Fortum – delivering excellence in district heating and CHP

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Fortum - a listed energy company

- Leading power and heat company in Nordic countries
- Listed at the Helsinki Stock Exchange 1998
- Over 90,000 shareholders
- Among the most traded shares in Helsinki stock exchange
- Market cap ~16 billion Eur

Shareholders 28 February 2010
Power Division consists of Fortum’s power generation, physical operation and trading, operation, maintenance and development of power plants as well as expert services for power producers.

Heat Division consists of combined heat and power generation, district heating activities and business to business heating solutions.

Electricity Solutions and Distribution Division is responsible for Fortum’s electricity sales, solutions and distribution activities. The division consists of three business areas: Distribution, Electricity Sales & Marketing and New Business.

Russia Division consists of power and heat generation and sales in Russia. It includes OAO Fortum and Fortum’s over 25% holding in TGC-1.
Heat is one of core businesses; operations in 8 countries: Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Poland and Russia.

Strategy increasing stakeholder value – customers, society and shareholders

Competitive edges – sustainability in focus, market insights, continuous asset renewal and relationship building

Annual investments ~10% of net assets
Heat Division: Core player in CHP deliveries

- One of four Fortum’s Divisions
- Heat 25 TWh and electricity 5 TWh
- 23 CHP plants and 700 heating plants and stations
- Leading district heat provider in the Nordic countries and the Baltic Rim area
- Concentrates on combined heat and power (CHP), district heating and cooling, and energy outsourcing services to industry
- Competence in multiple fuels
- Core products are district heating, steam and electricity
Heat Division: Large Investment Programme to New CHP’s

Projects finalized in 2009

- Estonia, Tartu: Biofuel and peat fired CHP plant. 25 MWe/52 MWt
- Latvia, Jelgava: Gas engine CHP plant. 4 MWe/5 MWt
- Finland, Suomenoja: Gas fired CHP plant. 234 MWe/214 MWt

Projects under construction

- Poland, Czestochowa: Coal and biofuel fired CHP plant. 64 MWe/120 MWt (ready 2010)
- Estonia, Pärnu: Biofuel and peat fired CHP plant. 24 MWe/45 MWt (ready 2010)

Projects under planning

Värtan bio CHP, Sweden
Järvenpää bio CHP, Finland
Brista waste CHP, Sweden
Wroclaw coal/waste CHP, Poland
Klaipeda waste CHP, Lithuania
Jelgava bio/waste CHP, Latvia
Fundamental idea of modern district heating

- Efficient utilization of local fuel and heat sources that would otherwise be lost or remain unused
- Infrastructure enabling this is well insulated heat networks
- Main sources of heat: combined power and heat production (CHP), industrial process and waste incineration
- Rest sources of heat are based on renewable energy sources (geothermal, biomass) and fossil fuels mainly for peak demand
- DH can utilize a wide variety of local energy sources that are impossible or difficult to handle in individual applications
- DH reduces local pollutants as particle emissions, sulphur dioxide and nitrogen oxides by relocating exhausts to centralized chimneys where, due to economics of scale, more effective pollution prevention measures can be implemented
- Decreasing dependence on and price volatility of imported fossil fuels
- DH enable a highly flexible and renewable energy mix which does not provide any adaptation measures by the customers
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European Summit on Energy

- Open and competitive markets
- Energy infrastructure development
- Energy efficiency and energy from renewable sources
- Research and development
- External dimension of the EU energy markets
Legislation effecting co-generation 2011

♦ CHP Directive
  ♦ Reference values review (Feb 2011)
  ♦ Support mechanisms report
♦ Eco Product Design Directive
  ♦ Implementation measures LOT1 boilers
♦ Energy Efficiency Plan (March 02/03)
♦ Energy Efficiency and Energy Savings Directive
  ♦ Based on ESD and may incorporate CHP legislation
♦ Energy Roadmap 2050
Energy efficiency target -20% by 2020

20% Energy efficiency target for 2020

- Historical consumption (Eurostat)
- Baseline projections for 2020 (Primes 2007)
- 20% Energy saving objective

- Expected achievements**: -166 Mtoe
- 20% objective: 368 Mtoe

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## CHP directive 2011

<table>
<thead>
<tr>
<th>Legislative Status</th>
<th>Legislation in effect. A review of the CHP Reference values is required by February 2011</th>
</tr>
</thead>
</table>
| Main Points Effecting review | • Industry believe that there is no requirement to change the reference values  
• The bio-energy values may be an exception.  
• Commission must report to the parliament on support mechanisms for CHP |
| Current status | • COGEN Europe and other associations involved with CHP are lobbying Commission to extend existing values until at least 2015  
• IRC Petten has been appointed consultant to Commission and will report on reference values at the end of January |
| Comments | • COGEN Europe is encouraging the Commission to develop transparent robust method for establishing ref values |
### SWOT analysis of district heating – EU perspective

