

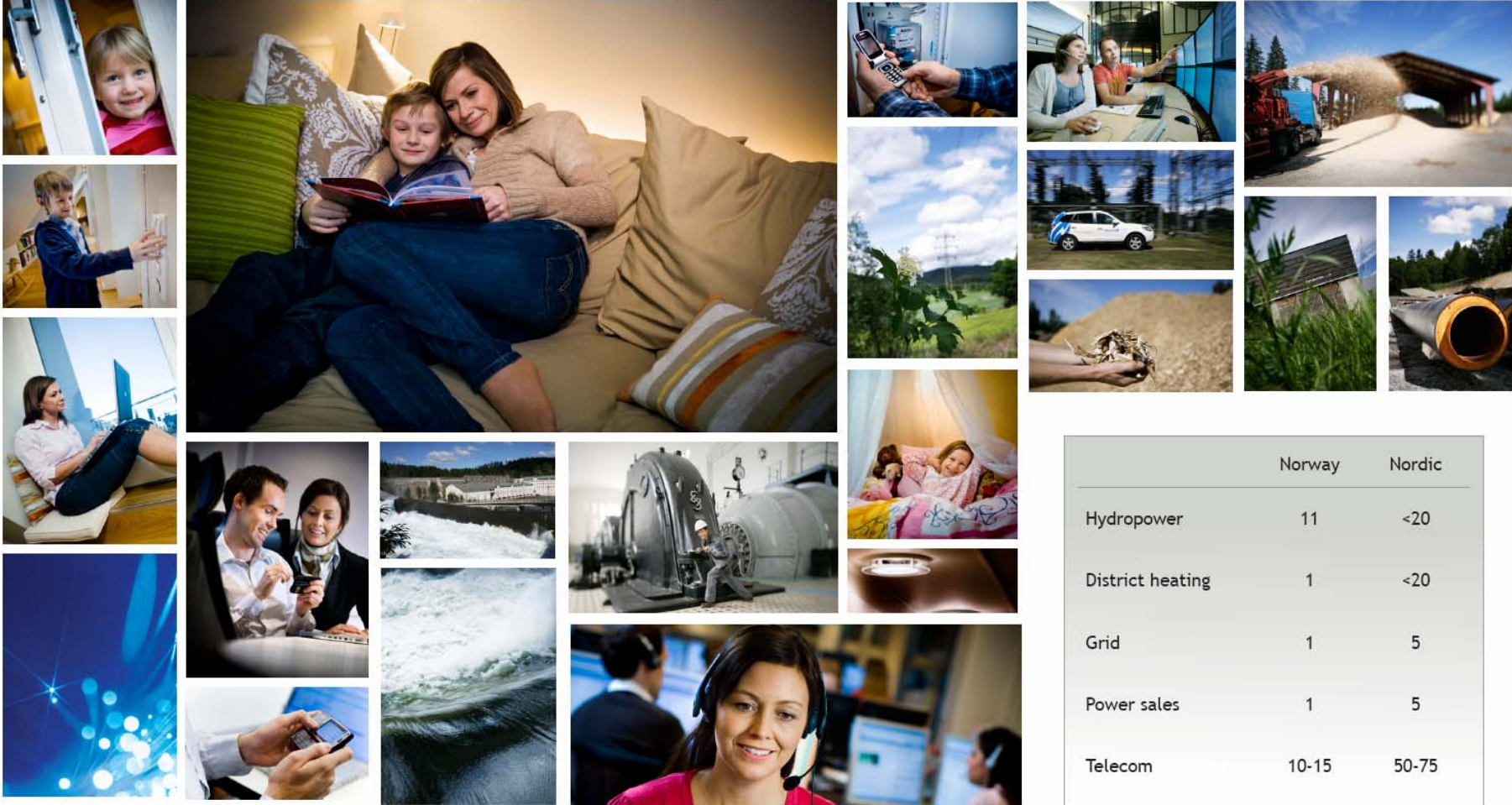
Renewable solid fuels replacing electricity and oil in an existing thermal energy market

By
Arild Dahlberg

VISION

We make
everyday life
safer and
better.

