# How to Design a Cost-Effective Carbon Tax on Motor Fuels ….

## …. and be in line with EU state aid rules

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# New National Climate Goals

- **Adopted by Parliament in June 2017**
  - By 2045 - no net emissions of greenhouse gases.
  - By 2030 - emissions from domestic transports (excl. aviation). reduced by 70 % compared to 2010.
- **Main challenge is the transport sector**
  - Sustainable biofuels is part of the solution.
  - Policy design should give long-term sustainability.

# Context …

- **Swedish carbon tax since 1991**
  - Based on fossil carbon content of motor fuels and heating fuels.
  - Current tax rate 1.13 SEK/kilogram (132 $/tonne) fossil carbon. In 2018 1.15 SEK/kg (135 $/tonne).
  - Key driver behind Sweden's success in cutting emissions.

- **A fossil-free vehicle fleet by 2030**
  - Major challenge ….
  - Introduce a quota obligation for biofuels (percentage or greenhouse gas [GHG] reduction mandate)?
  - How would a carbon tax work along with a quota scheme?
  - Impact of EU state aid rules?

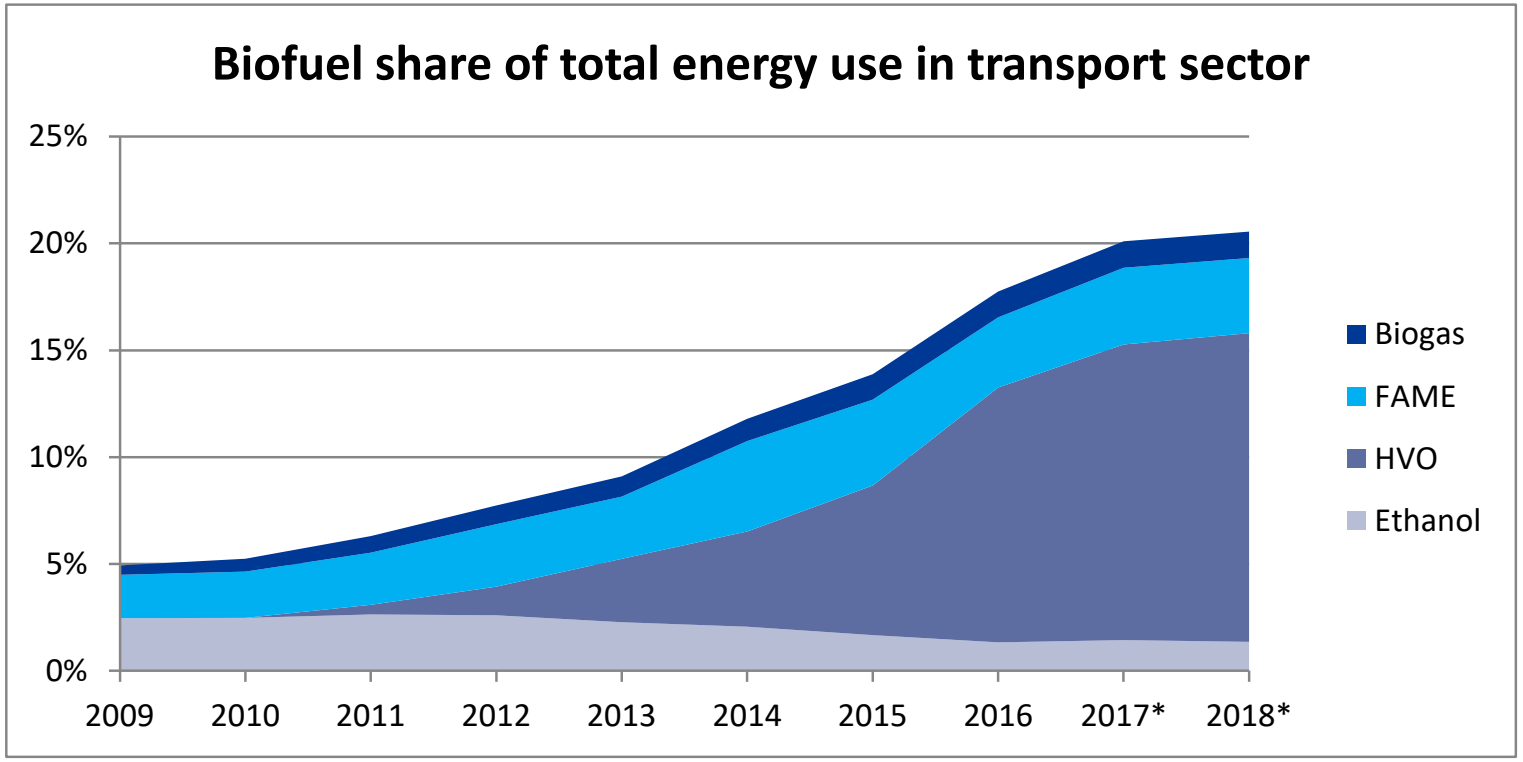

# Sustainable Biofuels

## *Current Swedish design of economic instruments in the transport sector*

- No carbon tax on sustainable biofuels.
- EU Commission considers no carbon tax on biofuels to be a state aid.
- EU state aid approvals until the end of 2018 (liquid biofuels) and 2020 (biogas).
- No quota obligation scheme.
- The tax design has been successful in significantly increasing the volumes of biofuels in the transport sector.

# Biofuel Development

## *Swedish market 2009-2018*




Note: Share in terms of energy content. Including both high and low blended biofuels. *Forecast for 2017-2018 (only takes into account current policy, i.e. not the reduction obligation).
Source: Swedish Energy Agency (SEA) and own calculations.


# Trends on the Swedish Biofuel Market

- **Biofuels chemically identical to fossil gasoline and diesel**
  - Small or no adaption of vehicles necessary.