#### Strengths
- Sustainable space heating solution
- CHP as energy efficient solution for heat and electricity production
- CHP is efficient small scale electricity production with RES and waste
- Competitive DH prices in most countries
- Best-in-class DH systems in Northern Europe
- High market penetration in Eastern Europe

#### Weaknesses
- Lack of market mechanisms and best-in-class customer orientation
- Regulatory regimes do not attract private investments, financing and efficiency
- Low political awareness of DH/CHP benefits
- Energy policy is still a part of social policy
- Poor efficiency and image of DH systems in Eastern Europe
- Technical knowledge gaps do exist

#### Opportunities
- Contribution to the EU energy policy
- Reaching new customers: low market penetration in Western Europe
- Substantial further CHP potential
- Full utilization of renewable fuels
- Waste incineration as base load heat production
- District cooling and related CHP

#### Threats
- Lack of energy policy that recognizes benefits of DH/CHP - political and regulatory negligence
- Unfair subvention of other heating alternatives e.g. artificially low gas prices for small users
- Decrease of DH demand in smaller municipalities when people are moving into capital areas
- Role of DH remaining as public service obligation
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Balancing interests of DH/CHP stakeholders

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

Customers
“Value added from DH and energy savings”

Industry
“Improved incentives for high performance, investments and sustainability”

Society
“Role of regulators for wanted sustainability and energy efficiency”

- Sustainability as success factor: sourcing of renewable fuels
- Competitive heat prices over time
- Consistent regulatory regimes to allow investment recouping
- Justified economic profits
- Energy efficiency improvements
- Feasibility for co-generation
- Unification of market designs and rules

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

14 February 2011
Policy and stakeholders

- There is a general agreement that CHP and DH can contribute to the sustainability and security objectives of energy policy (through higher fuel efficiency and/or use of alternative fuels)

- However, there does not seem to be consensus about the most appropriate industry structure and regulatory model for delivering the necessary investment

- In many countries, policy-makers continue to rely on not-for-profit models for the delivery of investment (including ownership by municipalities)

- DH associations are sometimes split over the merits of deregulation (privately owned versus municipally owned companies)

- Consumer associations do not seem to be a driving force, but consumers’ interests are often represented in local politics and regulators

How can DH contribute to the achievement of energy policy goals?

- Affordability
- Higher fuel efficiency
- Use of waste and biomass
- Sustainability
- Security
Regulatory development into market based DH pricing

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

**Rate of return - regulation**
- District heating as enduring monopolistic position
- High expectation to realize significant, turn-rounding refurbishment investments
- Political preference to regulate prices
- Efficiency requirements are being implemented

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

**Cost based regulation**
- High expectation to realize significant, turn-rounding refurbishment investments
- Political preference to regulate prices
- Efficiency requirements are being implemented

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

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

Source: Fortum analysis
Example of check-list for regulatory goals in DH

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

Is there a relationship between the form of regulation and the structure of the market?

- In Norway, Finland and Sweden, DH appears subject to a degree of competitive pressure and is regulated using light-touch approaches.

- In Denmark, Estonia and Lithuania, DH appears more 'dominant' and is regulated using cost-plus approaches.

- In Latvia and Poland, DH appears less 'dominant' (lower market share, flexible zoning policies, gas overlap) but is regulated using cost-plus approaches.

Note: Percentage figures in the maps refer to market share of DH in largest city studied.
Pricing of district heating

Where are heat prices likely to be most politically sensitive?

- in absolute terms (€/MWh), district heating (DH) is most expensive in the Nordic countries
- in relative terms (bill/income), DH is most expensive in the Baltic countries and Poland
- high bill/income might also be an obstacle to switching (due to equipment costs)
- within the Nordic countries, DH is most expensive in countries where there is price regulation
- highest growth of DH prices is in the Baltic countries (mainly due to increase in gas prices)
- most countries have a dual fee structure except the Baltic countries and Norway (commodity fee only)
**Price-competitiveness of district heating**

**How competitive is district heating?**

- DH is the most competitive source of heating in the markets examined, although the discount to the alternative varies.

- The discount to the alternative is also an indicator of how much could be gained by moving to alternative-based pricing.

- The most competitive alternatives are heat pumps and electricity in Scandinavian countries, and gas in other countries.