Delivering energy solutions and infrastructure for the future – simply and efficiently



	Norway	Nordic
Hydropower	11	<20
District heating	1	<20
Grid	1	5
Power sales	1	5
Telecom	10-15	50-75

Hafslund – operational structure

Heat and Power



Hydro power
Bio-energy
and heating
Pellets
Gas

District Heating



District heating
production and
distribution

Network



Network
System Control
Centre

Markets



Electricity
Customer
Services
Invoicing

Venture

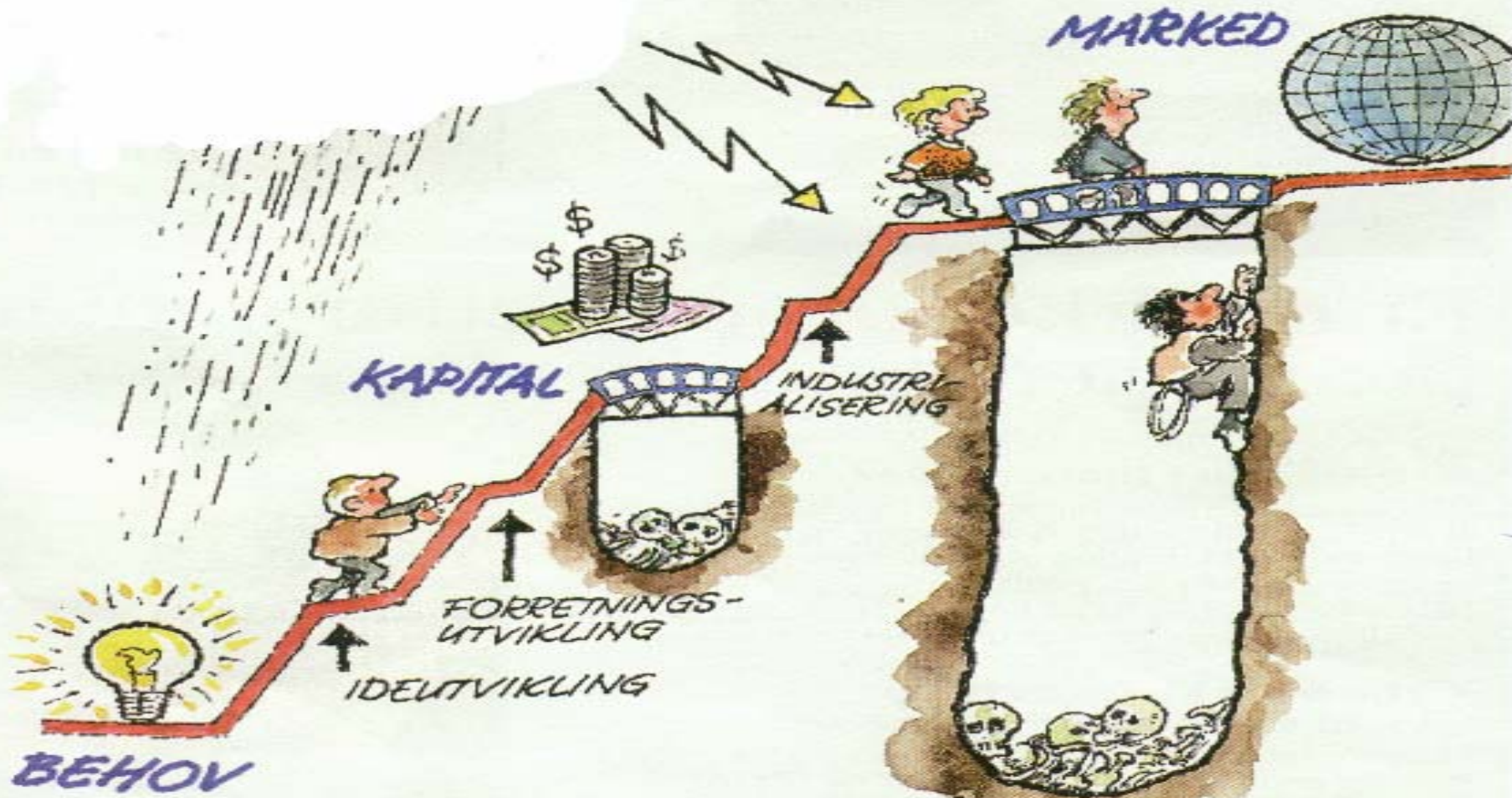


Power
Technology
Environment

From demand to possibilities

A road full of obstacles!

