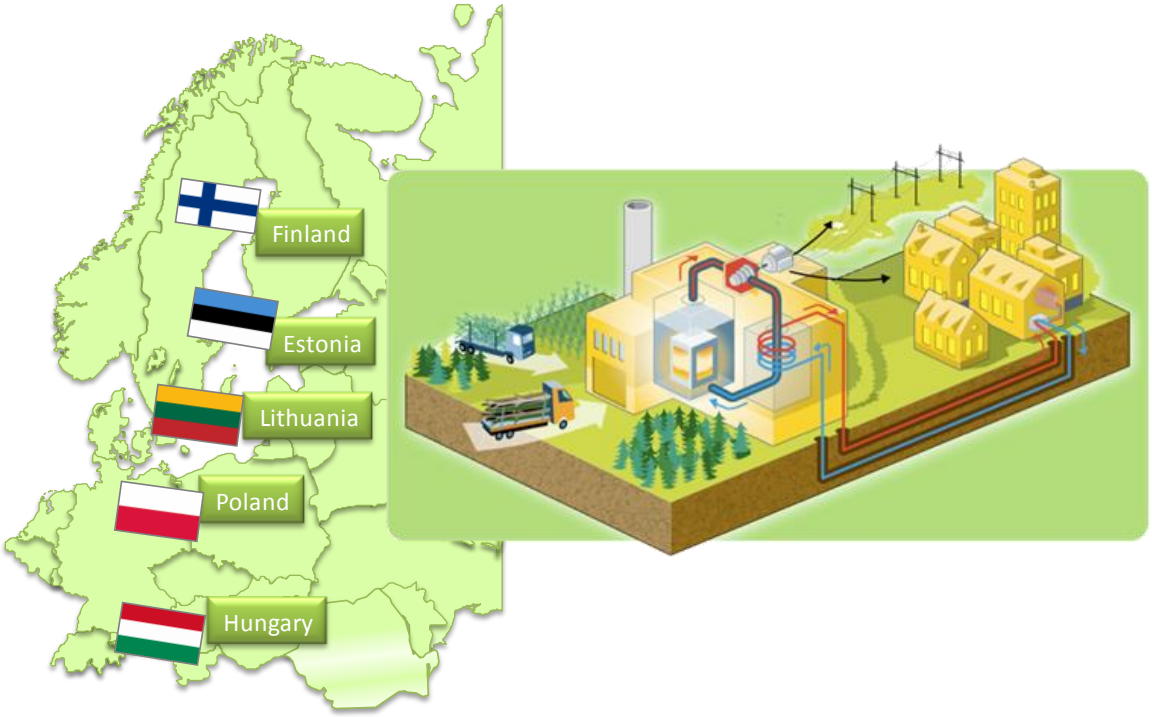


BENCHMARKING DISTRICT HEATING IN HUNGARY, POLAND, LITHUANIA, ESTONIA AND FINLAND

EXECUTIVE SUMMARY REPORT

PILOT CO-PROJECT OF ERRA AND FORTUM

April 2011

This Executive Summary Report is prepared in co-operation between ERRA, its member regulators in 4 countries and Fortum. External sentiment is prepared by professor Sven Werner, Halmstad University. Fortum is responsible for producing content of this report based on information collected and reviewed by ERRA and its member regulators.

Potential inquiries should be addressed to:

Energy Regulators Regional Association (ERRA)	Andrea Farkas	andrea.farkas@erranet.org
Fortum Power and Heat Oy (Fortum)	Harri-Pekka Korhonen	harri.korhonen@fortum.com
	Monika Kuusela	monika.kuusela@fortum.com

List of contents

1. EXECUTIVE FINDINGS AND CONCLUSIONS

Benchmarking is a tool to implement necessary incentives in regulated industries as it will enable to assess the level of performance and as accurate measures will be created and agreed. Benchmarking should not be seen as one-off exercise but as a valuable consistent and long-term tool to develop the efficiency of an industry. Benchmarking can be implemented as a part of either ex-ante or ex-post regulatory review. One further objective of benchmarking should be to create an asymmetric risk for the regulated industry i.e. that best performing companies will be rewarded for high efficiency and that worst performing companies cannot be guaranteed to recoup the full cost of equity as long as their performance is not on an acceptable level.

In district heating, there are some systematic efforts to establish regulatory benchmarking, for example by National Control Commission for Prices and Energy in Lithuania. The objective of this survey has not been to evaluate the current frameworks thus we have not included any in-depth analysis of Lithuanian benchmarking in this report. One limitation of benchmarking 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 and it may be difficult to find similar companies in one country. Thus the regulators should look for cross-border co-operation with other countries having comparable DH companies for benchmarking purpose.

This survey has also been a pilot nature co-effort between ERRA and Fortum and will establish an important step for future dialogue between regulators and heating industry to balance their objectives and to look for regulatory best-practices for district heating (market regimes, pricing, benchmarking). With this background, we want to emphasize the following key findings and further conclusions.

General

- Potential benchmarking areas in district heating
    - Energy policy and regulatory frameworks: market regimes, evaluation of outcomes
    - Heating costs: prices, specific heat consumption, average household income
    - Cost efficiency of heating industry: production with different fuels, CHP vs. HOB and heat networks
    - Competitiveness of district heating with alternative space heating solutions
    - Schemes to promote district heating and CHP (market regimes, subsidies)
- When running benchmarking, more 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 impact of 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 seems to be a high degree of diversification of regulatory methodologies between countries within district heating. For example, the amount of regulatory authorities and role of municipalities is varying. Furthermore, justification of costs and assets has significant differences although established under basic framework called cost-plus.

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 started to consider alternative based approach due to increasing competitive pressure coming from other space heating solutions. Cost-plus regimes do not automatically lead to higher cost efficiency. Instead, they may lead to lack of cost disciplines.

- 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.

2. EXTERNAL SENTIMENT *(prepared by Professor Sven Werner, Halmstad University)*

These comments are written after taking part of the February 4 PowerPoint version of the final report and a discussion with representatives from Fortum on February 10.

Initially, I would like to express my appreciation of the work performed, since it will shed more light upon the current situation for district heating in Europe. Hereby, the study is very good compliment to the current legal framework studies performed within the IEA implementing agreement about district heating and cooling (http://www.iea-dhc.org/010805.html) concerning countries outside Europe and within the Intelligent Energy Europe program (http://www.ecoheat4.eu/en/) considering 14 European countries. These three studies will bring substantial horizontal knowledge about the legal frameworks in the world.

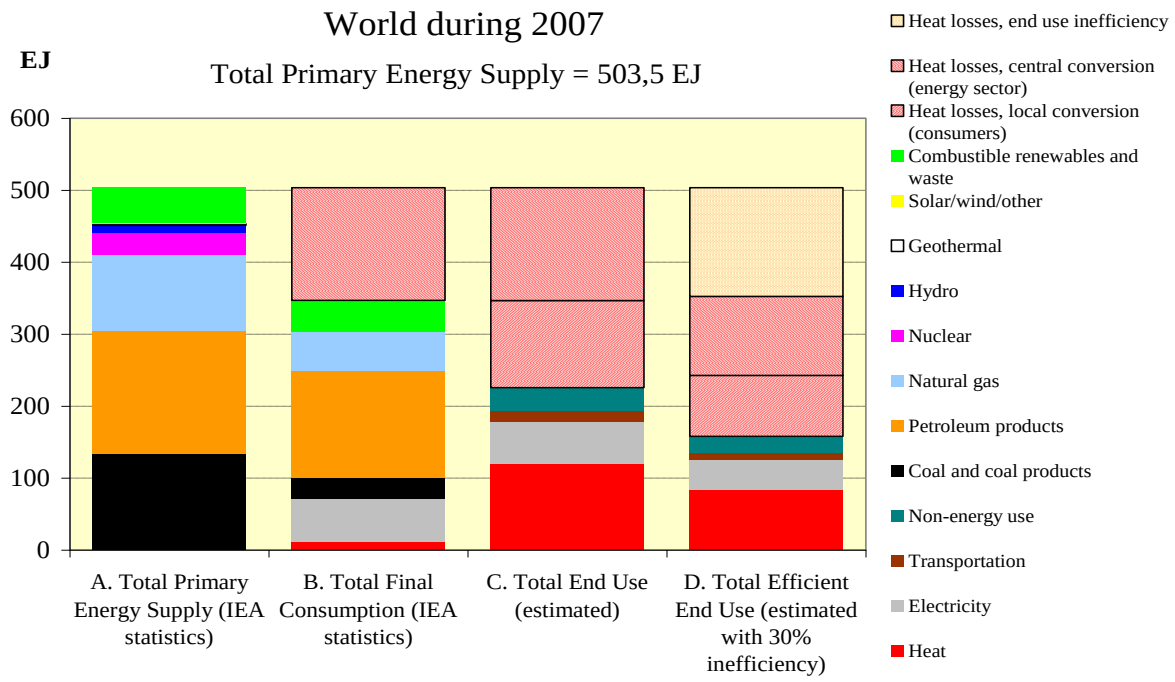
I shall give my comments according to four headlines:

- Introduction
- Price setting frameworks
- Benchmarking results
- Recommendation

Under the introductory headline, I define the total community value of district heating to be distributed by the different partners. The next two headlines follow the two main parts of the report. Finally, the recommendation headline summarizes my major conclusions concerning the report topics.

