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Agenda

• Towards Solar Economy
  – Efficient and competitive CHP
  – Fortum’s CHP strategy
  – Heat and CHP markets in Europe
  – Fortum’s Heat Divisions targets

• Heat in Russia

• Key takeaways
Transition towards Solar Economy

Traditional energy production
Exhaustible fuels that burden the environment

Advanced energy production
Energy efficient and/or low-emission production

Solar Economy
Solar based production with high overall system efficiency

Infinite fuel resources   Emissions free production

Finite fuel resources   Large CO2 emissions

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Implications of EU climate targets to efficient DHC and CHP

Energy Roadmap 2050 – recitals

• Heating & cooling has the largest share (42 %) on final energy demand (electricity 25 % and transport 33 %)

• Renewable and efficient district heating and cooling (DHC) and combined heat and power (CHP) are vital contributors for Europe’s targets for combating climate change and resource efficiency

• Need to shift energy consumption towards low carbon, and efficiently produced electricity and renewable energy

• Energy policy must focus equally on electricity, transport and heating & cooling

20-20-20 until 2020

- Reduce green house gas emissions with 20%
- Increase usage of renewable energy to 20%
- Increase energy efficiency and energy savings with 20%
Promotion of high-efficient CHP will call for further deployment of regulatory incentives

<table>
<thead>
<tr>
<th>Directive</th>
<th>Description</th>
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<tbody>
<tr>
<td>Energy Efficiency Directive (EE-D 2012)</td>
<td>energy efficiency through promoting efficient district heating and cooling, and high-efficient CHP replacing existing CHP Directive 2004</td>
</tr>
<tr>
<td>Revision of State Aid Rules (ongoing)</td>
<td>setting EU wide pre-conditions for national support mechanisms</td>
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<tr>
<td>Industrial Emissions Directive (IE-D 2011)</td>
<td>boosting refurbishments of outdated CHP assets</td>
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<tr>
<td>Emission Trading Scheme Directive (ETS-D 2009)</td>
<td>preferred market-based climate instrument</td>
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<tr>
<td>Renewable Energy Directive (RES-D 2009)</td>
<td>promoting renewable electricity and high-efficient co-generation</td>
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<td>Energy Taxation Directive (ET-D 2003)</td>
<td>increasing tax burden on fossil fuels</td>
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<tr>
<td>Energy Performance of Buildings Directive (EPB-D 2002)</td>
<td>promoting increased energy efficiency through stricter building regulations</td>
</tr>
</tbody>
</table>
Frequent advantages of high-efficient and renewable CHP

- Efficient use of resources
- Economically viable in small scale: Electricity
- Large global potential
- Fuel flexibility
- Renewable fuels competitive to fossil fuels
- One plant – multiple products
The disadvantage of small scale investments is set off by high fuel efficiency (heat production) and ability to effectively use local renewable fuels.

CHP are small scale electricity production in comparison with traditional thermal condensing plants for electricity production.
High-efficient CHP - primary energy savings up to 30%

District heating and CHP in Europe – EU energy policy encouraging further deployment

DH sales and penetration in heat markets

DH market share ~15% in European heating markets

CHP production and share of gross electricity production

CHP market share ~11% in European electricity markets

Sources: Euroheat & Power, KPMG benchmarking, Fortum analysis.
### Heat market in Europe – key industrial-scale CHP producers