FRA IDÉ TIL MARKED



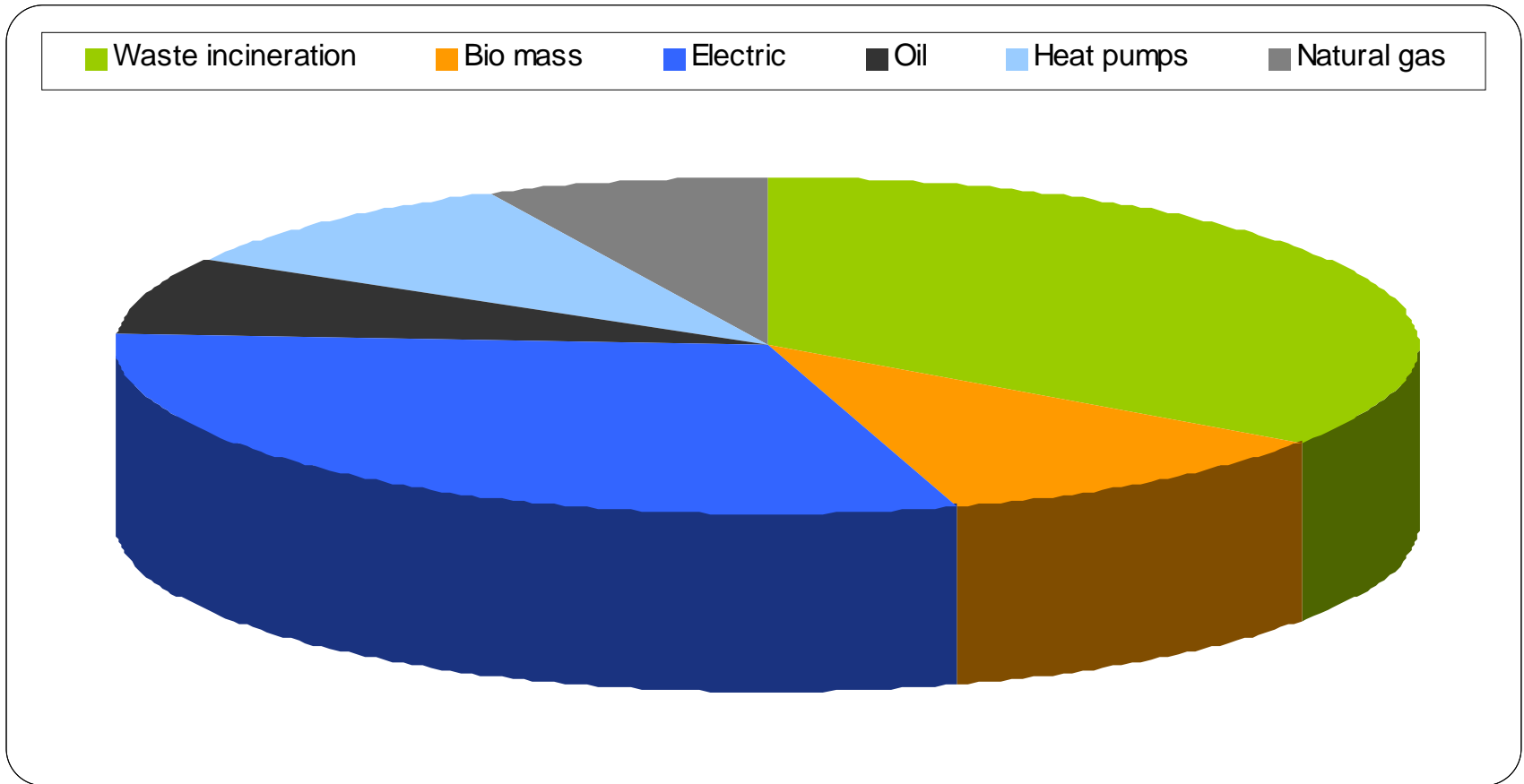
The Oslo City Council's Goal

- One of the world's most environmental friendly and sustainable capital cities.
- reduce climate gas emissions in the city by 50 % within 2030 (ref. 1990).
- 20 % reduction within 2020 according to EU's renewable energy directive.