The fundamental idea of district heating is to recycle heat losses from the energy system in order to mainly substitute primary energy supply for heating buildings and heating low temperature industrial processes. Heat recycling is an urban synergy, since low cost heat distribution can be accomplished in heat dense urban areas.

The energy system losses are huge in the world as communicated in figure 1. During 2007, the world energy system losses were 160 EJ from central energy conversion (in the energy sector) and 120 EJ from local energy conversion (at the consumers). The amount of heat recycled into district heating systems was below 10 EJ. Hence, the available energy system heat losses are no restriction for expanding district heating in the world.



Picture 1. The World energy balance in four steps during 2007. Data source: own estimations from IEA energy balances, 2009 edition.

The economic value of the energy system heat losses during 2007 were 2900 billion US$, when valued with the 2007 average crude oil price. This amount corresponds to about 5% of world GDP. Hence, this amount represents the major financing resource for maintaining and expanding district heating in the world.

District heating systems create hereby large community values by increased energy efficiency giving lower primary energy supply. These community values should be expressed in each country in order to fully understand the full benefits of district heating. The higher community values, the more district heating infrastructure investments can be made and the more competitive district heat prices can be offered to heat consumers.

i) Price setting frameworks

The national price setting frameworks aims at securing the consumer part of the local community value obtained from the district heating benefits. I have the following three major comments to this part of the report:

- **Allocation of the combined heat and power (CHP) benefits:** The CHP benefit is the main driver for district heating in the five countries studied. How this benefit is allocated is the most influential parameter on the local heat prices. If a major part of the benefit is allocated to the electricity part, the potential for low consumer prices becomes very low. I lack a real horizontal

analysis in the report about this influence on the corresponding price levels.

- **Regulated district heat prices when fuel prices are market priced:** This situation gives a very secure market situation for the district heat consumers. The total market risk is taken by the district heat providers. By this risk allocation, it becomes very hard for the future to attract private capital to exploit and develop the district heating benefits.

- **Energy and social policy interaction:** Price regulation is sometimes used as a general social policy measure in order to avoid fuel (or heat) poverty. But then the district heat price is also reduced for considerable population groups having higher ability to pay for district heat. In order to exploit the full potential of the district heating benefits, a general recommendation would be to separate social policy and energy policy by introduction of more target directed social benefit systems. This recommendation also concerns also United Kingdom (outside the survey), applying lower VAT for energy commodities in order to avoid fuel poverty, especially among elderly having low pension payments.

ii) Benchmarking results

The benchmarking result part of the report analyses the rewarding conditions for the companies operating district heating systems. I have the following three major comments to this part of the report:

- **Price distribution:** It is obvious from the price comparisons that large price distributions appear within in each country. This is a fact also known from Denmark, Germany and Sweden. I see these price distributions as different district heating systems fulfill the district heating benefits with a large variation. When the benefits are fully fulfilled, the prices are generally lower.

- **Company incentives:** The report shows also a significant variability with respect to company margins. Whether this variability comes from various degrees of company efficiency or inadequate price regulation is unclear for me. The ideal situation should be that companies introducing improvements towards higher utilization of the district heating benefits should be rewarded. The reference should then be the full exploitation of the district heating benefits, not the current situation.

- **World Class System:** For benchmarking, a world class district heating system should be defined based on parameters as the use of heat meters, demand side control, linear heat density, heat recycling methods etc. Any direction towards this world class system should be rewarded, since in the end only higher community energy efficiency will create future competitiveness for district heating.

iii) Recommendations

From the comments above, I see the possibility to develop an international benchmarking system based on how a district heating system fulfill and reach the community values of district heating systems. As concluded above, avoiding energy system heat losses are the obvious financial resource for district heating systems in the world. The higher market fossil fuel prices, the higher will the incentives be for more efficient district heating.

The companies operating district heating systems should be rewarded according to the degree they create community values from district heating systems. This will also create competitive heat prices for the consumers.

I foresee that the future national price regulation frameworks must first define the local community value from district heating before setting the allocation between the district heat consumers and the district heat providers.

3. PROJECT INTRODUCTION

Energy Regulators Regional Association ("**ERRA**") is a roof organization for national regulatory authorities. 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 operations of ERRA.

Fortum Power and Heat Oy ("**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 business divisions: Power, Heat, Electricity Solutions and Distribution (ESD), and Russia. Fortum is one of leading DH and CHP operators in Europe having these operations in eight (8) countries: Sweden, Finland, Norway, Estonia, Latvia, Lithuania, Poland and Russia. District heating and CHP belong to Fortum's core businesses. Fortum is a corporate member in Euroheat & Power and COGEN Europe.

"The European Commission's working paper recognizes that energy efficiency will be one the way to improve Europe's competitiveness and set economies on a virtuous part of growth and sustainability. The current European energy system is indeed very inefficient. The European balance clearly shows that more than half of the energy contained in primary fuels is lost in conversion and transformation processes on the way from source to en and in end-use - vented as waste heat. On the other hand, almost 40 % of the final energy demand in the EU is related to heating purposes: space heating, warm water preparation and low temperature industrial processes. Today, this demand is mainly covered with imported fuels (gas and oil) or low-efficiency electricity. These energy losses have a significant value. With the available amounts of heat losses, Europe has no shortage of heat. The problem of the heat market is neither a problem of energy availability nor carbon content, but organization and investments." Source: Euroheat &Power: Contribution to the Commission consultation on the future 'EUR 2020 strategy'.

ERRA and Fortum initiated discussions and joint ambitions during March 2009 to understand better the position and future barriers to promote district heating and CHP. As an outcome of these discussions they agreed to run a piloting survey for benchmarking district heating and CHP. The desire was 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 in order to jointly implement a pilot benchmarking survey for district heating and combined heat and power production ("CHP"). The scope of pilot survey was agreed to cover the following countries: Hungary, Poland, Lithuania, Estonia and Finland. The collection of company specific data was agreed to be carried out by national regulatory authorities on confidential (no-name) basis. Data in Finland was carried out by Fortum based on externally available sources e.g. annual reports.

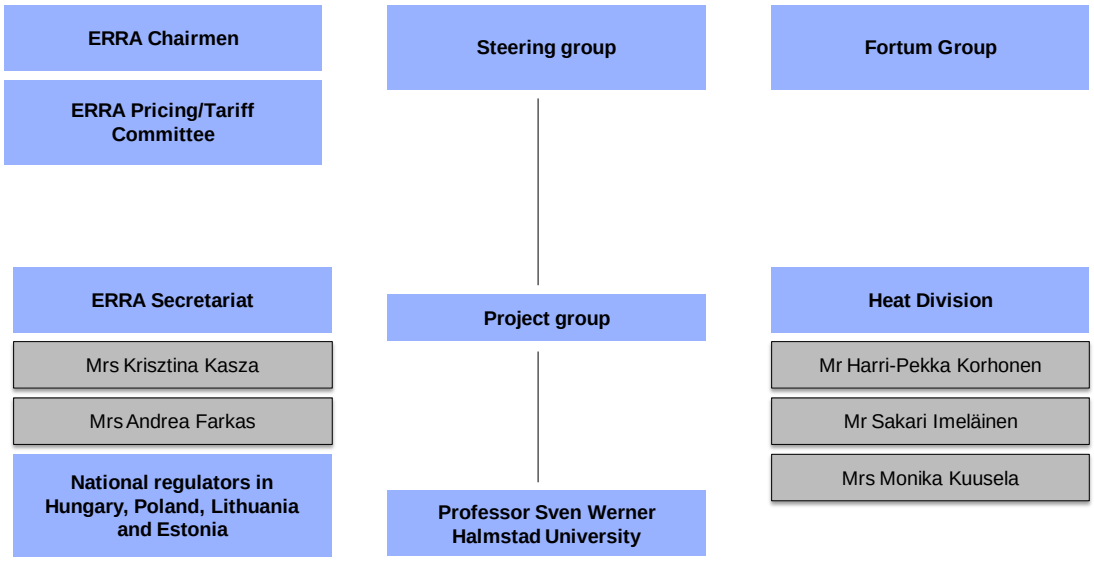
National regulators who supported the project initiative and decided to join the pilot project were:

Hungarian Energy Office ("**HEO**"), Energy Regulatory Office in Poland ("**ERO**"), National Control Commission for Prices and Energy in Lithuania ("**NCCPE**") and Estonian Competition Authority ("**ECA**") whose are the regulatory authorities for district heating and CHP in each country.

