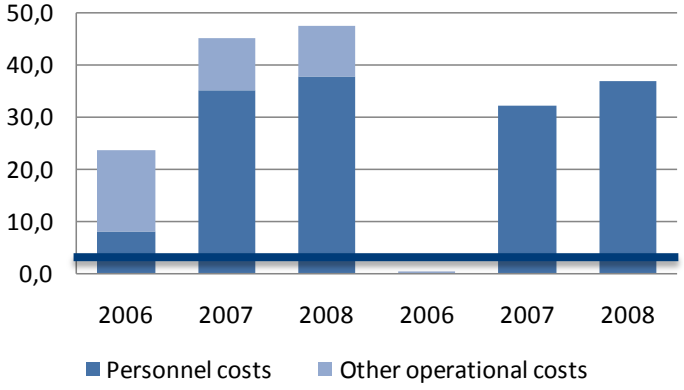
Estonia
no references included

- **High increase during 2006-08**
- **Fuel costs between 20…50 EUR/MWh**
  - Price level of natural gas in different countries has not been analyzed in detail
  - Some own gas sources in Poland
  - Gas transportation cost has limited impact on presented price levels
- **Benchmark line at 25 EUR/MWh to reflect currently valid price levels**
  - Highest gas fuel costs in Lithuania and Finland
- **In Estonia, no companies included in this category**

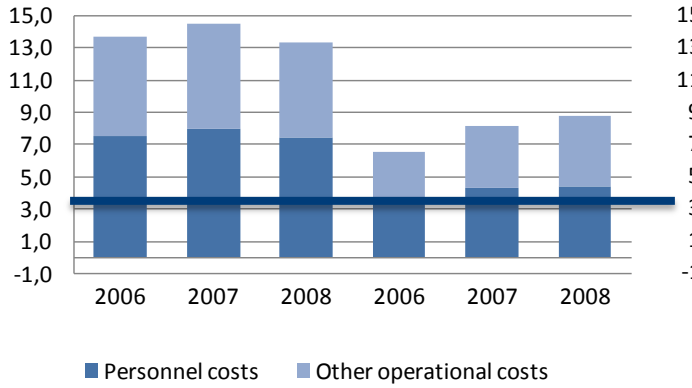
NOTE! Cost allocation in Hungary indicative as detailed data not available.

OPEX (EUR/MWh) – small natural gas DH companies

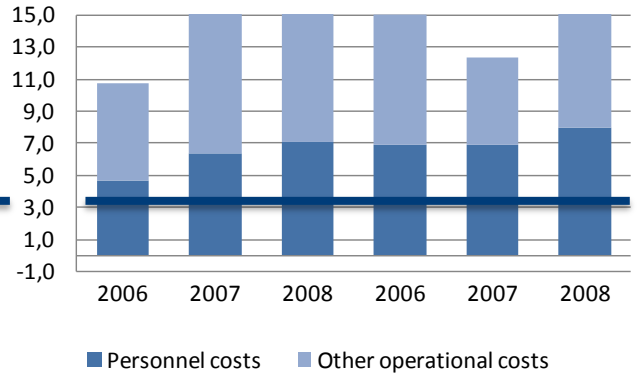
Hungary (companies 5-6)



Poland (companies 4 and 7)

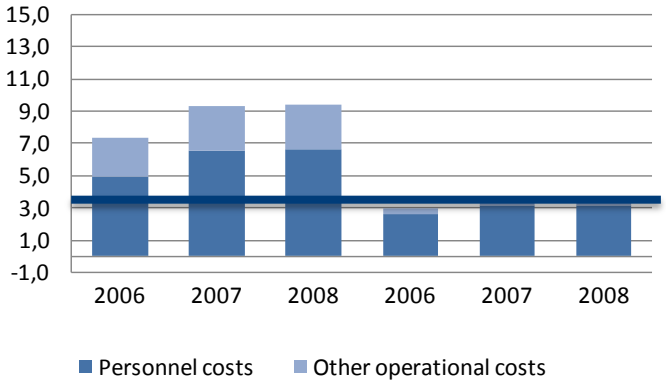


Lithuania (companies 7 and 8)



Estonia
no references included

Finland (companies 4 and 8)

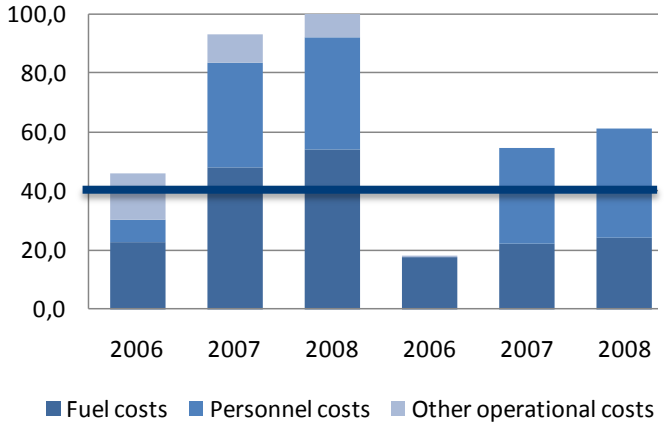


- **OPEX between 3…15 EUR/MWh**
- **Benchmark line at 3 EUR/MWh**
- **In Estonia, no companies included in this category**

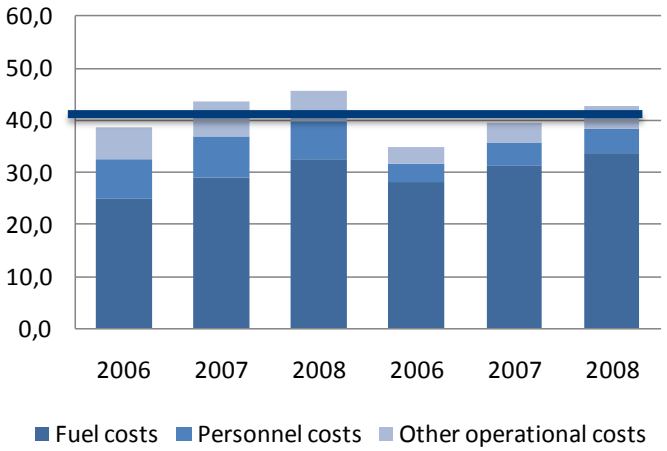
NOTE! Cost allocation in Hungary indicative as detailed data not available.

Fuel and OPEX (EUR/MWh) – small natural gas DH companies

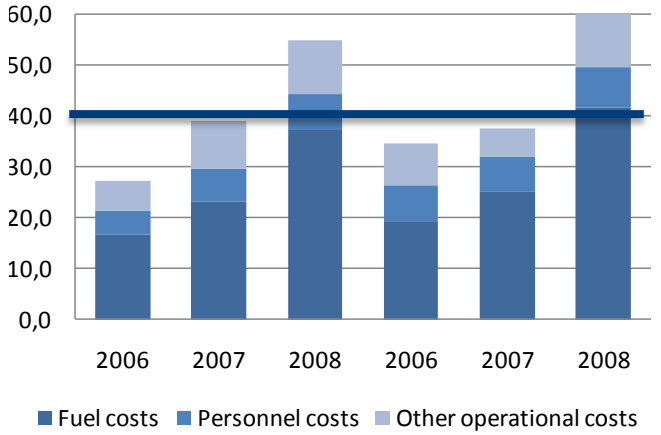
Hungary (companies 5-6)



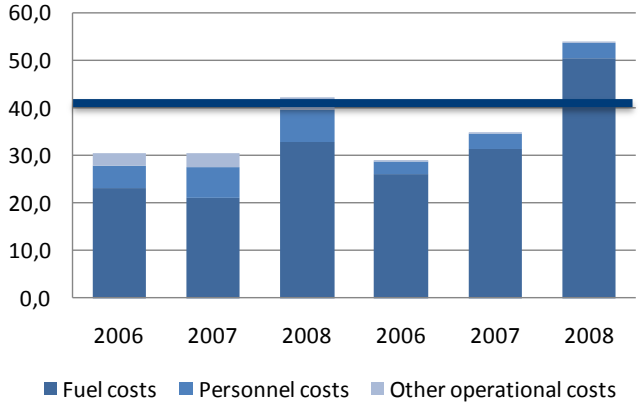
Poland (companies 4 and 7)



Lithuania (companies 7 and 8)



Finland (companies 4 and 8)



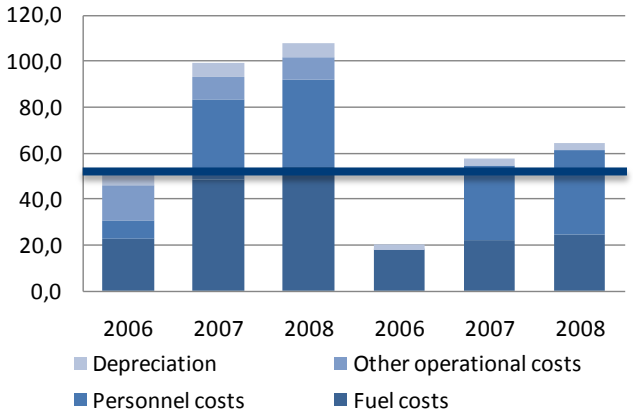
Estonia
no references included

- **Fuel and OPEX between 40…50 EUR/MWh**
  - In Hungary and Lithuania, slightly higher up to 60 EUR/MWh
- **Benchmark level 40 EUR/MWh in Poland and Finland**

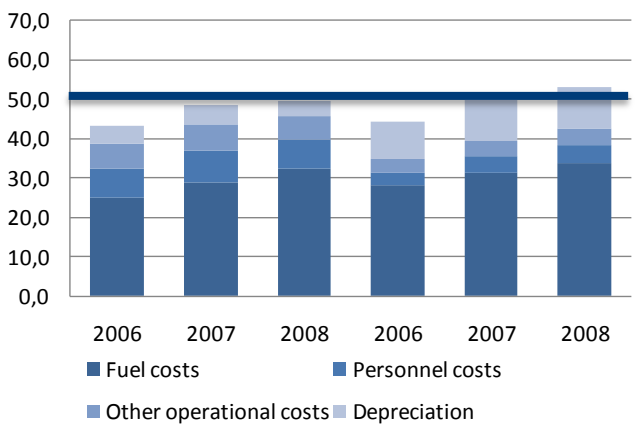
NOTE! Cost allocation in Hungary indicative as detailed data not available.

