

Sweden pitches for data centers

It boasts cheap energy, free and cheap cooling. The Invest in Sweden Agency has begun allocating resources to market the Nordic state as a good place to build data centers. By Yevgeniy Sverdlik

The Invest in Sweden Agency (ISA) has a confident pitch for data center operators. It includes cheap, renewable electricity, free cooling, plenty of fibre, and district cooling and heating systems, which some data centers use to cool computer rooms and heat office space.

There is also a widespread practice of selling excess heat from data centers back to utilities that in turn use it to heat other customers' buildings.

"Compared with other European markets, we do have cheap energy prices here in Nordic countries," says Andreas Lundgren, an external relations manager for IBM in Sweden. That, however, is expected to change.

Sweden is expecting its energy prices to triple over the next several years. "The tripling means we will level with the European price," Lundgren says.

"It has to do with the energy market and how the framework of the energy market is regulated. There are changes on the way."

ALREADY THERE

International firms with data centers in Sweden include Volvo, IKEA and Sungard, among others. These facilities were built by Coromatic – a company that has built more than half of all data centers in the Nordics, according to the ISA's Tomas Sokolnicki

"One of the best examples is IBM, which since 1977 has fed excess heat into the district heating networks," says Sokolnicki, who focuses on IT and telecommunications industries at the agency.

"They actually have a fairly advanced mechanism in which they can choose dynamically either to heat their own offices (3,000 people) during the entire year, or they can feed the energy back out into the district heating network." Operators of the facility also have the option of trading heating energy for cooling energy.

ISA – a government-funded organisation – has been around for about 15 years. Its primary mission is to attract foreign

investment to the country. Other sectors it targets are cleantech, life sciences, material sciences and the automotive industry.

SHARED INFRASTRUCTURE

An important source of income for Sweden's economy is export of products made at its many processing plants, and the country has had a lot of experience with district heating systems.

"The district heating systems are designed so they can take as energy input industrial waste heat from process plants such as paper mills or steel mills," says ISA's Richard Stamm, who is based in California's Silicon Valley. "These process plants use tremendous amounts of electricity: many times what a data center would use, so that's how we developed the technology."

District cooling is a much younger market for the country, according to Mikael Burlin, who works as a real estate manager for IBM Sweden. Energy companies such as Fortum – one of the largest in the Nordics – have been promoting the practice for wider adoption.

IBM has two data centers in Sweden – both in the Stockholm area. One of them, as mentioned above, is connected to the district cooling and heating systems in the City of Kista. The other site is in Solna. IBM uses both facilities to house its outsourcing customers' equipment.

The Kista data center has about 37,700 sq ft of raised floor in a 108,000 sq ft building. Its power capacity is 2MW, which it buys from Fortum, along with cooling capacity. IBM hires Johnson Controls to run facilities at both its Swedish data centers.

The Kista facility's primary cooling supply comes from the district system, says Jonny Crobarg, Johnson's country technical manager for Sweden. He manages the IBM account.

Crobarg says IBM was able to save on both the capital expense of installing a traditional independent cooling system, as well as on the operational maintenance and power expenses as a result of using district cooling in the facility. Maintenance



was only 5% of what it would cost to run its own chillers and cooling towers, and energy cost associated with running the system was 30-40% lower.

Fortum built the pipes to connect the building to the main system, and IBM installed a heat exchanger, water pumps and a building management system.

HEAT FOR SALE

In addition to using heat generated by the computer room to warm the office space in the building, IBM sells an average of about 265,000kWh of excess heat capacity back to Fortum every year in the form of hot water, Crobarg says, making about 300,000 Swedish krona, or about US \$43,500 at a rate of about \$0.15 per one krona.

The district cooling system is 99.97% reliable, Crobarg says. In case it does get cut off, the BMS switches to the data center's own backup cooling system automatically until the district system resumes normal operation.

Because the data center is in the Stockholm area, where district cooling and heating infrastructure is fairly robust, it took Fortum about two months to build the pipelines to connect the site. Some cities have less developed systems, while others do not have them at all.