Key survey objectives are as follows:

- Benchmark national district heating market characteristics and regulatory regimes;
- Benchmark heat prices, cost efficiency, profitability and sustainability (methodology pilot including limited number of companies);
- Create the multi-national in-depth understanding of the business environment for district heating and CHP and
- Establish an organized and constructive dialogue between ERRA, its member regulators and Fortum who have major interests in defining future best-practice regimes for district heating.

Project organization was as follows:



Picture 2. Project organization

The project has been reported in several steps from January 2010 till April 2011. The findings and conclusions have been presented to ERRA as follows:

- Draft report to ERRA chairmen October 2010
- Draft report to ERRA tariff/pricing committee October 2010
- Final report to ERRA licensing/tariff committee May 2011

4. Benchmarking methodology

National district heating characteristics and regulatory frameworks have been analyzed by preparing a common set of questions to national regulators who have collected the requested information. We have summarized the information into this report.

A sample of minimum eight (8) companies has been targeted in each country. 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 the relevant report results. Data in Finland is collected from public sources (annual reports and energy statistics).

Key performance indicators (KPIs) were selected as metrics to benchmark selected areas: prices, efficiency, profitability and sustainability. The total number of KPIs has been thirteen (13).

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

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

The scope of sample amounted up to 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 individual companies should be performed.

It has been agreed from the beginning 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.

Benchmarking period was selected 2006-08. It is important to note that high increase of natural gas and oil prices has a major gradual impact on heat prices during this period. Also during this period there has arise substantial limitations of regulatory information in Hungary as until 2009 the municipalities were the main responsible authorities for district heating. The following 4 company categories were agreed:

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.

Whereas analyzing the presented results the following limitations need be notified:

- The sample consists of 35 DH companies which have been selected randomly. Thus the results do not represent the whole industry and the best performing companies, and should be looked upon as indicative in each country.
- Average annual temperature and heating conditions vary to some extent between and within each country. However, the results of survey have not been adjusted according to varying climate conditions (heating degree days) in each country.
- We have defined detailed formula for data collection to calculate KPIs in a similar way. How-

ever lack of sufficient data has created limitations in the comparability of available data.

- Cost efficiency of CHP based heat production is calculated by allocating total costs on both heat and electricity volumes which should be reflected as higher efficiency of CHP compared to heat-only (HOB) solutions.

Project results have been reported in two documents:

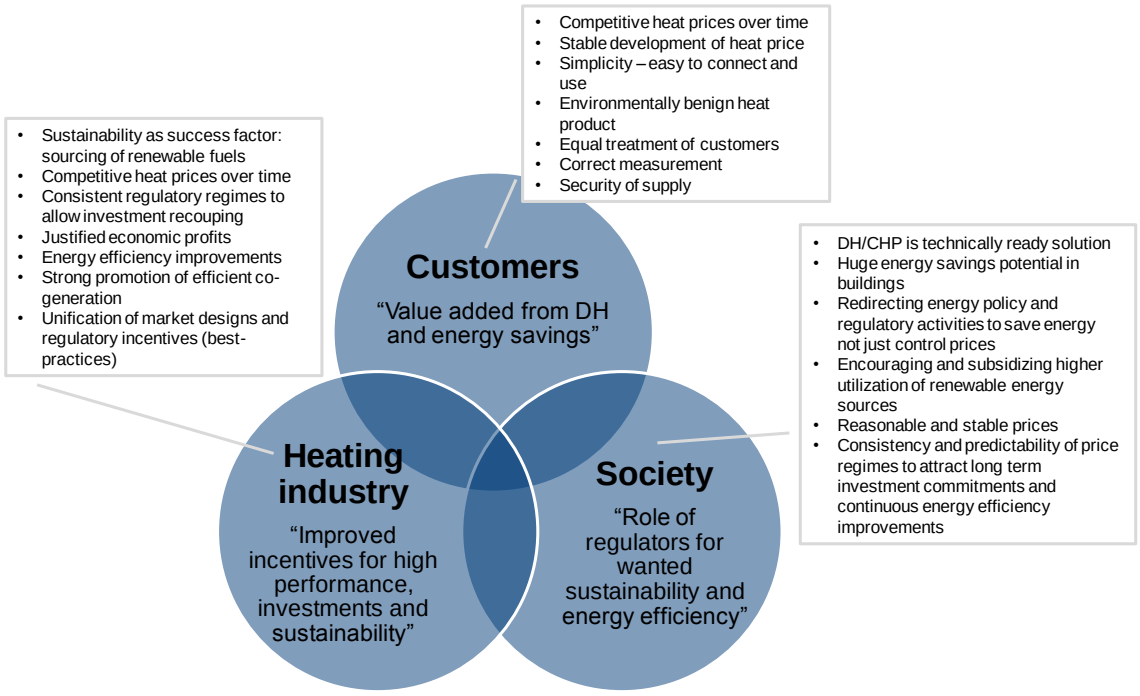
- **Executive summary report** (this document)
- **Presentation of benchmarking results** (does not include external sentiment from professor Sven Werner)

5. DISTRICT HEATING MARKETS AND PRICE SETTING FRAMEWORKS

i. Energy policy - a key driver for heat markets and pricing

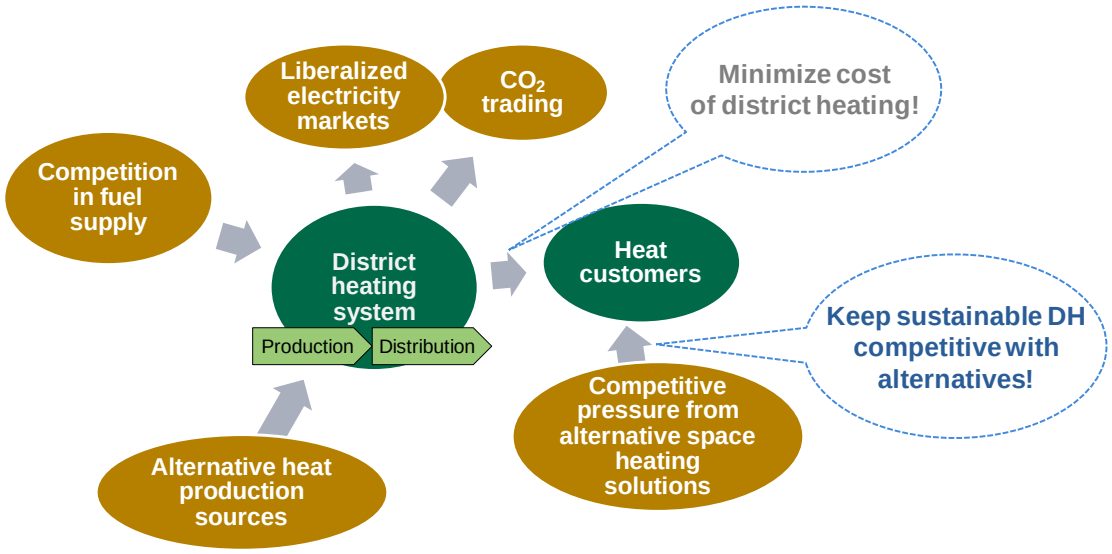
Linkages between national energy policies and actions to promote district heating and CHP should be improved. The regulatory approaches focusing mainly on protecting customers for too high one-off heat price increases and to minimize the cost of district heating seem on the one hand to be rather heavy but on the other hand not sufficient to enable an effective implementation of EU's energy policy targets i.e. improving energy efficiency and increasing utilization of RES and CHP in district heating. One simple reason, in our analysis, has been that lack of sufficient regulatory incentives and consistency does not create a favorable and confident climate for taking necessary investments whose expected economical and technical life-time should be 20-40 years. We would like to propose a new with EU energy policy aligned regulatory approach: "Promote sustainable and energy efficient district heating based on CHP which should remain always competitive with alternative space heating and electricity production solutions".

A key enabler of reaching politically acceptable but also implementable regulatory solutions is to balance well the interests between stakeholders: the customers, the society and the heating industry. The variety of expectations in this 3-party balance is described in a holistic example in the picture 3 below.



