Sindal District Heating company was until 2018 using Natural Gas for district heating, partly by running gas-motors and partly gas boilers.

Sindal was seeking cheaper and more environmentally friendly fuels and chose to build a Dall Energy gasifier with an ORC turbine.

With this plant, Sindal obtains:
- Cheap & environmentally friendly fuels (Garden waste, wood chip)
- Utilizing biomass both summer and winter in just one plant
- Low NOx emissions
- Low CO emission
- Low dust emission
- Co-production of heat and power

The project is a demonstration project supported by the Danish R&D fund “EUDP”.

The investment and its technology
Sindal district heating has been investing about € 9 million in a new biomass fired CHP plant which now supplies the town with heat and power from local resources - forest residues and garden and park waste.

The CHP plant itself cost about € 5.5 million while the rest of the investment was spent on a new building and a new heat transmission line.

The technology is from Dall Energy and consists of
- A biomass updraft gasifier with partial oxidation
- An afterburner
- Thermal oil heater
- Scrubber system for recovery of heat.

A number of advantages
The plant is a third generation of the “Dall Energy Furnace”. The first generation was built in Bogense (Denmark) and second generation in Sønderborg (Denmark) and Warwick Mills (USA).

The first plants have verified that the “Dall Energy Furnace” technology offers a number of advantages as for instance:
- Ability to utilise low cost fuel
- Emission of 95 percent less dust than conventional grate furnaces
Ability to operate between 10 - 100% load
Low NOx and CO emissions
Low maintenance costs
Low power consumption

Factors behind the decision
Sindal District Heating Company was facing increased costs (for natural gas) and reduced income. This due to decreasing electricity price in a market with an increased amount of variable renewable sources (mainly wind energy) and thus constrained number of operational hours. Further, the national subsidy for co-producing heat and power would be removed. To avoid an increasing heat price for the owners/customers the company needed to do something.

According to Danish Heating legislation Sindal is in the category of CHP plants which means that any new thermal plant should be a CHP plant.

In 2015 a consulting company (Ramboll) was engaged to find alternative solutions. The consultant found that the Dall Energy gasification technology would result in the lowest heating price and furthermore at very low emission levels. In addition, the project would benefit the local economy via supplying local fuels for the heating plant.

Fuel type:
- Gasified biomass

Comment:
- Garden and park waste (twigs, leaves, tops and branches)

Feedstock origin:
- Domestic silviculture residuals from thinning, tops, branches etc
- Domestic forestry by-products/residuals: bark, wet wood chips, etc
- Domestic wood manufacture by-products/residuals: dry chips, shavings, dust

Conversion system:
- Boiler combustion, e.g. stand-alone boiler plant including co-firing and combined heat and power

Comments:
- Gasification type of unit

Co-fire:
- Heat generator (i.e. boiler) is 100 percent biomass-fired.

Heating system heat sources:
- Biomass is the only heat source in system
Lessons learned
First emission measurements showed very low emissions.
Handover from Dall Energy to Sindal was done two weeks prior to the agreed date.
Now the plant is in commercial operation. The project was successful.

Success factors
Denmark has a feed-in tariff system which gives a high feed in tariff for technologies which have good environmental performances.
In Denmark it is rather easy to get bank loans for district heating projects, because the municipality issues a guarantee for the loan to the bank.

Constraints
If the above factors are not in place the project would not be successful.
Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

**Contribution of the investment:**
- The investment supports the transition from fossil fuels to sustainable, locally grown, renewable fuels in the supply of heat and power.

**Repliﬁcity potential:**
- High local replicability
- High regional replicability
- High national replicability
- High international replicability

**Scale-up potential:**
- Low local potential
- Medium regional potential
- High national potential
- High international potential

**Comment:**
Simple and proven technology; Using a globally traded biofuel makes it easy to replicate at all scales, but for large boilers cheaper and more difficult bio fuels (wet wood chips) are often more competitive.

Principle diagram of Dall Energy gasifier for Sindal.
Web sites:
www.dallenergy.com
www.sindal-varmeforsyning.dk/
www.energiforskning.dk/da/project/
bæredygtig-biomassekraftvarme-i-sindal
www.ri.se
www.energimyndigheten.se/en/
www.iea.org/tcp/
www.ieabioenergy.com

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Watch on YouTube:
Indløft af røggasvasker og opfugter
Biomass plant in Sønderborg
Dall Energy Biomass Thermal Oxidizer
CNN Biomass Bentzen