- Heat pumps are growing more popular, although their lifelong costs are very uncertain.

- In the Baltic States, the gas price increase has led to an increase in the discount.

**DH discount to estimated ‘all-in’ cost of the alternative**

<table>
<thead>
<tr>
<th>Country</th>
<th>Discount (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>72%</td>
</tr>
<tr>
<td>Poland</td>
<td>49%</td>
</tr>
<tr>
<td>Finland</td>
<td>48%</td>
</tr>
<tr>
<td>Estonia</td>
<td>34%</td>
</tr>
<tr>
<td>Norway</td>
<td>32%</td>
</tr>
<tr>
<td>Russia</td>
<td>23%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>17%</td>
</tr>
<tr>
<td>Latvia</td>
<td>12%</td>
</tr>
<tr>
<td>Sweden</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Alternative technology (most competitive alternative in bold)**

- Denmark: gas, oil, electricity
- Poland: gas, oil, heat pump
- Finland: heat pump, electricity, pellets, oil
- Estonia: gas, electricity, heat pump
- Norway: electricity
- Russia: gas
- Lithuania: gas, heat pump, electricity
- Latvia: gas, heat pump, electricity
- Sweden: heat pump, pellets

**Standardised capital cost assumptions used**

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Equipment Costs (€)</th>
<th>Asset Lives (years)</th>
<th>Discount Rate (%)</th>
<th>Annualised Equipment Costs (€)</th>
<th>Maintenance Costs (€)</th>
<th>Fuel Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>1,074</td>
<td>15</td>
<td>8</td>
<td>126</td>
<td>92</td>
<td>90</td>
</tr>
<tr>
<td>Electricity</td>
<td>1,092</td>
<td>15</td>
<td>8</td>
<td>128</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Heat Pump</td>
<td>11,830</td>
<td>15</td>
<td>8</td>
<td>1,382</td>
<td>92</td>
<td>300</td>
</tr>
</tbody>
</table>

Note: The equipment costs and efficiency factors for electricity, and the equipment costs of heat pumps are taken from information provided by Lithuania. The efficiency of heat pumps is based on information provided at the workshop in December 2010. Equipment and maintenance costs and the efficiency factor for gas heating are taken from the information provided by Latvia. Identical maintenance costs have been assumed for heat pump as for gas; these assumptions have been applied to the Baltic States, Poland and Russia. The equipment costs applied to Finland and Norway are those provided by Finland. The equipment costs provided exclude VAT.
Best practice pricing regimes need further development

<table>
<thead>
<tr>
<th>Alternative based pricing / light-touch regulation</th>
<th>Regulated prices (costs and investments)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rationale</strong></td>
<td><strong>Rationale</strong></td>
</tr>
<tr>
<td>• DH competitive with alternatives over time</td>
<td>• Historical reasoning due to public ownership</td>
</tr>
<tr>
<td>• Fair to customers</td>
<td>• Fear for dominant market power and unjustified pricing</td>
</tr>
<tr>
<td>• Incentivizing productivity improvements and investments</td>
<td>• Public and political control is easy to accept</td>
</tr>
<tr>
<td>• Simple, straight forward and high quality</td>
<td>• Expectation for low prices due to low income level of customers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Development areas</strong></th>
<th><strong>Development areas</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Transparency of pricing and alternatives which may change over time</td>
<td>• Transparency and fairness to all stakeholders</td>
</tr>
<tr>
<td>• Market conditions to enhance competition</td>
<td>• Economical justification and modelling</td>
</tr>
<tr>
<td>• Difficult to accept by politicians who fear that prices may become higher</td>
<td>• How to avoid inefficiency?</td>
</tr>
<tr>
<td></td>
<td>• How to implement systematic incentives for higher performance and quality?</td>
</tr>
<tr>
<td></td>
<td>• Creates room for manipulation and negotiation</td>
</tr>
<tr>
<td></td>
<td>• Rigid to changing business environment (new fuels and investments)</td>
</tr>
</tbody>
</table>

Norway, Netherlands, Sweden, Finland and Czech Republic

Poland, Baltic countries, Russia, Denmark, Hungary, Slovakia, Romania, Bulgaria
Main issues with cost-plus regimes

- **WACC**
  - lack of transparency in estimation
  - lack of relevant market data on financing costs
  - lack of consensus on risk profile of DH

- **RAB**
  - unclear rationale for valuation standard
  - unclear regulatory commitment to the RAB
  - high one-off tariff increases when assets are replaced