Picture 3. Example of different stakeholder expectations for district heating and CHP

The following somewhat simplified heat market outlook in picture 4 can be drawn to comprehend the view on what is the business environment for district heating:

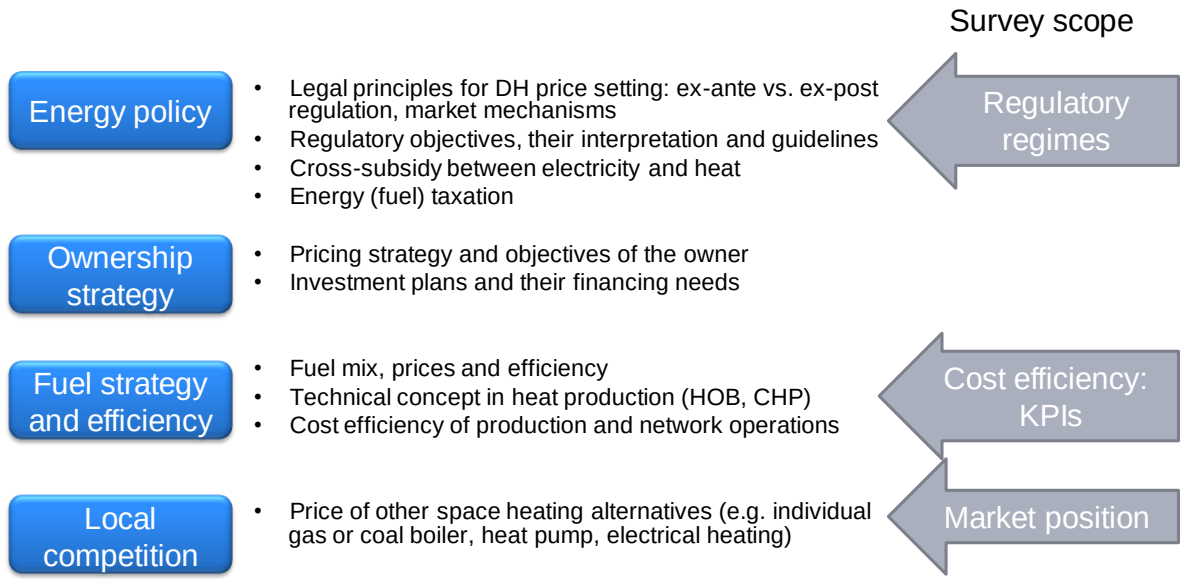


Picture 4. District heating system is under competitive pressure in several frontiers

In our conclusion, the stakeholders of a DH system should have clear and consistent incentives to always seek for low-cost and sustainable solutions for heat and electricity production, and keep DH competitive towards alternative space heating solutions. The main regulatory approaches fall under two basic alternatives: cost-plus regulation supported by benchmarking or alternative based heat pricing.

We have not included any more specific definitions or comparisons of these two basic models in this survey. Cost-plus regulation is much more common solutions (e.g. methodology in Hungary, Poland, Lithuania, and Estonia and in several other countries). Alternative based heat pricing is set as the leading methodology in Norway and Netherlands. It is also being applied increasingly in Sweden and Finland but driven by the increasing competitive pressure from alternative solutions.

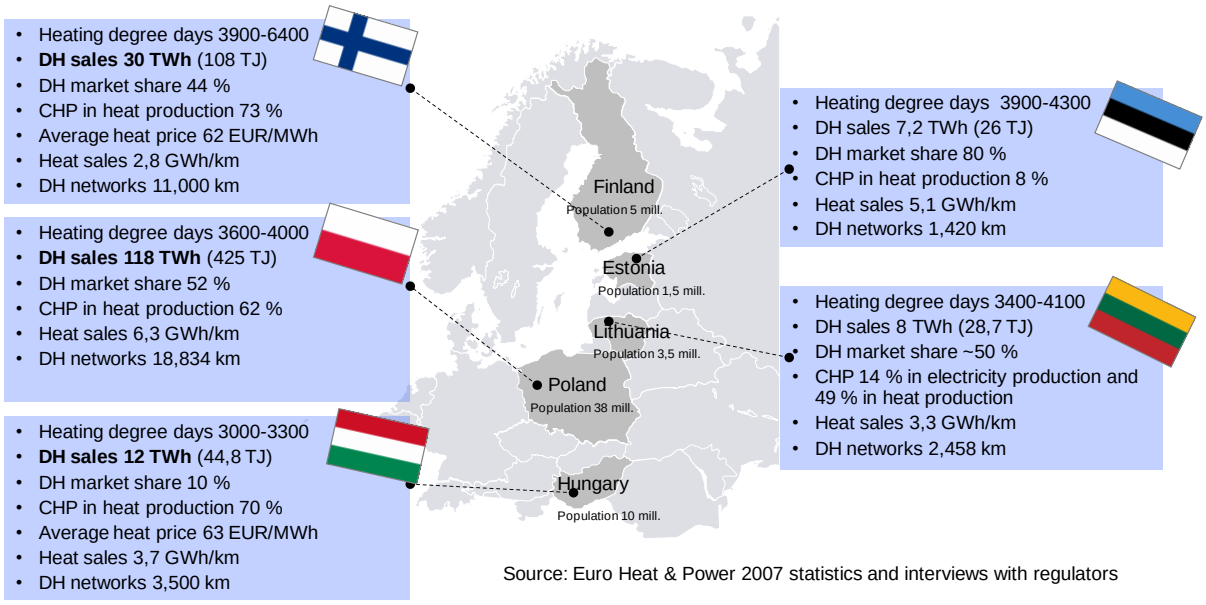
To understand and compare the development of district heating prices we have used the following analysis (picture 5) as framework in our survey. We would like to emphasize that the potential impacts arising from ownership strategy may have an important influence on heat prices locally but have not been included in our analysis. For example, some municipalities have a local political objective to minimize the heat prices artificially low and thus do not expect any owner returns for holding DH assets. One main implication of such ownership strategy may be the lack of financial resources for necessary investments and new connections within a DH company.



Picture 5. Framework of drivers for DH prices

ii. District heating markets

District heating market characteristics vary rather substantially in Hungary, Poland, Lithuania, Estonia and Finland. Share of district heating varies in respect to total space heating markets. There is some lack of comparability in the below indicative figures. For example, in Hungary DH market share varies a lot between residential and industrial customer segments. In some cases, DH market share is calculated to apply only to those urban areas where DH can be feasible and in other countries for the whole heating market. The main information is presented in picture 6.



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

Picture 6. District heating market characteristics in 5 countries

The main structural differences:

- Market share of district heating 10 % … 80 % of total space heating markets
- Heating degree days (average outdoor temperature) between 3,000 … 6,000 days
- Share of CHP based heat production between 10 % … 70 %
- Usage of fossil and non-fossil fuels - share of RES between 5 %... 30 %
- Heat prices between countries and especially between companies - 30 … 80 EUR/MWh excl. VAT
- Regulatory regimes vary from non full-cost recovering to alternative based prices
- Authorized responsibility for price setting - regulatory office or DH company
- History as non-profit operations in Eastern Europe compared to Finland

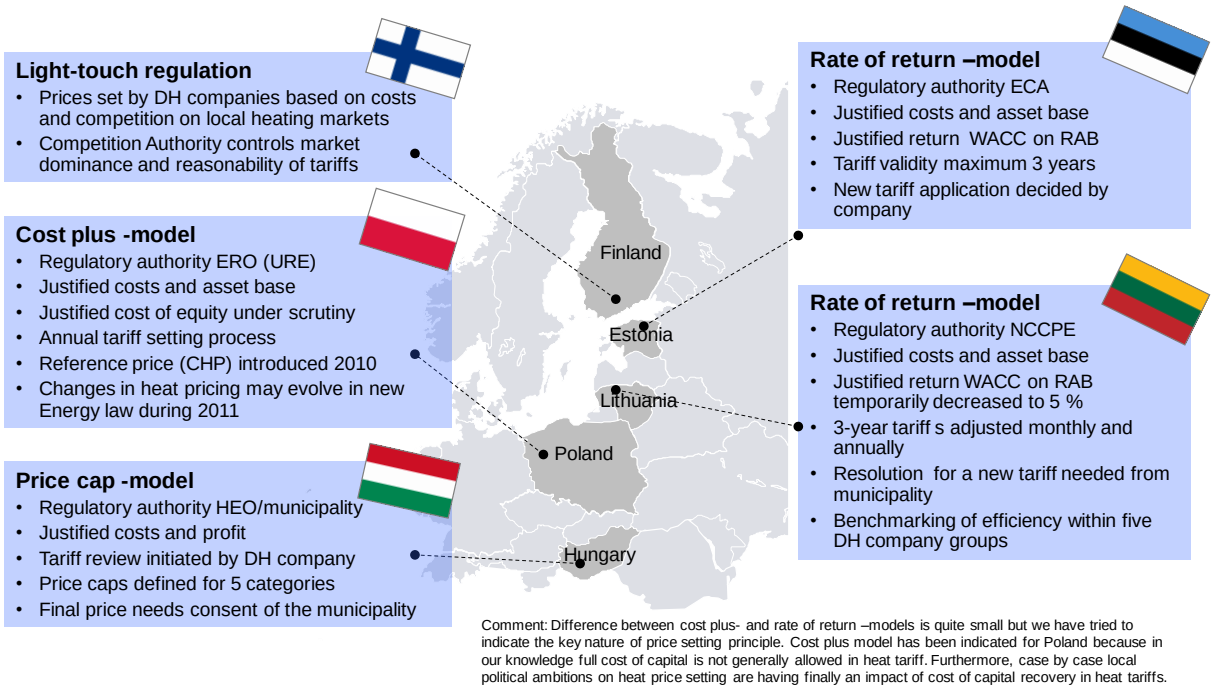
The main structural similarities are:

- Mixed private and public ownership with different ownership strategies
- Both vertically integrated and separated structures between production and distribution

Share of average heating cost per GDP per capita has not been studied. Based on Fortum's own analysis average heating cost / GDP per capita varies between 3 %...10 % for residential customer group.