  - Raw material: forest and waste residues possible (if such raw material is used, food-based raw material use can be reduced).
  - Significantly higher reductions of $CO_2$ emissions (compared to most food-based)
- **HVO diesel** (hydrated vegetable oils and fats)
  - On the market since 2011.
  - In 2016 approx. 64 % of biofuel market (low and high blends)
- **Synthetic gasoline**
  - On the market since 2015.
  - Still very small volumes, but possibly big potential.


# Facts to Consider …..

- A quota obligation for biofuels is generally not a state aid.
- A tax reduction, e.g. no carbon tax for biofuels, is a state aid.
- State aid to biofuels covered by a quota obligation is not allowed => options ….
  - *if a quota obligation applies*
    - the biofuels covered need to be taxed at the tax rate of equivalent fossil fuels per liter = no state aid
  - *if no quota obligation applies*
    - time-limited approved state aid possible for tax reductions on sustainable biofuels
    - from 2021 food-based biofuels cannot be granted state aid

# New Policy Package for Motor Fuels I

*Into effect from 1 July 2018*

- **Time table**
  - Government proposal in Budget Bill to Parliament 20 Sept. 2017
  - Parliament decision November 2017
- **Main elements of proposal**
  - *Reduction obligation scheme*: mandatory to reduce greenhouse gas (GHG) emissions from fossil gasoline and diesel by blending in biofuels.
  - *Redesign of carbon tax* levied on gasoline and diesel
  - Continued tax exemptions for *high blended biofuels* (not covered by the reduction obligation, e.g. E85, ED95, HVO100). New EU state aid approval until the end of 2020.

# New Policy Package for Motor Fuels II

*Reduction obligation scheme*

## Mandatory to reduce emissions by blending in biofuels

- Compared to fossil gasoline and diesel, GHG emissions are to be
  - reduced by certain % GHG reduction for all gasoline and diesel sold/consumed
- Fulfilled on annual basis by distributors and large consumers
  - energy and carbon tax payers, abt. 300 companies
- Incentive to use biofuels with high GHG emission reductions.
- More details, see annex.