<table>
<thead>
<tr>
<th>Presence</th>
<th>DH/CHP share of revenues</th>
<th>Heat sales TWh</th>
<th>Number of CHP plants</th>
<th>Focus on DH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland Sweden Baltic</td>
<td>&gt; 25%</td>
<td>50,5</td>
<td>30</td>
<td>DH</td>
</tr>
<tr>
<td>Poland Russia</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>France UK Czech Rep. Poland</td>
<td>&gt; 50%</td>
<td>&gt;50 (est.)</td>
<td>14</td>
<td>DH</td>
</tr>
<tr>
<td>Romania Estonia Lithuania</td>
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<td></td>
<td></td>
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<tr>
<td>Poland Hungary</td>
<td>&lt; 10%</td>
<td></td>
<td>10</td>
<td>DH</td>
</tr>
<tr>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany Sweden</td>
<td>&lt; 50%</td>
<td>29,4</td>
<td>54</td>
<td>DH</td>
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<tr>
<td>Netherlands Denmark</td>
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<tr>
<td>France Sweden</td>
<td>&lt; 10%</td>
<td></td>
<td>33</td>
<td>DH</td>
</tr>
<tr>
<td>Germany Belgium Netherlands</td>
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<td>Italy</td>
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<td>Hungary</td>
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<tr>
<td>Germany UK Sweden Finland</td>
<td>&lt; 10%</td>
<td>7,7</td>
<td>40</td>
<td>DH</td>
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<tr>
<td>Poland</td>
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<tr>
<td>Germany Czech Rep. UK</td>
<td>&lt; 10%</td>
<td></td>
<td>22</td>
<td>DH</td>
</tr>
<tr>
<td>Czech Republic</td>
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</tr>
<tr>
<td>Poland</td>
<td>&lt; 50%</td>
<td>4,0 (FC2012)</td>
<td>17</td>
<td>DH</td>
</tr>
<tr>
<td>Spain Portugal</td>
<td>&lt; 50%</td>
<td>&gt;10,6</td>
<td>&gt;22</td>
<td>DH</td>
</tr>
<tr>
<td>Russia</td>
<td>&gt; 50%</td>
<td>11,8</td>
<td>24</td>
<td>DH</td>
</tr>
<tr>
<td>Lithuania</td>
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<tr>
<td>Denmark Norway</td>
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<td></td>
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<tr>
<td>UK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>&gt; 50%</td>
<td>16,6</td>
<td>38</td>
<td>DH</td>
</tr>
<tr>
<td>Lithuania</td>
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* The list is based on the plant list collected by GIA; the data has been partly updated by Fortum.
Heat regulation regimes vary across Europe – transition towards competitive heat markets and pricing

Regime categories

- **DH company sets competitive prices** while authorities monitor pricing based on competition law
  - **Sweden, Finland**, Denmark, Germany, Austria, Belgium, France and UK

- **Alternative-based heat pricing** as main pricing principle to promote DH against other heating solutions
  - **Norway** and Netherlands

- **Heavy-touch ex-ante price control** based on established methodology and approval of autonomous regulator
  - **Estonia, Latvia, Lithuania, Poland**, Czech Republic, Slovakia, Hungary, Bulgaria and Macedonia

- **Heavy-touch ex-ante price control** based on multi-level approval by state, regional and local authorities
  - **Russia**, Romania, Belorussia and Ukraine

*Source: Fortum analysis based on benchmarking selected DH/CHP markets in Europe. KPMG survey 2012,*
Competitive CHP
- hedging and system optimization is critical

Industrial heat customers
Electricity and CO₂ markets
Local heating customers
Alternative space heating solutions

Industry’s own energy alternative
On-site CHP plant
DH networks
Competing alternative heat sources

Fundamentals
National legislation and regulation
Local conditions

Fuel sourcing
Operation & Maintenance
Initial investment

Competitive, market-based pricing mechanisms
Short- or long-term hedging contracts
Regulation when market failures occur (country specific)
Prospect for effective competition
Towards competitive heat markets and pricing

- Effective competition: Fair and effective competition in local heat markets between space heating alternatives and heat producers.
- Competitive pricing: Competitive and value-added DH through alternative-based heat pricing.
- DH system optimization: Clear responsibility and incentive mechanisms for long-term DH system optimization.
- Attractive return allowance: Attractive, risk-adjusted returns on refurbishment of privatized DH assets and on green field CHP investments.
- Incentives for benchmark performance: World-class DHC/CHP operators can earn higher than average returns.

Enhancing market functionality and appropriate regulatory incentives will increase returns in long-run
Long-term system optimization – targeting improved capacity utilization

- Optimizing the cost of peak heat load through heat trading between customers having own capacity and DH operator – Fortum is running a pilot program on “Open DH system” in Stockholm, Sweden
- Improving CHP capacity utilization – Fortum will start industrial scale bio-oil production in Joensuu CHP plant, Finland

Figure. Annual production curve of a DHC system

DH system specific priority order

```
Waste/biomass/coal/gas
Gas/oils
Biomass/coal/gas
Biomass/coal/gas
```

“Open district heating”
Condensing mode and new products i.e. cooling, bio-oils
Long-term potential - competitiveness of energy efficient CHP will increase driven by fuel prices and by need to reduce emissions

- CHP is local, smaller scale production
  - Resource efficiency compensates scale
  - Possibility to use local fuels (bio, waste)
- CHP covers about 10% of world electricity supply with significant growth potential globally
- CO₂ issue will increase CHP’s competitiveness
- EU’s Industrial Emissions Directive to drive new CHP investment potential further
- Synergy opportunities in the growing bio energy and bio fuel markets
- Organic growth potential in emerging markets