Main regulatory and price setting regimes for district heating are presented in picture 7. As the regulatory regimes are under constant change e.g. in Poland and Hungary at the moment, we have not

targeted to present a detailed analysis. The main development areas we have identified are: more efficient tariff application and approval processes; increased instructions, transparency and consistency; cost justification being clarified and economical justifications for cost of equity.



Picture 7. District heating regulatory regimes

On the other hand, the following expectations for improvement could be also identified: amendment of regulatory objectives and tool to emphasize and encourage energy efficiency, wanted RES and CHP investments and competitiveness of district heating. Also, there seems to be lack of well-structured and consistent incentive schemes to motivate DH operators for higher performance and new investments. Such comprehensive schemes, where available subsidies for RES heat and electricity, and the regulatory incentives are balanced and coordinated would best enable society to reach the EU driven energy goals related to district heating.

District heating is often 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). When a new customer gets connected, one could deem that district heating is having a strong market position as it is usually unfeasible to change heating solution during economical life time of DH connection in 10…20 years. To choose another heating solution becomes feasible when major refurbishments are needed. New technical solutions may in future increase the amount of economically justified alternatives e.g. solar heating. In picture 8 we have compared the market position 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)

Picture 8. Market position of district heating

District heating seem to be competitive against alternative space heating solutions in Poland, Estonia and Finland. There are obvious competitive challenges in Hungary and Lithuania which we have not analyzed in more detail. This comparison should be treated as an indicative description of market positions as we have not concluded a thorough analysis.

6. Key benchmarking results

In this chapter we collected the key results of benchmarking. In appendix we presented the detailed calculation principle of each key performance indicator (KPI). The comprehensive report of measured KPIs and related conclusions can be found in the full report presentation.

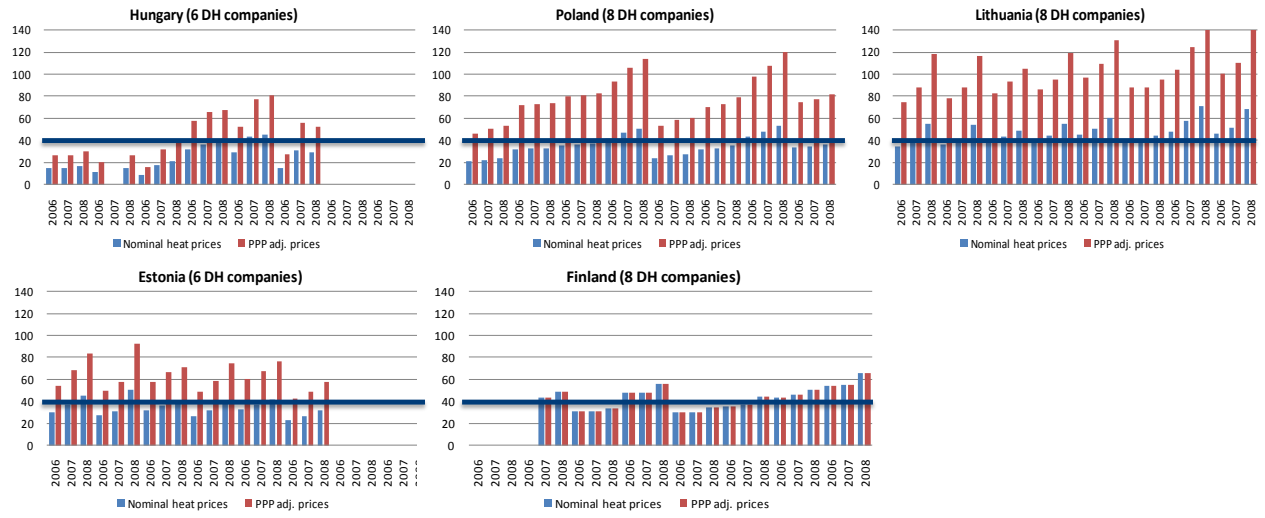
i. Heat prices

Heat prices vary between companies and countries. It should be emphasized that prices vary substantially between DH companies. Main reasons can be listed:

- Fuel prices, availability and strategy as fuels represent often 40 % ... 70 % of total costs
- Efficiency of heat production
- Efficiency of DH system - fixed costs often 10 % … 25 % of total costs and capital costs 20 % … 35 %
- Regulatory impact e.g. non-allowance for profit and cross-subsidy from electricity revenues
- Ownership and company policies

In the course of the work, we have come to a conclusion that there are substantial limitations to analyze national level average heat prices and their development. Instead a good reference can be found in Finland where DH association is publishing heat prices bi-annually and one can find comparisons of heat price developments with inflation and fuel prices.

In order to evaluate the potential linkages between selected regulatory preferences and heating costs, international comparisons should be developed. For that purpose, the comprehensive analysis should include heat prices, specific heat consumption, customer segments, typical living space, purchasing power adjustments and average household income information.



Picture 9. Nominal and PPP adjusted heat prices 2006-08 by company

It is not purposeful to analyze individual reasons behind the presented prices. In Hungary, Poland, Lithuania and Estonia there exists a rather clear regulatory driven cross-subsidy between electricity revenues and allowed heat revenues. It has not been possible to analyze the impact of that. In Finland the benefits of CHP are often shared between electricity and heat with company specific principles following the market position of both products.

It also seems that local political ambitions may, generally speaking, be higher in Hungary and Lithuania than elsewhere. One reason is that the municipalities are having a regulated role in price approvals. In Finland the interests of municipalities are driven by expectations to receive regular profits from utilities.

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. 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.

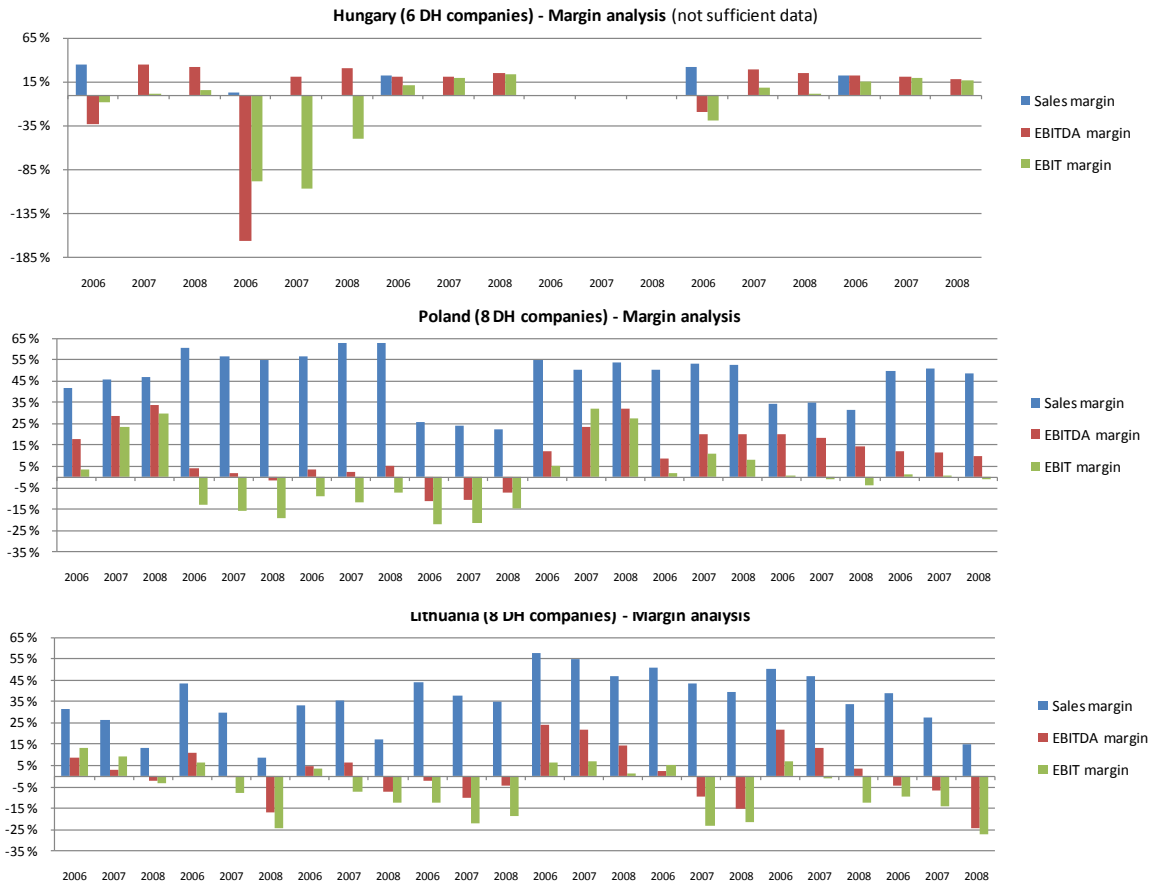
The following 3-year average currency exchange rates and purchasing power parities have been used in all comparisons for 2006-08. Rationale for using 3-year average statistics has been to eliminate the fluctuations of currency exchange rates and thus to eliminate that impact from price comparisons.

