

SUCCESS STORY:

# Carbon dioxide tax decarbed district heating

## POLICY CASE

### Title:

Carbon dioxide taxation and the greening of Swedish district heating

### Year (commissioned):

1991/95

### Location:

Sweden

### Stakeholders:

1. Members of Parliament
2. Lobby organisations
3. Several NGO's, among those The Swedish Society for Nature Conservation

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The Swedish District heating sector has been decarbonized. Emissions dropped from 240 kg CO<sub>2</sub>/MWh heat to 120 kg/MWh in 10 years and 25 years after the shift started emissions were down to a quarter (Energiföretagen Sverige, 2018).

Being a large-scale business with energy professionals, the District heating sector managed a major shift in use of biofuels in just a few years. A significant driver for the fast transition was the introduction of a carbon dioxide tax on fossil heating fuels. The carbon dioxide tax made biofuels that are cheap but difficult to combust competitive for the District Heating sector.

Evaluations have shown that the emissions of carbon dioxide would have been significantly higher today without these increases of the carbon dioxide tax (Regeringskansliet / Miljödepartementet, 2014).

The tax is based on a mutual long-term agreement between the major parties in the Swedish parliament, regardless of political affiliation. The agreement included an overall goal to have a fossil fuel independent building sector by 2020. Over the years the tax has been increased to continue to push for a phase out of fossil fuels for heating.

The tax is based on actual emissions (SEK/kg CO<sub>2</sub>), but is set in each fuels trading unit, i.e. SEK/ton, SEK/m<sup>3</sup>, etc.

Initially, the fee level in 1991 was 25 € /ton CO<sub>2</sub>. Ten years later, year 2000, it had been raised to € 37, and from this point a sharp raise was made to 91 €/ton by 2005, as part of a tax reform (Statens Energimyndighet, 2006). By 2015 the tax is 112 €/ton CO<sub>2</sub>. This can be compared with price levels in the EU Emissions Trading System (ETS) the last couple of years, which most of the time has been 4-8 €/ton.

There are some exceptions from the tax. Companies included in the European Emission Trading System (ETS) has been omitted. Combined heat and power plants with electrical efficiency above 15% get a reduction and pays 21% of the tax. (The tax is on heat only, not power generation. The reduction promotes efficient CHP). The industry sector also has a tax reduction, but it has started to be phased out.

## The Policy and its mechanisms

Emissions of CO<sub>2</sub> from fossil fuels for heating are taxed to create a driving force away from carbon intense fuels.

**Feedstock origin:**

- Domestic silviculture residuals from thinning, tops, branches etc
- Domestic and imported forestry by-products/residuals: bark, wet wood chips, etc
- Domestic waste, woody industrial/residential: Construction wood, furniture, etc
- Domestic waste, non-woody industrial/residential: paper/pulp, textiles, etc

**Conversion system:**

- Boiler combustion, e.g. stand-alone boiler plant including co-firing and combined heat and power

**Co-fire:**

- Heat generator (i.e. boiler) is 100 percent biomass-fired.
- Heat generator (i.e. boiler) is co-fired with waste

**Heating system heat sources:**

- Biomass is the only heat source in system
- Heat generator is part of a system with fossil fuel fired boilers
- Heat generator is part of a system with heat pumps

**Comments:**

- Above is the main fuel used indicated as well as main technologies affected by the tax. The tax itself is neutral and doesn't promote any specific biofuel.



For district heating, the tax has been a clear and present driver towards bio-fuels.

The tax is set per fuel in its traded unit, i.e. for heating oil in SEK/m<sup>3</sup> and for fire coal in SEK/ton. However, the tax is the same for all fossil heating fuels in terms of SEK/kg CO<sub>2</sub> emissions, making the tax lower per caloric content for natural gas and higher for coal. All bio-fuels are excluded from CO<sub>2</sub> tax (Sveriges Riksdag, 2017).

For district heating, the tax has been a clear and present driver towards bio-fuels. The higher cost for oil and coal has made bio-fuels, including difficult to combust wet bio-fuels and sorted bio waste fuels competitive alternatives for district heating (Statens Energimyndighet, 2007).

The long-term agreement made by the parties in the Parliament, across the political blocks, has been of importance for the long-term credibility of the tax reform.

The tax is here to stay, which is of importance for decision makers who are going to decide on large investments in solid fuel biomass boilers with long depreciation time, such as large solid fuel biomass boilers.

