

Forestry

Denmark plans to ditch fossil fuels by 2050

The first impression of Denmark's renewable energy programme for visitors arriving by air is of a country obsessed with wind energy. As our plane descends over Jutland and the south Kattegat Sea, it's easy to form the view that wind power is the only Danish renewable energy source as onshore, nearshore and offshore wind farms form a pervasive turbine network across Denmark's land and seascape.

But should visitors take time to call in to the State of Green headquarters in Copenhagen, they will hear that while wind energy has transformed the Danish renewable energy economy, bioenergy, from biomass, is still the main renewable energy source (Figure 1).

Dan Howis Lauritsen, head of communications at State of Green, outlined the vision of the Danish Government and renewable energy stakeholders. Denmark aims to be "the first country in the world to become a green growth economy, entirely independent of fossil fuels by 2050," he said. This at first sounded like an extravagant objective to the Irish delegation who recently visited Denmark as part of a study tour organised by the Irish Bioenergy Association (IrBEA). But as the group visited projects such as Vestfyen Brewery's conversion to biomass and three district heating systems, it became obvious that creating a green economy is not a pipe dream for the Danes but a vision based on performance.

Oil to wood

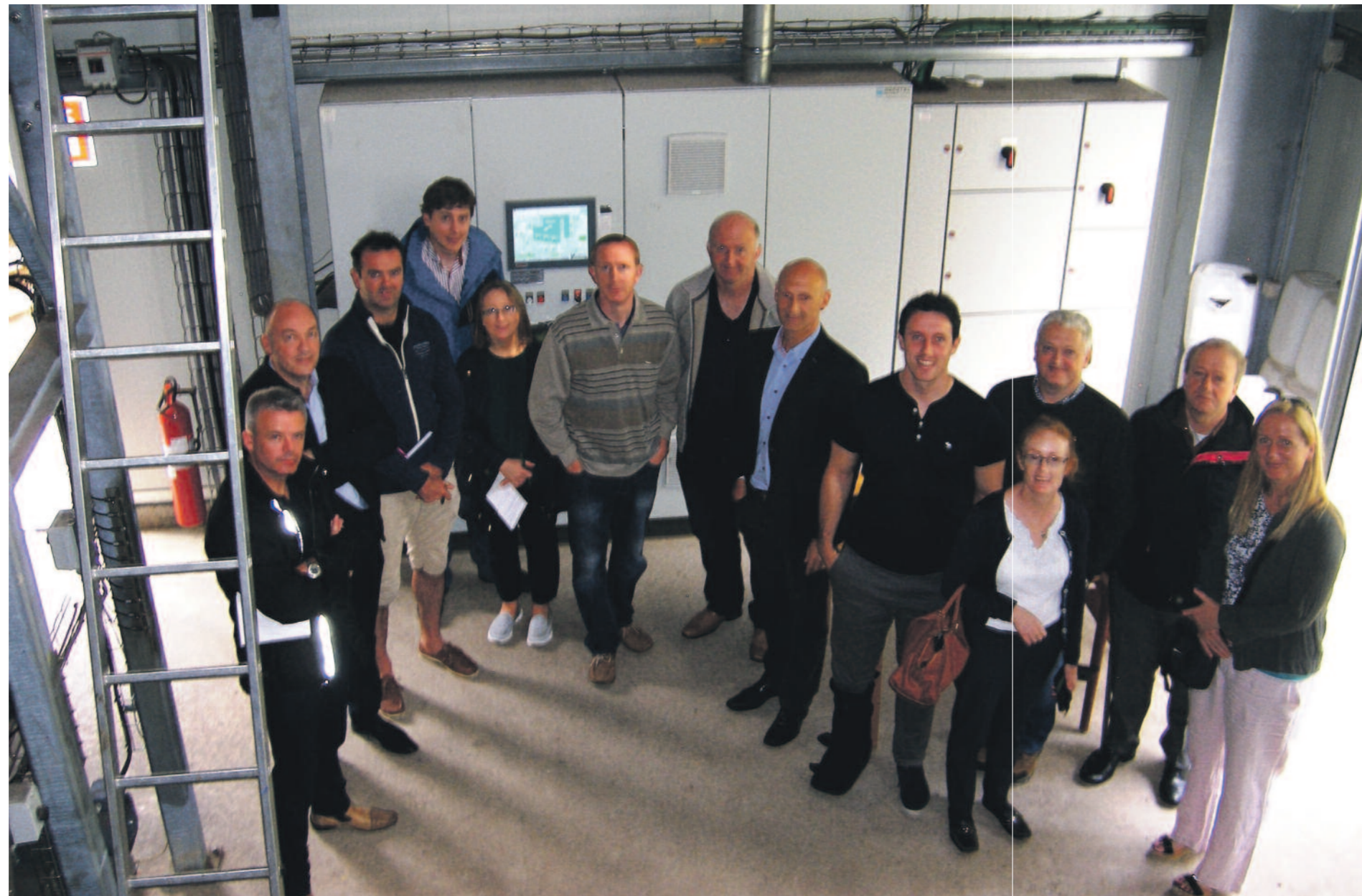
Vestfyen Brewery converted from oil heating to wood chips in January 2015. The conversion, including planning, grant application, management and construction, was completed in 14 months, explained Jens-Ole Aagaard Jensen, managing director Focus BioEnergy, the Danish company which specialises in advising companies on delivering projects that replace fossil fuels with sustainable biomass.

