

EUROPEAN DISTRICT HEATING PRICE SERIES

REPORT 2016:316



European District Heating Price Series

SVEN WERNER

ISBN 978-91-7673-316-5 | © 2016 ENERGIFORSK

Energiforsk AB | Phone: 08-677 25 30 | E-mail: kontakt@energiforsk.se | www.energiforsk.se

Foreword

This report is part of the research project “The future role of district heating in Europe”. The report contains the first collection of long time series of national average district heating prices in Europe. This data may contribute and be used as a basis to further analysis of district heating prices in European countries.

The study is made by Professor Sven Werner, Halmstad University. A reference group has followed the project and commented the report. The group has consisted of Carina Bergsten (Uddevalla Energy, until March 2016), Erik Thornström (Swedish District Heating Association/Swedenergy), Staffan Larsson (Kalmar Energy) and Peter Öhman (Gothenburg Energy).

The project is part of the Fjärrsyn research program which is financed by Swedish District Heating Association and Swedish Energy Agency. The research aims at support the competitiveness for district heating and cooling through increased knowledge about the role of district heating for the sustainable society for example to open for economical feasible solutions and the future's technology.

Leif Bodinson

Chairman of The Business Intelligence Council at Swedenergy.

Sammanfattning

Detta projekt har bestått av en insamling av långa tidsserier av nationella fjärrvärmepriser i Europa, då dessa inte samlas in av vare sig International Energy Agency eller Eurostat.

Totalt har långa tidsserier av fjärrvärmepriser identifierats för 23 europeiska länder, varav 20 av dessa är med i EU. Övriga länder som ingår i studien är Island, Norge och Schweiz. Dessa årliga fjärrvärmepriser har skattats enligt tre olika metoder. Datakällor har primärt varit olika nationella källor som de nationella statistikmyndigheterna. Sekundärt har internationella datakällor använts då nationella källor inte har haft den efterfrågade informationen.

Resultaten från studien består av långa tidsserier av nationella medelvärden av årliga fjärrvärmepriser t o m 2013 samt samhörande nationella intäkter och värmeleverenser. Totalt har 560 årliga medelvärden av nationella fjärrvärmepriser skattats.

Fem slutsatser kan dras från detta prisinsamlingsprojekt avseende europeiska fjärrvärmepriser:

1. För närvarande finns ingen reguljär insamling av fjärrvärmepriser från olika länder i Europa. Syftet med detta projekt har varit att eliminera denna informationsbrist.
2. Internationella energiprisanalytiker har därför inte inkluderat fjärrvärmepriser i deras analyser.
3. Länder med höga fjärrvärmepriser under 2013 var Danmark, Slovakien, Tyskland, Norge och Sverige.
4. Länder med låga fjärrvärmepriser under 2013 var Island, Bulgarien, Schweiz, Ungern och Polen.
5. Länder med höga andelar av fjärrvärmekostnader i befolkningens disponibla inkomster under 2013 var Slovakien, Litauen, Lettland och Estland.

Marknadsanalyser och ytterligare slutsatser baserade på de skattade tidsserierna av nationella fjärrvärmepriser kommer att publiceras i en annan publikation. Därför lämnas inga förklaringar i denna rapport om varför nivåerna på fjärrvärmepriserna varierar från land till land.

Summary

This project has been devoted to collection of long time series of national average district heating prices in Europe, since this information is neither collected by the International Energy Agency nor Eurostat.

In all, relatively long time series of district heating prices have been identified in 23 European countries, of which 20 countries are currently members of the European Union. Additional countries were Iceland, Norway, and Switzerland. These annual average prices have been estimated according to three different methods. Data sources have primarily been various national sources as national statistical authorities. Secondarily, various international sources have been used, when national sources could not provide required information.

The outputs from this price collection project consist of long time series of national average district heating prices until 2013 and the corresponding annual revenues and heat sales. In all, 560 annual average national district heating prices have been estimated.

Five main conclusions have been identified concerning European district heating prices:

1. Currently, very little aggregated information is available about district heating prices in various European countries. The purpose with this price collection has been to close this information gap.
2. International energy price analysts have therefore excluded district heating prices from their analyses.
3. Countries with high district heating prices during 2013 were Denmark, Slovak Republic, Germany, Norway, and Sweden.
4. Countries with low district heating prices during 2013 were Iceland, Bulgaria, Switzerland, Hungary, and Poland.
5. Countries with high proportions of district heating costs in the disposable incomes during 2013 were Slovak Republic, Lithuania, Latvia, and Estonia.

Market analyses and further conclusions based on these estimated time series of national district heating prices will be published in another publication. Hence, no explanations for different price levels in various countries have been provided in this report.

List of content

1	Introduction	10
1.1	Background	10
1.2	Fundamental idea of district heating	10
1.3	Pricing of district heating	10
1.4	European energy price transparency directives	11
1.5	Surveys of energy prices	11
1.5.1	International surveys	11
1.5.2	European surveys	11
1.5.3	National surveys	12
1.6	Surveys of district heating prices	12
1.6.1	European surveys	12
1.6.2	National surveys	13
1.7	Project purpose	13
2	Price estimation methods	14
2.1	Effective national average prices	14
2.2	Typical national average prices	14
2.3	Typical company average prices	14
2.4	Additional information sources	14
2.4.1	European Commission – VAT rates	14
2.4.2	Eurostat exchange rates	14
3	Information sources	15
3.1	National sources	15
3.2	International sources	15
3.3	Complementing information sources	16
3.3.1	Eurostat HICP statistics	16
3.3.2	Eurostat enterprise statistics	16
4	Collected information	17
5	Results	20
5.1	District heating price series	20
5.2	District heating revenues	24
5.3	District heating deliveries	26
5.4	Eurostat HICP	26
6	Conclusions	29
7	Acknowledgement	30
8	References	31
	Annex 1: Austria	34
	Annex 2: Bulgaria	35
	Annex 3: Croatia	36

Annex 4: Czech Republic	37
Annex 5: Denmark	38
Annex 6: Estonia	39
Annex 7: Finland	40
Annex 8: France	41
Annex 9: Germany	42
Annex 10: Hungary	43
Annex 11: Iceland	44
Annex 12: Italy	45
Annex 13: Latvia	46
Annex 14: Lithuania	47
Annex 15: Netherlands	48
Annex 16: Norway	49
Annex 17: Poland	50
Annex 18: Romania	51
Annex 19: Slovak Republic	52
Annex 20: Slovenia	53
Annex 21: Sweden	54
Annex 22: Switzerland	55
Annex 23: United Kingdom	56

1 Introduction

1.1 BACKGROUND

A Swedish discussion started among district heating customers during the 1990s in Sweden about district heating prices. The discussion was initiated by several ownership changes, when power and private companies started to acquire municipal district heating systems. The important issue became: What should the district heating price be when a non-municipal owner operates a district heating systems?

The previous price condition was that district heating systems were mainly municipally owned and these activities followed the non-profit principle in the Swedish Municipality Act. However, this municipal principle was removed for electricity and district heating in 1996 in conjunction with deregulation of the electricity market. Hence, the price discussion was then extended to also include municipal district heating companies.

The Swedish price discussion in the 1990s initiated an early international literature survey, which revealed that very little international information was available about district heating prices in various countries. Therefore, this research project was started in 2000 in order to close this international knowledge gap.

1.2 FUNDAMENTAL IDEA OF DISTRICT HEATING

According to (Frederiksen & Werner, 2013), the fundamental idea of district heating is *'to use local fuel or heat resources that would otherwise be wasted, in order to satisfy local customer demands for heating, by using a heat distribution network of pipes as a local market place'*. Typical heat resources are combined heat and power (CHP) plants, Waste-to-Energy plants, and industrial processes with excess heat. Hereby, district heating systems prefer recovered heat and are avoiding ordinary primary energy supply. Hence, the district heating economy can be characterised as economy-of-scope instead of economy-of-size that characterise other parts of the energy system.

District heating is then not priced according to primary energy supply, but in competition from ordinary primary energy supply. In order to stay competitive in the heat market, district heating prices should be somewhat lower than traditional primary energy supply in order to achieve customer confidence.

1.3 PRICING OF DISTRICT HEATING

International scientific energy journals contain few articles concerning district heating prices. A review about price models for district heating has been presented by (Li, Sun, Zhang, & Wallin, 2015). Mostly Swedish traditions were reported. The actual synergies with power generation in CHP plants in district heating prices have been analysed by (Linden & Peltola-Ojala, 2010) and (Åberg, Widén, & Henning, 2012). The basic principles of marginal cost pricing have been presented by (Difs & Trygg, 2009) and (Zhang, Ge, & Xu, 2013). An risk assessment of new

pricing strategies has been performed by (Björkqvist, Idefeldt, & Larsson, 2010). The influence of public or private ownership has been analysed by (Åberg, Fäلتing, & Forssell, 2016).

This short summary reveals that available articles focus on district heating pricing principles and models. Hence, no aggregated information about European district heating prices appears in international scientific energy journals.

1.4 EUROPEAN ENERGY PRICE TRANSPARENCY DIRECTIVES

The first European directive for the collection of energy prices was approved in (European Council, 1990). It covered prices charged to industrial consumers only; household energy prices were only provided on a voluntary basis. The price statistics at the time were collected on the basis of tariffs for standard consumers.

As the liberalisation process of electricity and gas markets progressed, the notion of tariffs, especially for industries, did not make much sense. The methodology for the prices data collection in a liberalised market and what energy prices should cover had to reflect the fact that real prices are set by market forces and are not the fixed tariffs used in the past.

A new methodology for the collection of prices paid by industry customers was agreed by the EU Member States in December 2006 and initiated the second energy price transparency directive (European Parliament and Council, 2008).

However, the energy price transparency directive covers only electricity and gas prices. District heating prices are excluded.

1.5 SURVEYS OF ENERGY PRICES

1.5.1 International surveys

The most comprehensive compilation of international energy prices is provided by the International Energy Agency (IEA) in (IEA, 2015). This quarterly publication contains a major international compilation of energy prices of OECD countries: including crude oil and oil product spot prices, import costs by crude stream, industry prices, and consumer prices. The end-user prices cover the main petroleum products, gas, coal and electricity. Every issue includes full notes on sources and methods and a description of price mechanisms in each country. Time series availability varies with each data series.

The main conclusion from these international energy price surveys is that district heating prices are not reported by IEA.

1.5.2 European surveys

Eurostat gather energy price statistics (Eurostat, 2016) according to the current European energy price transparency directive. Electricity and natural gas prices are available since 1985 for some locations. Fossil fuel prices are regularly reported by the European Commission in their Weekly Oil Bulletins (European Commission, 2016). These energy prices are used when reporting all kinds of

prices, as in (Eurostat, 2008). But since district heating prices are not included in the Commission efforts of energy price transparency, district heating prices are omitted from all European surveys concerning energy prices.

In January 2014, the European Commission adopted a Communication on energy prices and costs in Europe (European Commission, 2014a, 2014b, 2014c). This noted that energy price rises create additional cost burdens on households and industry and affect competitiveness. It noted that the European Commission had prepared an analysis of energy prices and costs in Europe, with a focus on electricity and gas prices, while drawing conclusions to help inform decision makers on the policy measures that might be needed. The European Commission proposed a number of courses of action with a view to ensuring that Europe's citizens and businesses can deal effectively with the energy price challenge and that the EU can maintain its competitiveness, today, to 2030, and beyond. None of these proposals included district heating prices.

The main conclusion from European energy price surveys is that district heating prices are not reported.

1.5.3 National surveys

In national energy price surveys, district heating prices or revenues appear regularly. Examples are (Besson, 2008) concerning France and (AGFW, 2015) concerning Germany. In Sweden, annual price comparisons for various heating options were published by the Swedish Energy Agency between 2001 and 2005 and the Swedish Energy Markets Inspectorate between 2006 and 2012. The latest published price comparison became (Swedish Energy Markets Inspectorate, 2012). Similar national price comparisons appear also in other countries.

The main conclusion from national energy price surveys is that district heating prices are also reported.

1.6 SURVEYS OF DISTRICT HEATING PRICES

1.6.1 European surveys

World Energy Council arranged a workshop in Romania in 2002 about restructuring and privatisation of the district heating systems in Central and Eastern Europe. One of the workshop presentations (Cherubin, 2002) brought up the price levels and practices in some of these countries.

Preliminary results from this project were first presented at the 9th International Symposium on District Heating and Cooling in Helsinki (Brodén & Werner, 2004). These preliminary results were also included in the analysis of the European heat market in the Ecoheatcool project (Werner, 2005).

Energy Regulators Regional Association (ERRA) and Fortum have together performed a benchmarking study concerning district heating in five countries (ERRA and Fortum, 2011). District heating prices were briefly discussed and presented.

Euroheat & Power started to include compilations of national average district prices in their 1999 survey (Euroheat & Power, 1999). The most recent survey (Euroheat & Power, 2015) presents an introductory table of national revenues from heat sales for 21 countries, thereof 19 European countries.

1.6.2 National surveys

Germany has a long tradition to gather and publish both local and national average district heat prices. An early study was published by (Dommann, 1972) that was followed by annual price surveys for various German district heating systems (Müller, 1974). Nowadays, these more detailed price surveys have been replaced by a national price survey (AGFW, 2014). The information gathered has been used for providing more pronounced price analyses (Seifert, 1992).

Information about district heating prices for various systems makes it possible to perform benchmarking studies by using Data Envelopment Analyses. This kind of analyses has been performed for Finland (Lygnerud & Peltola-Ojala, 2010), Poland (Raczka, 2001), and Denmark (Agrell & Bogetoft, 2005) and (Munksgaard, Pade, & Fristrup, 2005).

1.7 PROJECT PURPOSE

The conclusions from this introduction are that

- International scientific energy journal articles do not provide aggregated information about European district heating prices.
- The European energy price transparency directive excludes district heating prices.
- IEA, European Commission, and Eurostat do not report district heating prices in their publications or databases concerning energy prices and taxes.
- National surveys of annual heating costs include district heating in some countries.
- Some fragmented surveys of European district heating prices have been published.
- National surveys of district heating prices appear in some mature district heating countries.

The main purpose of this project has been to put some stronger light on district heating prices in Europe in order to increase the transparency of district heating in European countries. This purpose has been achieved by an extensive collection of long time series of annual heat sales and annual revenues from these heat sales from many European countries. Hereby, effective national annual district heating prices can then be estimated by dividing the annual revenues by the annual heat sales.

Market analyses and further conclusions based on the estimated time series of national district heating prices will be published in another publication. Hence, no explanations for different price levels in various countries will be provided in this report. Neither will these estimated prices be compared with costs related to other heating options.