	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

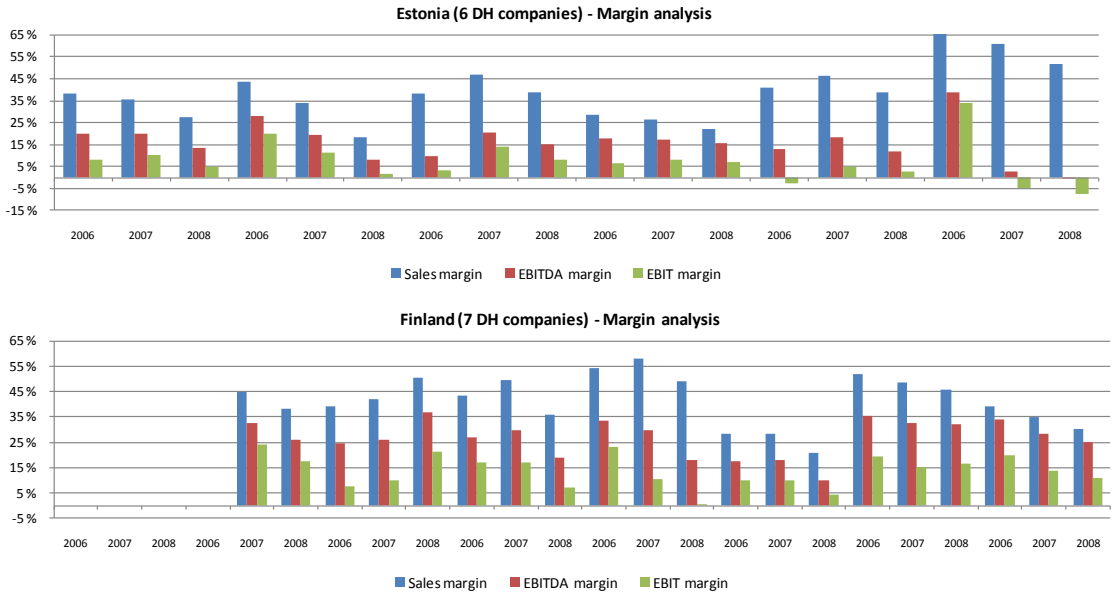
Picture 10. 3-year average currency exchange rates and purchasing power

ii. Margins and profitability

We have included an analysis of sales, operating and profit margins and an analysis of returns on assets and equity in the benchmarking. We present the key results and conclusions here. Basically if these margins remain too low or even negative, the liquidity and solidity of a DH company becomes endangered and its ability to take care or to attract owner or commercial market priced financing for its operations and investments are seriously limited.



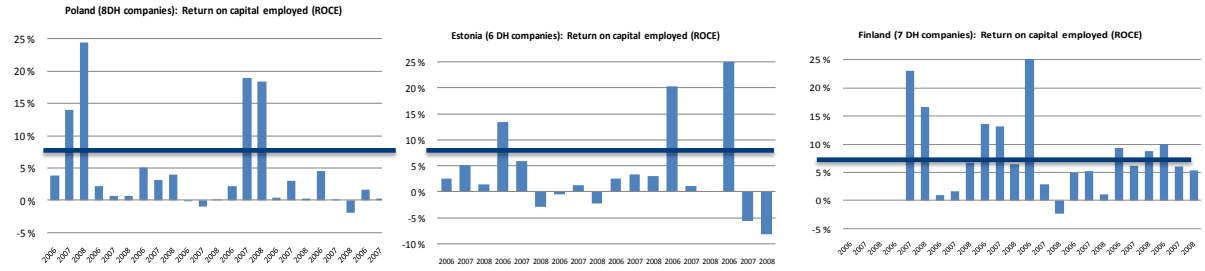
Picture 11. Margin summary of countries with high margin volatility



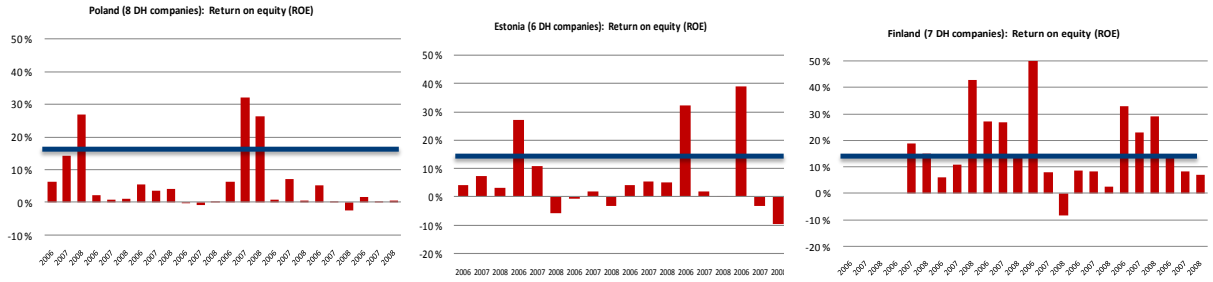
Picture 12. Margin summary of countries with low margin volatility

Theoretically, a regulated industry should be able to recover costs on consistent basis in order to sustain its liquidity and financing requirements. In those countries where DH companies have had too low or negative margins, DH industry may meet an asymmetric risk where they will under-recover their costs but have afterwards quite limited chances or incentives to recover. The main reason, too much delayed pass-through of natural gas cost has been solved in Lithuania.

We have also analyzed the profitability of DH companies with two measures: return on capital employed (ROCE) and return on equity (ROE). Due to lack of sufficient data for Hungary and Poland, these results could be presented only for Lithuania, Estonia and Finland.



Picture 13. Return on capital employed (ROCE) in Lithuania, Estonia and Finland



Picture 14. Return on equity (ROE) in Lithuania, Estonia and Finland

The measured profitability indicates huge variance between years and companies. General assumption is that a regulated industry has rather stable profit volatility but the above examples indicate total opposite. As a conclusion, DH companies are meeting a financing challenge for daily operations and long term investments.

iii. Cost efficiency

Cost efficiency of a DH company depends on several drivers. We have described these drivers with the following structure. The role and impact of each driver is very much company specific.

Regulatory incentives	• **How DH companies are rewarded for higher cost efficiency?** • Is 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

Picture 16. Drivers for cost efficiency in district heating

There are also issues that certainly have an impact in cost efficiency analysis but have not been included in this survey.