Hafslund Fjernvarme

- An important tool for Oslo City to reach the ambitious climate goal.
- Hafslund goal: From 1 to 2 TWh in 8 years.
- New customers: From 40 to 125 GWh/yr.
- Increase production capacity accordingly:
 - Upgrade existing plants.
 - Expand existing plants.
 - Build 1-2 new big plants.

Hafslund Fjernvarme - Energy mix 2009



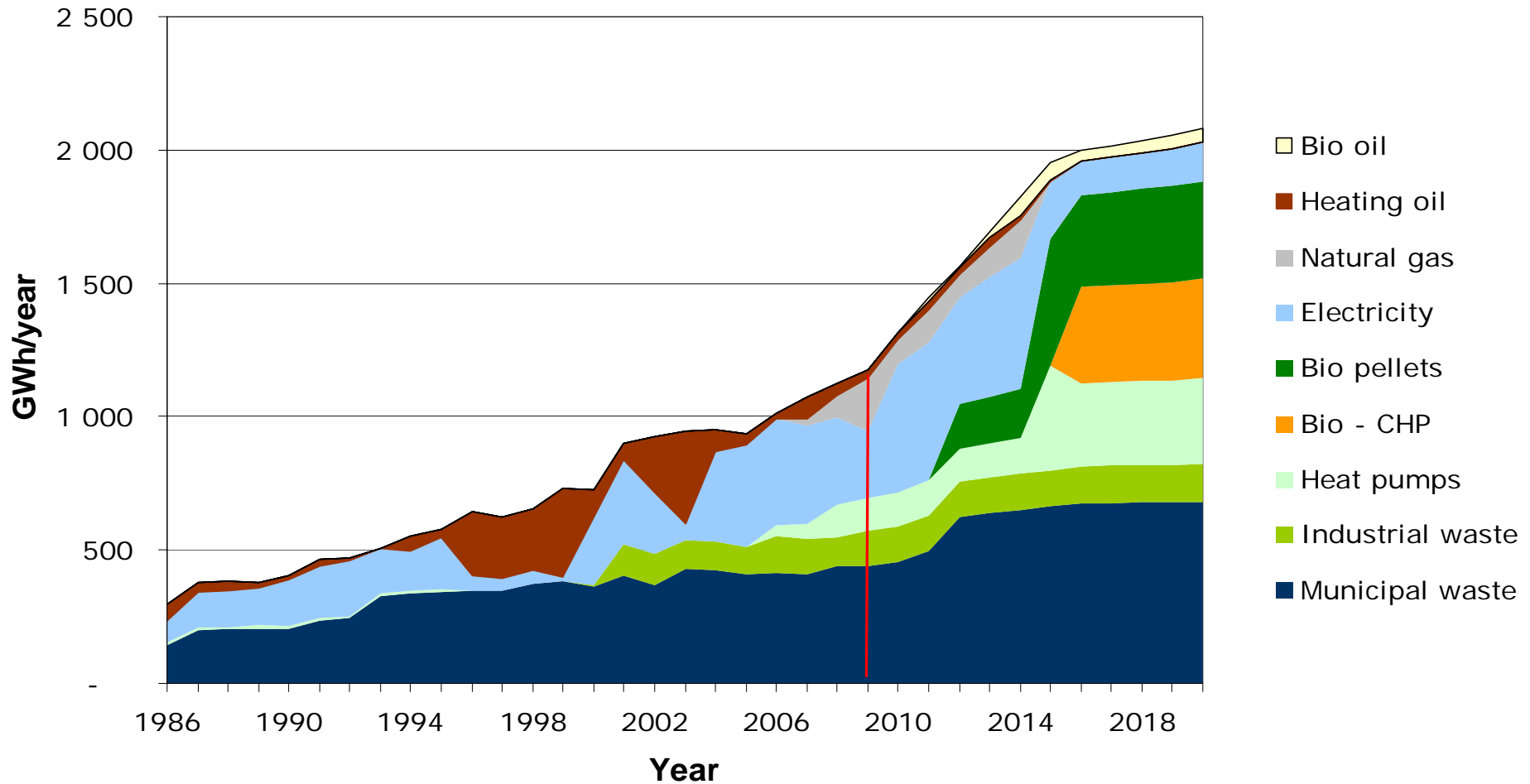
Total production: 1380 GWh

Hafslund Fjernvarme – Production sites

- Total production 2009: 1380 GWh/yr
- One common control centre for DH & Power.
- Production plants:
 - 1 x 30 MW Bio mass
 - 2 x 16 MW Waste incineration; North
 - 2 x 20 MW Waste incineration; South
 - 1 x 18 MW Heat pump
 - 1 x 9 MW Heat pump
 - 2 x 50 MW Natural gas