2 Price estimation methods

2.1 EFFECTIVE NATIONAL AVERAGE PRICES

The preferred option has been to obtain effective national average prices by dividing national annual revenues from heat sales by national quantities of heat sold from district heating systems. When the national revenues were not available from the national statistical authorities, the revenues were estimated with the product of annual heat sales and annual average heat prices according to the second and third option.

2.2 TYPICAL NATIONAL AVERAGE PRICES

The second option was to gather typical national heat prices from various national statistical authorities, regulators, or national district heating associations.

2.3 TYPICAL COMPANY AVERAGE PRICES

Neither effective average prices nor typical average prices were available for three countries. The third option became then to gather typical annual effective or typical average heat prices from one or many major national district heat providers.

2.4 ADDITIONAL INFORMATION SOURCES

Some additional information sources have been used when the district heating prices have been estimated in order to harmonise and compare national price series.

2.4.1 European Commission – VAT rates

The ambition has been to present all annual heat prices without any value added taxes (VAT). When heat prices included VAT, these tax additions were removed by using annual VAT information from (European Commission, 2015) that reports annual VAT for various commodities and years.

2.4.2 Eurostat exchange rates

Another ambition was to convert national heat prices into euro per GJ in order provide comparisons between different countries, when euro was not used as national currency. The actual annual average exchange rates to the euro were used for these conversions to euro. These annual average exchange rates were obtained from the Eurostat database. Exchange rates reflecting purchasing power parities were not used for the conversions.

3 Information sources

That initial ambition was to use primary national statistical sources for the collection of heat prices and heat sales. When this collection was not successful, secondary international statistical sources were used.

3.1 NATIONAL SOURCES

The preferred option of collecting was to obtain both national revenues and heat sales from national statistical authorities. This was completely accomplished for 12 countries and partly for 6 countries concerning heat sales. For remaining countries, international statistical sources were used.

Only 6 countries could provide annual national revenues (Denmark, France, Norway, Sweden, Switzerland, and United Kingdom). Typical annual prices were used for 14 countries, when estimating national revenues. Annual company reports from large district heating providers were used as information sources for the three countries (Croatia, Iceland, and Italy) lacking the first and second options for estimated prices.

3.2 INTERNATIONAL SOURCES

Euroheat & Power is the European association for district heating and cooling. It was founded in 1954 as the Union Internationale des Distributeurs de Chaleur (Unichal). The original 'Nomenclature and Statistics' committee of Unichal was founded in 1961 and presented the first statistical information about member systems for 1964 and 1965 at the 1967 Unichal meeting in London. The first national statistical survey was presented in (Unichal, 1973) and this report was later published as (Mölter, 1974).

The bi-annual statistical reports from Unichal and Euroheat (Unichal, 1991, 1993, 1995), (Euroheat & Power - Fernwärme International, 1997), (Euroheat & Power, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015) have been used for both providing annual heat sales and typical annual heat prices, when national sources have not been found. The major drawback with these Unichal and Eurostat information sources is that the original national statistical sources are not stated.

In case of Iceland, the former Nordvärme statistical reports and the Nordic statistical yearbooks have been used in order to obtain several annual heat sale volumes.

IEA in Paris collects annually energy statistics from most countries in the world together with Eurostat and UN Statistical Division. These statistical questionnaires are defined by (IEA, 2005). Missing annual heat sales have been obtained from (IEA, 2016a, 2016b), when not available from national or Unichal/Eurostat sources. As previously mentioned in section 1.5.1, IEA do not gather district heating prices.

3.3 COMPLEMENTING INFORMATION SOURCES

3.3.1 Eurostat HICP statistics

When annual gaps have occurred in gathered heat price series, national or Eurostat price indices have been used to fill these gaps between years with estimated heat prices.

Eurostat generates Harmonised Indices of Consumer Prices (HICP) from regular national price questionnaires in order to estimate European and national inflation rates. The 'Classification of individual consumption by purpose', abbreviated as COICOP, is a nomenclature developed by the United Nations Statistics Division to classify and analyse individual consumption expenditures incurred by households, non-profit institutions serving households and general government according to their purpose. It includes categories such as clothing and footwear, housing, water, electricity, and gas and other fuels. Heat prices are classified as COICOP 0455 in the Eurostat HICP database.

3.3.2 Eurostat enterprise statistics

Eurostat has in their structural business statistics (SBS) aggregated information about various parameters as annual turnover for various national industrial activities, as heat selling companies. It is therefore possible to check the magnitudes of this Eurostat statistics with the annual revenues estimated for district heating systems in this research project.

4 Collected information

In all, relatively long time series of district heating prices have been identified in 23 European countries, of which 20 countries are currently members of the European Union. Additional countries are Iceland, Norway, and Switzerland. Remaining eight EU member countries were not included, since district heating is not a typical activity in these countries. Very few systems are operated in Luxembourg, Belgium, Ireland, Portugal, Spain, and Greece, while no district heating appears in Cyprus and Malta.

Original time series of collected or estimated annual heat sales and corresponding revenues are presented in the ending annexes for each country.

An overview of annual national heat sales is presented in Table 1 with respect to national or international sources used. National sources were used as the only source for twelve countries, while corresponding international sources were used for five countries. A combination of national and international sources was used for six countries.

Between 1980 and 2013, 706 annual estimates of national heat sales have been identified for the 23 countries, giving the average time length of 30.7 years for the national time series. Full time series of 34 years was obtained for fifteen countries (Austria, Bulgaria, Denmark, Finland, France, Germany, Hungary, Iceland, Italy, Netherlands, Poland, Slovak Republic, Slovenia, Sweden, and Switzerland). The shortest time interval of fifteen years (1999-2013) was obtained for United Kingdom.

An overview of collected national district heating price series is presented in Table 2 with respect to the three different price estimation methods defined in chapter 2. The primary option of effective average prices from actual national revenues is available from six countries (Denmark, France, Norway, Sweden, Switzerland, and United Kingdom). The second option of typical national prices is available from fourteen countries, while the third option of average prices for major district heating providers is available from three countries (Croatia, Iceland, and Italy). The typical national prices include also estimations for missing years by using national or the Eurostat HICP price indices for heat energy.

Between 1980 and 2013, 560 annual estimates of national average district heating prices are available for the 23 countries, giving the average time length of 24.3 years for the national time series. Full time series of 34 years was obtained for seven countries (Denmark, Finland, France, Germany, Iceland, Sweden, and Switzerland). The shortest time series of eleven years (1999-2009) was obtained for Italy.

Table 1. Overview of sources used for estimation of national district heating deliveries. Used abbreviations for national bodies are defined in the ending national annexes.

Country	National sources	International sources
Austria	Statistics Austria (1970-)	
Bulgaria	NSI (1990-)	IEA energy balances (1971-1989)
Croatia		IEA energy balances (1990-)
Czech Republic		Unichal and Euroheat & Power (1991-)
Denmark	DDHA (1959-1974) and Statistics Denmark (1975-)	
Estonia	Statistics Estonia (1985-)	
Finland	FDHA & FEI (1960-)	
France	INSEE (1960-1983) and SNCU (1984-)	
Germany	AGFW (1960-1989) and AG Energiebilanzen (1990-)	
Hungary	Hungarian Energy Office (1990-)	IEA energy balances (1965-1989)
Iceland	Various historical sources (1944-1979)	Nordic SYB (1980-1989), Nordvärme (1990-2004), and Euroheat & Power (2005-)
Italy	AIRU (1999-)	Unichal and Euroheat & Power (1978-1998)
Latvia	CSB (1990-)	
Lithuania	Statistics Lithuania (1990-)	
Netherlands		Unichal and Euroheat & Power (1978-)
Norway	Statistics Norway (1983-)	
Poland		IEA energy balances (1960-)
Romania		IEA energy balances (1971-)
Slovak Republic	SOSR (2001-)	IEA energy balances (1993-2000)
Slovenia	SORS (1995-)	IEA energy balances (1990-1994)
Sweden	SDHA (1950-1968) and Statistics Sweden (1969-)	
Switzerland	Bundesamt für Energie (1978-)	
United Kingdom	DUKES (1999-)	
Number of countries	18, thereof 12 as only source	11, thereof 5 as only source

Table 2. Overview of methods used for estimating national district heating price series. Used abbreviations for national bodies are defined in the national ending annexes.

Country	Effective average prices from actual national revenues	Typical national prices including estimations with price indices	Average prices for major district heating companies
Austria		EHP statistical reports with national and Eurostat price indices	
Bulgaria		NSI with Eurostat price indices	
Croatia			HEP
Czech Republic		Czech Statistical Office	
Denmark	Statistics Denmark		
Estonia		Estonian Energy publication with Eurostat price indices	
Finland		FDHA and FEI	
France	INSEE & SNCU		
Germany		AGFW	
Hungary		CSO with Eurostat price indices	
Iceland			Reykjavik
Italy			Owner company of the Torino system
Latvia		CSB	
Lithuania		NCC (regulator) with Eurostat price indices	
Netherlands		EHP statistical reports, but no price indices available	
Norway	Statistics Norway		
Poland		EHP statistical reports with Eurostat price indices	
Romania		ANRE (regulator) with national price indices	
Slovak Republic		URSO (regulator)	
Slovenia		SORS with national price indices	
Sweden	Statistics Sweden		
Switzerland	Bundesamt für Energie		
United Kingdom	DUKES		
Number of countries	6	14	3

The outputs from this price collection project consist of time series of national average district heating prices and corresponding annual revenues and heat sales. These results are presented in the following four sub-chapters. Further market analyses based on these estimated time series of district heating prices will be published in another publication.

Each national annual average district heating price is presented in Table 3, while the total annual averages among the analysed countries and the corresponding standard deviations are presented in Figure 1. Each national price series in this section are not deflated and contains therefore inflation. All reported prices should also exclude additions of VAT.

EUR/GJ	Countries																All countries, average	All countries, standard deviation	2013							
	Austria	Bulgaria	Croatia	Czech Republic	Denmark	Estonia	Finland	France	Germany	Hungary	Iceland	Italy	Latvia	Lithuania	Netherlands	Norway				Poland	Romania	Slovak Republic	Slovenia	Sweden	Switzerland	United Kingdom
Year																										
1980					8.6		4.8	8.7	6.2		1.0									6.8	8.1		6.8	3.6	7	
1981					10.5		6.1	11.0	7.9		1.5				6.3					9.1	9.3		8.6	4.5	8	
1982					12.3		6.7	11.1	8.8		1.3				8.1					9.1	10.7		9.4	5.1	8	
1983					11.9		7.1	11.4	9.5		1.3				8.6	9.0				9.9	12.4		9.7	5.2	9	
1984					12.2		7.3	12.6	9.8		2.7				9.4	9.3				10.9	11.8		10.3	5.4	9	
1985					12.2		7.7	12.6	10.0		2.6				9.8	9.4				10.6	12.0		10.3	5.4	9	
1986	12.2				13.9		6.0	11.0	9.4		2.7				9.3	7.1				9.6	11.5		9.8	5.3	10	
1987	11.2				14.6		4.9	10.0	9.2		2.7				7.3	5.5				9.1	8.8		9.2	4.9	10	
1988	11.0				14.2		5.2	9.5	8.9		3.0				7.5	5.7				9.9	7.6		9.2	4.8	10	
1989	10.8				14.9		5.5	9.4	9.2		2.7				7.6	6.7				10.8	8.2		9.6	5.0	10	
1990	10.9				15.1		5.9	9.8	9.6	1.5	3.0				8.5	7.5				10.9	9.8		9.1	5.1	11	
1991	11.5				15.3		6.1	9.5	10.9	2.2	3.0				8.8	8.8				12.4	8.9		10.0	5.3	11	
1992	11.6				16.5		6.3	10.0	11.2	2.7	3.4				8.5	8.7			5.5	12.9	8.7		10.4	5.3	12	
1993	11.6		3.3	16.0		6.4	10.3	11.3	5.4	3.7			1.4	8.6	8.4			3.3	5.7	10.3	8.2		8.3	4.8	15	
1994	11.7		3.8	16.9		6.6	10.4	11.4	5.7	3.6			1.9	8.8	8.6			3.4	5.5	10.3	8.2		8.7	4.9	15	
1995	11.8		4.4	18.2		7.0	11.0	11.4	4.9	3.5			2.6	9.0	8.8		2.7	3.6	5.9	10.5	8.1		7.7	5.0	16	
1996	12.0		4.9	18.0	4.5	6.9	11.9	11.7	5.3	3.5		6.5	4.1	9.4	9.4	2.6		3.6	5.4	11.5	8.7		7.9	4.8	18	
1997	12.2	2.3		6.4	18.5	4.6	7.2	11.7	11.9	6.6	4.0		7.4	5.5	9.6	9.9	3.7	3.8	5.8	11.9	8.4		8.4	4.7	19	
1998	12.3	3.2		7.7	19.2	5.0	7.4	12.4	11.6	6.1	4.0		7.5	6.6	9.1	8.6	5.2	2.9	4.2	6.0	11.6	8.8		8.3	4.4	20
1999	12.2	4.1	5.8	7.8	21.0	5.2	7.5	12.9	11.3	6.7	4.2	14.1	8.0	7.1	8.9	9.3	5.1	2.9	5.6	6.0	11.8	10.4	6.3	8.6	4.1	23
2000	12.4	4.3	6.0	8.4	22.1	5.4	7.9	13.2	12.4	7.2	4.6	15.5	9.4	8.4	10.3	10.5	5.8	4.8	8.2	7.5	13.1	10.7	6.9			

It is obvious that district heating prices were stable between 1985 and 2000, but increased between 2000 and 2013. This price development is similar to the development of the global fossil fuel prices, revealing a strong correlation to the fossil fuel prices. This correlation has mainly two explanations. First, the heat supply in many district heating systems is still based on fossil fuels. Second, district heating prices are also set in competition with fossil prices, when the heat supply is based on heat recycling.

The variation in district heating prices among countries is illustrated in Figure 2, revealing that the highest prices are found in Denmark, Slovak Republic, Germany, Norway, and Sweden, while the lowest prices are obtained in Iceland, Bulgaria, Switzerland, Hungary, and Poland. Denmark has a strong planning legislation concerning district heating and high fuel oil taxes, giving a very strong case for district heating. This favourable situation means that the Danish district heating systems can afford high heat distribution costs, giving higher district heating prices. The dominating geothermal heat supply in Iceland gives low heat supply costs and low district heating prices.

The wide variation of district heating prices among the five Nordic countries is evident in Figure 3. Three other groups of countries are presented in Figure 4, Figure 5, and Figure 6.