Located to the west of the island of Funen (Fyn), outside the town of Assens, Vestfyen is a medium-sized brewery with an annual production of 120m units of beer and soft drinks.

The conversion from oil to wood chips was influenced by environmental considerations but was ultimately based on economics. Two boilers running on 700,000 litres of heating oil each year were replaced with a 4 megawatt (MW) biomass fire steam boiler, fuelled annually by 10,000m³ of wood chips.

The payback period on the €2m conversion to biomass is two and a half years helped by a grant of €940,000 from the Danish Energy Agency. Without the grant, the payback period would have been around four years, but the Danish government support makes environmental and economic sense in driving the country towards energy security and a green economy. The conversion also saves 2,000t of carbon dioxide annually.

The operation is extremely efficient as wood chips are loaded into two 90m³ containers and transferred to the boiler by auger. When one container is emptied, the wood chip supplier is automatically notified by text and delivery takes place within 48 hours. Wood chips are sold to the customer based on gigajoule



Jens-Ole Aagaard Jensen (sixth from the right) managing director Focus BioEnergy explained why Vestfyen Brewery converted from oil to wood biomass during the recent IrBEA study tour of renewable energy projects in Denmark. Pictured from left: Des O'Toole, Coillte; Ger Crosse, Wood Energy Solutions (WES); Lloyd Dowzer, Leinster Pellets; Tony Quinn, Department of Agriculture, Food and the Marine; Pauline Leonard, Western Development Commission; Noel Gavigan, Irish BioEnergy Association (IrBEA); Pat Collins, IFA; Jens-Ole Aagaard Jensen; Padraic Mac Giolla Bhríde, D.Fallon Consulting Engineers; Teresa O'Brien, IrBEA; Declan Crosse (WES); Gearoid Dorchaí, Údarás na Gaeltachta; Dr Orla Nic Suibhne, UCD.

of energy. The preferred moisture (MC) is 35%, but the boiler will handle wood chips up to 50% as the system utilises steam at 60 bar, reaching 280°C.

"The brewery shuts down on weekends and when the steam flow is turned on, every Monday morning, the system goes from zero steam flow to 6t per hour in a five minutes," explained Jens-Ole. The system is also exceeding targets on operational costs as the annual 900 hours allocated has been reduced to 200 hours.

District heating

The group visited three district heating systems in Jutland, fuelled mainly by wood chips and pellets with options for straw. The Stoholm district heating system in the municipality of Viborg provides heating for 780 households to the town, which has a population of 2,500. This unit was fuelled by an average of 6t of wood pellets daily. The 1MW pellet boiler provides heating and hot water for all households from late spring to early autumn while a larger capacity gas boiler is utilised to meet the peak winter load demand. The district heating system in Sønder Omme in central Jutland uses wood chips sourced in the surrounding forests, but can also burn straw.

The fully automated 6MW system built by Danstoker, provides energy for 760 households and surrounding industries.

It requires between 8 and 30 tonnes of wood chips daily depending on demand. As in all district heating systems, it has a stand-by diesel boiler in case of failure of biomass unit but as not been required to date.

Seven miles south of Sønder Omme we visited the district heating plant in Grindsted where Peter Larsen of Justsen, the boiler installation company, explained the background to the two-year old 5.5MW system which is running at 75% capacity. This is one of a number of district heating systems in Grindsted which has a population of about 10,000. The Justsen project provides heating for 1,000 consumers including households, industries, schools and hotels.

While bioenergy is new to Ireland, the Danes have a much longer history at all forms of renewable energy and this is typified by Danstoker, the Herning-based manufacturer of energy efficient boilers since 1935.

The group received a tour of Danstoker's immense plant, housed in an aircraft hangar purchased in the UK after World War II and reassembled on site.

Anders Hjørnholm, the company's senior consultant, showed us how the Danstoker range is made from beginning to the end of the production line ranging in size from domestic scale to 20MW giant boilers capable of generating be-

Any renewable heat policy should aim to accelerate market growth by removing the economic barriers currently preventing major capital projects from proceeding in Ireland

COMMENT

What Ireland can learn from the Danes

Comparisons between Ireland's renewable energy programme and Denmark's far more advanced approach leaves the Irish visitor with a sense of deflation. This is due to Denmark's remarkable performance in developing renewables compared with Ireland's deplorable performance in renewable energy to date.

Within 19 years, Denmark plans to eliminate fossil fuels in all district heating systems, which means in cities such as Copenhagen, all energy will be renewably sourced. By 2050, Denmark plans to have a total green economy without any dependence on fossil fuels.