- 8 different plants spread out in the Oslo region based fired by oil and electricity (38 boilers in total)
- District heating also in nearby regions of Oslo;
 - Oppegård
 - Gardermoen (Separate system with bio plant 13 MW)



Hafslund Fjernvarme - Energy sources in the future



Hafslund Fjernvarme – Projects

From fossil fuels to bio fuels

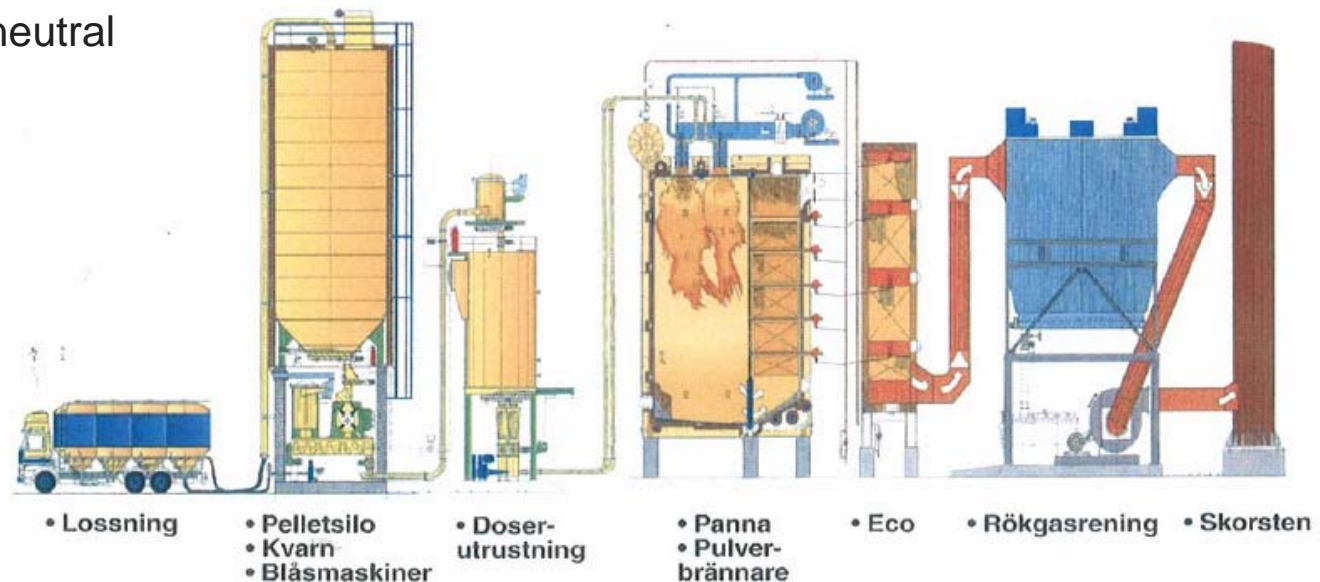
- Fuels of current interest based on:
 - Animal fat from slaughter waste, fish waste
 - Vegetable oils
 - Paralysis oil
- Viscous fuels - pre-heating and heat tracing.
- Corrosive on brass and copper.
- Higher cost than for fossil fuels.
- Bio-fuels tested on oil boilers at Haraldrud and Vika.
- Promising NO_x-emissions from rotary burners
- Plan to convert and install boilers for bio fuels in 2010-2011.