Total Costs (EUR/MWh) – small natural gas DH companies

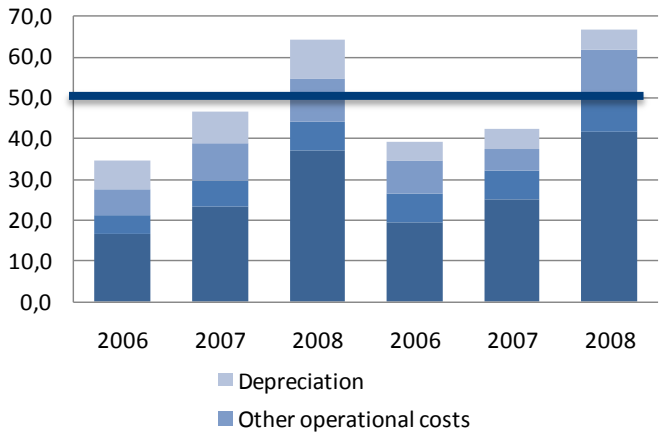
Hungary (companies 5-6)



Poland (companies 4 and 7)

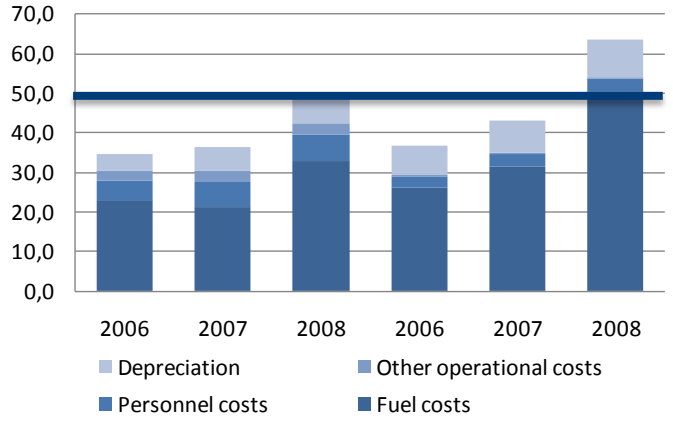


Lithuania (companies 7 and 8)



Estonia
no references included

Finland (companies 4 and 8)



- **Total costs between 50…65 EUR/MWh**
- **Benchmark total cost level 50 EUR/MWh in Poland**

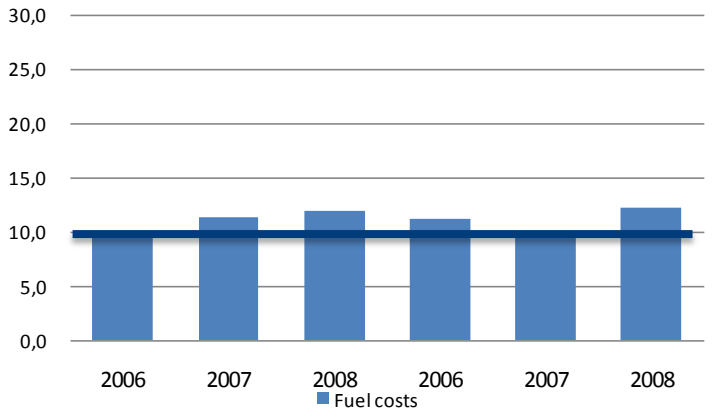
NOTE! Cost allocation in Hungary indicative as detailed data not available.

Cost Efficiency: Large solid fuel DH companies in Poland and Finland

Fuel Costs (EUR/MWh) – large solid fuel DH companies

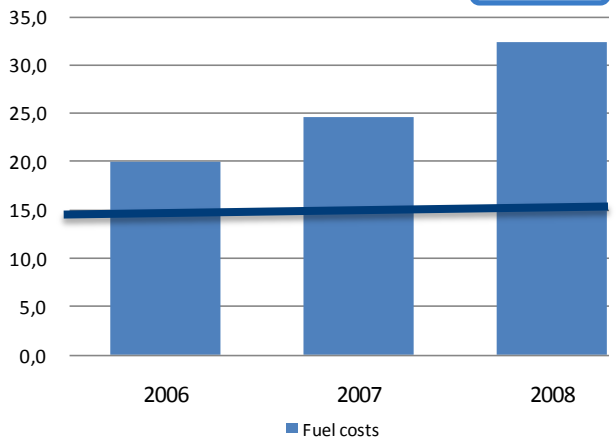
Hungary
no references included

Poland (companies 2 and 8) Coal

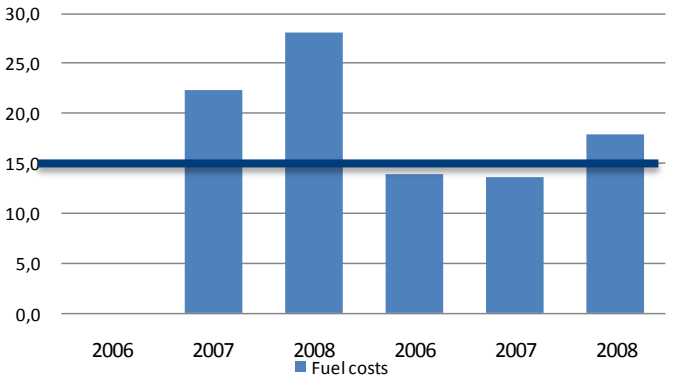


Lithuania
no references included

Estonia (companiy 4) Solid/gas



Finland (companies 2 and 5) Bio/peat



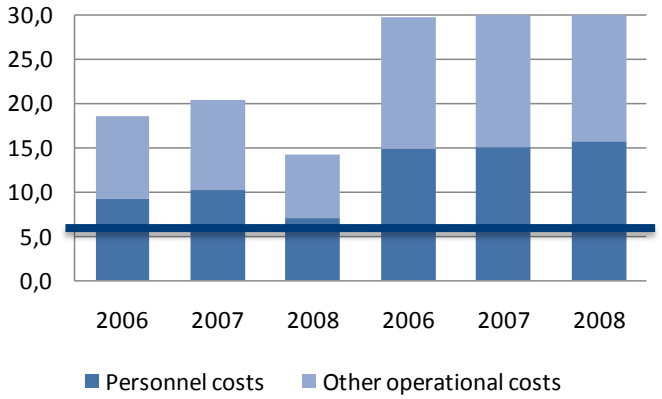
- **Fuel costs based on coal ~10 EUR/MWh in Poland**
- **Coal as main solid fuel in Poland**
- **Fuel costs based on biomass over 20 EUR/MWh in Finland**
- **Peat and biomass as main solid fuels in Finland**
- **Fuel costs based on bio/peat fuel mix ~15 EUR/MWh in Finland**

OPEX(EUR/MWh) – large solid fuel DH companies

Hungary
no references included

Poland (companies 2 and 8)

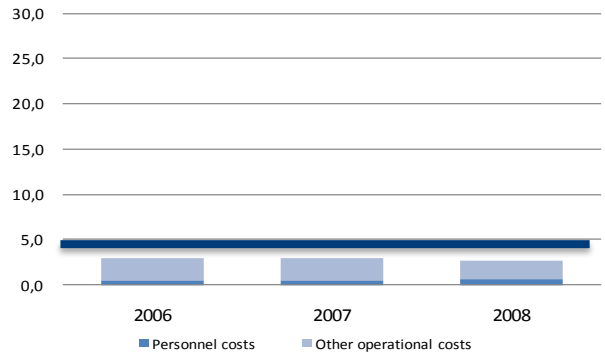
Coal



Lithuania
no references included

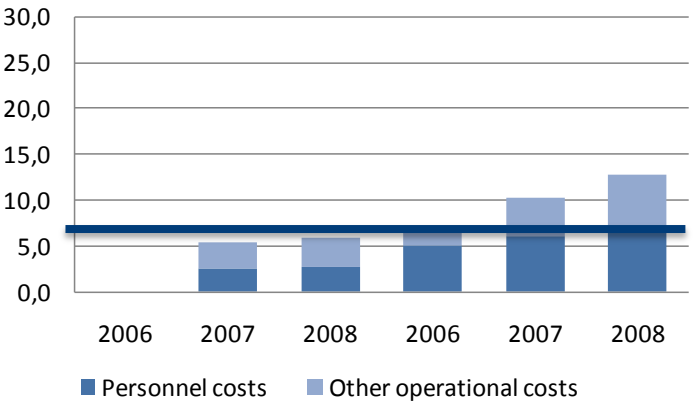
Solid/gas

Estonia (companiy 4)



Finland (companies 2 and 5)