- **benchmarking**
  - little effort to capture exogenous factors
  - differential treatment of OPEX/CAPEX

- **incentives**
  - lack of clarity on treatment of under-/overspend
  - lack of clarity on duration of regulatory period
  - lack of clarity on what needs to be delivered in the price control
### Key elements for defining cost of capital (WACC)

**DISTRICT HEATING**

--- WACC example ---

<table>
<thead>
<tr>
<th>Country</th>
<th>Latvia</th>
<th>Lithuania</th>
<th>Poland</th>
<th>Hungary</th>
<th>Czech Rep.</th>
<th>Slovakia</th>
<th>Romania</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Long term risk free interest rate (RFR)</td>
<td>9.24%</td>
<td>9.24%</td>
<td>5.15%</td>
<td>5.15%</td>
<td>5.53%</td>
<td>5.53%</td>
<td>6.87%</td>
</tr>
<tr>
<td>Debt premium</td>
<td>1.0%</td>
<td>2.5%</td>
<td>1.0%</td>
<td>2.5%</td>
<td>1.0%</td>
<td>2.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Country risk premium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-tax cost of debt</td>
<td>10.2%</td>
<td>11.7%</td>
<td>6.2%</td>
<td>7.7%</td>
<td>6.5%</td>
<td>8.0%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Tax rate</td>
<td>15%</td>
<td>15%</td>
<td>20%</td>
<td>20%</td>
<td>19%</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td>After-tax cost of debt</td>
<td>8.7%</td>
<td>10.0%</td>
<td>4.9%</td>
<td>6.1%</td>
<td>5.3%</td>
<td>6.5%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Market risk premium (ERP)</td>
<td>4.0%</td>
<td>6.0%</td>
<td>4.0%</td>
<td>6.0%</td>
<td>4.0%</td>
<td>6.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Asset beta (unlevered), βₐ</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Equity beta (levered), βₑ</td>
<td>1.00</td>
<td>1.67</td>
<td>1.00</td>
<td>1.67</td>
<td>1.00</td>
<td>1.67</td>
<td>1.00</td>
</tr>
<tr>
<td>Non-liquidity premium</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Cost of equity</td>
<td>13.4%</td>
<td>19.4%</td>
<td>9.4%</td>
<td>15.4%</td>
<td>9.7%</td>
<td>15.7%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Gearing, % (equity ratio)</td>
<td>50%</td>
<td>30%</td>
<td>50%</td>
<td>30%</td>
<td>50%</td>
<td>30%</td>
<td>50%</td>
</tr>
<tr>
<td>Pre-tax WACC (nominal)</td>
<td>13.0%</td>
<td>15.1%</td>
<td>8.9%</td>
<td>11.1%</td>
<td>9.3%</td>
<td>11.4%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Inflation</td>
<td>3.3%</td>
<td>3.3%</td>
<td>4.2%</td>
<td>4.2%</td>
<td>4.0%</td>
<td>4.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Pre-tax WACC (real)</td>
<td>9.7%</td>
<td>11.8%</td>
<td>6.7%</td>
<td>6.9%</td>
<td>5.3%</td>
<td>7.4%</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

Notes and comments:

1) Central Bank of Europe: Long-term 10y interest rates. However, economical life-time of DH/CHP investments: production 30-40 years and networks 30-60 years.
2) Average debt premium from utilities. Debt premium is also affected by ownership, profitability and solidity of company. Often higher for small companies.
3) Determined by the relative amount of money that the state has to pay in excess compared to the countries with higher credit rating. Interest rate difference in case of government bonds not available.
4) www.tax-consultants-international.com
5) Nominal ERP is an additional return above the nominal risk-free rate that investors expect to receive for holding the portfolio of risky assets. Source: Frontier Economics: Historical international evidence on the ERP 1900-2002, page 22. Regulatory praxis adapted by most regulators in Europe. Premium above RFR what investors on average expect to earn from stock market for their equity investments (shares).
6) Formula: RA = (1-g) * RF, where g = gearing %. Riskiness of business compared to average beta = 1. In case of debt-free business.
7) Riskiness of business compared to industry average.
8) Premium to equity investor due to non-liquidity of stock markets; specially due to the nature on utility stocks.
9) Gearing = Equity / (Total Equity and Debt). Recommendation is to use targeted equity ratio.
10) REGULATORY WACC => Respectively EBIT.

Sources:
- ERRA Tariff and pricing committee issue paper: Determination of the regulatory asset base, prepared by KEMA. October 2009.
- Estonian Competition Authority Guidelines for determination of Weighted Average Cost of Capital. 2010.