This is more than far-fetched strategic planning because when it comes to renewable energy the Danes have consistently matched performance with vision. Unlike the Irish Government, which up until recently claimed to deliver 16% renewable energy by 2020 without the remotest chance of achieving this goal, the Danish government set a target of 30% for the same period. However, the Danes will not only achieve their targets but are likely to deliver 33% renewables.

Denmark's drive towards renewable energy is all the more remarkable as the country was even more dependent on fossil fuels than Ireland during the 1970s oil crisis.

Wind v bioenergy

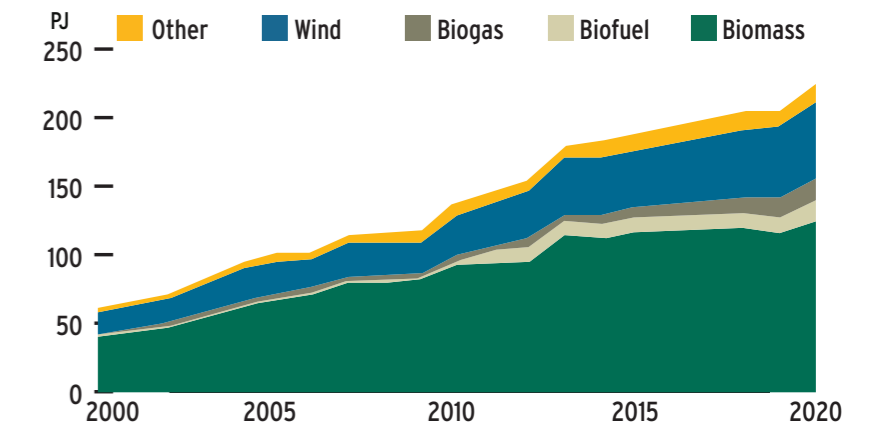
Differentiating between renewables is really not the issue in Denmark, although there is a rivalry between the twin leading renewable sources – bioenergy and wind. Wind energy maybe winning the PR battle – as it is in Ireland – but bioenergy is the more widespread renewable energy source and will continue to make up the majority of total Danish renewable energy consumption in 2020 (Fig 1). Bioenergy comprises biomass, biogas and biofuels. Biomass, including mainly wood residue (wood chips and pellets), straw and waste, forms 75% of the bioenergy programme.

Denmark has an in-built advantage over Ireland in achieving renewable energy in urban areas as towns were piped for district heating systems going back to the 1960s and many have made the transition from coal and oil to natural gas and more recently to biomass.

However, Ireland has advantages over many areas in Denmark as our forests are more productive and well suited to biomass production. While Ireland's forest cover at 11% of the land area is below Denmark's cover of 14%, Ireland's forests are capable of producing far higher yields of biomass, especially compared with

Figure 1

With a significant increase in solid biomass, biogas and biofuels, bioenergy will continue to make up the majority of total Danish renewable energy consumption (PJ) in 2020. Source: State of Green, 2015



forests in Jutland. We also have a higher rate of forests per capita – 0.17ha compared to 0.10ha in Denmark.

However, the big difference between Ireland and Denmark lies in State incentives to transfer from fossil fuels to renewables. "Any renewable heat policy should aim to accelerate market growth by removing the economic barriers currently preventing major capital projects from proceeding in Ireland," said Des O'Toole, commercial biomass business development manager, Coillte, and the company's representative on the Denmark study tour. "I was impressed how Denmark takes renewable heat seriously and provides targeted incentives to underpin investor confidence in the sector."

It has been agreed between successive governments and bodies such as IrBEA that Ireland needs a renewable heat incentive (RHI) to begin the process of achieving realistic targets for renewable energy in industry to begin with. O'Toole believes we have waited long enough for an RHI, which was promised as far back as 2013. "Why should we leave ourselves dependent on external energy markets when cheaper, cleaner, greener energy is available today," he maintains. "With a relatively modest investment we could make substantial progress against our renewable energy targets, improve our natural environment and enhance Irish industry."

On a positive note, a number of industries are now considering renewables as an energy options while some have already converted to biomass. It was encouraging to hear from Gearoid Dorchaí on the tour, that Údarás na Gaeltachta are proposing to install a district heating system using biomass in the Gaioth Dhoibhair Business Park in Donegal. "We are currently carrying out a feasibility study on the proposal and initial indications would suggest that the proposal will have a positive outcome," he said.

Unlike wind energy, our high-yielding, sustainably managed forest can create an energy source all year round, capable of generating electricity and heat, tailor-made for Ireland. The RHI promised three years ago needs to be activated to make up lost ground in developing a viable renewable energy programme for Ireland and avoid long-term fines from the EU for consistently failing to reach renewable energy targets.



The district heating system in Sønder Omme in central Jutland uses wood chips, sourced in the surrounding forests to provide heating for 760 households as well as energy for surrounding industries.