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POWER PLAY

How Denmark Paved Way To Energy Independence

Thirty-Year Plan Uses Wind, Taxes, Pig Fat; Consumers Pay More

By LEILA ABBOUD
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HORSENS, Denmark -- Nothing goes to waste in the new Danish Crown slaughterhouse in eastern Denmark. Even the inedible fat of 50,000 pigs killed and processed here each week is used to heat the plant.

Turning pig blubber into heating oil is one of several techniques Danish Crown uses to save heat, water and electricity. The abattoir recently developed a method of scalding and removing hair from pig carcasses that conserves heat.

"We redesigned the whole manufacturing process to save energy," says Søren Eriksen, technical director of Danish Crown, a meat company that produces $11 billion of pork and beef annually. "Everything is reused."

SEE A PHOTO SLIDESHOW

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Danish Crown

Workers prepare pigs' meat for export to Japan and U.S. at Danish Crown's new, energy efficient slaughterhouse.

Danish Crown is part of Denmark's successful 30-year effort to keep its energy consumption in check. Through a wide variety of government-driven initiatives, this small northern European country has overcome one thorny challenge of global warming: how to dramatically reduce energy consumption while maintaining a solid growth rate and low unemployment. The downside is higher taxes and costs for businesses and consumers.

Today hundreds of thousands of Danish homes and other buildings are warmed by surplus heat from power plants. Government policies have spurred developers to build homes with thick insulation, and consumers to buy energy-efficient appliances. Utilities that can't meet government energy-savings guidelines can buy credits from companies that have invested in efficiencies.

The result of these and other policies is that Denmark's energy consumption -- the amount of fuel it uses to heat its buildings, drive its cars and power its economy -- has held stable for more than 30 years, even as the country's gross domestic product has doubled, according to the International Energy Agency, a Paris group that tracks energy prices and policies. During the same period, energy consumption in the U.S. has risen 40%, while its GDP has quadrupled. The average Dane uses 6,600 kilowatt hours of electricity a year, compared with 13,300 for the average American.

"You can't just sit back and wait for market forces to do this for you," says Peter Bach, a civil engineer who has worked as a regulator at the Danish Energy Authority for 26 years.

Peter Bach

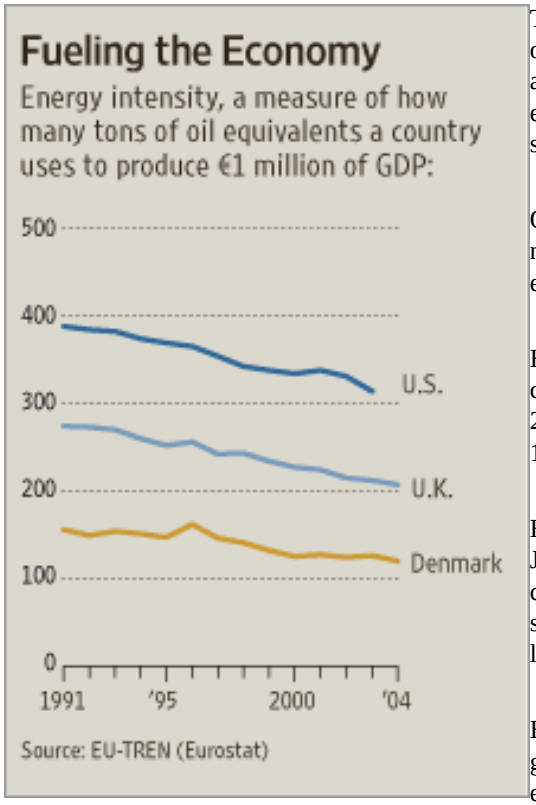
Some of Denmark's approaches can't be easily replicated elsewhere. U.S. policy makers and businesses have resisted the type of aggressive intervention and regulation behind Denmark's successes, concerned about higher costs and taxes, reduced competitiveness and slower growth.

But in Denmark, much of the country's energy sector is in the hands of nonprofit cooperatives, with residents as shareholders, which makes it easier for government to direct policy with little opposition from business interests. With a population of 5.5 million people, Denmark also is a social welfare state that puts a higher priority on things like generous health care, free schools and guaranteed pensions than on profits, low taxes and individualism.

Danish consumers and businesses clearly pay a price for the energy programs. A Dane buying a new car must pay a registration fee of approximately 105% of the car's value, plus additional taxes on fuel. Danish companies pay 43% more per megawatt hour of electricity than companies in the U.S., 24% more than in France and 19% more than in England, according to Dansk Industri, an industry trade association. Denmark's high energy costs and its costly social-welfare system likely slow its economic growth in comparison to the U.S., but haven't kept its economy from becoming one of Europe's strongest, says Jonathan Coony, an energy specialist at the World Bank.