The carbon tax is the main driver to move away from fossil fuels, but some other surrounding mechanisms affecting the district heating sector that should be mentioned are:

1. The Swedish legislation on waste handling and waste taxes in combination with the carbon tax have constituted strong forces to transfer the waste stream from deposits to material and energy recovery; the latter mainly in the form of district heating. Among other, the legislation comprises a prohibition to deposit

## Relation to Sustainable Development Goals:



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



**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**



**Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss**

organic waste (from 2005). Despite the high capital costs connected to waste combustion the revenue from sold heat have made it possible to exact rather low fees for turning waste in for incineration. The substantial decrease of waste deposition and the increased waste incineration has led to a dramatic reduction in the emission of greenhouse gases from waste treatment. (OECD Environmental Performance Reviews: Sweden 2014, 2014)

- Two national climate investment programs (LIP and KLIMP) have contributed to the expansion of district heating (OECD Environmental Performance Reviews: Sweden 2014, 2014). The latter program had a strong focus on cost efficient CO<sub>2</sub> reduction, ranking projects by the subsidy (SEK) per avoided CO<sub>2</sub>-emission (kg), making district heating network expansion high ranking.
- The EU Emissions Trading System (EU ETS): Large operations whom are part of ETS are omitted from the tax. At the same time EU-ETS trading prices have been much lower than the tax level. By 2015 the tax is 112 €/ton CO<sub>2</sub> while EU ETS has had price levels 10 to 20 times lower the last couple of years.

## Reasons behind the implementation

It all started in the 1970's with the oil crises, which led to a national decision 1980 to move away from fossil heating oil. 10 years later, In the 1990's, climate change appeared on the political agenda. This time it led to a move away from all fossil fuels for heating.

As part of a broad political agreement across the political blocs, policies in the form of taxes on carbon dioxide and sulphur were introduced. The carbon dioxide tax started as a fee in 1991 and was turned into a tax year 1995. In 1990/95 the energy tax was reduced in the same magnitude as the CO<sub>2</sub> tax was raised [FORES]. In 2000/06 a major green tax reform was made, with a significant raise of taxes on energy and emissions and reduction of tax on work, i.e.

reduced income tax and employment fee (Brunhage, 2006).

Evaluations have shown that the emissions of carbon dioxide would have been significantly higher today without these increases of the carbon dioxide tax (Regeringskansliet / Miljödepartementet, 2014).

District Heating networks had already expanded heavily in the decades before the decision to move away from fossil oil in 1980, and continued to expand during 80's and 90's. As a consequence of the policies to replace oil, its share in District Heating dropped from 90% year 1980 to 50% 1983, almost by half in just three years! 1990 it was down to 10%. Oil had been replaced with mostly coal (Statens Energimyndighet, 2017)

In 1990's The District heating sector was once again able to make a fast fuel-switch. In 1990 before the carbon dioxide fee (later carbon tax) was introduced, the carbon intensity was just over 240 kg/MWh delivered heat. In 1995 it had been reduced with about 30%, and by 2000 it was down 50%! By 2015 the carbon intensity is reduced with more than 70% from 1990 years level.

The fossil fuel share was 8 percent of the added energy for district heating production in 2015.

If all fuel of fossil origin is considered (household waste and more), the fossil share is 20 percent for 2015. (Statens Energimyndighet, 2017)

## Lessons learned

The evaluations made has not shown any major flaws in the system.

However, one aspect to consider is the overall diversified energy and environment taxation system. Lately there has been some success in reducing the exceptions in the system. Still, several sectors have a reduction of the CO<sub>2</sub> taxation, which can decrease their incentives to use energy efficiently (OECD Environmental Performance Reviews: Sweden 2014, 2014).The Industry sector is one of the sectors that has an exception and does not pay full CO<sub>2</sub>-tax.

Companies included in EU-ETS are excluded from the

**Replicability potential:**

- High national replicability
- High international replicability

**Scale-up potential:**

- High national potential
- High international potential

**Connection to policy case:**

- Dairy industry investment case, Sweden

tax. EU-ETS has had a price of about 5-8 € / ton CO<sub>2</sub> (about 45-80 SEK/ton), compared to the tax-level slightly above 110 €/ton.

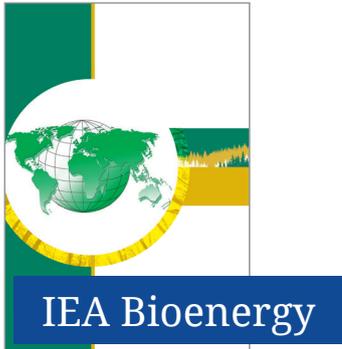
## Success factors

The ability to come to broad political agreements that last for long time and isn't depending on who wins the next election is of essence, since large-scale infrastructure investment in large boilers is needed to achieve the fuel-switch that the tax targets.

The two tax reforms implemented reduced other taxes, keeping the overall tax level constant while creating incentives to work towards sustainability.

## Constraints

The tax has been and still is colliding with EU legislation regarding the industry (and some other) sector's tax reduction. EU has considered the industrial tax reduction to be a non-legitimate government support. Sweden has chosen to exclude the industry, since the CO<sub>2</sub> tax within EU and on other markets that Sweden's export industry is competing on is significant lower, or non-existing. Heating of buildings is in comparison a local/domestic market.



**Web sites:**

[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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