Hafslund Fjernvarme – Projects

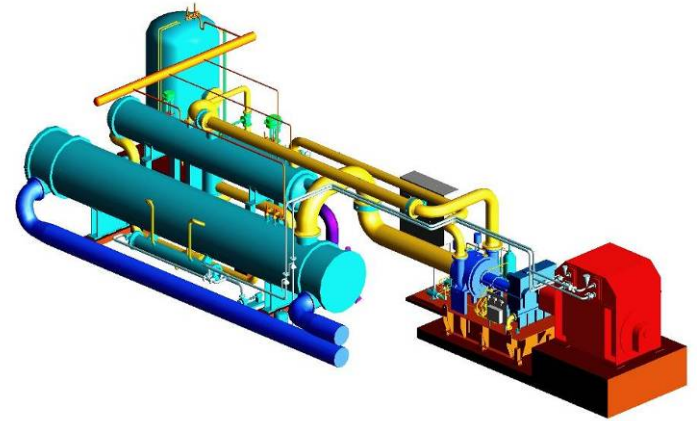
Powder fired boiler - principle

- 50 MW boiler based on wood pellets being converted to powder before being blown into the fire chamber.
- Replacing an existing 20 MW boiler
- Emmissions; CO2 neutral
- Planned commissioning autumn 2011



Hafslund Fjernvarme– Projects Heat and Cooling unit (Heat Pump)

- Combined heat and cooling unit located in the Oslo harbour
- Cooling power of 40 MW for Bjørvika
- Heating power of 60 MW
- Peak load boilers
- Utilise seawater as a heat source, from a depth of 40 m.
- Heat capacity per year: 200-250 GWh/år
- Cooling capacity per year: 35-40 GWh/år



Hafslund Fjernvarme – Projects

Bio CHP

- Decide upon location 2010
- Schedule:
 - Further planning: 2 år
 - Building periode: 3 år
- Capacity:
 - 122 MW generation of heat
 - 50 MW power
- Peak load taken by:
 - Bio powder boilers: 100 MW
 - Boiler for bio fuels: 50 MW



Hafslund Miljøenergi AS

Bio-El Fredrikstad (HME-BEF)

Borregaard Waste to Energy (HME-BWtE)

Mosseporten Miljøenergi AS (MME)

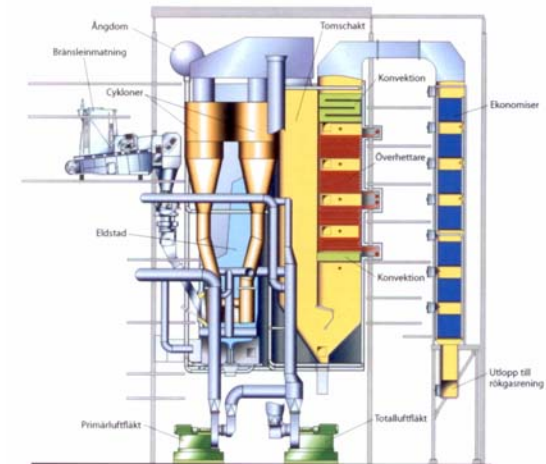
+ several projects applying small and large scale thermal plants



Hafslund Miljøenergi - Bio-El Fredrikstad

- Investment: aprox. NOK 440 mill
- Production: aprox. 25 MW and 192 GWh
- Energy sales: Industrial steam, District heating and electricity
- Customers: Kronos Titan, Denofa, Fredrikstad DH, Øraveien Industripark, Electricity + +
- Fuel demand: 62.000 ton industrial waste / y
- The facility is operated by FREVAR KF (www.frevar.com) through an operational and cooperate agreement.