Yet Denmark has remained dogged about conservation. Like other countries, Denmark embarked upon its energy-saving crusade after 1973, when Arab nations temporarily cut off oil exports to countries that supported Israel. Many nations, including the U.S., relaxed their efforts as soon as the geopolitical situation stabilized. But Denmark, along with Japan, was one of the few countries that persisted.

Denmark was heavily dependent on imported oil in the 1970s, and the oil crisis helped set off a prolonged economic recession. To cope with the immediate energy shortage, driving was banned on Sundays. Some towns turned off street lights and schools cranked down the heat.



The experience convinced government officials that the country couldn't rely on foreign oil. So in 1976, a government led by the Social Democratic Party laid out a series of ambitious energy plans, including developing renewable energy from wind turbines, exploring the North Sea for oil and natural gas, and conserving energy. Denmark is now self-sufficient in energy and actually exports oil, gas and electricity.

One key policy change was a gradual increase in taxes on the consumption of oil, natural gas and electricity. Taxes now make up more than half of Danish households' electricity bills; prices at the gas pump doubled once fuel taxes took effect.

High energy costs, coupled with rising labor expenses, have made it harder for many companies to compete, especially in energy-intensive sectors like steel and cement. In 2005, 14% of the Danish labor force worked in manufacturing, down from 28% in 1966, according to Danish government statistics.

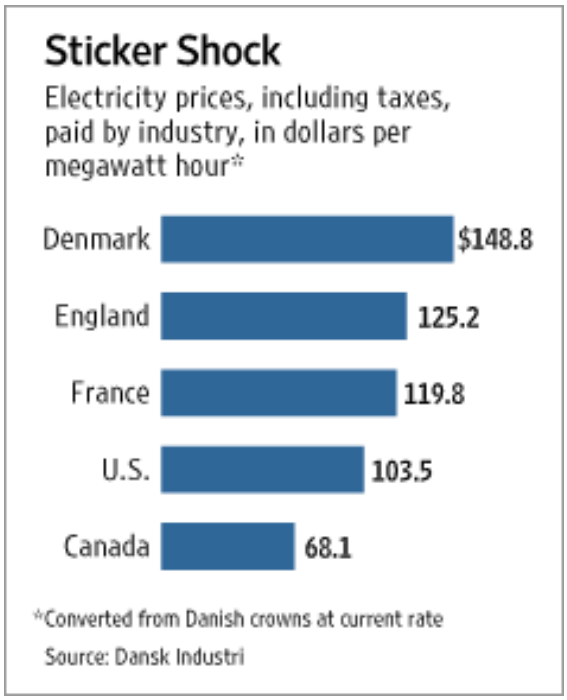
High energy taxes have been "good for the country, but not good for companies," says John Tang, energy and environmental manager at Dalum Papir A/S, a 133-year-old company that makes glossy paper for magazines out of recycled materials. Mr. Tang says several Danish paper companies have gone out of business in the past 15 years, leaving Dalum with one main rival in Denmark.

But Danish companies that did survive, like Dalum, were forced into strategies that gave them a head start on European rivals that are just now starting to become energy-efficient. Dalum overhauled its factories to save energy in the 1990s, installing more efficient motors and redesigning heating systems to waste less heat, says Mr. Tang.

High taxes have also been a burden on consumers. Yet Danish individuals have largely acquiesced to the higher energy prices. In an opinion poll by the European Union last year, more people in Denmark than in any other country said they would be willing to pay higher prices for energy derived from clean sources.

In addition to raising taxes, the Danish government in the 1980s embarked on a massive overhaul of the heating system. Homes used to be heated entirely with oil, often in inefficient individual boilers in their basements.

In a project financed largely by municipalities and local banks, Denmark developed a combined heat-and-power system in which surplus heat produced as a byproduct at power plants would be transported in insulated pipes to heat homes and offices. This "cogeneration" or "district heating" technology wasn't new, but had thus far been confined to close-knit communities such as university campuses, or in Eastern Europe under Communism.



Building the district-heating system was a pharaonic undertaking that took a decade. Streets had to be torn up to install massive underground pipes. Power plants needed to be moved or built closer to people's homes or offices so that heat could be transferred over shorter distances. The heat is transported from hundreds of small power plants near cities, compared to 15 big power plants that supplied electricity nationwide in the mid-1980s.