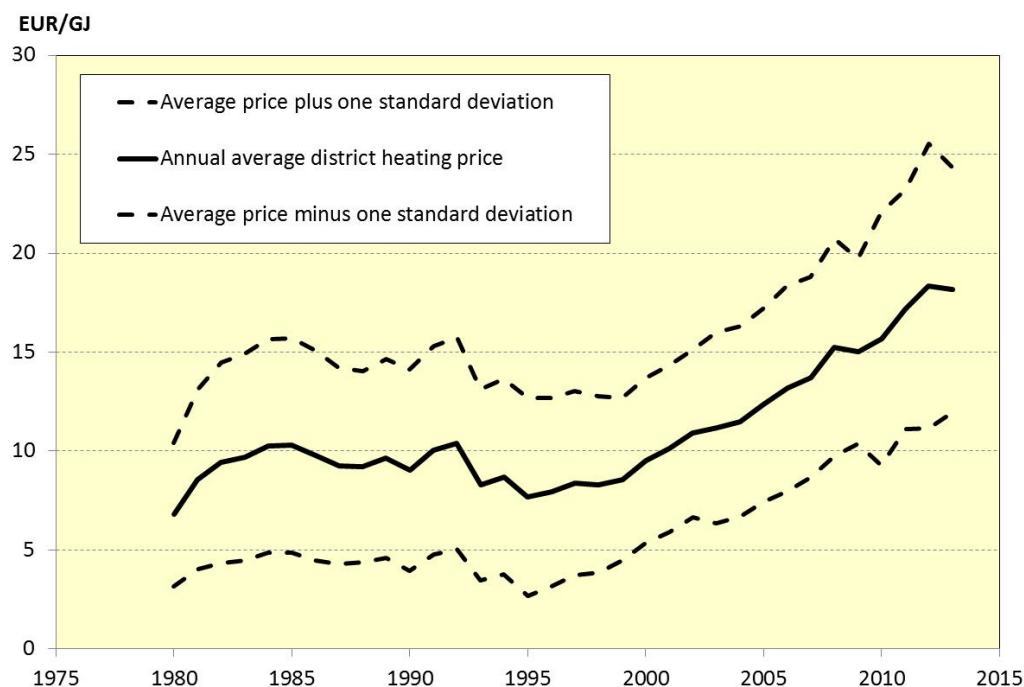


Figure 1. Development of the estimated annual average district heating prices for the analysed target countries and the corresponding standard deviations between 1980 and 2013.

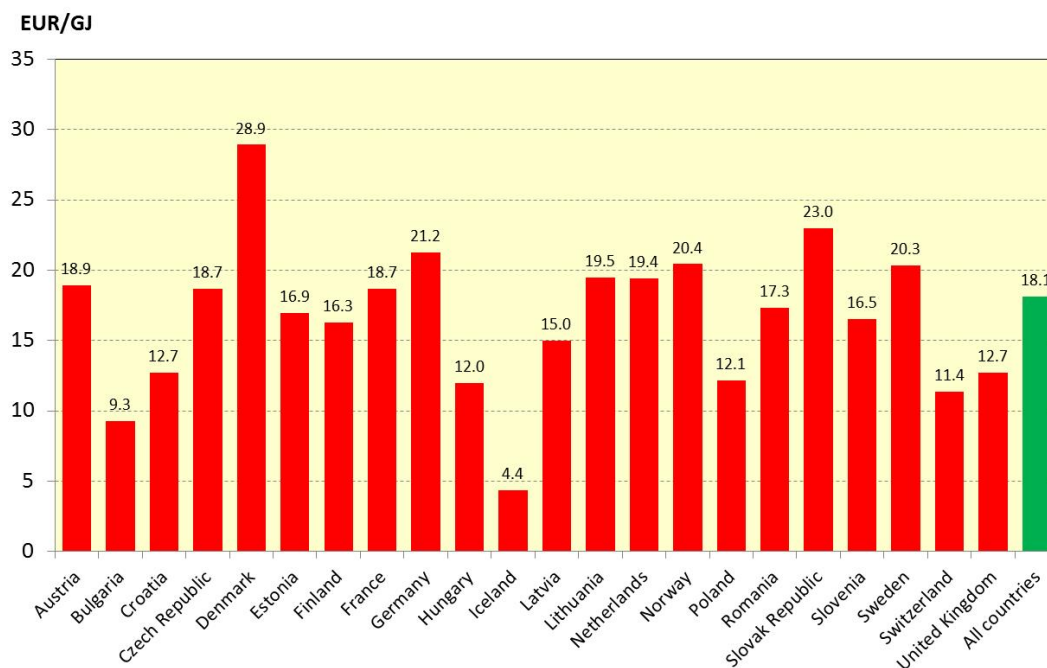


Figure 2. National average district heating prices for 22 European countries in 2013.

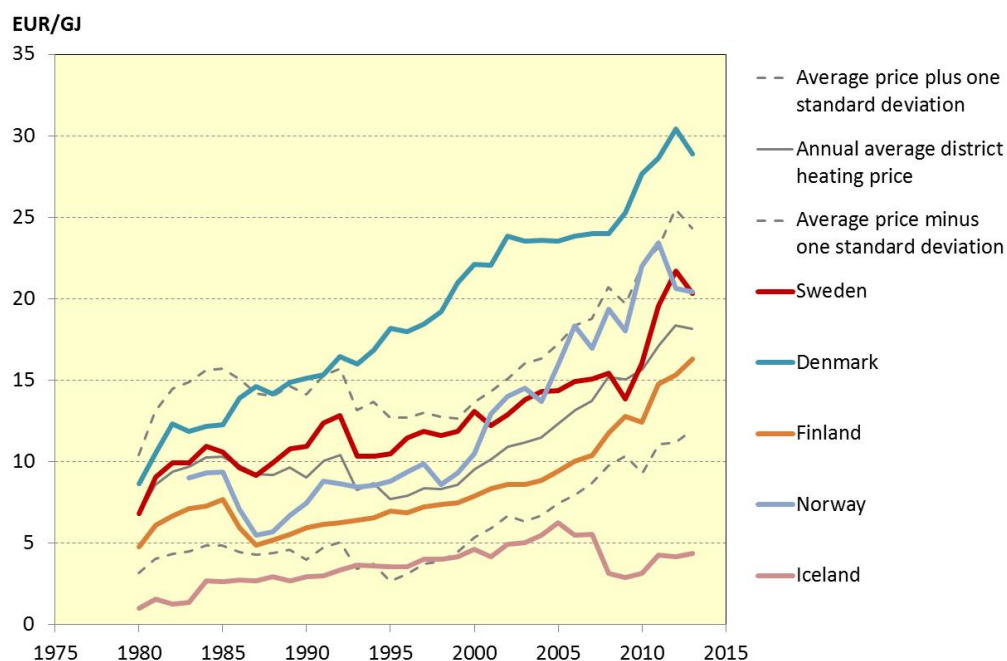


Figure 3. Annual average national district heating prices for the five Nordic countries together with the average European prices and the corresponding standard deviations.

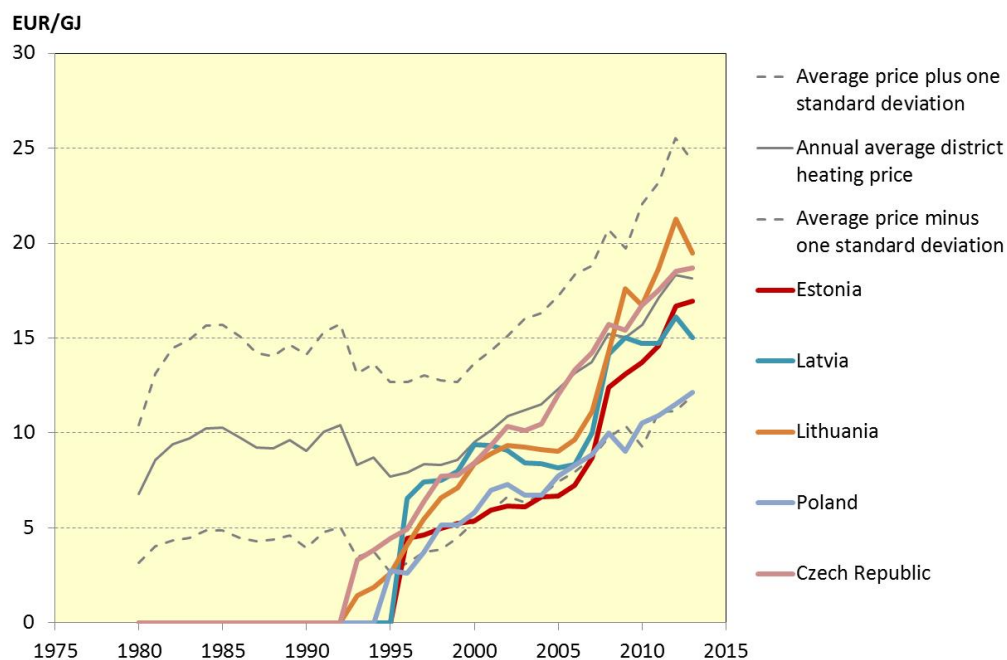


Figure 4. Annual average national district heating prices for the three Baltic countries, Poland, and Czech Republic together with the average European prices and the corresponding standard deviations.

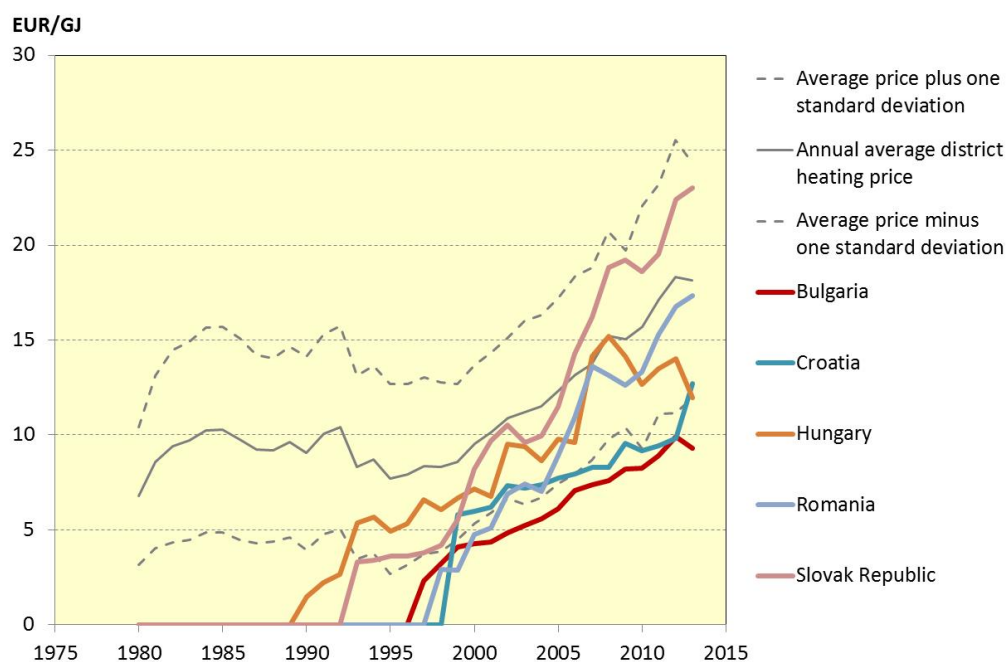


Figure 5. Annual average national district heating prices for Bulgaria, Croatia, Hungary, Romania, and Slovak Republic together with the average European prices and the corresponding standard deviations.

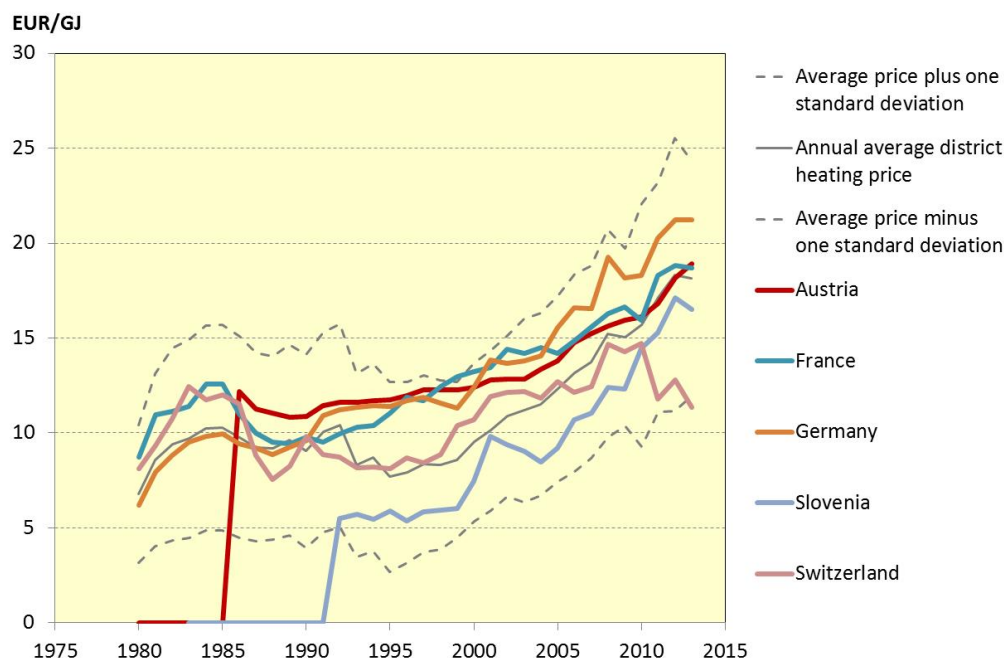


Figure 6. Annual average national district heating prices for Austria, France, Germany, Slovenia, and Switzerland together with the average European prices and the corresponding standard deviations.

5.2 DISTRICT HEATING REVENUES

The estimations of annual revenues from heat sales in district heating systems are presented in Table 4, revealing that the current European district heating revenues exceeds 30 billion euro each year.

The correlation between these estimations for 2013 and the estimated annual turnovers in thirteen national heat sectors for the same year is presented in Figure 7. The latter turnovers have been obtained from the Eurostat structural business statistics, which cannot deliver these annual turnovers for the remaining nine countries.

The figure reveals that the correlation is rather bad between the two sets of revenues. In France, the Eurostat turnover is higher, since large volumes of heat are sold outside district heating systems. In Germany, the Eurostat turnover is lower, since district heating is also provided by CHP plants, classified as belonging to the power industry. Revenues and Eurostat turnovers are almost equal for Croatia, Czech Republic, Lithuania, and Slovak Republic.

Table 4. Development of European district heating revenues 1980-2013 in million euros.