Modern facility with very high environment standard and fuel flexibility. Reduces emissions of fossil CO₂, improves local industries operational conditions, provide heat and power, and secure employment possibilities to the population of Fredrikstad. Good balance between material and energy recovery are secured by the choice of boiler (CFB).



Hafslund Miljøenergi - Borregaard Waste to Energy

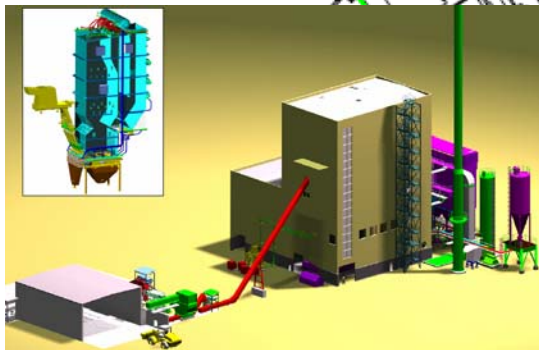
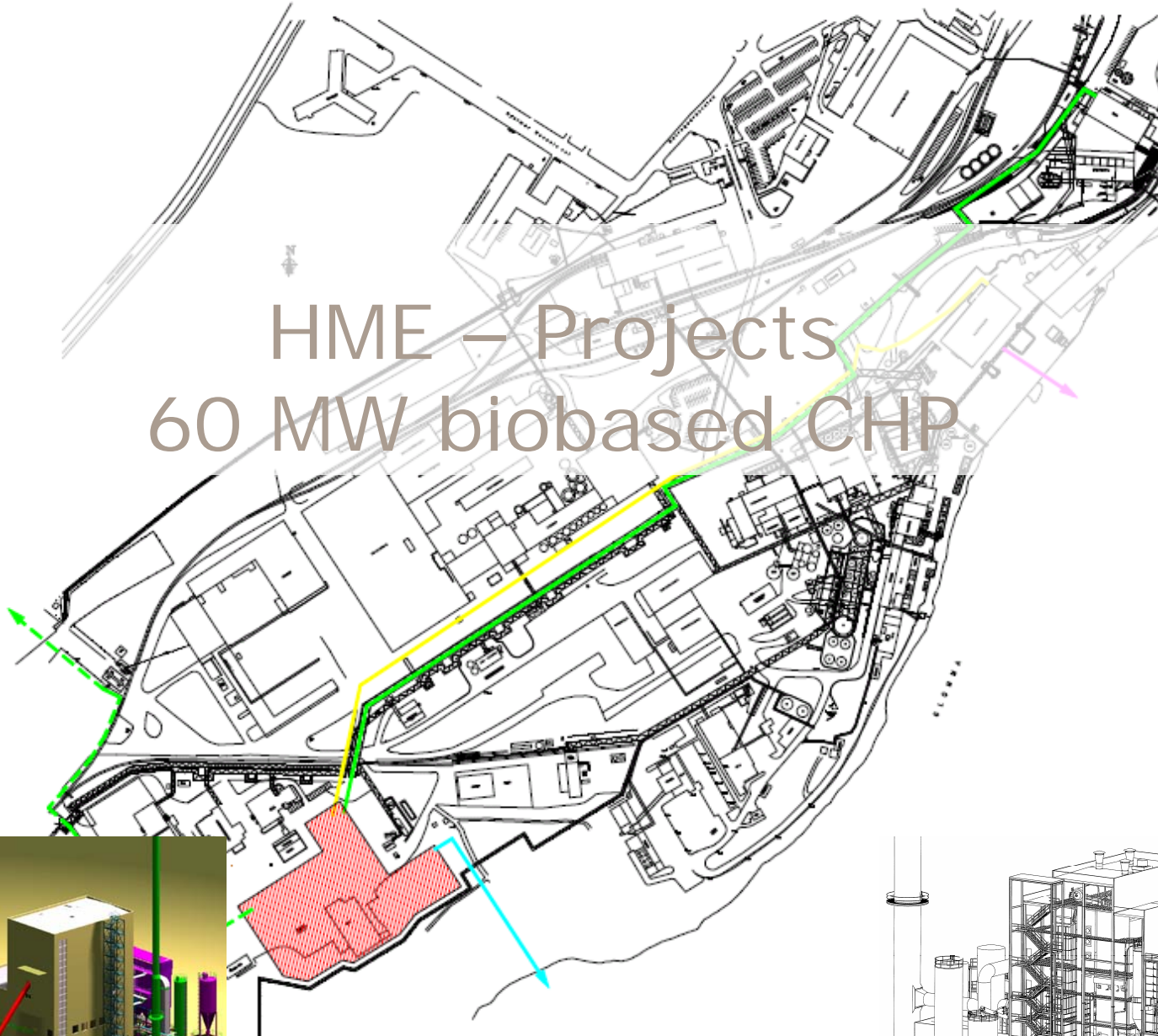
The plant are established to secure Borregaards demand for industrial steam and reduce use of heavy oil. And are built inside Borregaards industrial area in Sarpsborg. The plant are owned and operated by Hafslund