Bio/peat



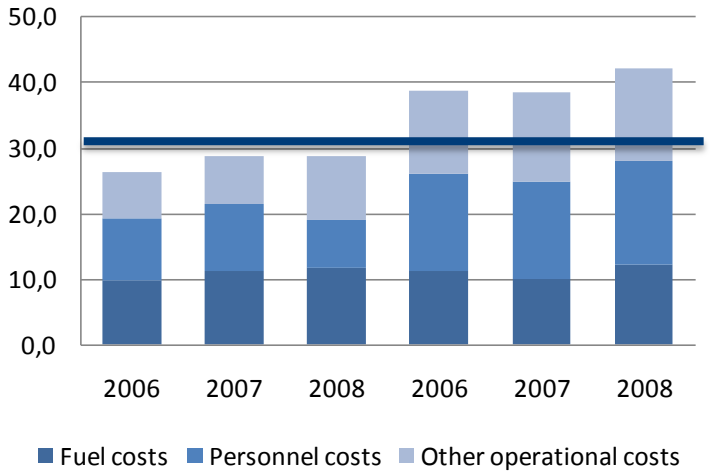
- **OPEX between 5…30 EUR/MWh**
  - Clearly higher in Poland compared with Finland
- **OPEX benchmark cost ~5 EUR/MWh**

Fortum

Fuel and OPEX(EUR/MWh) – large solid fuel DH companies

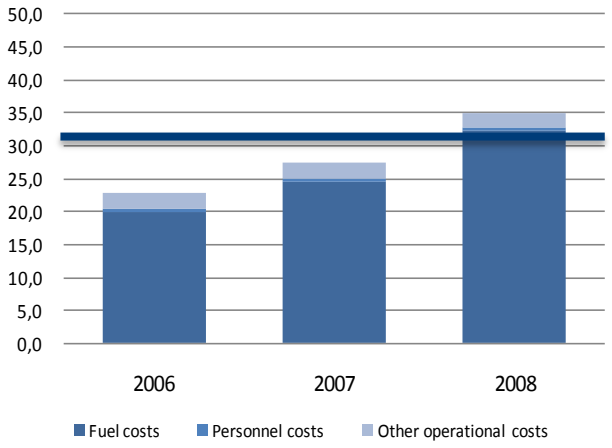
Hungary
no references included

Poland (companies 2 and 8) Coal

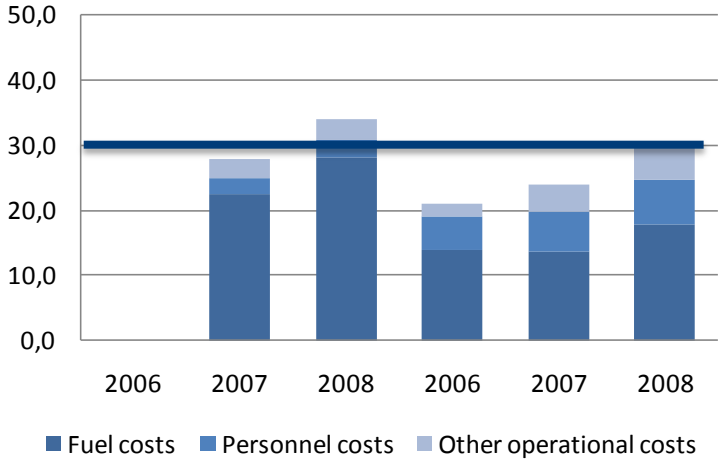


Lithuania
no references included

Estonia (companiy 4) Solid/gas



Finland (companies 2 and 5) Bio/peat

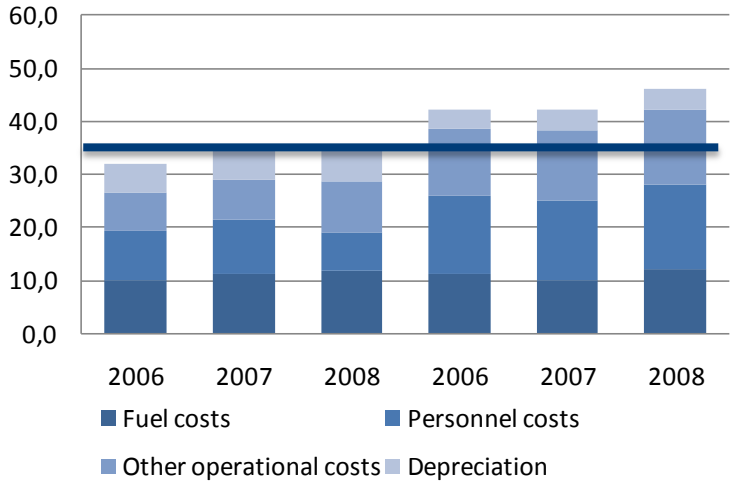


- **Fuel and OPEX between 30…40 EUR/MWh**
- **Poland compared with Finland**
  - Fuel cost lower 10-15 EUR/MWh
  - OPEX higher 10-25 EUR/MWh
- **Fuel and OPEX benchmark cost ~30 EUR/MWh**

Total Costs (EUR/MWh) – large solid fuel DH companies

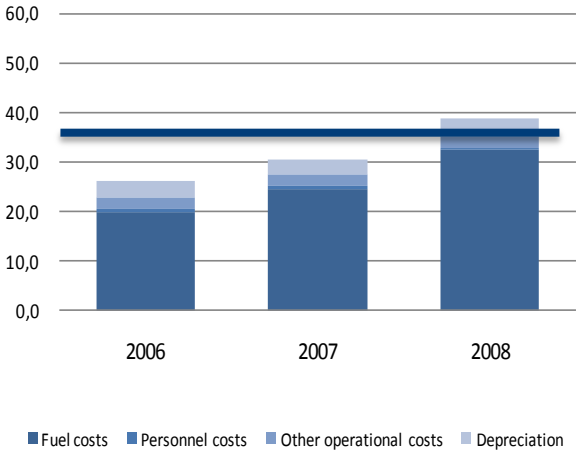
Hungary
no references included

Poland (companies 2 and 8) Coal

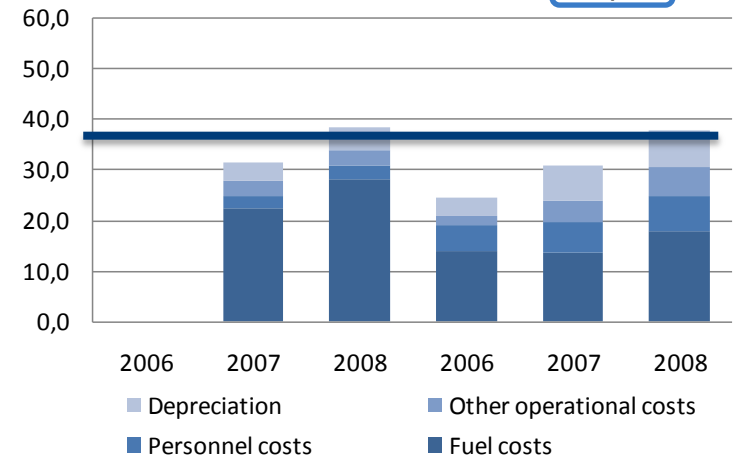


Lithuania
no references included

Estonia (companiy 4) Solid/gas



Finland (companies 2 and 5) Bio/peat

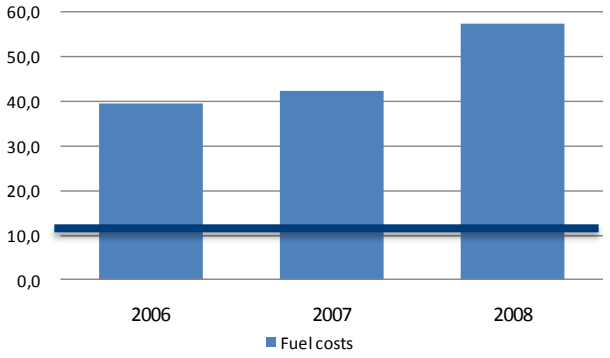


- **Total costs between 35…45 EUR/MWh**
- **Poland compared with Finland**
  - Fuel cost lower 10-15 EUR/MWh
  - OPEX higher 10-25 EUR/MWh
  - Lower depreciation
- **Fuel and OPEX benchmark cost ~35 EUR/MWh**

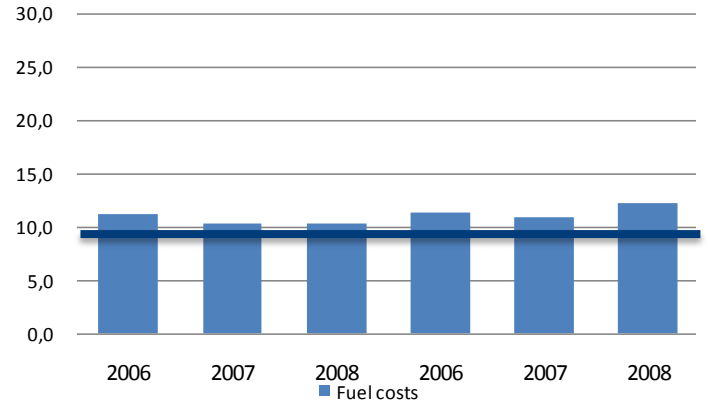
Cost Efficiency: Small solid fuel DH companies in Hungary, Poland, Lithuania, Estonia and Finland