MEUR	Countries																									
Year	Austria	Bulgaria	Croatia	Czech Republic	Denmark	Estonia	Finland	France	Germany	Hungary	Iceland	Italy	Latvia	Lithuania	Netherlands	Norway	Poland	Romania	Slovak Republic	Slovenia	Sweden	Switzerland	United Kingdom	All countries		
1980					512		224	589	973		12									683	64		3058	23		
1981					611		314	711	1228		20				34					927	78		3924	7		
1982					731		364	786	1389		17				47					1012	91		4438	8		
1983					728		414	860	1522		19				57	6				1022	107		4735	9		
1984					772		458	920	1666		38				70	9				1178	108		5219	9		
1985					897		597	1015	1743		40				84	14				1422	113		5926	9		
1986	258				1046		451	915	1697		45				84	14				1271	114		5895	10		
1987	252				1159		414	856	1765		44				71	15				1294	99		5968	10		
1988	250				1082		415	742	1746		49				66	17				1289	81		5736	10		
1989	256				1093		416	754	1546		47				71	19				1290	89		5579	10		
1990	279				1119		476	795	3678	123	54				84	23				1348	102		8080	11		
1991	349				1288		519	875	4118	166	55				103	31				1689	107		9299	11		
1992	341				1385		533	901	3999	196	65				103	32			44	1735	105		9438	12		
1993	383			924	1427		571	920	4018	384	71			73	108	33			90	46	1494	92	10636	15		
1994	374			875	1510		601	902	3987	410	72			104	107	35			85	43	1508	93	10705	15		
1995	418			914	1712		623	942	4174	363	67			131	116	38	1014		109	48	1557	97	12323	16		
1996	538			909	1870	148	658	1024	4031	360	65		257	189	168	44	1025		127	44	1873	108	13437	18		
1997	496	110		1035	1810	150	688	1025	3664	435	75		279	246	170	46	1345		118	47	1790	109	13637	19		
1998	518	144		1098	1933	144	732	1066	3603	379	75		257	280	175	43	1740	609	138	48	1828	117	14929	20		
1999	530	163	57	1131	2051	150	723	1087	3271	410	80	189	227	269	164	51	1639	477	148	49	1865	137	660	15528	23	
2000	530	157	53	1120	2094	143	724	1109	3278	404	94	215	235	291	195	55	1667	712	213	61	1942	141	722	16155	23	
2001	584	171	62	1232	2254	158	849	1127	3703	396	87	252	252	317	201	85	2213	704	430	81	2042	166	651	18016	23	
2002	580	174	71	1252	2406	166	911	1202	3690	537	105	250	241	349	213	97	2170	767	451	72	2161	170	644	18681	23	
2003	621	200	76	1290	2447	156	941	1215	6131	528	101	290	228	358		112	2076	750	412	72	2334	177	499	21014	22	
2004	691	203	77	1280	2437	179	941	1270	6489	437	109	306	209	342		114	2009	644	420	70	2466	175	354	21220	22	
2005	741	241	83	1367	2397	184	993	1270	6989	489	143	355	206	343		135	2285	795	458	76	2432	194	380	22555	22	
2006	818	266	76	1396	2412	195	1087	1259	7468	444	130	384	205	381		165	2444	911	496	86	2515	191	367	23694	22	
2007	847	251	76	1362	2369	226	1126	1247	7057	572	135	370	238	428		169	2570	1027	505	79	2544	183	336	23715	22	
2008	976	294	79	1485	2423	312	1242	1432	8404	574	79	433	317	516		203	2674	979	564	97	2630	227	414	26356	22	
2009	1026	320	91	1433	2612	324	1494	1437	7782	536	73	461	333	653	503	214	2410	862	618	94	2486	219	623	26603	23	
2010	1241	331	94	1518	3302	350	1605	1520	8634	497	81		354	645		341	2882	918	668	117	3306	254	618	29275	21	
2011	1224	386	94	1543	3021	334	1660	1435	8516	493	113		308	679	404	315	2643	1063	632	123	3382	187	657	29210	22	
2012	1401	407	94	1643	3302	409	1873	1583	9156	539	113		361	806		313	2861	1055	722	132	4087	216	771	31847	21	
2013	1510	352	123	1671	3100	390	1858	1676	9239	491	123		325	692	506	346	3019	1026	715	128	3792	203	730	32016	22	
	28	17	15	21	34	18	34	34	34	24	34	11	18	21	25	31	19	16	21	22	34	34	15	560	560	

Annual turnover
according to
Eurostat SBS,
MEUR during 2013

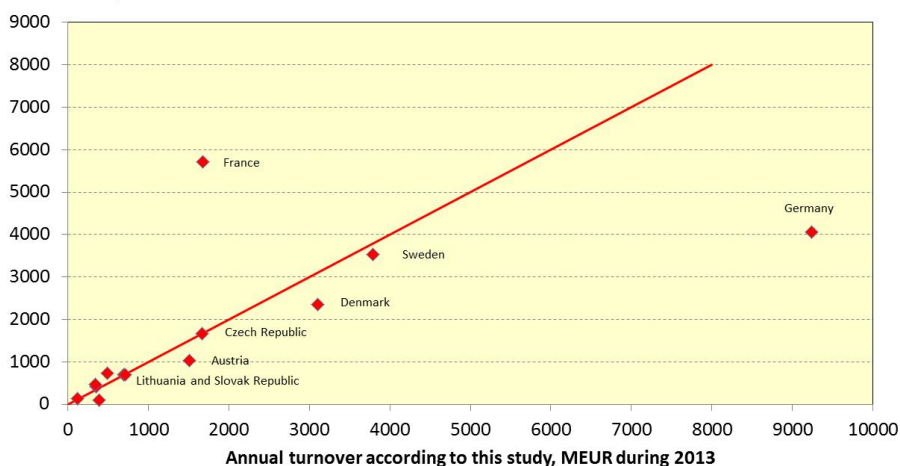


Figure 7. Correlation between national district heating turnover for heat enterprises in the Eurostat structural enterprise statistics (SBS) and the national revenues estimated for national district heating sectors in this study. The red line corresponds to the equality line.

5.3 DISTRICT HEATING DELIVERIES

Each national annual heat delivery is presented in Table 5. These heat deliveries have been used together with the annual revenues in Table 4 in order to obtain the national average district heating prices in Table 3.

Table 5. Development of European district heating deliveries 1980-2013 in PJ per year.

PJ	Countries																									
Year	Austria	Bulgaria	Croatia	Czech Republic	Denmark	Estonia	Finland	France	Germany	Hungary	Iceland	Italy	Latvia	Lithuania	Netherlands	Norway	Poland	Romania	Slovak Republic	Slovenia	Sweden	Switzerland	United Kingdom	All countries with revenues		
1980	14	79			59	69	47	68	157	81	12	2	87		5		754	197	19		100	8		451	17	
1981	14	59			58		51	65	155	73	13	2			5		703	200	19		102	8		458	15	
1982	17	59			59		54	71	158	78	13	3			6		699	200	19		102	8		472	15	
1983	17	72			61		58	76	160	77	14	3			7	1	714	200	20		103	9		488	16	
1984	18	67			63		63	73	170	82	14	3			8	1	739	200	21		108	9		509	16	
1985	20	60			73	79	78	81	175	85	15	3			9	1	771	214	23		134	9		576	17	
1986	21	63			75	80	76	83	180	85	16	4			9	2	754	228	23		132	10		604	17	
1987	22	83			79	81	85	86	191	86	16	4			10	3	753	238	25		142	11		646	17	
1988	23	61			76	81	80	78	197	83	17	5			9	3	717	263	25		130	11		623	17	
1989	24	190			73	85	75	80	167	71	17	5			9	3	687	270	25		120	11		579	17	
1990	26	190	12		74	90	80	81	383	84	18	6	84	87	10	3	651	258	27	8	123	10		893	21	
1991	30	150	11	282	84	89	85	92	378	75	18	7	81	92	12	4	647	202	28	9	136	12		926	22	
1992	29	125	10	280	84	61	85	90	356	73	19	7	65	70	12	4	607	372	28	8	135	12		908	22	
1993	33	115	10	278	89	46	89	89	355	71	20	8	46	51	13	4	532	361	27	8	145	11		1283	22	
1994	32	109	9	228	90	42	91	87	349	72	20	8	41	55	12	4	498	224	25	8	146	11		1230	22	
1995	36	117	10	206	94	31	89	85	366	73	19	9	39	50	13	4	369	196	30	8	148	12		1603	22	
1996	45	122	11	184	104	33	96	86	344	68	18	9	39	46	18	5	390	235	35	8	163	12		1697	22	
1997	40	48	10	163	98	33	95	87	309	66	19	10	38	45	18	5	362	204	31	8	151	13		1629	22	
1998	42	45	10	142	101	29	99	86	311	62	19	12	34	43	19	5	338	210	33	8	158	13		1796	22	
1999	43	40	10	146	98	29	96	84	290	61	19	13	28	38	18	5	319	166	27	8	157	13	105	1814	23	
2000	43	37	9	133	95	27	92	84	265	56	20	14	25	35	19	5	288	149	26	8	149	13	105	1696	23	
2001	46	39	10	132	102	27	102	84	268	59	21	16	27	36	20	7	316	138	44	8	167	14	97	1777	23	
2002	45	36	10	121	101	27	106	84	270	56	21	16	27	37	21	7	298	112	43	8	168	14	88	1714	23	
2003	48	38	11	127	104	26	110	86	444	56	20	17	27	39	20	8	309	101	43	8	169	15	75	1880	23	
2004	52	36	10	122	103	27	106	88	462	51	20	18	25	37	21	8	300	92	42	8	172	15	52	1847	23	
2005	54	39	11	114	102	27	105	90	450	50	23	20	25	38	21	8	295	89	40	8	169	15	55	1828	23	
2006	55	38	10	105	101	27	108	85	450	46	24	20	25	40	21	9	295	83	35	8	168	16	52	1800	23	
2007	56	34	9	96	99	26	108	80	427	40	25	21	24	39	21	10	291	75	31	7	169	15	47	1727	23	
2008	62	39	10	94	101	25	105	88	436	38	25	23	22	36	23	11	268	74	30	8	170	15	51	1731	23	
2009	64	39	10	93	103	25	117	86	428	38	25	24	22	37	25	12	267	68	32	8	179	15	50	1769	23	
2010	77	40	10	91	119	26	129	95	472	39	26	28	24	39	25	15	274	69	36	8	206	17	53	1867	23	
2011	73	43	10	88	106	23	112	79	420	36	26	26	21	36	25	13	243	70	32	8	173	16	50	1704	23	
2012	77	41	10	89	109	24	122	84	431	39	27	29	22	38	25	15	248	63	32	8	188	17	51	1737	23	
2013	80	38	10	89	107	23	114	90	435	41	28	33	22	35	26	17	249	59	31	8	187	18	57	1764	23	
	34	34	24	23	34	30	34	34	34	34	34	34	25	24	34	31	34	34	34	24	34	34	15	706	706	

5.4 EUROSTAT HICP

From the Eurostat HICP database, the national annual average price changes between 2000 and 2013 have been obtained for electricity, natural gas, liquid fossil fuels, and heat. These estimations are presented in Table 6 and Figure 8.

Among all analysed countries, both electricity and natural gas deliveries have had somewhat higher price changes than heat. All of these average price changes are higher than the corresponding inflation rates. The cause to these real price changes is mainly that all global energy prices increased in real terms during this period because of higher energy demand, especially in China.

Concerning heat sales, the lowest price changes appeared in Sweden and Denmark during these years, while the highest were found in Estonia, Latvia, and Slovenia.

Table 6. Average annual price changes between 2000 and 2013 for various energy commodities according to the Eurostat HICP estimations.

	Electricity	Gas	Liquid fuels	Heat energy
Austria	2.3%	4.3%	6.1%	3.3%
Bulgaria	6.3%	7.6%	7.0%	7.1%
Czech Republic	5.5%	8.4%	5.1%	5.3%
Denmark	3.2%	2.1%	5.6%	2.5%
Estonia	10.3%	9.4%		9.2%
Finland	5.1%		7.5%	6.0%
France	2.0%	5.6%	5.8%	5.5%
Germany	5.4%	4.5%	5.6%	5.7%
Iceland	5.9%			5.3%
Italy	3.1%	3.9%	4.4%	
Latvia	6.9%	9.6%		8.5%
Lithuania	5.4%	7.9%		6.4%
Netherlands	2.7%	6.8%		
Norway	5.9%		5.0%	3.3%
Poland	6.0%	6.7%	4.5%	4.5%
Slovakia	5.7%	10.9%		7.2%
Slovenia	5.9%	6.9%	8.0%	7.9%
Sweden	5.0%	8.9%	7.0%	2.3%
United Kingdom	6.3%	9.5%	9.0%	
Total average	5.2%	5.9%	4.2%	4.7%

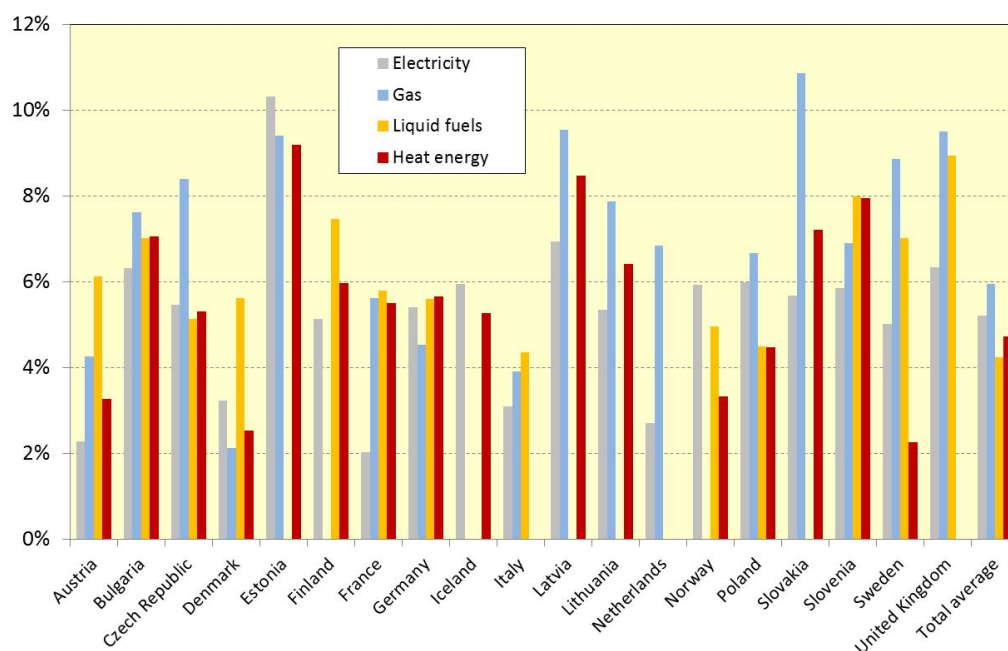


Figure 8. Average annual price changes between 2000 and 2013 for various energy commodities according to Table 6.