Global new CHP potential 1,350 TWhₑ
From 2,000 TWhₑ up to total 3,350 TWhₑ by 2020
Fuel flexibility is critical for long-term system optimization

**Fortum’s European heat production in 2011**

- Coal: 26%
- Biomass fuels: 24%
- Other: 4%
- Peat: 3%
- Waste: 4%
- Oil: 5%
- Natural gas: 22%
- Heat pumps, electricity: 12%

European production: 22.0 TWh
(Production capacity 10,625 MW)

**EU’s sustainability targets are driving energy efficiency and increased utilization of RES and waste for energy production**

- Concerns over security of supply and prices of fossil fuels
- Cost of CO₂ emissions
- Increasing fossil fuel taxation
- Dedicated RES support mechanisms (FIT, certificates, investment grants)
- Bio fuel price development
- More restricted sustainability criteria
- More competitive European wide biomass and waste markets

**Fuel flexibility and sourcing becoming further critical**

- Fuel cost has large share in OPEX
- CHP location and local fuel sourcing, logistics and hedging
- Multi-fuel boiler technology and availability
- O&M excellence
- New CHP concepts
- CHP is a long-term investment

**Technology challenges**

- Validation of new fuels
- Combustion modelling & testing
- On-line combustion monitoring
- Co-firing of coal and bio-fuels
- Boiler materials

Target to increase biomass and waste fuels
CHP strategy calls for continuous asset reshaping

- Divestment on non-core assets – EUR 600 million since 2006
- Investments in new CHP plants:
  - Commissioned CHP’s: Parnu, Tartu, Suomenoja and Częstochowa
  - CHP’s under construction: Brista, Järvenpää, Jelgava, Klaipeda

- Divestment of small-scale heat business:
  - E.ON Finland DH in Espoo and Joensuu
  - Nokia CHP plant
  - Suomenoja CCGT
  - Brista, Järvenpää, Jelgava, Klaipeda

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Heat Division - delivering energy efficient CHP strategy

**Key competence areas**

- Liberalized electricity markets
- Competitive and regulated local heat markets
- Fossil and renewable fuel markets
- Excellence in O&M
- New CHP concepts
- Large investment projects and M&A

**Operating areas**

- Finland, Sweden, Norway, Baltic countries and Poland

**Total sales**

- Heat sales 1,238 MEUR (22.7 TWh)
- Electricity sales 343 MEUR (6.2 TWh)

**Operating profit**

- 380 MEUR

**Net assets**

- 4,177 MEUR

**Production capacity**

- 23 CHP plants

**Employees**

- 2,504 (31.12.2011)

**Strategic aspiration**

- Providing sustainable and price competitive heat for local heat markets against main alternatives and locally produced electricity for electricity markets
  - Profitability to invest into CHP in heat-only based DH systems
- Replacing fossil fuels with biomass and waste-to-energy
- Long-term optimization in own DH networks
- Competitive access to third party DH networks
  - Renewal of outdated CHP assets
  - Targeting improved energy efficiency
  - Efficiently incurred investments
  - Capturing access to and stable returns on capital from DH network operations

Making sustainability profitable. Flexible to continuous changes in business environment.
Current asset portfolio

Own DHC systems and connected CHP plants
- Stockholm DH network and CHPs
- Baerum DH
- Espoo, Joensuu, Keski-Uusimaa and Nokia DH networks and 3 CHPs
- Pärnu and Tartu DH networks and 2 CHPs
- Jelgava DH network and 1 CHP
- Wroclaw, Czestochowa and Plock DH networks and 1 CHP

Recently finalized projects 88 MW_e/165 MW_th
- Estonia, Pärnu: Biofuel and peat fired CHP plant. 24 MW_e/45 MW_th
- Poland, Czestochowa: Coal and biofuel fired CHP plant. 64 MW_e/120 MW_th

Under construction 66 MW_e/150 MW_th
- Sweden, Brista 2: waste 20 MWe / 60 MW_th
- Finland, Järvenpää: bio and peat 23 MW_e / 45 MW_th
- Latvia, Jelgava: bio and peat 23 MWe /45 MWth

Stand-alone CHP plants (long-term contacts)
- Kuusamo, Uimaharju, Kauhtua, Kirkniemi and Naantali
- Swiebodzice, Zabrze and Bytom

Under construction
- Lithuania, Klaipeda: waste 20 MWe / 50 MWth
New CHP+ concepts – Integrated production adding value