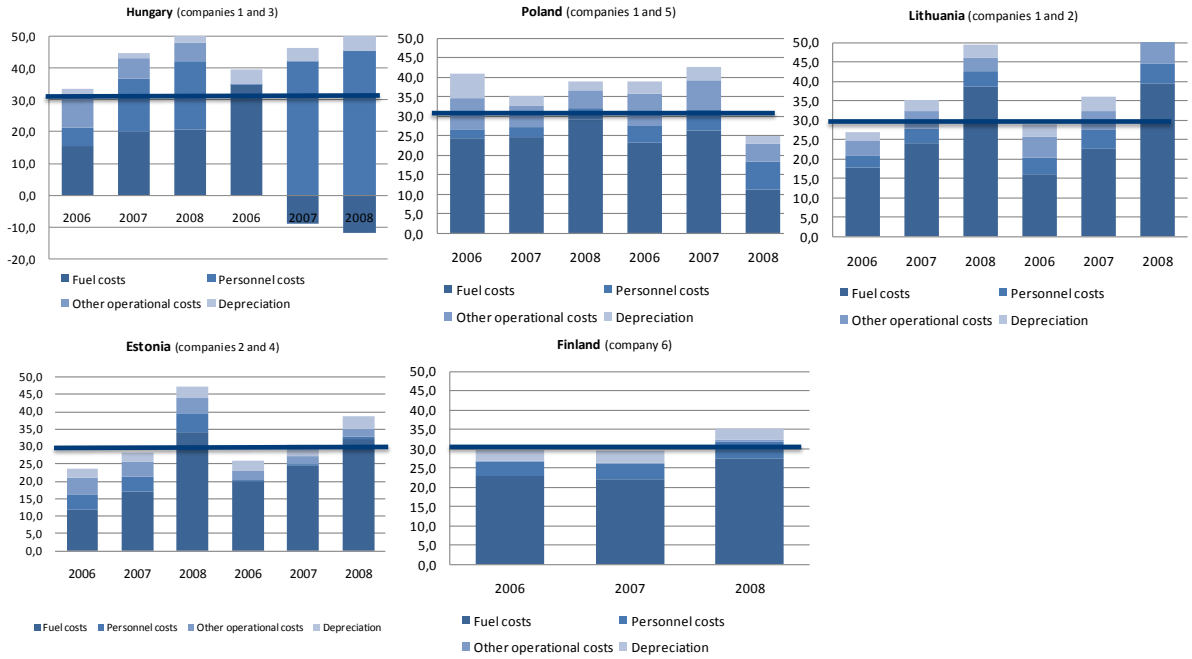
- Annual outdoor temperature, heat demand and fuel price variations
- Impact of annual variations in electricity prices and volumes – in case of condensing production
- Customer structures (residential, public, commercial, industrial)
- Level of outsourcing – typically some maintenance costs can be included 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).

In the following pictures, we have compared the cost efficiency of different company categories within this survey. Cost efficiency is compared in four cost categories:

- Fuel costs (fuel and heat purchase, other direct costs)
- Personnel costs (salaries and salary related costs)
- Other operational costs (e.g. maintenance, administration)
- Depreciation (often planned depreciation)

We have called personnel and other operational costs as "operating costs" in our comments.

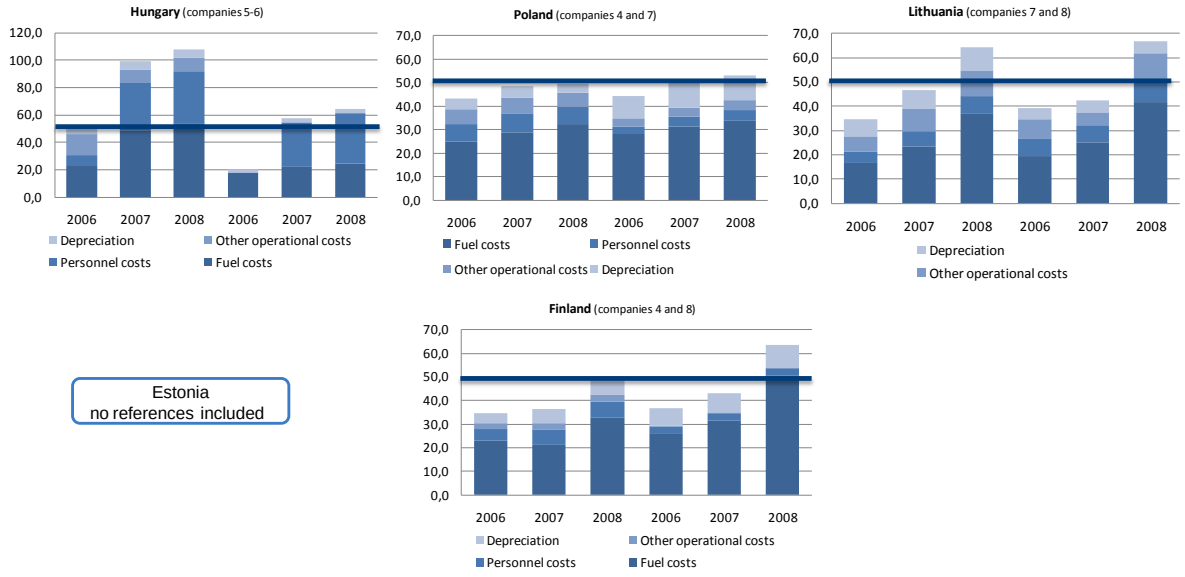
In the picture 16, we have compared the total cost expenditure of large natural gas companies in all five countries.



Picture 16. Total costs (EUR/MWh) of large natural gas companies

Price of natural gas increased significantly during 2006-08, and they seem to be highest in Lithuanian and Hungary. Fuel costs vary between 25…40 EUR/MWh and operating costs between 4… 10 EUR/MWh. Total costs are 35…50 EUR/MWh mainly due to differences in natural gas prices and cost efficiency where the highest cost is about 70 % higher. Benchmarking total cost expenditure is about 35 EUR/MWh.

In the picture 17, we have compared the total cost expenditure of small natural gas companies in Hungary, Poland, Lithuania and Finland.



Picture 17. Total costs (EUR/MWh) of small natural gas companies

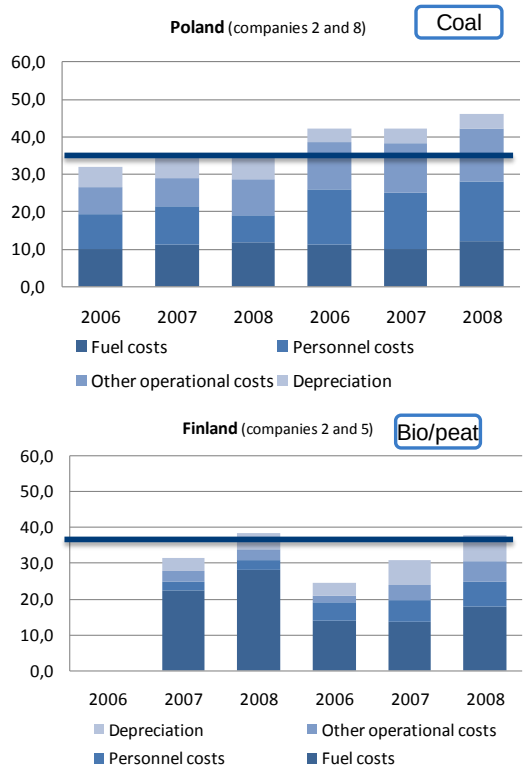
Price of natural gas increased significantly during 2006-08, and they seem to be highest in Lithuanian and Hungary. Fuel costs vary between 30…50 EUR/MWh and operating costs between 3… 15 EUR/MWh. Total costs are 50…65 EUR/MWh mainly due to differences in natural gas prices and cost efficiency where the highest cost is about 30 % higher. Benchmarking total cost expenditure is about 50 EUR/MWh.

In the picture 18, we have compared the total cost expenditure of large solid fuel companies in Poland and Finland. Main fuel in Poland is domestic coal and in Finland a fuel mix of biomass and peat.

Hungary
no references included

Lithuania
no references included

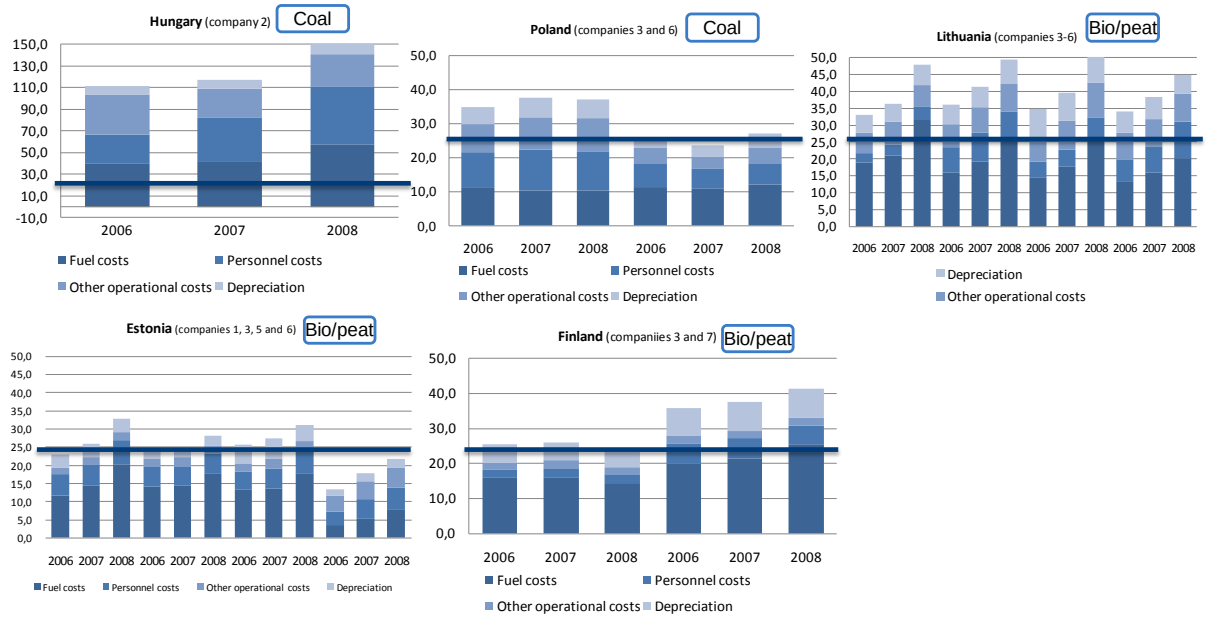
Estonia
no references included



Picture 18. Total costs (EUR/MWh) of large solid fuel companies

Fuel costs are about 10 EUR/MWh in DH companies using coal or peat only and between 15…20 EUR/MWh in DH companies using bio/peat fuel mix. Operating costs between 5… 15 EUR/MWh. Total costs are 35…45 EUR/MWh mainly due to differences in fuel mix and cost. Benchmarking total cost expenditure is about 35 EUR/MWh.