Fuel Costs (EUR/MWh) – small solid fuel DH companies

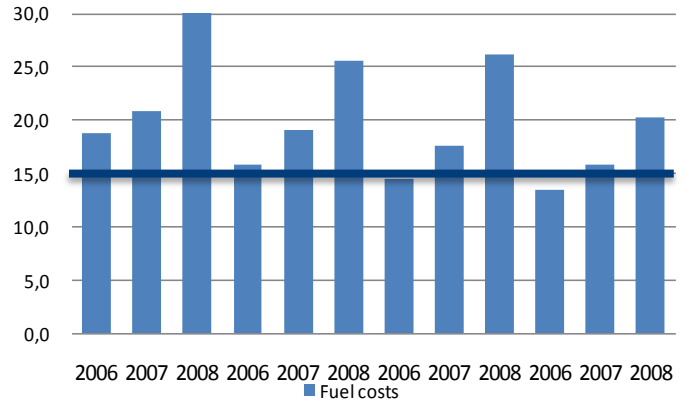
Hungary (company 2) Coal



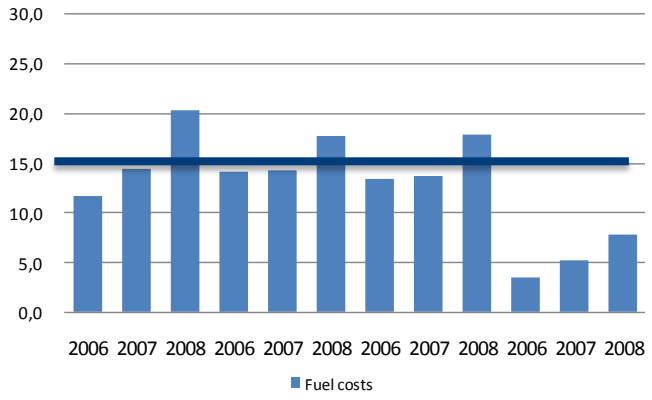
Poland (companies 3 and 6) Coal



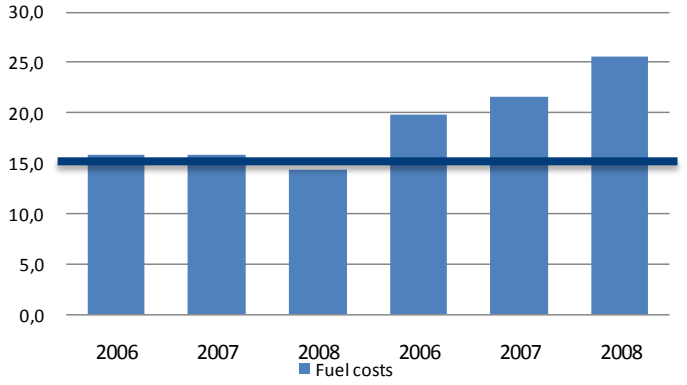
Lithuania (companies 3-6) Bio/peat



Estonia (companies 1, 3, 5 and 6) Bio/peat



Finland (companies 3 and 7) Bio/peat



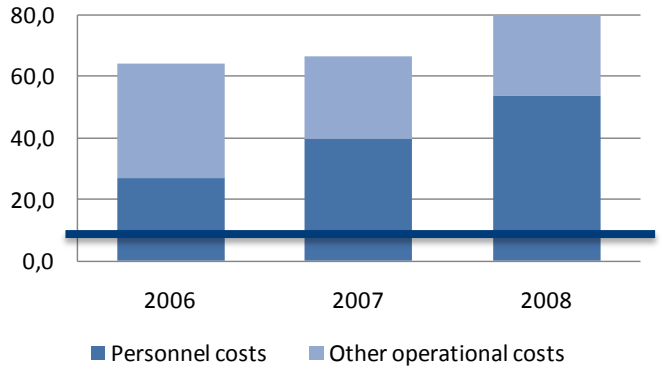
- **Benchmark fuel costs based on coal ~10 EUR/MWh in Poland**
  - Coal as main solid fuel in Hungary and Poland
- **Fuel costs based on bio/peat 15…25 EUR/MWh**
  - Peat and biomass as main solid fuels in Lithuania, Estonia and Finland
- **Benchmark fuel costs based on bio/peat fuel mix ~15 EUR/MWh in Finland**
  - Fuel cost based solely on peat < 10 EUR/MWh

NOTE! Reference company in Hungary is a coal-condensing power and heat company having own coal mining activities

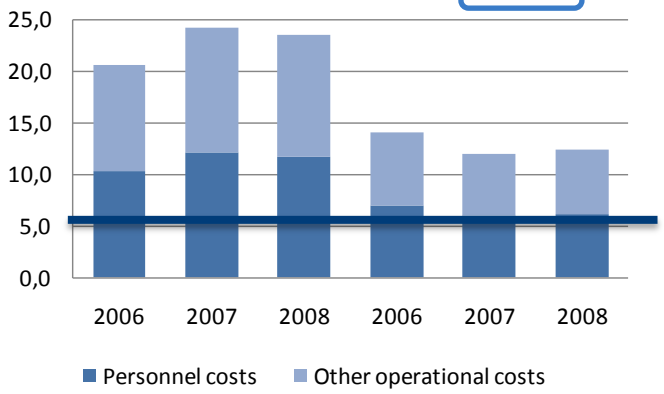
Fortum

OPEX (EUR/MWh) – small solid fuel DH companies

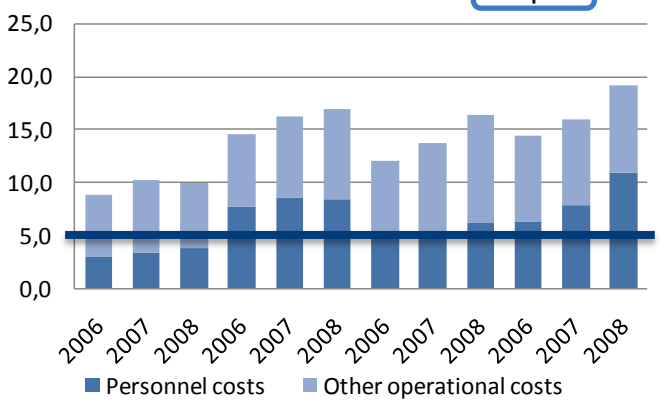
Hungary (company 2) Coal



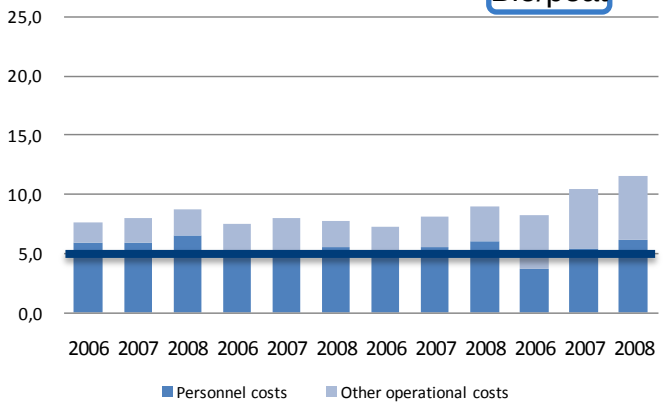
Poland (companies 3 and 6) Coal



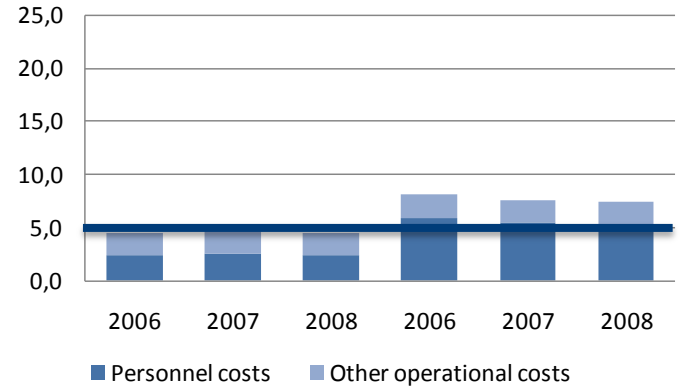
Lithuania (companies 3-6) Bio/peat



Estonia (companies 1, 3, 5 and 6) Bio/peat



Finland (companies 3 and 7) Bio/peat

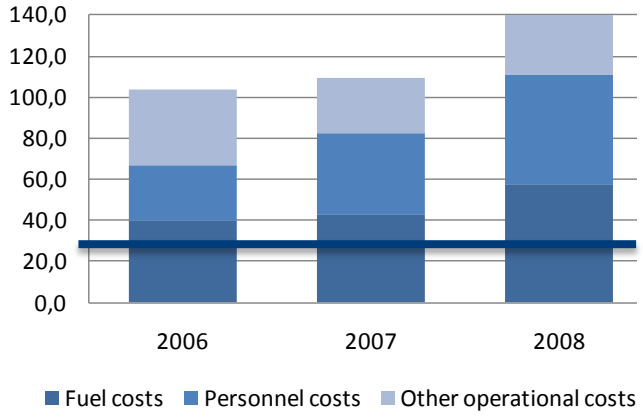


- **OPEX between 5…20 EUR/MWh**
- **Benchmark OPEX ~5 EUR/MWh in Finland**
  - No major differences because of using either coal or bio/peat
  - Peat and biomass as main solid fuels in Lithuania, Estonia and Finland

