Energy Efficiency, **Sonderborg and ProjectZero**

From June 6 to 9 in the small city of Sonderborg in Denmark, the International Energy Agency (IEA) held its 2022 Energy Efficiency (EE) conference. Peter Middleton attended and highlights some notable efficiency and decarbonisation successes from this remarkable city.

Opening the first of the press event of the IEA Energy Efficiency 2022 conference in Sonderborg, Kim Fausing, president and CEO of Danfoss said: "Energy efficiency is a cornerstone in the energy transition – and if we look at Sonderborg where we are today, very clearly, seeing is believing."

While Denmark has set an ambitious target of 70% emissions reductions by 2030, Sonderborg, through a public-private partnership (PPP) called ProjectZero, has already decarbonised by 52%, and the municipality is confident that Sonderborg will achieve net-zero status by 2029.

Fausing succinctly summarised ProjectZero's strategy: first, use less energy; second re-use residual energy such as the heat from data centres and supermarkets; and only then, switch to green energy generation. "This is the right thing to do for climate; it helps to curb energy prices and consumption, and it actually makes good business sense as it offers very short payback times," he added, before encouraging us all to go out and see some of the many implemented examples in this remarkable town.

"The seventh annual global Congress, couldn't be timelier," continued Brian Motherway, head of the Energy Efficiency Division at the IEA. "When we talk about energy policy, what comes to mind is a wind turbine, or an oil rig, or where we get our energy from. We tend not to think much about how energy is used – and that's a lost opportunity," he noted. But the issue is 'particularly burning' since Russia's invasion of Ukraine. "Primarily, we've seen a humanitarian crisis in Ukraine, but we've also seen a global energy crisis as a result of Russia's actions, bringing higher price and volatility.

"Energy efficiency is really at the forefront of this and over the next couple of days, we'll be asking two questions related to energy efficiency: why and how? It's really appropriate that we're here in Sonderborg, because we want to focus on action and what actually works on the ground – and we've seen some great solutions in this town and in the broader region," he said.

In addressing the why question, Motherway introduced the new IEA findings about why early action on energy efficiency is so important. "The IEA measures progress

The Danfoss headquarters in Nordborg, through its already implemented combinations of all three ProjectZero principles, will be a carbon zero site by the end of 2022.

in energy efficiency using energy intensity, which is a ratio of units of energy consumed per unit of GDP in the global economy. And while steady progress has been made to reduce energy intensity, the new analysis is about looking forward to the future to determine what more can and needs to be done to decarbonise the energy landscape by 2050," he said.

The findings are summarised in the IEA Energy Efficiency Conference report entitled: The value of urgent action on energy efficiency. Highlights include:

- Doubling the current improvement rate for energy intensity from 2% to 4% per year over this decade will be required if we are to meet net zero emissions by 2050. This has the potential to avoid final energy consumption equivalent to that of China.
- This energy intensity improvement would cut CO_2 emissions by an additional 5 Gt per year by 2030, about a third of the total emissions abatement needed this decade in the IEA's net zero by 2050 scenario.
- In the high efficiency scenario, final energy demand could be around 5% lower by 2030, while serving a global economy 40% larger.

In terms of strengthening energy security, 95 EJ of energy savings per year by 2030 helps avoid almost 30-million barrels of oil per day, about triple Russia's average production in 2021; and 650 bcm of natural gas per year, around four times what the European Union imported from Russia in 2021.

IEA recommendations include providing clean and efficient cooking and heating to all those who lack it today, which by 2030 would avoid over 20 EJ of demand for the traditional use of biomass such as wood and charcoal, while dramatically improving the lives of billions of people.

In addition, total energy savings can contribute to lowering household energy bills by at least US$650-billion a year by 2030; while scaling up investments can support an extra 10-million jobs in efficiency-related fields by 2030.

The ProjectZero initiative

The Sonderborg municipality services an area of 495 km² with a population of 73 831 people, with the city of Sonderborg housing 27 000 of these people. Notable industry in the region includes the Danfoss Headquarters and Maersk Container Industries(MCI), which manufactures refrigeration machines for the Maersk Group.

The ProjectZero initiative can be traced back to the early 2000s, when the area was struggling with low income jobs, unemployment and decreasing population. Local politicians, businesses, foundations and citizens began to discuss ways of turning the tide, which ultimately culminated in the formation of ProjectZero in 2007.

By 2015, Sonderborg's energy related carbon emissions has been reduced by 28%, down from 700 000 to 501 000 t of CO_2. By 2020, the town had already achieved its 50% reduction target and it is now well on track to be carbon zero by 2029.