The national weights in the Eurostat HICP estimations during 2013 for five different energy commodities (heat, electricity, natural gas, automotive fuels, and liquid & solid fuels) are presented in Figure 9.

In total, the aggregated weights for these five energy products vary between almost 7 percent in Switzerland to 17 percent in Hungary, while the average for the European Union is 11 percent. These proportions correspond to the proportions of the average disposable incomes that are used for buying energy products in each country.

In general, countries with low GDP per capita have high proportions in Figure 9. They have about the same energy prices as richer countries, since energy prices are set on international markets. Hence, the opposite with low proportions is valid for countries with high GDP per capita.

The weights for heat prices vary both with the presence of district heating and the GDP level. The highest weights appear in Slovak Republic, Lithuania, Latvia, and Estonia, which all have high penetration rates for district heating.

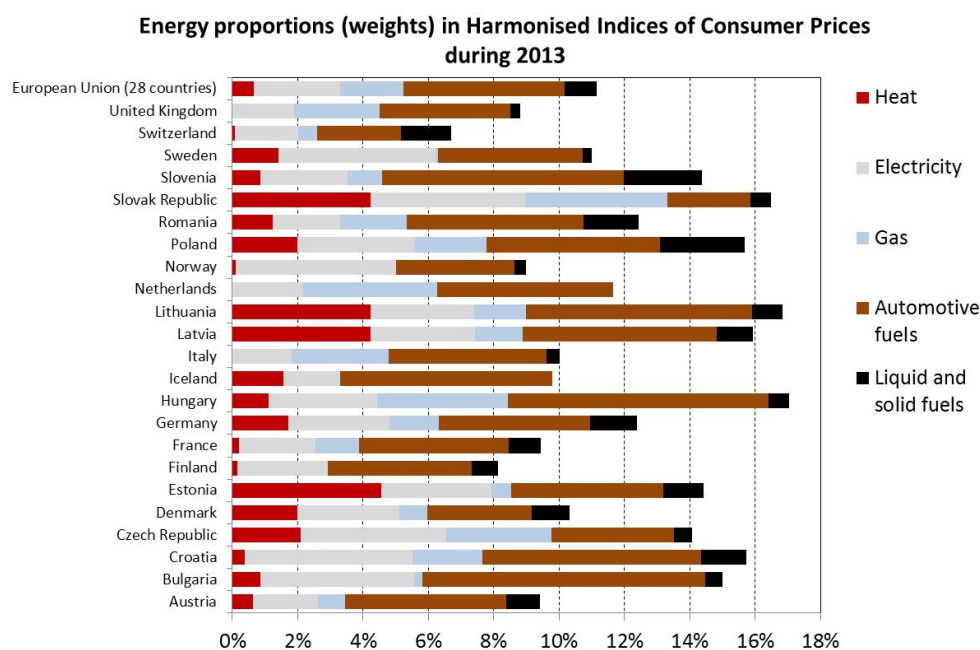


Figure 9. Proportions of energy commodities in the Eurostat Harmonised Indices of Consumer Prices during 2013 for the 23 target countries in this study and EU28.

6 Conclusions

Five main conclusions have been identified concerning European district heating prices:

1. Currently, very little aggregated information is available about district heating prices in various European countries. The purpose with this price collection has been to close this information gap.
2. International energy price analysts have therefore excluded district heating prices from their analyses.
3. Countries with high district heating prices during 2013 were Denmark, Slovak Republic, Germany, Norway, and Sweden.
4. Countries with low district heating prices during 2013 were Iceland, Bulgaria, Switzerland, Hungary, and Poland.
5. Countries with high proportions of district heating costs in the disposable incomes during 2013 were Slovak Republic, Lithuania, Latvia, and Estonia.

Market analyses based on these estimated time series of district heating prices will be published in another publication. Hence, no explanations for different price levels in various countries have been provided in this report.

7 Acknowledgement

This project started in 2000 within the adjunct professorship in District Heating Systems Technology at Chalmers University of Technology. I appreciate the early contributions from two MSc students at Chalmers, Magnus Kammerlind during 2001 and Anders Brodén during 2003, who initially supported me to identify relevant information sources of European district heating prices.

The project was finalised during 2015 and 2016 as one out of five sub-projects within the 'Future Role of District Heating in Europe' project, performed during 2014-2017 at Halmstad University. This research project has been supported by Fjärrsyn, the current Swedish district heating research and development program, financially supported by the Swedish Energy Agency and the Swedish District Heating Association.

8 References

- AGFW. (2014). Fernwärme-Preisübersicht (Stichtag: 01.10.2014). Frankfurt am Main.
- AGFW. (2015). Heizkostenvergleich nach VDI 2067. Munsterrechnung: 15.10.2015. Frankfurt am Main
- Agrell, P. J., & Bogetoft, P. (2005). Economic and environmental efficiency of district heating plants. *Energy Policy*, 33(10), 1351-1362. doi: <http://dx.doi.org/10.1016/j.enpol.2003.12.011>
- Besson, D. (2008). Consommation d'énergie: autant de dépenses en carburants qu'en énergie domestique. INSEE Premiere 1176. Paris
- Björkqvist, O., Idefeldt, J., & Larsson, A. (2010). Risk assessment of new pricing strategies in the district heating market: A case study at Sundsvall Energi AB. *Energy Policy*, 38(5), 2171-2178. doi: <http://dx.doi.org/10.1016/j.enpol.2009.11.064>
- Brodén, A., & Werner, S. (2004). *Prices in European District Heating Systems*. Paper presented at the 9th International Symposium on District Heating and Cooling, Helsinki
- Cherubin, W. (2002). *Present situation and current trends in restructuring the DH sector in Poland and other CEE countries*. Paper presented at the World Energy Council workshop on restructuring and privatizing the district heating/CHP industries in central and eastern Europe, Neptun (Romania).
- Difs, K., & Trygg, L. (2009). Pricing district heating by marginal cost. *Energy Policy*, 37(2), 606-616. doi: <http://dx.doi.org/10.1016/j.enpol.2008.10.003>
- Dommann, D. (1972). Fernwärme-Preiskonditionen verschiedener Versorgungsunternehmen. *Fernwärme International*, 1(3), 73-78.
- ERRA and Fortum. (2011). Benchmarking District Heating in Hungary, Poland, Lithuania, Estonia, and Finland. <http://www.ure.gov.pl/en/communication/news/124,Benchmarking-District-Heating-in-Hungary-Poland-Lithuania-Estonia-and-Finland.html>.
- Euroheat & Power - Fernwärme International. (1997). *Yearbook 1997*. Zürich
- Euroheat & Power. (1999). *District Heat in Europe - 1999 survey*. Brussels
- Euroheat & Power. (2001). *District Heat in Europe - Country by country 2001 survey*. Brussels
- Euroheat & Power. (2003). *District Heating and Cooling - Country by country 2003 survey*. Brussels
- Euroheat & Power. (2005). *District Heating and Cooling - Country by country 2005 survey*. Brussels
- Euroheat & Power. (2007). *District Heating and Cooling - Country by country 2007 survey*. Brussels
- Euroheat & Power. (2009). *District Heating and Cooling - Country by country 2009 survey*. Brussels
- Euroheat & Power. (2011). *District Heating and Cooling - Country by country 2011 survey*. Brussels
- Euroheat & Power. (2013). *District Heating and Cooling - Country by country 2013 survey* Retrieved from <http://www.euroheat.org/Publications-8.aspx?PID=211&M=NewsV2&Action=1&NewsId=557>
- Euroheat & Power. (2015). *District Heating and Cooling - Country by country 2015 survey* Retrieved from <http://www.euroheat.org/Publications-8.aspx?PID=211&M=NewsV2&Action=1&NewsId=557>
- European Commission. (2014a). *Energy Economic Developments in Europe. Staff Working Document SWD(2014) 19*. Brussels.

- European Commission. (2014b). *Energy Prices and Costs in Europe. Communication COM(2014) 21/2*. Brussels
- European Commission. (2014c). *Energy prices and costs report. Staff Working Document SWD(2014) 20*. Brussels.
- European Commission. (2015). *VAT Rates Applied in the Member States of the European Union. Situation at 1st September 2015. Taxud.c.1*. Brussels.
- European Commission. (2016). Weekly Oil Bulletins. from <http://ec.europa.eu/energy/en/statistics/weekly-oil-bulletin>
- European Council. (1990). *Council Directive 90/377/EEC of 29 June 1990 concerning a Community procedure to improve the transparency of gas and electricity prices charged to industrial end-users*. Brussels.
- European Parliament and Council. (2008). *Directive 2008/92/EC of 22 October 2008 concerning a Community procedure to improve the transparency of electricity and gas prices charged to industrial end-users (recast)*. Brussels.
- Eurostat. (2008). *European Price Statistics - An overview*. 2008 edition. Luxembourg
- Eurostat. (2016). Energy price statistics. Statistics explained. from http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_price_statistics
- Frederiksen, S., & Werner, S. (2013). *District Heating and Cooling*. Lund Studentlitteratur.
- IEA. (2005). *Energy Statistics Manual*. International Energy Agency. Paris.
- IEA. (2015). *Energy Prices and Taxes. 4th Quarter 2015*. International Energy Agency. Paris
- IEA. (2016a). *Energy balances for non-OECD countries until 2014*, International Energy Agency. Paris
- IEA. (2016b). *Energy balances for OECD countries until 2014*, International Energy Agency. Paris
- Kilpinen, U. (1985). Development of district heating in Finland during the first twenty years of activity of the Finnish District Heating Association. *Fernwärme International*, 14(6), 269-276.
- Kröhner, P., & Ruppert, K. (1991). Fernwärme-Preisvergleich 1990. *Fernwärme International*, 19(5/6), 306-337.
- Li, H., Sun, Q., Zhang, Q., & Wallin, F. (2015). A review of the pricing mechanisms for district heating systems. *Renewable and Sustainable Energy Reviews*, 42, 56-65. doi: <http://dx.doi.org/10.1016/j.rser.2014.10.003>
- Linden, M., & Peltola-Ojala, P. (2010). The deregulation effects of Finnish electricity markets on district heating prices. *Energy Economics*, 32(5), 1191-1198. doi: <http://dx.doi.org/10.1016/j.eneco.2010.03.002>
- Lygnerud, K., & Peltola-Ojala, P. (2010). Factors impacting district heating companies' decision to provide small house customers with heat. *Applied Energy*, 87(1), 185-190. doi: <http://dx.doi.org/10.1016/j.apenergy.2009.05.007>
- Munksgaard, J., Pade, L.-L., & Frstrup, P. (2005). Efficiency gains in Danish district heating. Is there anything to learn from benchmarking? *Energy Policy*, 33(15), 1986-1997. doi: <http://dx.doi.org/10.1016/j.enpol.2004.03.019>
- Müller, K. (1974). Fernwärme-Preisvergleich 1973. *Fernwärme International*, 3(3), 71-78.
- Mölter, F. (1974). Stand und Entwicklung der Fernwärme in den Mitgliedsländern der Unichal. *Fernwärme International*, 3(1), 3-12.
- Raczka, J. (2001). Explaining the performance of heat plants in Poland. *Energy Economics*, 23, 355-370.
- Seifert, B. (1992). Die Fernwärme-Preisbildung in der Bundesrepublik Deutschland – eine Analyse der Preisentwicklungsmuster und ihrer Bestimmungsfaktoren. *Fernwärme International*, 21(6), 287-300.

- Swedish Energy Markets Inspectorate. (2012). Uppvärmning i Sverige 2012 (Heating in Sweden 2012). Report EI R2012:09. Eskilstuna
- Unichal. (1973). Stand und Entwicklung der Fernwärmeversorgung in den Mitgliedsländern der Unichal. Studiekomitee "Nomenklatur und Statistik".
- Unichal. (1991). *District Heat in Europe - 1991 survey*. Zürich
- Unichal. (1993). *District Heat in Europe - 1993 survey*. Zürich
- Unichal. (1995). *District Heat in Europe - 1995 survey*. Zürich
- Werner, S. (2005). The European Heat Market, WP1 report *IEE Ecoheatcool project*. Brussels
- Zhang, J., Ge, B., & Xu, H. (2013). An equivalent marginal cost-pricing model for the district heating market. *Energy Policy*, 63, 1224-1232. doi: <http://dx.doi.org/10.1016/j.enpol.2013.09.017>
- Åberg, M., Fälting, L., & Forssell, A. (2016). Is Swedish district heating operating on an integrated market? – Differences in pricing, price convergence, and marketing strategy between public and private district heating companies. *Energy Policy*, 90, 222-232. doi: <http://dx.doi.org/10.1016/j.enpol.2015.12.030>
- Åberg, M., Widén, J., & Henning, D. (2012). Sensitivity of district heating system operation to heat demand reductions and electricity price variations: A Swedish example. *Energy*, 41(1), 525-540. doi: <http://dx.doi.org/10.1016/j.energy.2012.02.034>

Annex 1: Austria

Annual heat sales have been obtained from the Austrian energy balances provided by Statistics Austria. These heat sales are available since 1970.

Annual heat sale revenues have been obtained from the products of annual average prices obtained from the EHP biannual statistical reports and consider 2003, 2005, 2007, 2009, 2011, and 2013. Other years between 1986 and 2013 have been estimated by the following price index series.

The Eurostat HICP for COICOP 0455 (heat energy) in Austria are available for 1996-2013. The national EPI-Fernheizung price indices have been identified for 1986-2008.