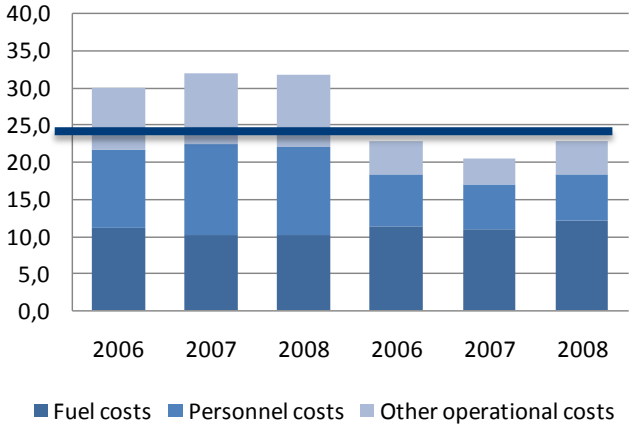
NOTE! Reference company in Hungary is a coal-condensing power and heat company having own coal mining activities

Fuel and OPEX (EUR/MWh) – small solid fuel DH companies

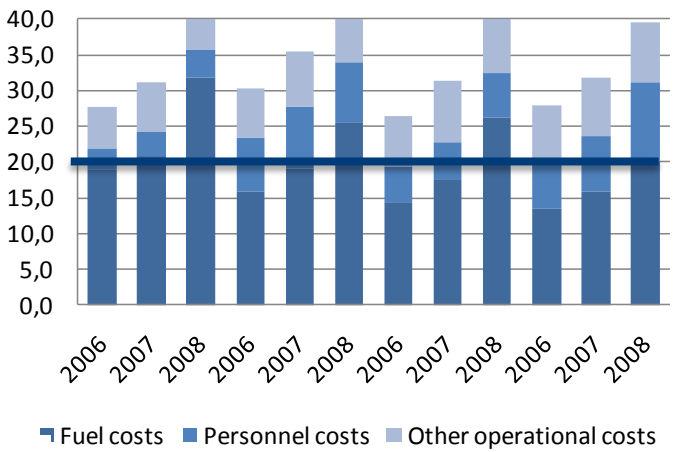
Hungary (company 2) Coal



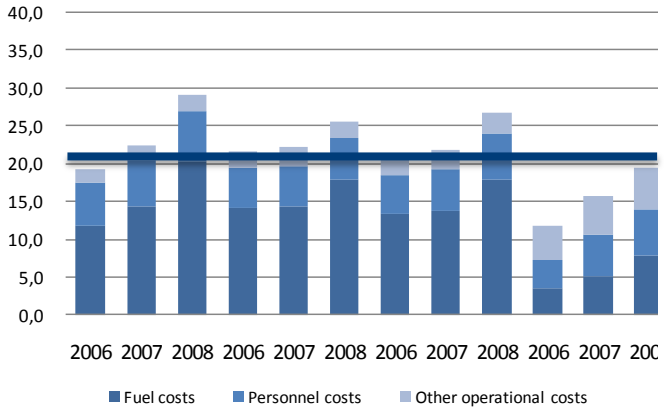
Poland (companies 3 and 6) Coal



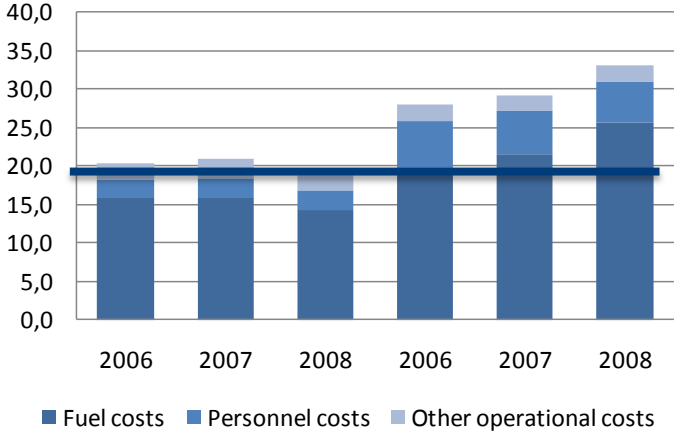
Lithuania (companies 3-6) Bio/peat



Estonia (companies 1, 3, 5 and 6) Bio/peat



Finland (companies 3 and 7) Bio/peat

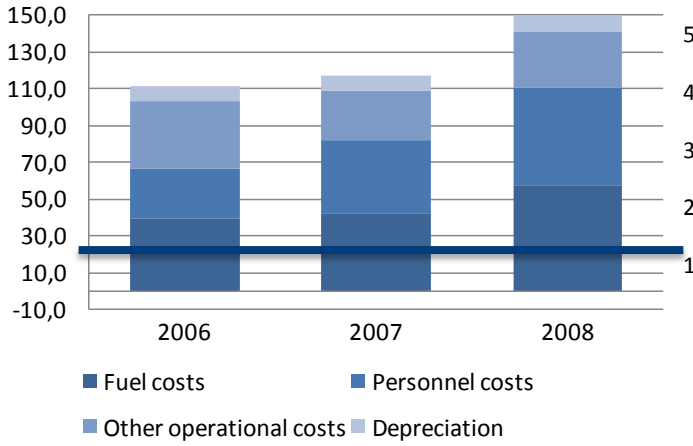


- **Benchmark fuel and OPEX based on coal ~25 EUR/MWh in Poland**
  - Coal as main solid fuel in Hungary and Poland
- **Benchmark fuel and OPEX based on bio/peat fuel mix ~20 EUR/MWh in Estonia and Finland**

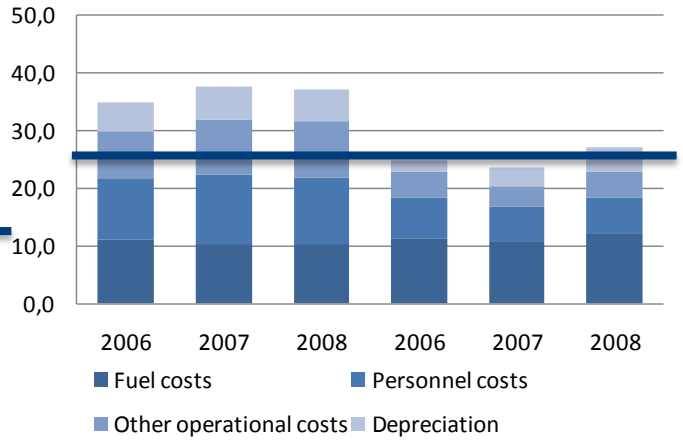
NOTE! Reference company in Hungary is a coal-condensing power and heat company having own coal mining activities

