JYVÄSKYLÄ ENERGY GROUP
Co-firing peat with wood in BFB and CFB plants and means to maximize the portion of wood in the fuel mix

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Finnish – Swedish Flame Days
April 2013
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Electricity, district heating and water

- Jyväskylä Energy Group’s field is production, supply, sale and distribution of electricity, district heating and water and business supporting them
- Personnel 2012 ~250
- Turnover 208 M€ (2012)
- Sales (2012)
  - Electricity 1 257 GWh
  - Electricity distribution 644 GWh
  - District heating 1 013 GWh
  - Invoiced water 7.7 million m³
A year in Jyväskylä Energy

• We produce 1,5 % of electricity in Finland and 1,2 TWh of district heating

• 3,4 TWh (billion kilowatt hours) of fuels: wood/peat 40/60

• Our annual need for fuels is 35 000 tandem trucks – from bumber to bumber that makes a 660 km long queue

• Business with us benefits Finnish business, transport and machinery companies by tens of millions of euros

• The production chain supports ~1000 full time equivalents

• 10–20 MEUR to CO₂ emissions trading

• We pay 5–10 MEUR of fuel taxes
Company ownership structure

City of Jyväskylä
100%

Jyväskylän Energia Oy
100%

JE-Siirto Oy
100%

Jyväskylän Energian-tuotanto Oy
100%

Jyväskylän Voima Oy
79.74%

Subsidiaries

Other holdings

KS-Energia-välitys Oy
44.7%

C-Ella Oy
33.3%

Suomen Hyötytuuli Oy
12.5%
Electricity distribution network

Fingrid’s national grid

Electricity station: electricity is converted to 20,000 volts for the distribution network

JE’s 110 kV high voltage power line

District heating pipe

KELJONLAHTI PRODUCTION PLANT

Electricity station

JE’s electricity network is connected to Fingrid’s national grid

Low voltage cable for households

Substation: electricity is reduced to low voltage

JE’s 110 kV high voltage underground cable

20 kV medium voltage underground cable

Distribution cabinet: Distribution point for low voltage network

JE’s electricity network is connected to Fingrid’s national grid
Rauhalahti production plant

- Fuels
  - peat
  - industrial by-products (sawdust, bark)
  - forest fuels (logging residues, stumps)
  - coal and oil
- BFB boiler fuel power 295 MW
- Electric/ thermal/ steam output 85/ 140/ 65 MW
- Plant efficiency 85%
- Plant availability from the year 1986 has been 99%
- Availability during the year 2012 was 100%
- Year of commissioning 1986
Keljonlahti production plant

- Main fuels peat and wood
- Two operating modes:
  - combined heat and power generation
  - condensate electricity production
- Operating modes can be adjusted continuously
- Plant’s overall efficiency varies annually from 41 to 86 % depending on the operating principle
- Plant availability during year 2012 was 99.1 %
- CFB Boiler fuel power 495 MW
- Electricity output from generator
  - in condensate mode max. 215 MWe
  - in combined heat and power mode production max. 260 MWh, then the electric power output is 163 MWe
Operating diagram of Keljonlahti production plant

KATHTILA
Boiler
495 MW
160 kg/s

164 bar
560°C

TURBIINI
Turbine

2 bar
100°C

100°C
1000 kg/s

KAUKOLÄMPÖ
District heat
0 - 260 MW

VESISTÖ
Waters

90 - 198 MW

KAUKOLÄMMÖN
LÄMMÖNVAIHDIN
Heat exchanger of
district heat

LAUHDUTIN
Condenser

5°C
50°C

5,5 m³/s
12°C

TURVE
Peat
n. 350 MW

PUU
Wood
n. 100 MW

That's Synergy.
Benefits of CHP

• In combined heat and power production the steam needed for the production of district heating is also used to generate electricity.

• CHP production reduces fuel consumption and emissions by 30 % compared to producing the same amount of energy separately.

• CHP production enables to use 90 % of energy contained by the fuel.
Fuel reception in Keljonlahti

1. Stations for side unloading (2)
2. Station for rear unloading
3. Screening stations
4. Reception for bio-fuels and on-site crusher
5. Truck drive-through wash
6. Yard storage
7. Fuel silos (3)
8. Sulfur silo
Reception station for bio fuels

- Finished in spring 2012
- The total cost of the reception hall, on-site crusher, screening station and conveyor belts for the reception station for bio fuels was 8.5 M€.
- The new station improves energy security because it makes possible to receive bigger amounts and different types of bio fuel through several reception lines.
- When the new bio-fuel reception line is working, the other two reception lines are used only for peat.
- Logistics improves because the queueing time for trucks reduces when the trucks use different reception areas. This means that more fuel can be delivered.
Processing of fuels

Fuel comes to reception hall
- peat
- wood based fuels
Automatic sampling

Unusable material is screened from the fuel in screening stations. Bigger pieces are separated and go to the screen crusher.

Fuel burns in the boiler

The fuel is stored in silos and in temporary storages
Station for side unloading
Keljonlahti CFB boiler

- Boiler fuel power: 495 MW
- Manufacturer: Foster Wheeler
- Surface area: 24 m x 8 m and height 42 m
- Superheated steam:
  - 565 Celsius
  - 164 bar(g)
  - 164 kg/s = 590 t/h
- Reheated steam:
  - 565 Celsius
  - 43 bar(g)
  - 142 kg/s = 511 t/h
Turbine and generator

- Turbine:
  - Combined condensate / back pressure turbine
  - Bleed (5 times)

- Generator
Fuel usage 1986 – 2025
Estimated after the year 2012 (red arrow)
Challenges with large portions of wood based fuel

Superheater III and reheater I: possibility for chlorine corrosion

Ekonomiser: possibility for slagging

Superheater IV and reheater II: Inside the sand bed are in a safe place

Heat recovery: possibility for slagging
How to survive with these challenges?

• Best way is to know what you are about to burn in your boiler when you are buying it
  – In this case boiler manufacurer can design the boiler properly and all dimensions, flue gas speeds and temperatures, tube materials etc. are suitable for wood based fuels
  – This means that the boiler is more expensive than peat/coal fired boiler and you might have to use lower steam parameters

• Other means have to be used when wood portion is getting larger in old plants
  – Fuel classification and selection to mixed burning
  – Sulfur injection to furnace
  – Aluminium silicate injection to furnace
  – New tube materials to critical areas and new back pass constructions
  – Research and tests with research companies and universities e.g. with pilot scale boilers
  – Measurements inside the furnace and back pass
Thank You!