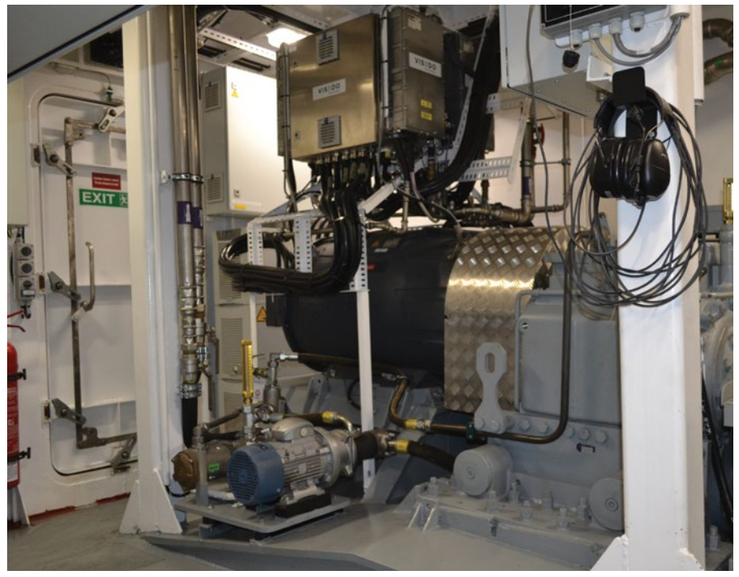
Based on three simple principles – energy efficiency: use only the energy needed; Sector integration: reuse energy already produced; and green energy: source demand from renewable sources – the clear message from ProjectZero to the world is "Don't wait. The solutions are ready". ProjectZero has been systematically built on existing cost-effective solutions with short payback times. And the project can certainly point to numerous examples.

Central to the IEA's reasoning for moving the IEA efficiency conference from Paris to Sonderborg was to showcase the extraordinary progress being made by the municipality and how this has been achieved.

The Scandic Hotel where the journalists were housed, for example, has installed modern LED spot lighting and energy-saving bulbs, water saving devices, motion sensors and modern energy efficient pumps to better distribute heat. In the past, a lot of energy was spent on ventilation for circulating heat over a large area. The new heat pumps use much less energy and savings accrue immediately.

This all falls under Part 1 of the strategy, to implement initiatives that use only the energy that is actually needed.

District heating, though, is the key innovation for Part 2 of the ProjectZero strategy, that is, reusing the residual heat. The Scandic Hotel now uses the municipality's district heating supply as its principal energy source, which has enabled the hotel



A Danfoss 750 kW synchronous reluctance-assisted permanent magnet propeller motor on Ellen, the World's first 100% electric car and passenger ferry.

to completely overcome its dependence on gas boilers. ProjectZero, the Sonderborg Municipality and industrial partners such as Danfoss and local heating installers, have established one of the world's best district heating systems. Built around a state-of-the-art geothermal facility, in combination with massive absorption heat pumps and waste-fuelled biomass burners, hot water is now being piped into a majority of households, businesses and industrial customers in Sonderborg, replacing the traditionally installed individual oil, gas or electric boilers. District heating is also able to collect and reuse waste heat via its return lines, resulting in exceptional system efficiency.

On a field trip to the SuperBrugsen supermarket in Horupav, just outside Sonderborg, we were shown how excess heat from the refrigeration and cooling systems was able to be reused to meet 78% of the space heating needs. In addition, the supermarket has been able to sell 133 MWh back into the district heating grid for use by other local buildings and households in the region, enough to meet the annual needs of seven households.

Three key innovations have driven these results:

- The switch to CO_2 as the refrigerant, which is both natural and, due to its inherently high operating temperature and pressure, highly-efficient.
- The installation of a heat exchanger to enable the heat of the compressed CO_2 to be extracted and reused, instead of being rejected into the atmosphere from the rooftop via fans or cooling towers. The extracted heat is simply transferred into hot water tanks, which can then be used to heat the store or for domestic hot water –with any excess being sold on or sent to municipality.

From a local generation perspective for Part 3 of the strategy, more than 50 rooftop solar-PV systems have been installed on Sonderborg's municipal buildings, while two massive new plants are to be established in Lysabild and Stevning, which will meet the direct electricity needs of some 19 000 local residents.

Local businesses have also invested in PV solar plants, with Danfoss' installation in Nordborg now producing some 25% of the site's electricity needs. To further decarbonise, Danfoss has signed a 10 year corporate power purchase agreement for 27 MW of capacity from the Horns Rev 2 offshore wind farm to fully decarbonise electricity use of all Danfoss sites in and around Sonderborg.

And as an example to all industrial sites in the world, the Danfoss Nordborg plant, through its already implemented combinations of all three ProjectZero principles, will be a carbon zero site by the end of 2022 – and implementation of these principles is being rolled out to all of the company's 100 facilities across the world.

Sonderborg and ProjectZero are an inspiration to us all, not only with respect to the irrefutable value of energy efficiency, but as a showcase of a real carbon-free world. The 2050 emissions deadlines can be met, and this greener world looks like a better one.

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