Total Costs (EUR/MWh) – small solid fuel DH companies

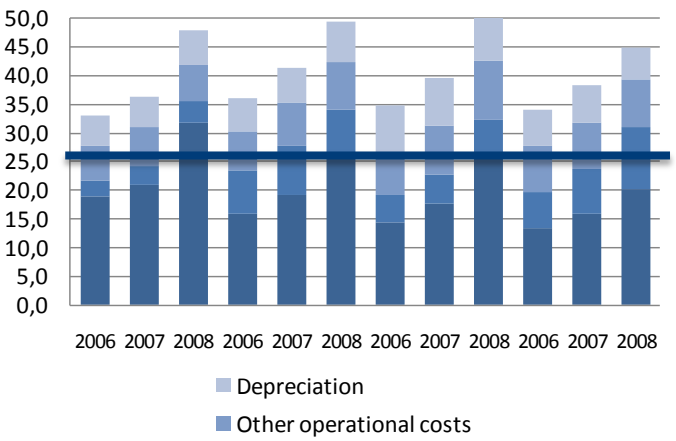
Hungary (company 2) Coal



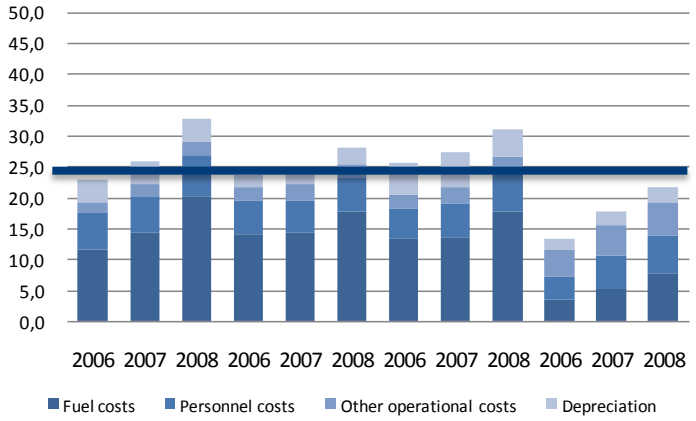
Poland (companies 3 and 6) Coal



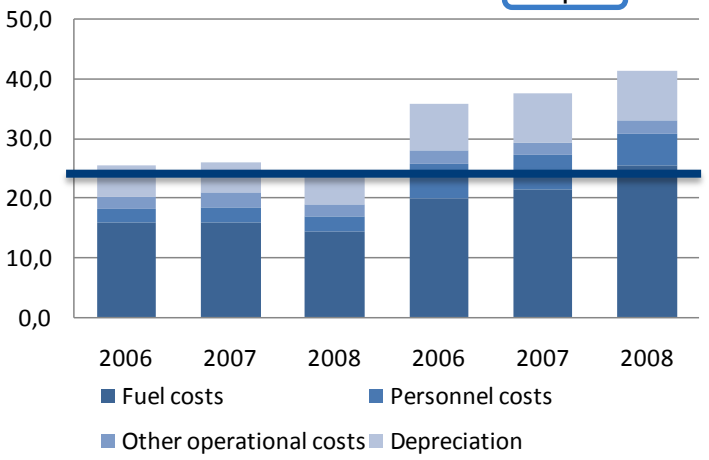
Lithuania (companies 3-6) Bio/peat



Estonia (companies 1, 3, 5 and 6) Bio/peat



Finland (companiies 3 and 7) Bio/peat



- **Benchmark total costs ~25 EUR/MWh**
  - In Poland, Estonia and Finland

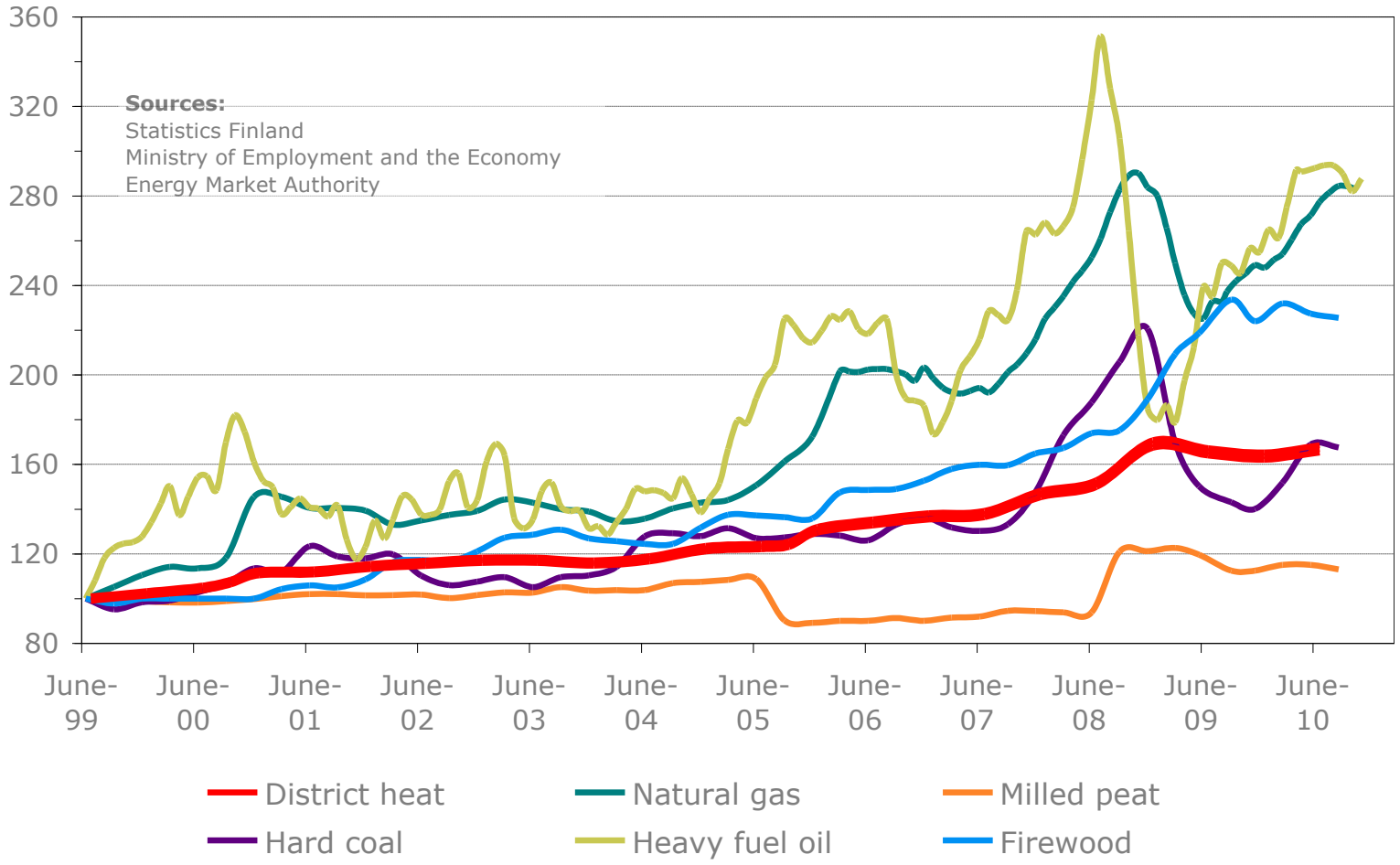
NOTE! Reference company in Hungary is a coal-condensing power and heat company having own coal mining activities

Fuel costs are major drivers of heat prices

- **Fuel strategy (global vs. local fuels)**
  - Price volatile global fuels: gas, coal and oil
  - Price stable local fuels: coal, biomass, peat and waste
- **Fuel costs represent 40 % … 70 % of heat price**
  - Increase of gas price has really hit the heat prices during 2006-08 in Estonia, Poland and Lithuania
- **Generic benefits of local solid fuels (biomass, waste, peat)**
  - Expected more stable price development compared to global fuels (gas, oil)
  - Enables energy efficient small scale CHP
  - Increasing future value as environmental concern gets higher
  - Lower emissions and renewability
  - Help solving waste treatment challenges

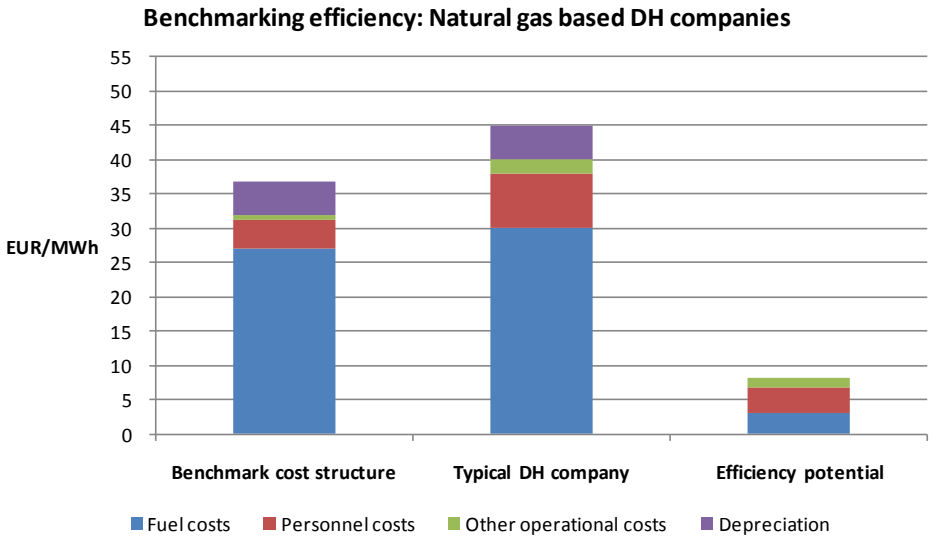
Case study: DH and fuel prices in Finland 1999-2010

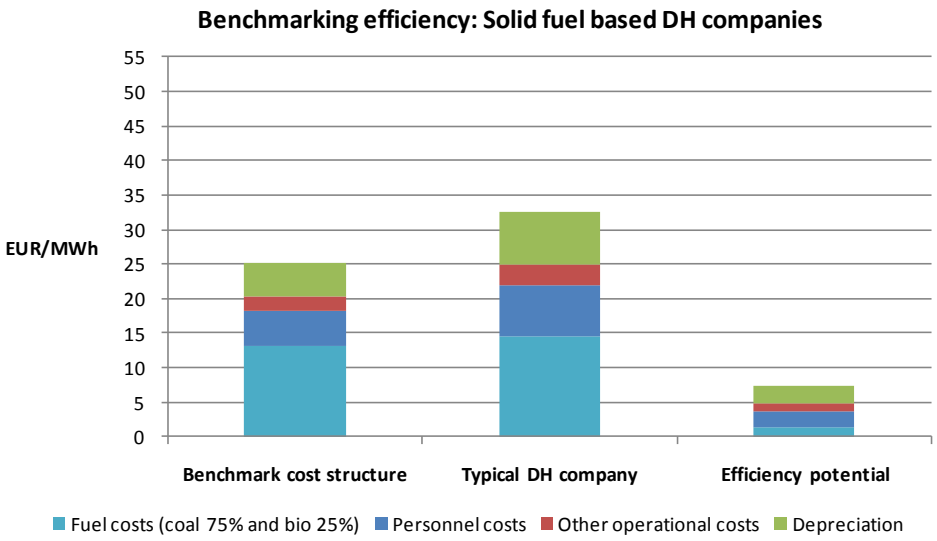
Source: Finnish Energy Industry (ET) June 1999=100



Cost Efficiency: Benefits of CHP and cost savings potential

Tentative cost efficiency potential





Natural gas DH companies

- Substantial variance depending on scale of operations
- Cost efficiency potential 5-8 EUR/MWh

Solid fuel based DH companies

- No major variance found between large and small DH companies
- Cost efficiency potential 4-7 EUR/MWh

NOTE! We have not targeted to analyze the explicit potential for cost savings due to limited number and random selection of companies. The purpose of this analysis is to demonstrate that there is a tentative cost efficiency potential in DH sector based on preliminary international benchmarking result.

Benchmark cost structure is representing the best companies within analysis and typical DH company the average companies within analysis.