Pricing for district cooling varies based on the size of the client and the amount of capacity they use, says Christer Boberg, Fortum's product manager for district cooling – a product the company has been providing since 1994.

Fortum is only aware of three companies (IBM being one of them) that use the system to cool their data centers, but it is possible that many more do the same.

The utility sells cooling capacity to commercial real estate owners, so it is hard for the company to know how many data center companies that lease space from those customers use it to cool computer rooms, Boberg explains.

Most customers do not pay for the infrastructure necessary to connect their facilities to the system. The ones that do have buildings that are prohibitively far from the main pipelines. In those cases, Fortum splits the cost with the customer.

Through its system, Fortum provides water at a temperature of 6° Celsius – considered high-quality cooling capacity. The utility uses several approaches to cooling the water.

“We use a lot of seawater cooling from the ocean,” Boberg says. “When that’s not enough, we use heat pumps. When that’s not enough, we use regular cooling machines. We have a lot of capacity coming from the heat pumps because they can use district cooling and district heating as well.”

The company is able to use free cooling by pumping cold water from the ocean from about January through to August. Once water temperature rises from 6° to 8°, cooling capacity has to come from elsewhere.

The system has been growing quicker than Fortum expected. When it was first established, the company thought maximum cooling capacity in the Stockholm area would be 50MW. Today, the utility delivers about 300MW.

The company has recently completed building a thermal storage facility in a mountain. The cave is capable of storing 40MW worth of cooling capacity, which Fortum hopes to bring up to 80MW.

“Right now, we have problems getting water in and out of the storage, and if we get the budget to put more piping into the canal, then we can connect the storage with downtown and get more district cooling out of the storage,” Boberg says. “Right now the piping is the problem.”

NETWORK INFRASTRUCTURE

In September 2009, University of Oxford's

Said Business School and Universidad de Oviedo completed a Cisco-sponsored study of broadband quality and penetration around the world. The researchers concluded that in terms of quality, broadband in Sweden was third after Korea and Japan.

The study based its quality judgment on latency and download and upload throughput.

Sweden was also determined to be one of the leaders in online penetration, with about 70% of households having access to broadband.

The ISA's Stamm says telecom infrastructure in Sweden is “extremely good. Both hot and dark fibre networks exist everywhere, practically. There are 100 different companies you can rent or buy dark fibre from.”

FREE COOLING IN A CAVE

In November, Tieto – one of the leading data center owners and operators in the Nordics – began building a new large data center in the Stockholm area that will not use district cooling.

The company is transforming a 215,000 sq ft cavern it has leased from the Swedish Fortifications Agency into an IT facility it will use to provide hosting and infrastructure services, says Tieto's head of IT Operations, Mikael Jupiter.

Tieto operates about 15 data centers in different countries, most of which are in Sweden and Finland. Jupiter declined to provide details but says that more than five of the company's facilities are in Sweden.

Because of its unique placement, the new data center (scheduled for launch in April 2010) will be able to use a lot of free cooling.

In the summer, when outside air is not cold enough to use for cooling the computer room, it will cool off as it passes through the long tunnels, Jupiter explains, requiring little electricity to cool it to acceptable temperature levels.

The data center will be able to use free cooling for most of the year, using regular chillers during the remaining days.

While not using district cooling, Tieto will sell excess heat from the computer room to the utility. It will also reuse some of the heat to warm the facility itself. “We will get a large amount of 50° (Celsius) water,” Jupiter says. “We are going to sell that to different parties.” ■

SUSTAINABLE TECHNOLOGIES – HEATING & COOLING

Heating & cooling

- Heat pumps: Sweden has the highest number of installed geothermal heat pumps in the world and is also home to some of the largest producers. This has created a platform for independent researchers and developers since the 1970s.
- District heating: Sweden is the world leader in district heating and Swedish carbon dioxide emissions have thereby dropped by 20%. Now 80% of the Swedish district heating is based on energy that would otherwise have gone to waste.
- District cooling: Sweden is a pioneering country in district cooling and first plant was in operation 1992. Now 30 plants producing district cooling and Swedish district cooling companies have laid a strong foundation for building systems in the form of pipelines.

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IKEA's data center is at home