Key rationale and potential

- New sustainable business opportunities and better utilization of assets
- Development of integrated technologies to produce upgraded higher value products e.g. traffic fuels or bio-chemicals
- Wider product range; new products in addition to electricity, heat and cooling from one plant
- Better management of fuel portfolio and prices; production of renewable fuels and replacement of fossil fuel oils
- New sustainable solutions to decrease emissions and use of fossil fuels, to improve energy efficiency and to create added value

CHP+ concept: Bio-oil production integrated to CHP-plant in Joensuu

- Investment 20 M€ to a industrial-scale demo plant
- Construction to be completed H1/2012-H2/2013
- Yearly bio-oil production of 50,000 tons equals 210 GWh to replace heavy fuel oil in existing heat boilers
### Short-term priority to improve financial performance

<table>
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<tr>
<th>Category</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales margin improvement</td>
<td>• Maintain electricity and heat revenue schemes&lt;br&gt;• Competitive heat price with appropriate cost pass-through&lt;br&gt;• Mitigate impacts of volatile fossil fuel prices</td>
</tr>
<tr>
<td>Performance excellence</td>
<td>• Monitor OPEX to keep competitiveness&lt;br&gt;• Focus on core activities</td>
</tr>
<tr>
<td>Asset renewal</td>
<td>• CAPEX prioritization&lt;br&gt;• Continue to divest non-core assets</td>
</tr>
<tr>
<td>CHP concepts</td>
<td>• Finalize ongoing CHP projects on planned time and cost schedules</td>
</tr>
</tbody>
</table>
Long-term value creation

<table>
<thead>
<tr>
<th>Category</th>
<th>Actions</th>
</tr>
</thead>
</table>
| RONA improvement                        | • Improve profitability  
• Optimise assets                                                          |
| Sales margin improvement                | • Electricity price hedging  
• Continuous heat profit improvement  
• New products i.e. pyrolysis                                              |
| Performance excellence                  | • Customers and sales  
• Multi-fuel boiler and fuel management                                      |
| Asset renewal / CHP concepts            | • Prioritization of growth options  
• New business models through partnerships, CHP plus concept development  
• Solar thermal business models                                               |
Key takeaways – Energy efficient CHP strategy delivering value

Energy efficient CHP will deliver economical and sustainable benefits
- Small scale electricity production with high energy efficiency and reliability
- Fuel flexibility
- Profitability determined both on local and fundament level

Transition towards more sustainable, competitive and profit-oriented heat business
- Today heat market regimes and DHC system efficiencies vary across Europe
- EU promotion for effective DHC/CHP will translate into national legislation
- Enabling synergy benefits with Russian heat market developments

Heat targets to strengthen its platform for long-term value creation focusing on profitability and prioritizing opening growth options in Europe
- Sustainable solutions i.e. biomass and waste-to-energy becoming more economically attractive when cost of CO₂ increases
- Drive for sustainable and affordable electricity and heat will require significant new investments in Baltic countries and Eastern Europe in next 10 years
An overview of the Russian heat market
The Russian heat market is the largest in the world - 2,100 TWh per year.

- 700 TWh is produced by combined heat and power plants (CHP) and 1,400 TWh is produced by heat only boilers (HOB).
- Russia is well known for large seasonal temperature changes - cold winters, warm summers.
- Heat pricing is currently regulated - set by local authorities within limits set at state level.
Fortum's Russian heat operations

- Heat sales EUR 308 million (LTM)
- Heat production 24.7 TWh
- Heat production capacity 13.4 GW (base load 8 GW, reserve 5.4 GW)
- Natural gas is the main fuel

Note: LTM numbers at the end of Q3/2012, Current heat capacity, Power capacity after completion of the investment programme.
Development of the Russian heat market

• The Federal law on heat came into force from the beginning of 2011
  – To put the law in practice requires the adoption of more than 30 by-laws, most of which have not been adopted
  – Elimination of the cross-subsidies between electricity and heat, and between industrial and residential customers is ongoing
  – Fortum is actively proposing pilot projects (e.g. in Chelyabinsk) to develop heat regulation in order to create incentives for new and more efficient heat production and network investments

• Further development of the heat market is needed
Heat pricing fundamentals has been adopted

- Long-term heat tariff methodologies adopted
- Rules to calculate heat network connection fee
- Methodology for price cap on the level of the heat only boilers (HOB)
- Description of the deregulation procedure which is possible at the local heat markets when certain criteria are met
- Savings from energy efficiency measures are retained in tariffs for 5 years