Production cost index (PCI) has been excluded from benchmarking result

- **PCI** (EUR/MWh) **is a total production cost** (fuel, OPEX and depreciation) **of heat where electricity is considered as bi-product and thus electricity revenues have been reducing the total costs of CHP production**

- **Value of PCI varies substantially as electricity revenues depend on**
  - Amount of electricity produced
  - Market and hedged prices of electricity
  - Subsidized electricity prices
  - Proportion of potential condensing production
  - Proportion of networks operations (heat) and CHP production (heat and electricity) from total costs
  - Own usage of electricity

- **As a result, PCIs** (total heat production costs of heat) **have varied between 10…40 EUR/MWh**

- **In order to calculate comparable PCIs, electricity prices should become standardized at anticipated market level** (e.g. 45 EUR/MWh)

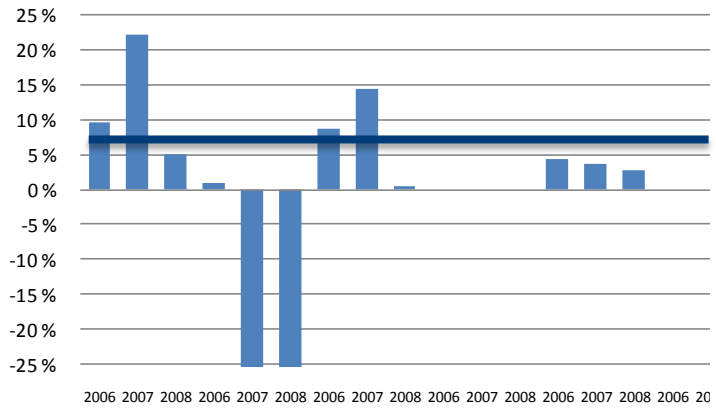
- **For the above said reasons, company specific benchmarking of PCIs is not presented**

E1. Profitability benchmarking in capital intensive DH/CHP

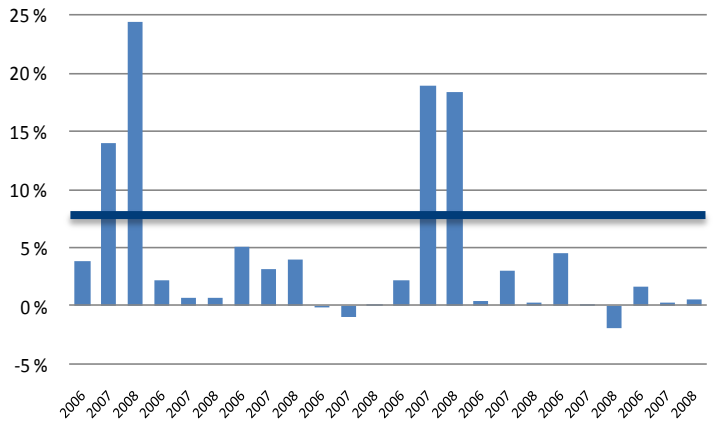
- **Return on capital employed (ROCE) = Operating profit (EBIT) / Total capital (%)**
- **Return on equity (ROE) = Net profit (EBIT after financing expenses) / Equity (%)**
- NOTE! Both ROCE and ROE have been calculated on pre-tax principle
- NOTE! ROCE is rather comparable with pre-tax WACC especially when RAB=Book value of assets

E2. Return on capital employed (ROCE)

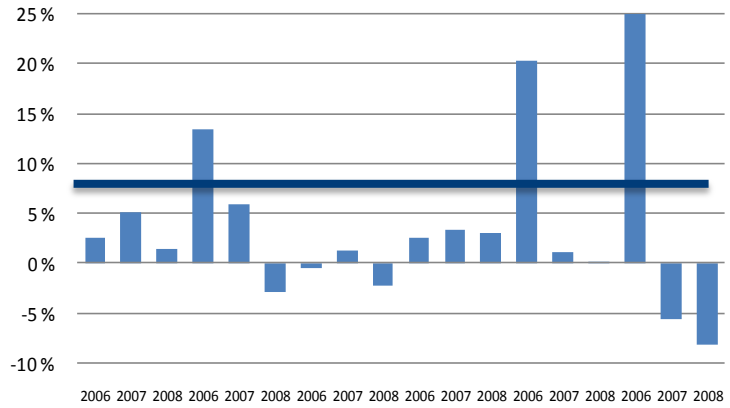
Hungary (6 DH companies): Return on capital employed (ROCE)



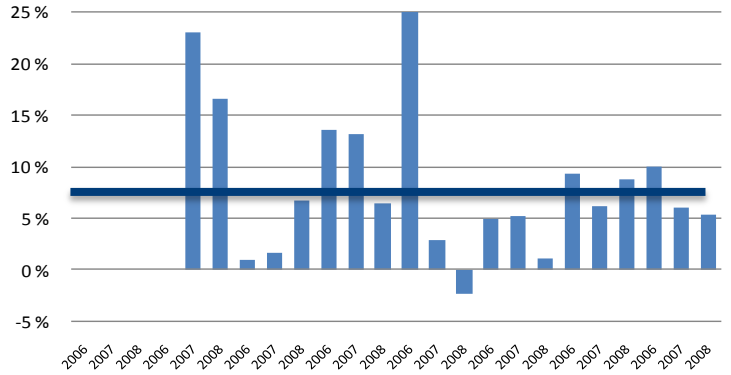
Poland (8DH companies): Return on capital employed (ROCE)



Estonia (6 DH companies): Return on capital employed (ROCE)



Finland (7 DH companies): Return on capital employed (ROCE)

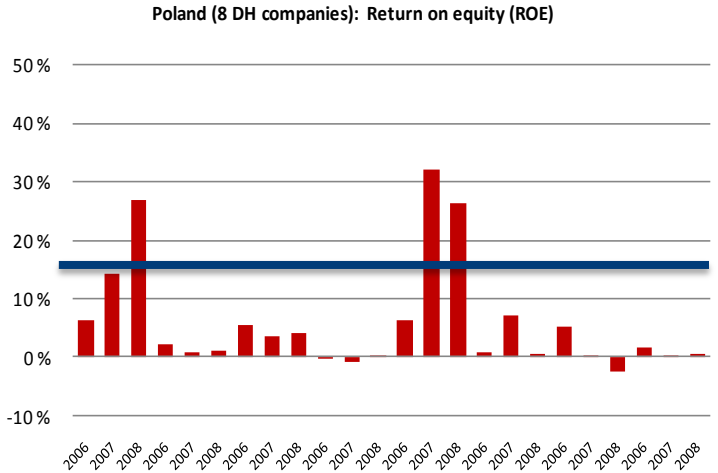


Lithuania
no references included

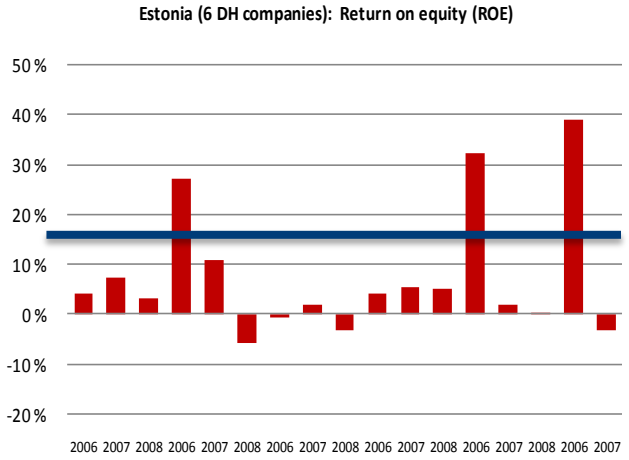
- **Benchmark level 8 % (~average targeted WACC for DH/CHP industry)**
- **Generally positive ROCE in Poland, Estonia and Finland**

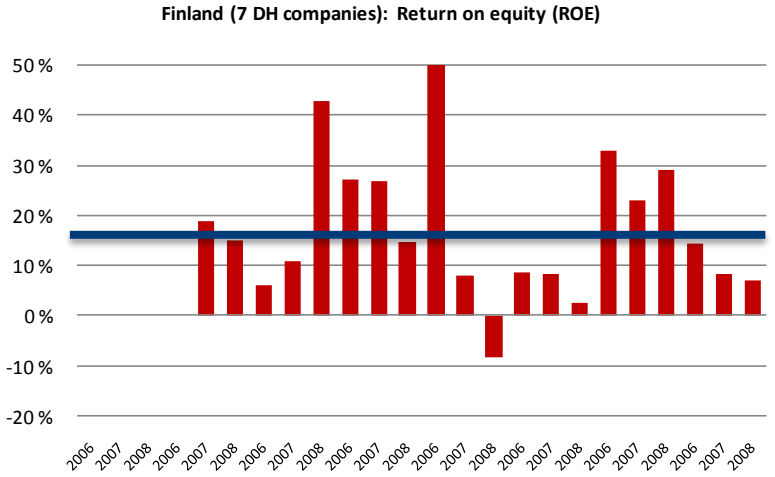
E3. Return on equity (ROE)

Hungary
no references included



Lithuania
no references included





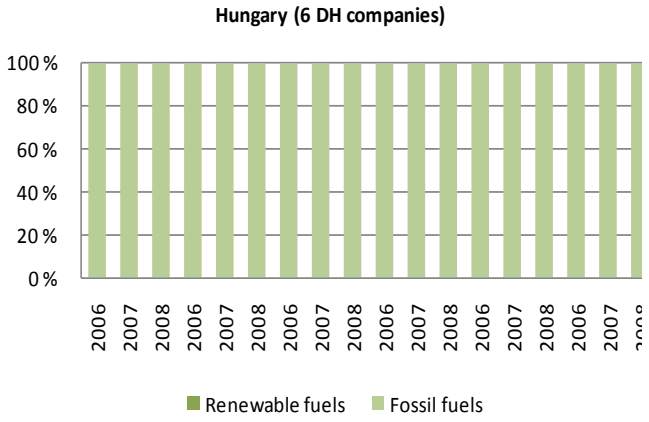
- **Benchmarking level 15 %**
- **Generally positive ROE in Poland, Estonia and Finland**
- **High variance between individual DH companies**

