



SUCCESS STORY:

# Environmentally friendly fuels

## INVESTMENT CASE

### Title:

Dall Energy CHP plant in Sindal - Denmark

### Year (commissioned):

2018

### Location:

Sindal, Denmark

### Stakeholders:

1. Sindal District Heating company
2. Dall Energy
3. EUDP (Danish R&D fund)

### Authors:

Jens Dall Bentzen, Dall Energy

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 NO<sub>x</sub> 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

**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



Sindal district heating has been investing about € 9 million in a new biomass fired CHP plant.

- 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.

## Relation to Sustainable Development Goals:



**End poverty in all its forms everywhere**



**Ensure healthy lives and promote well-being for all at all ages**



**Ensure access to affordable, reliable, sustainable and modern energy for all**



**Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all**



**Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation**



**Make cities and human settlements inclusive, safe, resilient and sustainable**



**Ensure sustainable consumption and production patterns**



**Take urgent action to combat climate change and its impacts**

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## 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.

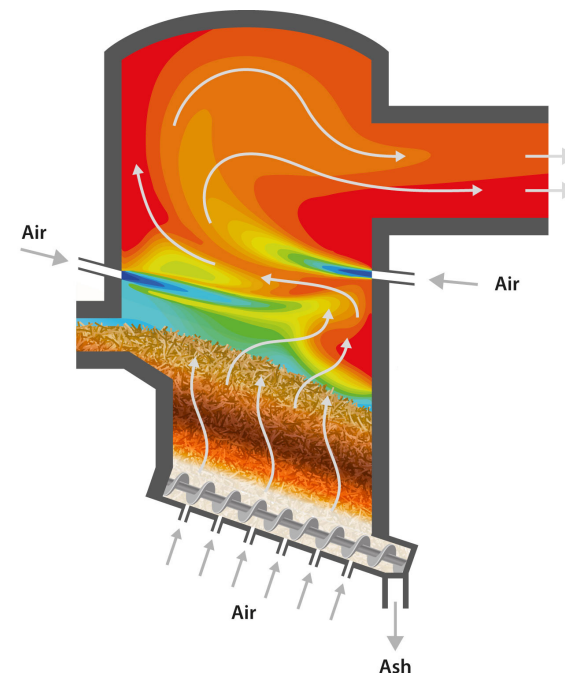
In Denmark it is rather easy to get bank loans for district heating projects, because the municipality issues a guarantee for the loan to the bank.

## Constraints

If the above factors are not in place the project would not be successful.



Dall Energy plant in Sønderborg (9 MW heat-only).



Plant with 2. generation Dall Energy furnace.



The CHP plant in Sindal at inauguration in September 2018.



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**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.

**Replicability potential:**

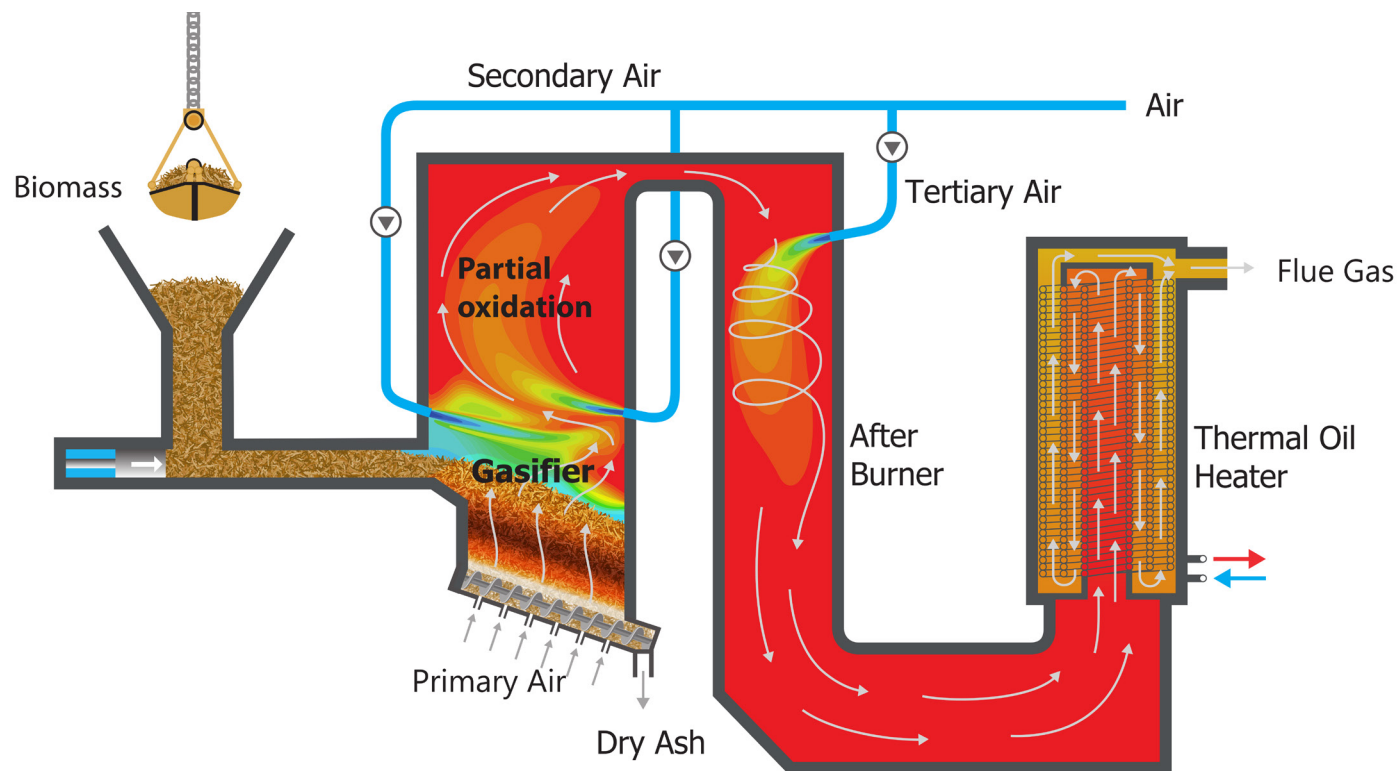
- High local replicability
- High regional replicability
- High national replicability
- High international replicability

**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](http://www.dallenergy.com)  
[www.sindal-varmeforsyning.dk/](http://www.sindal-varmeforsyning.dk/)  
[www.energiforskning.dk/da/project/  
baeredygtig-biomassekraftvarme-i-  
sindal](http://www.energiforskning.dk/da/project/baeredygtig-biomassekraftvarme-i-sindal)  
[www.ri.se](http://www.ri.se)  
[www.energimyndigheten.se/en/](http://www.energimyndigheten.se/en/)  
[www.iea.org/tcp/](http://www.iea.org/tcp/)  
[www.ieabioenergy.com](http://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](#)



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