In the picture 19, we have compared the total cost expenditure of small solid fuel companies in all five countries. Main fuel is domestic coal in Poland and exported coal in Hungary (not typical). In other countries a typical fuel mix consists of biomass and peat.



Picture 19. Total costs (EUR/MWh) of small solid fuel companies

Fuel costs are about 10 EUR/MWh in DH companies using coal or peat only and between 15…20 EUR/MWh in DH companies using bio/peat fuel mix. Operating costs between 5… 20 EUR/MWh. Total costs are 25…45 EUR/MWh mainly due to differences in fuel mix and cost. Range of total costs is quite high and is due to the differences in fuel costs and cost efficiency. Benchmarking total cost expenditure is about 25 EUR/MWh which is lower than in the large scale companies.

7. Next step options

Potential next steps should be discussed respectively to the targets. To structure that discussion we have divided the potential targets and respective future next step options into two main categories. The next steps preferences should depend on the target decisions and their prioritization, for example

- Target: Develop an international benchmarking system based on how district heating system fulfill and reach the community values of district heating.
- Basic option: Widening the scope of benchmarking for more companies and/or countries.
- Target: Future price regulation frameworks must first define the local community value from district heating.
- Basic option: Preparing issue paper(s) for best practice market designs and price setting regimes for district heating

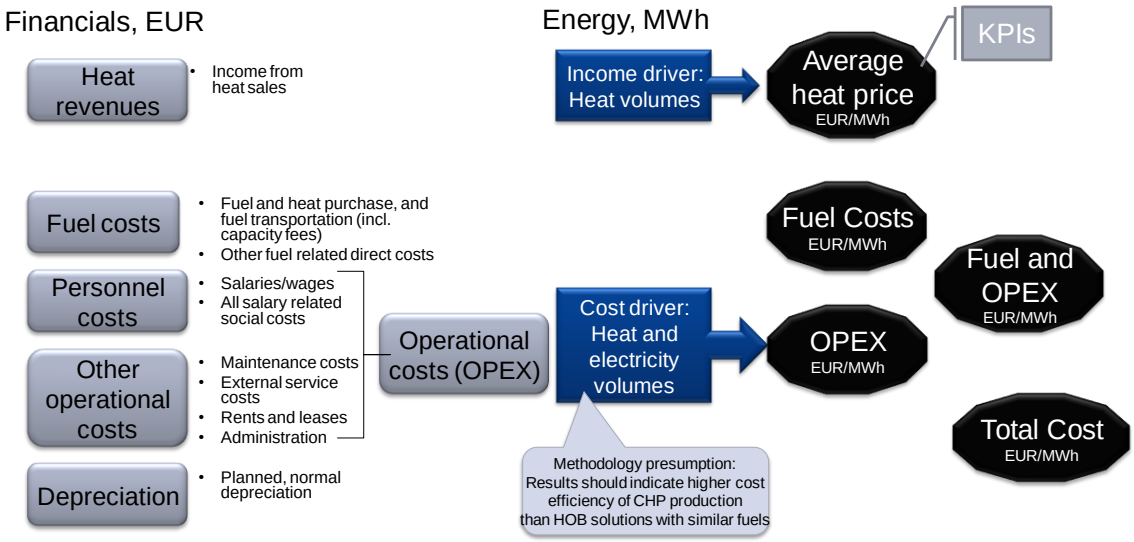
The picture describes the contents of these options in more detail. These next step proposals are offered as basis for future discussions between ERRA and Fortum. Potential pros and cons of these options should be discussed further, and ERRA's and its members views to be incorporated. We also recommend engaging an external project manager to run the work.

Basic objectives	**Develop an international benchmarking system based on how district heating system fulfill and reach the community values of district heating systems**		**Future price regulation frameworks must first define the local community value from district heating.**	
Basic options	**1) Widen the benchmarking scope for more companies 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.				

Picture 20. Options for next steps for discussion

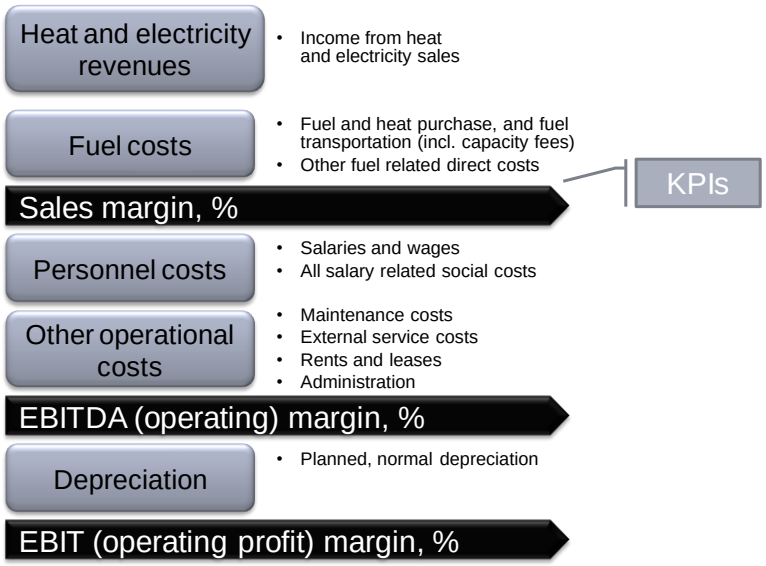
8. APPENDIX

i. Heat prices and cost efficiency - KPI calculations



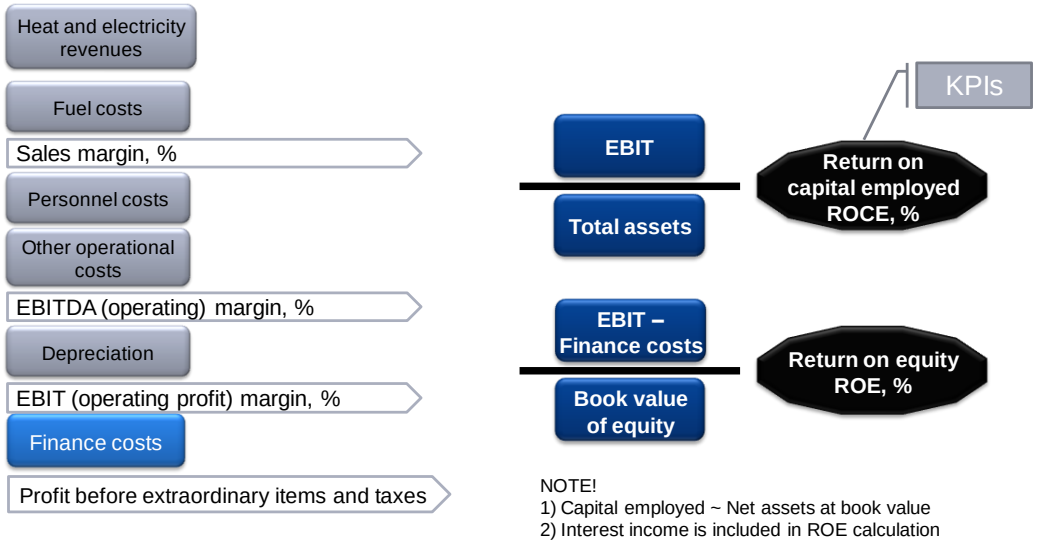
NOTE! Extraordinary items, CO2 income and costs, financing income and costs, and taxes are excluded from price and cost KPI analysis

ii. Calculation of margins - KPI calculations



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

iii. Calculation of profitability - ROCE and 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

List of sources:

- Data and commentary from national regulators
    1. Hungarian Energy Office (“HEO”),
    2. Energy Regulatory Office in Poland (“ERO”)
    3. National Control Commission for Prices and Energy in Lithuania (“NCCPE”)
    4. 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.