Overview of national heat sales and revenues for Austria					
1980	no revenues available		1997	40479 TJ, 6852 million ATS	
1981	no revenues available		1998	42213 TJ, 7179 million ATS	
1982	no revenues available		1999	43262 TJ, 7289 million ATS	
1983	no revenues available		2000	42699 TJ, 7295 million ATS	
1984	no revenues available		2001	45655 TJ, 8037 million ATS	
1985	no revenues available		2002	45224 TJ, 580 million EUR	
1986	21171 TJ, 3864 million ATS		2003	48381 TJ, 621 million EUR	
1987	22414 TJ, 3672 million ATS		2004	51724 TJ, 691 million EUR	
1988	22630 TJ, 3647 million ATS		2005	53754 TJ, 741 million EUR	
1989	23605 TJ, 3728 million ATS		2006	55330 TJ, 818 million EUR	
1990	25636 TJ, 4027 million ATS		2007	55650 TJ, 847 million EUR	
1991	30499 TJ, 5040 million ATS		2008	62471 TJ, 976 million EUR	
1992	29380 TJ, 4844 million ATS		2009	64351 TJ, 1026 million EUR	
1993	32911 TJ, 5211 million ATS		2010	77127 TJ, 1241 million EUR	
1994	31885 TJ, 5060 million ATS		2011	72864 TJ, 1224 million EUR	
1995	35515 TJ, 5504 million ATS		2012	77206 TJ, 1401 million EUR	
1996	45030 TJ, 7231 million ATS		2013	79892 TJ, 1510 million EUR	

Annex 2: Bulgaria

Annual heat sales have been obtained from the IEA energy balances (1971-1989) and the Bulgarian National Statistical Institute (1990-2013).

Annual heat sale revenues have been obtained from the products of annual heat sales and national average prices. These prices were obtained from the Bulgarian National Statistical Institute for 1997-2002 and remaining years between 1998 and 2013 were estimated by the Eurostat HICP for heat energy.

The Eurostat HICP for COICOP 0455 (heat energy) in Bulgaria are available for 1997-2013.

Overview of national heat sales and revenues for Bulgaria					
1980	no revenues available		1997	13375 GWh, 208 million BGN	
1981	no revenues available		1998	12363 GWh, 283 million BGN	
1982	no revenues available		1999	11095 GWh, 319 million BGN	
1983	no revenues available		2000	10200 GWh, 307 million BGN	
1984	no revenues available		2001	10862 GWh, 332 million BGN	
1985	no revenues available		2002	10002 GWh, 339 million BGN	
1986	no revenues available		2003	10595 GWh, 390 million BGN	
1987	no revenues available		2004	10072 GWh, 396 million BGN	
1988	no revenues available		2005	10921 GWh, 471 million BGN	
1989	no revenues available		2006	10455 GWh, 520 million BGN	
1990	no revenues available		2007	9478 GWh, 491 million BGN	
1991	no revenues available		2008	10758 GWh, 575 million BGN	
1992	no revenues available		2009	10828 GWh, 625 million BGN	
1993	no revenues available		2010	11142 GWh, 647 million BGN	
1994	no revenues available		2011	12060 GWh, 756 million BGN	
1995	no revenues available		2012	11421 GWh, 796 million BGN	
1996	no revenues available		2013	10537 GWh, 688 million BGN	

Annex 3: Croatia

Annual heat sales have been obtained from the IEA energy balances and are available since 1990. No reliable national source was identified.

Annual heat sale revenues have been obtained from the products of annual heat sales and annual average heat prices from the annual reports of Hrvatska elektroprivreda (HEP) between 1999 and 2013. This provider of district heating has district heating systems in Zagreb, Osijek, Velika, Gorica, Zapresic, Samobor and Sisak.

The Eurostat HICP for COICOP 0455 (heat energy) in Croatia are available for 2005-2013.

Overview of national heat sales and revenues for Croatia					
1980	no revenues available		1997	no revenues available	
1981	no revenues available		1998	no revenues available	
1982	no revenues available		1999	2745 GWh, 435 million HRK	
1983	no revenues available		2000	2477 GWh, 408 million HRK	
1984	no revenues available		2001	2780 GWh, 464 million HRK	
1985	no revenues available		2002	2698 GWh, 528 million HRK	
1986	no revenues available		2003	2952 GWh, 578 million HRK	
1987	no revenues available		2004	2896 GWh, 576 million HRK	
1988	no revenues available		2005	2989 GWh, 615 million HRK	
1989	no revenues available		2006	2663 GWh, 559 million HRK	
1990	no revenues available		2007	2535 GWh, 555 million HRK	
1991	no revenues available		2008	2640 GWh, 570 million HRK	
1992	no revenues available		2009	2652 GWh, 670 million HRK	
1993	no revenues available		2010	2849 GWh, 685 million HRK	
1994	no revenues available		2011	2768 GWh, 698 million HRK	
1995	no revenues available		2012	2663 GWh, 709 million HRK	
1996	no revenues available		2013	2687 GWh, 932 million HRK	

Annex 4: Czech Republic

Annual heat sales have been obtained from the Unichal and EHP biannual statistical reports since 1991. No reliable national source was identified.

Annual heat sale revenues have been obtained from the products of annual heat sales and national average prices obtained for 1991-2013 from the Czech Statistical Office.

The Eurostat HICP for COICOP 0455 (heat energy) in the Czech Republic are available for 2000-2013.

Overview of national heat sales and revenues for Czech Republic							
1980	no revenues available		1997	162905 TJ, 37191 million CZK			
1981	no revenues available		1998	142347 TJ, 39572 million CZK			
1982	no revenues available		1999	145885 TJ, 41709 million CZK			
1983	no revenues available		2000	133208 TJ, 39856 million CZK			
1984	no revenues available		2001	131707 TJ, 41975 million CZK			
1985	no revenues available		2002	120931 TJ, 38565 million CZK			
1986	no revenues available		2003	127392 TJ, 41084 million CZK			
1987	no revenues available		2004	122226 TJ, 40836 million CZK			
1988	no revenues available		2005	113854 TJ, 40726 million CZK			
1989	no revenues available		2006	104739 TJ, 39570 million CZK			
1990	no revenues available		2007	95624 TJ, 37829 million CZK			
1991	281918 TJ, 25542 million CZK		2008	94369 TJ, 37049 million CZK			
1992	279959 TJ, 25952 million CZK		2009	93114 TJ, 37888 million CZK			
1993	278000 TJ, 31581 million CZK		2010	90677 TJ, 38384 million CZK			
1994	227711 TJ, 29876 million CZK		2011	88240 TJ, 37952 million CZK			
1995	205908 TJ, 31710 million CZK		2012	88829 TJ, 41332 million CZK			
1996	184407 TJ, 31331 million CZK		2013	89417 TJ, 43412 million CZK			

Annex 5: Denmark

Annual heat sales have been obtained from the Danish District Heating Association (DDHA, 1959-1974) and Statistics Denmark (1975-2013).

Annual heat sale revenues have been obtained from Statistics Denmark and are available since 1966.

The Eurostat HICP for COICOP 0455 (heat energy) in Denmark are available for 1996-2013.

Overview of national heat sales and revenues for Denmark					
1980	59 PJ, 4006 million DKK	1997	98 PJ, 13548 million DKK		
1981	58 PJ, 4841 million DKK	1998	101 PJ, 14496 million DKK		
1982	59 PJ, 5966 million DKK	1999	98 PJ, 15250 million DKK		
1983	61 PJ, 5918 million DKK	2000	95 PJ, 15607 million DKK		
1984	63 PJ, 6292 million DKK	2001	102 PJ, 16796 million DKK		
1985	73 PJ, 7194 million DKK	2002	101 PJ, 17879 million DKK		
1986	75 PJ, 8299 million DKK	2003	104 PJ, 18180 million DKK		
1987	79 PJ, 9141 million DKK	2004	103 PJ, 18129 million DKK		
1988	76 PJ, 8604 million DKK	2005	102 PJ, 17863 million DKK		
1989	73 PJ, 8797 million DKK	2006	101 PJ, 17995 million DKK		
1990	74 PJ, 8790 million DKK	2007	99 PJ, 17648 million DKK		
1991	84 PJ, 10185 million DKK	2008	101 PJ, 18066 million DKK		
1992	84 PJ, 10816 million DKK	2009	103 PJ, 19453 million DKK		
1993	89 PJ, 10839 million DKK	2010	119 PJ, 24590 million DKK		
1994	90 PJ, 11390 million DKK	2011	106 PJ, 22507 million DKK		
1995	94 PJ, 12545 million DKK	2012	109 PJ, 24582 million DKK		
1996	104 PJ, 13764 million DKK	2013	107 PJ, 23123 million DKK		

Annex 6: Estonia

Annual heat sales have been obtained from the national energy balances from Statistics Estonia and are available since 1985.

Annual heat sale revenues have been obtained from the products of annual heat sales and annual average prices from the annual Estonian Energy publication for 1999-2006. Prices for 1996-1998 and 2007-2013 were estimated by the Eurostat HICP for heat energy.

The Eurostat HICP for COICOP 0455 (heat energy) in Estonia are available for 1996-2013.

Overview of national heat sales and revenues for Estonia							
1980	no revenues available		1997	9054 GWh, 2363 million EEK			
1981	no revenues available		1998	8087 GWh, 2272 million EEK			
1982	no revenues available		1999	7994 GWh, 2350 million EEK			
1983	no revenues available		2000	7383 GWh, 2237 million EEK			
1984	no revenues available		2001	7379 GWh, 2470 million EEK			
1985	no revenues available		2002	7500 GWh, 2590 million EEK			
1986	no revenues available		2003	7112 GWh, 2440 million EEK			
1987	no revenues available		2004	7491 GWh, 2802 million EEK			
1988	no revenues available		2005	7638 GWh, 2880 million EEK			
1989	no revenues available		2006	7497 GWh, 3059 million EEK			
1990	no revenues available		2007	7234 GWh, 3530 million EEK			
1991	no revenues available		2008	6985 GWh, 4876 million EEK			
1992	no revenues available		2009	6868 GWh, 5062 million EEK			
1993	no revenues available		2010	7097 GWh, 5479 million EEK			
1994	no revenues available		2011	6357 GWh, 334 million EUR			
1995	no revenues available		2012	6798 GWh, 409 million EUR			
1996	9204 GWh, 2255 million EEK		2013	6396 GWh, 390 million EUR			

Annex 7: Finland

Annual heat sales have been obtained from the Finnish Energy Industries (FEI) and the previous Finnish District Heating Association (FDHA) and are available since 1960.

Annual heat sale revenues have been obtained from the products of the annual heat sales and the annual average prices obtained from FEI and the previous FDHA. These prices are available since 1967. The early prices from 1967-1983 were presented in (Kilpinen, 1985).

Finland has the best developed district heating statistics in the world, making the Finnish district heating activities highly transparent in both the Finnish and English languages. This district heating statistics is also included in the national energy statistics by Statistics Finland.

The Eurostat HICP for COICOP 0455 (heat energy) in Finland are available for 1996-2013.

Overview of national heat sales and revenues for Finland					
1980	13067 GWh, 1159 million FIM	1997	26400 GWh, 4045 million FIM		
1981	14252 GWh, 1505 million FIM	1998	27520 GWh, 4381 million FIM		
1982	15136 GWh, 1714 million FIM	1999	26759 GWh, 4299 million FIM		
1983	16184 GWh, 2047 million FIM	2000	25489 GWh, 4304 million FIM		
1984	17465 GWh, 2165 million FIM	2001	28299 GWh, 5045 million FIM		
1985	21651 GWh, 2803 million FIM	2002	29469 GWh, 911 million EUR		
1986	20995 GWh, 2244 million FIM	2003	30417 GWh, 941 million EUR		
1987	23606 GWh, 2095 million FIM	2004	29500 GWh, 941 million EUR		
1988	22238 GWh, 2051 million FIM	2005	29300 GWh, 993 million EUR		
1989	20850 GWh, 1962 million FIM	2006	30100 GWh, 1087 million EUR		
1990	22270 GWh, 2309 million FIM	2007	30100 GWh, 1126 million EUR		
1991	23490 GWh, 2597 million FIM	2008	29300 GWh, 1242 million EUR		
1992	23570 GWh, 3095 million FIM	2009	32400 GWh, 1494 million EUR		
1993	24640 GWh, 3821 million FIM	2010	35900 GWh, 1605 million EUR		
1994	25330 GWh, 3718 million FIM	2011	31200 GWh, 1660 million EUR		
1995	24844 GWh, 3558 million FIM	2012	34000 GWh, 1873 million EUR		
1996	26670 GWh, 3836 million FIM	2013	31700 GWh, 1858 million EUR		

Annex 8: France

Annual heat sales have been obtained from Institut national de la statistique et des études économiques (INSEE, based on volume indices for code 0455 in 'Montant de la consommation effective par fonction en France de 1959 à 2006') for 1960-1983 and SNCU statistical reports for 1984-2013. SNCU is the abbreviation for Syndicat National du Chauffage Urbain et de la Climatisation Urbaine that is the national district heating association in France.

Annual heat sale revenues have been obtained from INSEE (heat sales at current prices in EUR for code 0455 in 'Montant de la consommation effective par fonction en France de 1959 à 2006') for 1960-2004 and SNCU for 2005-2013.

The Eurostat HICP for COICOP 0455 (heat energy) in France are available for 1996-2013.

Overview of national heat sales and revenues for France					
1980	18786 GWh, 589 million EUR	1997	24300 GWh, 1025 million EUR		
1981	18003 GWh, 711 million EUR	1998	23809 GWh, 1066 million EUR		
1982	19644 GWh, 786 million EUR	1999	23318 GWh, 1087 million EUR		
1983	21012 GWh, 860 million EUR	2000	23283 GWh, 1109 million EUR		
1984	20314 GWh, 920 million EUR	2001	23248 GWh, 1127 million EUR		
1985	22410 GWh, 1015 million EUR	2002	23212 GWh, 1202 million EUR		
1986	23084 GWh, 915 million EUR	2003	23765 GWh, 1215 million EUR		
1987	23832 GWh, 856 million EUR	2004	24318 GWh, 1270 million EUR		
1988	21623 GWh, 742 million EUR	2005	24870 GWh, 1270 million EUR		
1989	22188 GWh, 754 million EUR	2006	23557 GWh, 1259 million EUR		
1990	22594 GWh, 795 million EUR	2007	22244 GWh, 1247 million EUR		
1991	25525 GWh, 875 million EUR	2008	24430 GWh, 1432 million EUR		
1992	25114 GWh, 901 million EUR	2009	24025 GWh, 1437 million EUR		
1993	24840 GWh, 920 million EUR	2010	26505 GWh, 1520 million EUR		
1994	24157 GWh, 902 million EUR	2011	21807 GWh, 1435 million EUR		
1995	23695 GWh, 942 million EUR	2012	23356 GWh, 1583 million EUR		
1996	23998 GWh, 1024 million EUR	2013	24920 GWh, 1676 million EUR		

Annex 9: Germany

Annual heat sales have been obtained from the annual AGFW statistical reports concerning West Germany 1960-1989 and from AG Energiebilanzen concerning Germany 1990-2013. AGFW is the national district heating association in Germany.