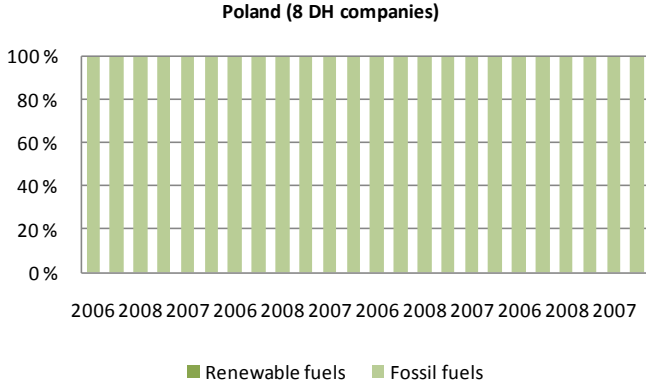
F1. Sustainability

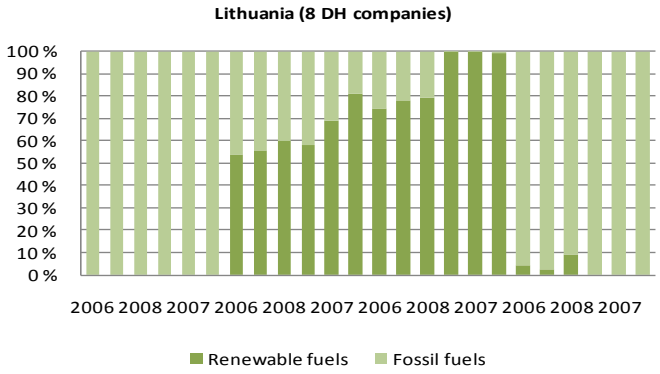
- **Sustainability of a DH system depends on**
  - **Fuel mix**
    - Fossil fuels: coal, natural gas, oil, peat
    - Renewable fuels: biomass, waste, other
  - **Energy efficiency of buildings, networks and production**
    - Specific heat consumption of buildings
    - Network heat and water losses- network efficiency
    - Production efficiency and availability
    - Utilization rate of production capacities

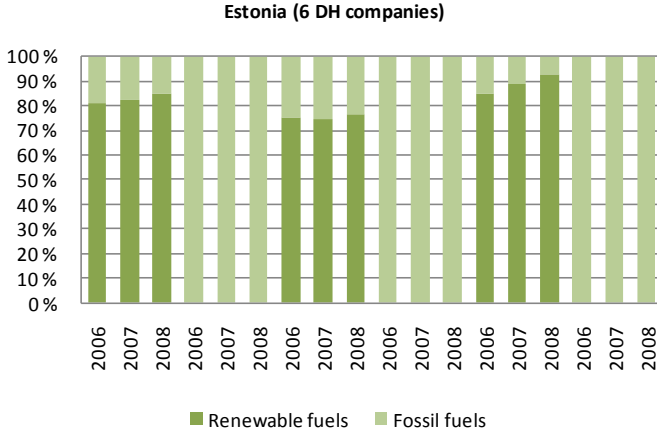
- **Key performance indicators**
  - Share of RES in production (%)
  - Amount of CO_2 emissions (g/kWh)

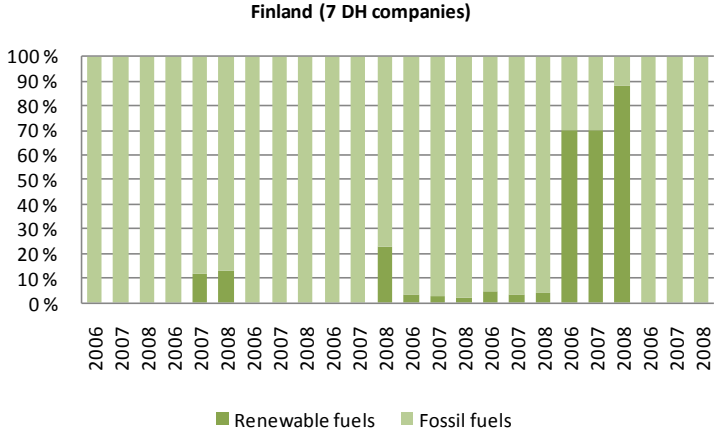
F2. Share of renewable fuels in production (%)







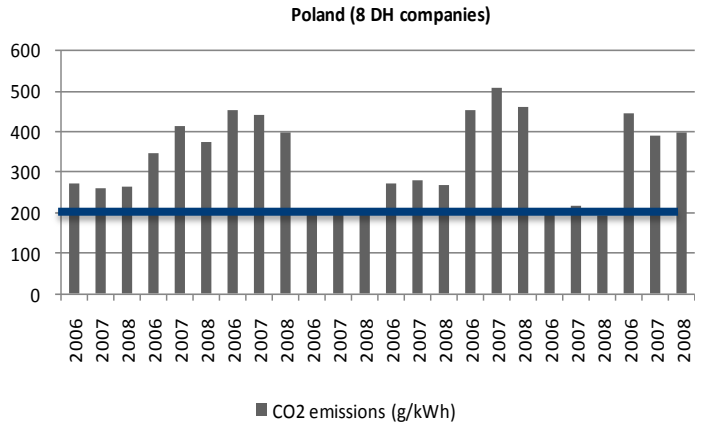


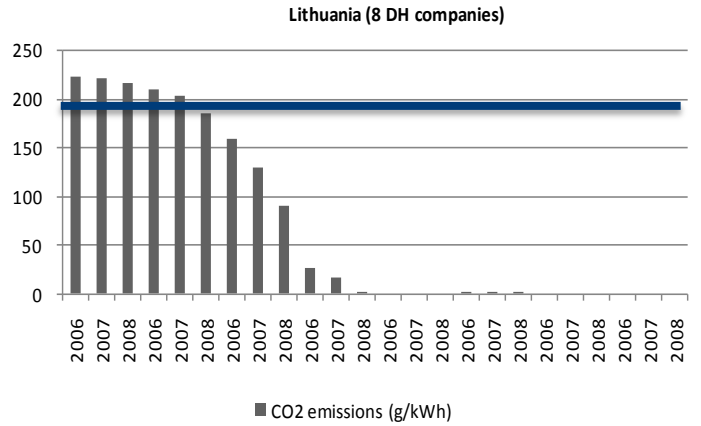


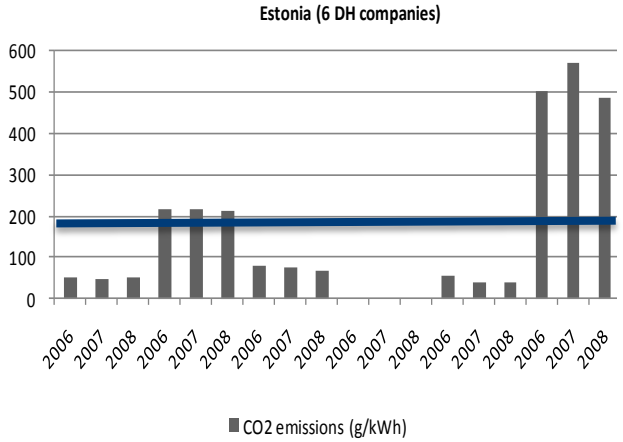
- **In Hungary and Poland, only fossil fuels have been used in selected DH companies**
- **In Lithuania, Estonia and Finland, some DH companies has substantial share of RES in their heat production fuel mixes**

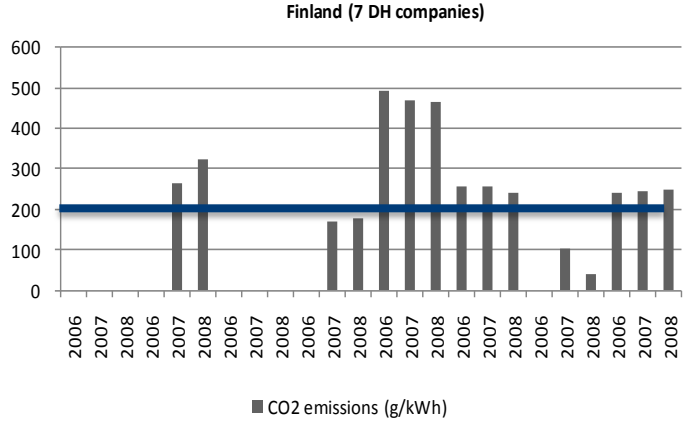
F3. CO_2 emissions per produced energy (g/kWh)

Hungary
no references included









- **Benchmarking level 200 g/kWh**
- **In Lithuania high degree of usage of natural gas and bio fuels**

- **Summary of conclusions and proposed next steps**
- **Project introduction**
- **DH markets and price setting frameworks**
- **Benchmarking results**
- **Appendix**

List of sources

- **Data and commentary from national regulators**
  - Hungarian Energy Office (“HEO”),
  - Energy Regulatory Office in Poland (“ERO”)
  - National Control Commission for Prices and Energy in Lithuania (“NCCPE”)
  - Estonian Competition Authority (“ECA”)
- **National legislation and regulatory instructions in Hungary, Poland, Lithuania and Estonia.**
- **National DH associations**
- **Annual reports of DH companies**
- **Euroheat & Power**: Contribution to the Commission consultation on the future "EU 2020 strategy".
- **Euroheat&Power**: Yearbook 2009.
- **Oxera Consulting Ltd**: Assessment of heat markets in 9 countries. Consultation work for Fortum. February 2011. Not publicly available.