When representatives from Denmark's energy regulator introduced the idea to local officials in towns and counties, "they thought we were crazy," recalls Mr. Bach. But the government bulldozed ahead, promising that district heating would, among other things, bring lower prices. Today it's cheaper than heating with natural gas or oil.

Today about 61% of households in Denmark are heated by district heating, a system Mr. Bach estimates accounts for about half of Denmark's energy savings in the past 25 years. The cost of the overall project is hard to know because much was done on the local level. But in Copenhagen's prosperous eastern suburbs alone, workers spent six years and about $475 million to tear up the streets to install the pipes.

To build on the success of the new heating system, the government introduced a new building code in 1979 that forced people to build their homes with thicker insulation and tighter-sealing windows that would preserve energy.

The building code is tightened periodically. It lowered Denmark's heating bill by 20% between 1975 and 2001, even though some 30% more heated floor space in buildings and homes was built during that period, according to the Danish Energy Authority.

Torben Mikkelsen, a veterinary surgeon and father of two, spent $105,000 last year to insulate his white single-level house and to replace sliding-glass doors and floor-to-ceiling windows with airtight models. Mr. Mikkelsen expects to save at least 60% on his heating bill, which last year totaled $5,400.

Mr. Mikkelsen says it doesn't bother him the project will take 30 years to pay for itself. For years, his family couldn't stay warm enough no matter how high they turned up the heat. "It's much more comfortable in the house now," he says.

Some local officials have taken conservation even further. In 2001, Willy Eliasen, then mayor of the town of Stenløse, some 25 miles from Copenhagen, decided to develop a new parcel of land. Homes on the land, he decreed, would have to be 50% more energy-efficient than what the building codes required.

Some construction companies balked, saying the new rules would cost too much, and didn't bid. But today the parcel has some 250 houses and apartments, many made of yellow brick and all with thick insulation panels. All have been sold and construction is under way for another 500 homes.

In the mid-1990s, the Danish government turned to energy-guzzling appliances, which consumers bought even when more efficient models were available. All appliances sold in Denmark bear an efficiency label that, according to EU standards, rates the appliance from "A" for the best to "G" for the worst. In 1995, a government study found that only one quarter of the fridges and freezers sold in Denmark had ratings of A or B.

A government-funded organization called the Electricity Savings Trust introduced a temporary subsidy program that gave $100 rebates, payable at the cash register, to people who bought appliances with A ratings. In exchange for the subsidies, the stores promised to devote more marketing and advertising to energy-efficient appliances and also to stock a wider variety of models.

"There are many options to choose from," said Greta Andreasen as she was shopping for a fridge at an appliance store in Copenhagen last month. Before her were 10 refrigerator models -- all with ratings of B or better, and half with grades of A+ or A++. The most energy-efficient models cost from $75 to $150 more than the other models.

With three national rebate campaigns from 1999 to 2005, the Trust passed out some $20 million in subsidies to consumers. In 2005, 92% of the freezers and fridges sold in Denmark had A ratings.

Denmark's center-right government, elected in 2001, has adopted more of a market-oriented approach to conservation. Its key target: utilities, which until recently, played mostly an advisory role. They would lend meters to households, for example, so residents could pinpoint which appliances in their homes were sucking up the most electricity. But the utilities, which distribute oil, electricity and gas, were never held accountable for whether their counseling worked or not.

In 2005, the government ruled that utilities would have to meet a certain level of energy savings every year by law. Utilities can meet their targets any way they want. An electricity company, for example, can persuade an industrial client to introduce more eco-friendly machines into its factory.

But some are skeptical the conservation goals can be met. "All the easy energy savings have already been implemented in many industries," says Ole Sundman, head of energy services at the giant state-owned energy company **DONG Energy**. "It will be more and more difficult to find energy savings, and more expensive."

Utilities are getting help. Along with the new targets, the government has set up a virtual exchange where utilities that have trouble saving energy can buy credits from any company that has saved energy. Last year, Dalum Papir was able to recover much of the $1 million it spent to replace electric dryers with those that run on natural gas. It did this by selling energy savings to a natural-gas company that needed to meet its annual energy-savings target. The company paid Dalum $625,000.

Mr. Bach, who has been working on Denmark's energy-conservation drive for a quarter of a century, scoffs at suggestions that all the feasible savings have already been made. He believes companies and individuals can conserve more, especially on homes and cars.

"It's like the apple trees I have in my garden," he says. "They grow low-hanging fruit every year."

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