Annual heat sale revenues have been obtained from the products of annual heat sales and typical average prices published annually by AGFW. These prices have been published since 1973 in their previous annual articles about Preisvergleich in Fernwärme International and consider West Germany (Kröhner & Ruppert, 1991; Müller, 1974). Since 1990, the prices for Germany have been published in their annual publication of Preisübersicht (AGFW, 2014).

The Eurostat HICP for COICOP 0455 (heat energy) in Germany are available for 1996-2013.

Overview of national heat sales and revenues for Germany					
1980	157 PJ, 2457 million DEM	1997	309 PJ, 3664 million EUR		
1981	155 PJ, 3088 million DEM	1998	311 PJ, 3603 million EUR		
1982	158 PJ, 3301 million DEM	1999	290 PJ, 3271 million EUR		
1983	160 PJ, 3456 million DEM	2000	265 PJ, 3278 million EUR		
1984	170 PJ, 3728 million DEM	2001	268 PJ, 3703 million EUR		
1985	175 PJ, 3880 million DEM	2002	270 PJ, 3690 million EUR		
1986	180 PJ, 3613 million DEM	2003	444 PJ, 6131 million EUR		
1987	191 PJ, 3655 million DEM	2004	462 PJ, 6489 million EUR		
1988	197 PJ, 3621 million DEM	2005	450 PJ, 6989 million EUR		
1989	167 PJ, 3200 million DEM	2006	450 PJ, 7468 million EUR		
1990	383 PJ, 7548 million DEM	2007	427 PJ, 7057 million EUR		
1991	378 PJ, 4118 million EUR	2008	436 PJ, 8404 million EUR		
1992	356 PJ, 3999 million EUR	2009	428 PJ, 7782 million EUR		
1993	355 PJ, 4018 million EUR	2010	472 PJ, 8634 million EUR		
1994	349 PJ, 3987 million EUR	2011	420 PJ, 8516 million EUR		
1995	366 PJ, 4174 million EUR	2012	431 PJ, 9156 million EUR		
1996	344 PJ, 4031 million EUR	2013	435 PJ, 9239 million EUR		

Annex 10: Hungary

Annual heat sales have been obtained from the IEA energy balances for 1965-1989 and the Hungarian Energy Office for 1990-2013.

Annual heat sale revenues have been obtained from by the product of annual heat sales and annual average heat prices for residential customers obtained from the Hungarian Central Statistical Office for 1990-2006. For the remaining years 2007-2013, the annual average prices were estimated by the Eurostat HICP for heat energy.

The Eurostat HICP for COICOP 0455 (heat energy) in Hungary are available for 2001-2013.

Overview of national heat sales and revenues for Hungary					
1980	no revenues available		1997	66067 TJ, 91974 million HUF	
1981	no revenues available		1998	62256 TJ, 91070 million HUF	
1982	no revenues available		1999	61354 TJ, 103556 million HUF	
1983	no revenues available		2000	56477 TJ, 105057 million HUF	
1984	no revenues available		2001	58649 TJ, 101694 million HUF	
1985	no revenues available		2002	56374 TJ, 130551 million HUF	
1986	no revenues available		2003	56171 TJ, 133934 million HUF	
1987	no revenues available		2004	50564 TJ, 110041 million HUF	
1988	no revenues available		2005	50101 TJ, 121401 million HUF	
1989	no revenues available		2006	46200 TJ, 117246 million HUF	
1990	83514 TJ, 16092 million HUF		2007	40449 TJ, 143694 million HUF	
1991	75349 TJ, 23604 million HUF		2008	37810 TJ, 144474 million HUF	
1992	73375 TJ, 33870 million HUF		2009	37840 TJ, 150160 million HUF	
1993	71400 TJ, 41288 million HUF		2010	39322 TJ, 137018 million HUF	
1994	72403 TJ, 51304 million HUF		2011	36472 TJ, 137663 million HUF	
1995	73405 TJ, 59730 million HUF		2012	38505 TJ, 155920 million HUF	
1996	67618 TJ, 69681 million HUF		2013	41030 TJ, 145810 million HUF	

Annex 11: Iceland

Annual heat sales have been obtained from various historical sources (1944-1979), the Nordic Statistical Yearbooks (1980-1989), the Nordvärme statistics (1990-2004), and the EHP biannual statistical reports (2005-2013).

Annual heat sale revenues have been obtained from the products of annual heat sales and the annual average price for geothermal water from the Reykjavik system. This price has been published by Statistics Iceland since 1971. The heat content of geothermal water was assumed to be 50 kWh/m³.

The Eurostat HICP for COICOP 0455 (heat energy) in Iceland are available for 1996-2013.

Overview of national heat sales and revenues for Iceland					
1980	3230 GWh, 77 million ISK	1997	5190 GWh, 6012 million ISK		
1981	3640 GWh, 162 million ISK	1998	5190 GWh, 6011 million ISK		
1982	3730 GWh, 206 million ISK	1999	5348 GWh, 6194 million ISK		
1983	3870 GWh, 413 million ISK	2000	5658 GWh, 6849 million ISK		
1984	3930 GWh, 943 million ISK	2001	5795 GWh, 7569 million ISK		
1985	4227 GWh, 1268 million ISK	2002	5931 GWh, 9057 million ISK		
1986	4524 GWh, 1810 million ISK	2003	5556 GWh, 8737 million ISK		
1987	4567 GWh, 1955 million ISK	2004	5500 GWh, 9463 million ISK		
1988	4610 GWh, 2489 million ISK	2005	6338 GWh, 11185 million ISK		
1989	4830 GWh, 2927 million ISK	2006	6574 GWh, 11431 million ISK		
1990	5039 GWh, 3971 million ISK	2007	6810 GWh, 11871 million ISK		
1991	5061 GWh, 3988 million ISK	2008	6915 GWh, 11313 million ISK		
1992	5334 GWh, 4822 million ISK	2009	7020 GWh, 12593 million ISK		
1993	5427 GWh, 5655 million ISK	2010	7187 GWh, 13151 million ISK		
1994	5567 GWh, 6004 million ISK	2011	7353 GWh, 18177 million ISK		
1995	5295 GWh, 5710 million ISK	2012	7591 GWh, 18202 million ISK		
1996	5098 GWh, 5498 million ISK	2013	7828 GWh, 19950 million ISK		

Annex 12: Italy

Annual heat sales have been obtained from the Unichal & EHP statistical reports for 1978-1998 and from AIRU, the Italian District Heating Association, for 1999-2013.

Annual heat sale revenues have been obtained from the products of annual heat sales and the annual average district heating price for the owner of the Torino system. These prices were only available for 1999-2009 and were obtained from the annual reports of AEM Torino (1999-2005) and IRIDE (2006-2009). The current owner (IREN) does not publish detailed income statements for district heating, so these average prices cannot be estimated anymore.

The Eurostat HICP for COICOP 0455 (heat energy) is not available for Italy.

Overview of national heat sales and revenues for Italy					
1980	no revenues available		1997	no revenues available	
1981	no revenues available		1998	no revenues available	
1982	no revenues available		1999	3715 GWh, 189 million EUR	
1983	no revenues available		2000	3854 GWh, 215 million EUR	
1984	no revenues available		2001	4323 GWh, 252 million EUR	
1985	no revenues available		2002	4362 GWh, 250 million EUR	
1986	no revenues available		2003	4795 GWh, 290 million EUR	
1987	no revenues available		2004	5097 GWh, 306 million EUR	
1988	no revenues available		2005	5500 GWh, 355 million EUR	
1989	no revenues available		2006	5642 GWh, 384 million EUR	
1990	no revenues available		2007	5697 GWh, 370 million EUR	
1991	no revenues available		2008	6257 GWh, 433 million EUR	
1992	no revenues available		2009	6734 GWh, 461 million EUR	
1993	no revenues available		2010	no revenues available	
1994	no revenues available		2011	no revenues available	
1995	no revenues available		2012	no revenues available	
1996	no revenues available		2013	no revenues available	

Annex 13: Latvia

Annual heat sales have been obtained from the Latvian Central Statistical Bureau (CSB) and are available since 1990.

Annual heat sale revenues have been obtained from the products of annual heat sales and annual average prices obtained or estimated from CSB information. Average prices were available for 1999-2000 and 2006-2013, while national price indices for 1996-2013 were used for estimation of the 1996-1998 and 2001-2005 average prices.

The Eurostat HICP for COICOP 0455 (heat energy) in Latvia are available for 1996-2013.

Overview of national heat sales and revenues for Latvia					
1980	no revenues available		1997	10492 GWh, 184 million LVL	
1981	no revenues available		1998	9522 GWh, 170 million LVL	
1982	no revenues available		1999	7894 GWh, 142 million LVL	
1983	no revenues available		2000	6959 GWh, 131 million LVL	
1984	no revenues available		2001	7472 GWh, 141 million LVL	
1985	no revenues available		2002	7363 GWh, 140 million LVL	
1986	no revenues available		2003	7530 GWh, 146 million LVL	
1987	no revenues available		2004	6922 GWh, 139 million LVL	
1988	no revenues available		2005	7016 GWh, 143 million LVL	
1989	no revenues available		2006	6834 GWh, 143 million LVL	
1990	no revenues available		2007	6604 GWh, 166 million LVL	
1991	no revenues available		2008	6220 GWh, 223 million LVL	
1992	no revenues available		2009	6169 GWh, 235 million LVL	
1993	no revenues available		2010	6687 GWh, 251 million LVL	
1994	no revenues available		2011	5804 GWh, 217 million LVL	
1995	no revenues available		2012	6220 GWh, 252 million LVL	
1996	10885 GWh, 179 million LVL		2013	6027 GWh, 228 million LVL	

Annex 14: Lithuania

Annual heat sales have been obtained from the national heat balance provided by Statistics Lithuania and are available since 1990.

Annual heat sale revenues have been obtained by the products of annual heat sales and annual average prices obtained from the National Commission for Energy Control and Prices (NCC) for 1993-2011. The 2012 and 2013 prices were estimated by the Eurostat HICP for heat energy.

The Eurostat HICP for COICOP 0455 (heat energy) in Lithuania are available for 1996-2013.

Overview of national heat sales and revenues for Lithuania					
1980	no revenues available		1997	12517 GWh, 1117 million LTL	
1981	no revenues available		1998	11814 GWh, 1255 million LTL	
1982	no revenues available		1999	10516 GWh, 1147 million LTL	
1983	no revenues available		2000	9625 GWh, 1074 million LTL	
1984	no revenues available		2001	9896 GWh, 1137 million LTL	
1985	no revenues available		2002	10351 GWh, 1206 million LTL	
1986	no revenues available		2003	10729 GWh, 1235 million LTL	
1987	no revenues available		2004	10416 GWh, 1182 million LTL	
1988	no revenues available		2005	10530 GWh, 1185 million LTL	
1989	no revenues available		2006	10981 GWh, 1314 million LTL	
1990	no revenues available		2007	10702 GWh, 1479 million LTL	
1991	no revenues available		2008	10033 GWh, 1783 million LTL	
1992	no revenues available		2009	10297 GWh, 2254 million LTL	
1993	14297 GWh, 373 million LTL		2010	10719 GWh, 2226 million LTL	
1994	15355 GWh, 493 million LTL		2011	10109 GWh, 2344 million LTL	
1995	13882 GWh, 687 million LTL		2012	10526 GWh, 2784 million LTL	
1996	12829 GWh, 961 million LTL		2013	9860 GWh, 2388 million LTL	

Annex 15: Netherlands

Annual heat sales have been obtained from the Unichal and EHP biannual statistical reports, since no reliable statistical source has been identified. These annual heat sales are available since 1978.

Annual heat sale revenues have been obtained from the products of annual heat sales and national average prices from Unichal and EHP biannual statistical reports.

The Eurostat HICP for COICOP 0455 (heat energy) is not available for Netherlands. Neither has a national price index been identified. Hereby, revenues for years with missing price information have not been able to estimate.

Overview of national heat sales and revenues for Netherlands					
1980	no revenues available		1997	17730 TJ, 375 million NLG	
1981	5400 TJ, 95 million NLG		1998	19147 TJ, 389 million NLG	
1982	5770 TJ, 122 million NLG		1999	18400 TJ, 361 million NLG	
1983	6700 TJ, 145 million NLG		2000	18850 TJ, 429 million NLG	
1984	7500 TJ, 177 million NLG		2001	19654 TJ, 444 million NLG	
1985	8600 TJ, 212 million NLG		2002	20614 TJ, 213 million EUR	
1986	9035 TJ, 202 million NLG		2003	no revenues available	
1987	9650 TJ, 165 million NLG		2004	no revenues available	
1988	8910 TJ, 155 million NLG		2005	no revenues available	
1989	9326 TJ, 165 million NLG		2006	no revenues available	
1990	9865 TJ, 194 million NLG		2007	no revenues available	
1991	11693 TJ, 239 million NLG		2008	no revenues available	
1992	12057 TJ, 234 million NLG		2009	25300 TJ, 503 million EUR	
1993	12600 TJ, 236 million NLG		2010	no revenues available	
1994	12100 TJ, 231 million NLG		2011	24500 TJ, 404 million EUR	
1995	12930 TJ, 243 million NLG		2012	no revenues available	
1996	17820 TJ, 360 million NLG		2013	26100 TJ, 506 million EUR	

Annex 16: Norway

Annual heat sales have been obtained from Statistics Norway and are available since 1983.

Annual heat sale revenues have been obtained from Statistics Norway and are available since 1983.

The Eurostat HICP for COICOP 0455 (heat energy) in Norway are available for 1996-2013.

Overview of national heat sales and revenues for Norway					
1980	no revenues available		1997	1282 GWh, 365 million NOK	
1981	no revenues available		1998	1377 GWh, 362 million NOK	
1982	no revenues available		1999	1508 GWh, 421 million NOK	
1983	193 GWh, 41 million NOK		2000	1457 GWh, 445 million NOK	
1984	257 GWh, 55 million NOK		2001	1815 GWh, 681 million NOK	
1985	409 GWh, 90 million NOK		2002	1932 GWh, 732 million NOK	
1986	568 GWh, 105 million NOK		2003	2144 GWh, 896 million NOK	
1987	748 GWh, 115 million NOK		2004	2319 GWh, 957 million NOK	
1988	813 GWh, 128 million NOK		2005	2350 GWh, 1080 million NOK	
1989	802 GWh, 148 million NOK		2006	2495 GWh, 1327 million NOK	
1990	836 GWh, 179 million NOK		2007	2758 GWh, 1351 million NOK	
1991	978 GWh, 248 million NOK		2008	2917 GWh, 1673 million NOK	
1992	1030 GWh, 258 million NOK		2009	3293 GWh, 1864 million NOK	
1993	1079 GWh, 272 million NOK		2010	4300 GWh, 2728 million NOK	
1994	1131 GWh, 292 million NOK		2011	3730 GWh, 2455 million NOK	
1995	1186 GWh, 312 million NOK		2012	4222 GWh, 2343 million NOK	
1996	1298 GWh, 359 million NOK		2013	4701 GWh, 2699 million NOK	

Annex 17: Poland

Annual heat sales have been obtained from the IEA energy balances and are available since 1960. No set of national long term heat balances was identified at the Polish Central Statistical office.