- Investment: NOK 500 mill
- Production: approx. 32,8 MM and 243 GWh
- Sales: 230 GWh industrial steam
- Customer: Borregaard
- Fuel: 80.000 ton/y, industrial and municipal waste
- Operational: from January 2010 (under commissioning)



Under bygging i januar 2009

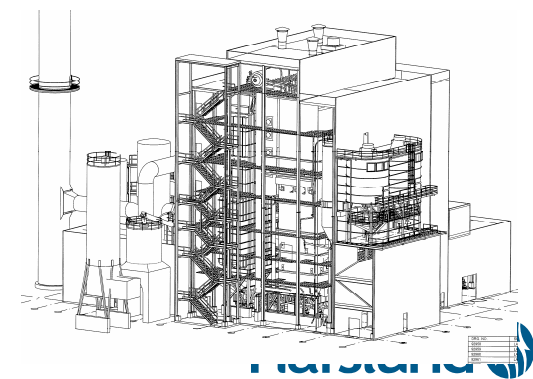
HME – Projects 60 MW biobased CHP



Rist



FB



BioWood Norway



- Established at Averøy 2006
- Shareholders Hafslund (78%), MRBB (22%)
- Investment € 60 mill.
- Start up spring 2010, full production during 2010
- Capacity 450.000 mt/year (2-2,5 TWh energy content)
- 35 employees (in addition to 15-20 hired people for unloading woodchip carriers)
- One of the world's leading wood pellet plants

Enova
(NOK 97 mill)

Start of
construction:
vår 2008

Commissioning:
Spring 2010



Hafslund evaluation; energy production from forest residues and waste

Combustion of forest residues and waste, more than energy production:

- Health & environment
- Climate
- Business policy

Infrastructure for district heating and industrial steam is the key factor to establish a plant for production of thermal energy



Hafslund's evaluation; today's situation in the Norwegian waste market

- Norway needs to develop district heating and use waste (renewable energy) to meet our climate commitment. The Norwegian government are supporting the market and the development with financial help through ENOVA
- Norwegian plants are today missing fuel based on waste
 - Waste are exported out of Norway
 - Export prohibition must be evaluated
- External conditions between Norway and Sweden has to be harmonized
- Land fill prohibition from 1. July is a good initiative, but has to be used in practise!
- Reduction or removal of taxes (sluttbehandlingsavgift) in power and heat production



Entirety politic are missing!

Hafslund are heavily engaged in the thermal market

Hafslund District Heating

- Norway's largest producer and distributor
- Wood chips, pellets, energy based on waste production and heat pumps

Hafslund Miljøenergi

BioEI og BWtE

60 MW bio-based CHP plant

Mosseporten Miljøenergi

Regional and local district heating

BioWood Norway

- Largest producer of wood pellets in Europe
- 450 000 ton pr year
- Commissioning 2010

Our commitment are maid with good fait to Norwegian and International environmental politics



Hafslund takes **environmental responsibility** by developing and expanding **renewable energy**.