Annual heat sale revenues have been obtained from the products of annual heat sales and annual average prices. These prices have been obtained from the EHP statistical reports for 1995, 1997, 1999, 2002, 2005, 2009, 2011, and 2013. Remaining years between 1995 and 2013 have been estimated by the Eurostat HICP for heat energy.

The Eurostat HICP for COICOP 0455 (heat energy) in Poland are available for 1996-2013.

Overview of national heat sales and revenues for Poland					
1980	no revenues available		1997	362 PJ, 4996 million PLN	
1981	no revenues available		1998	338 PJ, 6816 million PLN	
1982	no revenues available		1999	319 PJ, 6927 million PLN	
1983	no revenues available		2000	288 PJ, 6681 million PLN	
1984	no revenues available		2001	316 PJ, 8126 million PLN	
1985	no revenues available		2002	298 PJ, 8371 million PLN	
1986	no revenues available		2003	309 PJ, 9133 million PLN	
1987	no revenues available		2004	300 PJ, 9096 million PLN	
1988	no revenues available		2005	295 PJ, 9191 million PLN	
1989	no revenues available		2006	295 PJ, 9520 million PLN	
1990	no revenues available		2007	291 PJ, 9723 million PLN	
1991	no revenues available		2008	268 PJ, 9392 million PLN	
1992	no revenues available		2009	267 PJ, 10428 million PLN	
1993	no revenues available		2010	274 PJ, 11513 million PLN	
1994	no revenues available		2011	243 PJ, 10891 million PLN	
1995	369 PJ, 3215 million PLN		2012	248 PJ, 11974 million PLN	
1996	390 PJ, 3506 million PLN		2013	249 PJ, 12673 million PLN	

Annex 18: Romania

Annual heat sales have been obtained from the IEA energy balances and are available since 1971. No set of national long term heat balances was identified at the Romanian National Institute of Statistics (NIS).

Annual heat sale revenues have been obtained from the products of annual heat sales and annual average prices. These prices were obtained from the 2005 annual report from the Romanian Energy Regulatory Authority (ANRE) for 1998-2005. The remaining prices for 2006-2013 were estimated by using the national NIS price indices for heat energy.

The Eurostat HICP for COICOP 0455 (heat energy) in Romania are available for 2001-2013.

Overview of national heat sales and revenues for Romania					
1980	no revenues available		1997	no revenues available	
1981	no revenues available		1998	209844 TJ, 609 million RON	
1982	no revenues available		1999	165724 TJ, 779 million RON	
1983	no revenues available		2000	149398 TJ, 1419 million RON	
1984	no revenues available		2001	137719 TJ, 1832 million RON	
1985	no revenues available		2002	111557 TJ, 2398 million RON	
1986	no revenues available		2003	101259 TJ, 2815 million RON	
1987	no revenues available		2004	91506 TJ, 2608 million RON	
1988	no revenues available		2005	89371 TJ, 2878 million RON	
1989	no revenues available		2006	83427 TJ, 3212 million RON	
1990	no revenues available		2007	75264 TJ, 3425 million RON	
1991	no revenues available		2008	74469 TJ, 3604 million RON	
1992	no revenues available		2009	68441 TJ, 3655 million RON	
1993	no revenues available		2010	69027 TJ, 3866 million RON	
1994	no revenues available		2011	69529 TJ, 4506 million RON	
1995	no revenues available		2012	62916 TJ, 4706 million RON	
1996	no revenues available		2013	59190 TJ, 4534 million RON	

Annex 19: Slovak Republic

Annual heat sales have been obtained from the IEA energy balances for 1993-2000 and 2013, while the Statistical Office of the Slovak Republic (SOSR) was the source for 2001-2012.

Annual heat sale revenues have been obtained from the products of annual heat sales and the national average prices identified in the annual reports from the Slovakian Regulatory Office for Network Industries (URSO). These prices were available between 1993 and 2013.

The Eurostat HICP for COICOP 0455 (heat energy) in the Slovak Republic are available for 1996-2013.

Overview of national heat sales and revenues for Slovak Republic							
1980	no revenues available		1997	30935 TJ, 4486 million SKK			
1981	no revenues available		1998	33028 TJ, 5450 million SKK			
1982	no revenues available		1999	26665 TJ, 6533 million SKK			
1983	no revenues available		2000	25911 TJ, 9069 million SKK			
1984	no revenues available		2001	44303 TJ, 18607 million SKK			
1985	no revenues available		2002	42804 TJ, 19262 million SKK			
1986	no revenues available		2003	42998 TJ, 17113 million SKK			
1987	no revenues available		2004	42083 TJ, 16791 million SKK			
1988	no revenues available		2005	39883 TJ, 17668 million SKK			
1989	no revenues available		2006	34786 TJ, 18471 million SKK			
1990	no revenues available		2007	31152 TJ, 17040 million SKK			
1991	no revenues available		2008	29958 TJ, 17645 million SKK			
1992	no revenues available		2009	32210 TJ, 618 million EUR			
1993	26874 TJ, 3225 million SKK		2010	35897 TJ, 668 million EUR			
1994	24949 TJ, 3243 million SKK		2011	32404 TJ, 632 million EUR			
1995	30223 TJ, 4231 million SKK		2012	32220 TJ, 722 million EUR			
1996	35246 TJ, 4934 million SKK		2013	31102 TJ, 715 million EUR			

Annex 20: Slovenia

Annual heat sales have been obtained from the IEA energy balances for 1990-1995 and the Statistical Office of the Republic of Slovenia (SORS) for 1995-2013.

Annual heat sale revenues have been obtained from the products of annual heat sales and the annual average price from the SORS between 1990 and 2000. The prices for later years have been estimated by the national price index for heat energy from SORS.

The Eurostat HICP for COICOP 0455 (heat energy) in Slovenia are available for 2000-2013.

Overview of national heat sales and revenues for Slovenia					
1980	no revenues available		1997	7972 TJ, 8430 million SIT	
1981	no revenues available		1998	8098 TJ, 8964 million SIT	
1982	no revenues available		1999	8149 TJ, 9518 million SIT	
1983	no revenues available		2000	8181 TJ, 12610 million SIT	
1984	no revenues available		2001	8258 TJ, 17668 million SIT	
1985	no revenues available		2002	7735 TJ, 16367 million SIT	
1986	no revenues available		2003	7965 TJ, 16820 million SIT	
1987	no revenues available		2004	8246 TJ, 16664 million SIT	
1988	no revenues available		2005	8268 TJ, 18279 million SIT	
1989	no revenues available		2006	8017 TJ, 20578 million SIT	
1990	8034 TJ, 650 million SIT		2007	7179 TJ, 79 million EUR	
1991	8759 TJ, 1331 million SIT		2008	7812 TJ, 97 million EUR	
1992	7917 TJ, 4580 million SIT		2009	7613 TJ, 94 million EUR	
1993	8070 TJ, 6123 million SIT		2010	8119 TJ, 117 million EUR	
1994	7922 TJ, 6608 million SIT		2011	8042 TJ, 123 million EUR	
1995	8097 TJ, 7366 million SIT		2012	7719 TJ, 132 million EUR	
1996	8191 TJ, 7529 million SIT		2013	7744 TJ, 128 million EUR	

Annex 21: Sweden

Annual heat sales have been obtained from the Swedish District Heating Association (SDHA, 1950-1968) and Statistics Sweden (1969-2013).

Annual heat sale revenues have been obtained from Statistics Sweden since 1969. Some overestimation is likely for 2011-2013, since annual revenues to final customers are estimated by the difference between all heat sale transactions and the heat sales between district heating companies, and the latter seems to be underestimated.

The Eurostat HICP for COICOP 0455 (heat energy) in Sweden are available for 1996-2013.

Overview of national heat sales and revenues for Sweden					
1980	27821 GWh, 4017 million SEK	1997	41876 GWh, 15484 million SEK		
1981	28383 GWh, 5224 million SEK	1998	43766 GWh, 16302 million SEK		
1982	28334 GWh, 6219 million SEK	1999	43727 GWh, 16424 million SEK		
1983	28638 GWh, 6968 million SEK	2000	41288 GWh, 16404 million SEK		
1984	29898 GWh, 7668 million SEK	2001	46369 GWh, 18900 million SEK		
1985	37341 GWh, 9273 million SEK	2002	46663 GWh, 19800 million SEK		
1986	36630 GWh, 8890 million SEK	2003	46935 GWh, 21300 million SEK		
1987	39316 GWh, 9460 million SEK	2004	47843 GWh, 22500 million SEK		
1988	36147 GWh, 9332 million SEK	2005	46998 GWh, 22575 million SEK		
1989	33252 GWh, 9156 million SEK	2006	46772 GWh, 23276 million SEK		
1990	34288 GWh, 10139 million SEK	2007	46885 GWh, 23536 million SEK		
1991	37895 GWh, 12629 million SEK	2008	47304 GWh, 25292 million SEK		
1992	37503 GWh, 13071 million SEK	2009	49761 GWh, 26400 million SEK		
1993	40156 GWh, 13631 million SEK	2010	57278 GWh, 31529 million SEK		
1994	40475 GWh, 13817 million SEK	2011	48063 GWh, 30543 million SEK		
1995	41171 GWh, 14534 million SEK	2012	52324 GWh, 35574 million SEK		
1996	45413 GWh, 15946 million SEK	2013	51824 GWh, 32804 million SEK		

Annex 22: Switzerland

Annual heat sales have been obtained from the Gesamtenergiestatistik published by the Bundesamt für Energie and are available since 1978.

Annual heat sale revenues have also been obtained from the Gesamtenergiestatistik and are available since 1980.

The Eurostat HICP for COICOP 0455 (heat energy) in Switzerland are available for 2005-2013.

Overview of national heat sales and revenues for Switzerland					
1980	7920 TJ, 150 million CHF	1997	12980 TJ, 180 million CHF		
1981	8320 TJ, 170 million CHF	1998	13250 TJ, 190 million CHF		
1982	8430 TJ, 180 million CHF	1999	13210 TJ, 220 million CHF		
1983	8610 TJ, 200 million CHF	2000	13180 TJ, 220 million CHF		
1984	9210 TJ, 200 million CHF	2001	13900 TJ, 250 million CHF		
1985	9430 TJ, 210 million CHF	2002	14020 TJ, 250 million CHF		
1986	9860 TJ, 200 million CHF	2003	14590 TJ, 270 million CHF		
1987	11250 TJ, 170 million CHF	2004	14770 TJ, 270 million CHF		
1988	10720 TJ, 140 million CHF	2005	15240 TJ, 300 million CHF		
1989	10780 TJ, 160 million CHF	2006	15720 TJ, 300 million CHF		
1990	10420 TJ, 180 million CHF	2007	14670 TJ, 300 million CHF		
1991	12090 TJ, 190 million CHF	2008	15470 TJ, 360 million CHF		
1992	11970 TJ, 190 million CHF	2009	15320 TJ, 330 million CHF		
1993	11310 TJ, 160 million CHF	2010	17240 TJ, 350 million CHF		
1994	11280 TJ, 150 million CHF	2011	15860 TJ, 230 million CHF		
1995	11970 TJ, 150 million CHF	2012	16880 TJ, 260 million CHF		
1996	12480 TJ, 170 million CHF	2013	17890 TJ, 250 million CHF		

Annex 23: United Kingdom

Annual heat sales have been obtained from the Digest of UK Energy Statistics (DUKES) from the Department of Energy & Climate Change and are available since 1999.

Annual heat sale revenues have been obtained from DUKES and are also available since 1999.

The Eurostat HICP for COICOP 0455 (heat energy) is not available for United Kingdom.

Overview of national heat sales and revenues for United Kingdom					
1980	no revenues available		1997	no revenues available	
1981	no revenues available		1998	no revenues available	
1982	no revenues available		1999	2498 ktoe, 435 million GBP	
1983	no revenues available		2000	2515 ktoe, 440 million GBP	
1984	no revenues available		2001	2327 ktoe, 405 million GBP	
1985	no revenues available		2002	2101 ktoe, 405 million GBP	
1986	no revenues available		2003	1794 ktoe, 345 million GBP	
1987	no revenues available		2004	1247 ktoe, 240 million GBP	
1988	no revenues available		2005	1309 ktoe, 260 million GBP	
1989	no revenues available		2006	1245 ktoe, 250 million GBP	
1990	no revenues available		2007	1128 ktoe, 230 million GBP	
1991	no revenues available		2008	1209 ktoe, 330 million GBP	
1992	no revenues available		2009	1206 ktoe, 555 million GBP	
1993	no revenues available		2010	1266 ktoe, 530 million GBP	
1994	no revenues available		2011	1206 ktoe, 570 million GBP	
1995	no revenues available		2012	1226 ktoe, 625 million GBP	
1996	no revenues available		2013	1372 ktoe, 620 million GBP	

EUROPEAN DISTRICT HEATING PRICE SERIES

Här redovisas tidsserier av nationella medelvärden av årliga fjärrvärmepriser, nationella intäkter och värmeleveranser för 23 europeiska länder, varav 20 är med i EU. Tidsserierna stäcker sig till och med 2013.

Det har tidigare inte funnits någon reguljär insamling av fjärrvärmepriser från olika länder i Europa. Internationella energiprisanalytiker har därför inte inkluderat fjärrvärmepriser i sina analyser.

De länder som hade höga fjärrvärmepriser under 2013 var Danmark, Slovakien, Tyskland, Norge och Sverige. Länder med låga fjärrvärmepriser samma år var Island, Bulgarien, Schweiz, Ungern och Polen.

Marknadsanalyser och ytterligare slutsatser baserade på de skattade tidsserierna av nationella fjärrvärmepriser kommer att publiceras senare varför inga förklaringar till de olika nivåerna lämnas i den här rapporten.

Another step forward in Swedish energy research

Energiforsk – Swedish Energy Research Centre – an industrially owned body dedicated to meeting the common energy challenges faced by industries, authorities and society. Our vision is to be hub of Swedish energy research and our mission is to make the world of energy smarter! We are actively meeting current energy challenges by developing new ways to store energy, helping to create a fossil free transportation system, establishing new market models for the heat and power sector, developing new materials and regulating the grid. www.energiforsk.se



Energiforsk