# New Policy Package for Motor Fuels III

## *Logic of redesign of carbon tax rates*

- **No elements of selectivity = no state aid**
  - No specific tax exemption for biofuels in gasoline or diesel.
  - Carbon tax rates for gasoline and diesel still expressed per liter fuel.
  - When calculating the tax rates, the estimated average share of biofuels resulting from the reduction obligation scheme is taken into account.
    - Less fossil $CO_2$ emissions per liter gasoline and diesel. Carbon tax rate still 135 $/tonne fossil carbon 2018.
    - Only part of the calculation mechanism for the general carbon tax rates for gasoline and diesel.
    - The actual composition of each liter of gasoline or diesel sold is irrelevant. Same carbon tax per liter regardless of content of biofuels.
- **Updating energy and fossil carbon values used in calculations**
  - Until now the 1991 values have still been used.

# New Policy Package for Motor Fuels IV

## *Redesign of carbon tax rates in figures*

**Table 1 Emission factors for gasoline and diesel, kilogram fossil carbon dioxide emissions per liter**

| | *Emission factors currently used* | *Updated emission factors* | *Emission factors when share of biomass is accounted for* |
|---|---|---|---|
| Gasoline | 2.32 | 2.36 | 2.24 |
| Diesel | 2.86 | 2.54 | 1.91 |

**Table 2 Carbon tax rates, per liter**

| *Carbon tax** | *Gasoline, env. class 1* | *Diesel, env. class 1* |
|---|---|---|
| Carbon tax January 1, 2018 | 2.66 SEK/0.31 USD | 3.292 SEK/0.39 USD |
| Incl. updated emission factors | 2.71 SEK/0.32 USD | 2.921 SEK/0.34 USD |
| Incl. account for share of biomass following reduction obligation scheme = tax rate from July 1, 2018 | 2.57 SEK/0.30 USD | 2.181 SEK/0.26 USD |

*Corresponds to a general carbon tax rate of 1.15 SEK/kg in 2018 (131 $/tonne) fossil carbon, i.e. the carbon tax rate per liter is the product of the emission factor of the respective fuel and the general carbon tax rate.
Currency conversion using official rate per 3 October 2016, 1 USD = 8.54 SEK.

# New Policy Package for Motor Fuels V

## *Conclusions*

- **Reduction obligation scheme ensures a certain reduction of the GHG emissions**.
- **Increased obligation levels over time**
  - To reach 2030 target 50 % of gasoline and diesel sold should be biofuels (estimate).
- **What biofuels will be used to fulfill the obligation?**
  - Within fuel standards ….
  - Food-based biofuels (e.g. ethanol and Fame)? HVO?
  - Raw material shortage? – in the short run? in the long run?
  - How to ensure sustainability world wide?
  - Future technical development – new fuels? new raw materials? The sky is the limit ….
- **Fuel price increases** following the introduction of a reduction obligation scheme?
  - Tax rate adjustments can to some extent be used as compensation, if deemed politically appropriate.

# New Policy Package for Motor Fuels VI

*Conclusions cont.*

- **Carbon tax on gasoline and diesel still has a role to play**
  - A basic pricing of all fossil carbon emissions outside the EU ETS
- **Carbon tax per liter gasoline and diesel** can be **further lowered** when biofuel obligation levels are increased.
- Carbon tax design still in line with **Polluters Pay Principle**
  - A high carbon tax per tonne fossil carbon can be maintained.
- **In the long run ….**
  - Increased biofuel obligation levels.
  - Will there be any tax base left for a carbon tax on gasoline and diesel?

# Thank you for your attention!

# Questions?

# Further information

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# Annex

## *some additional information about the Swedish carbon tax*

# Swedish Energy and Carbon Taxation

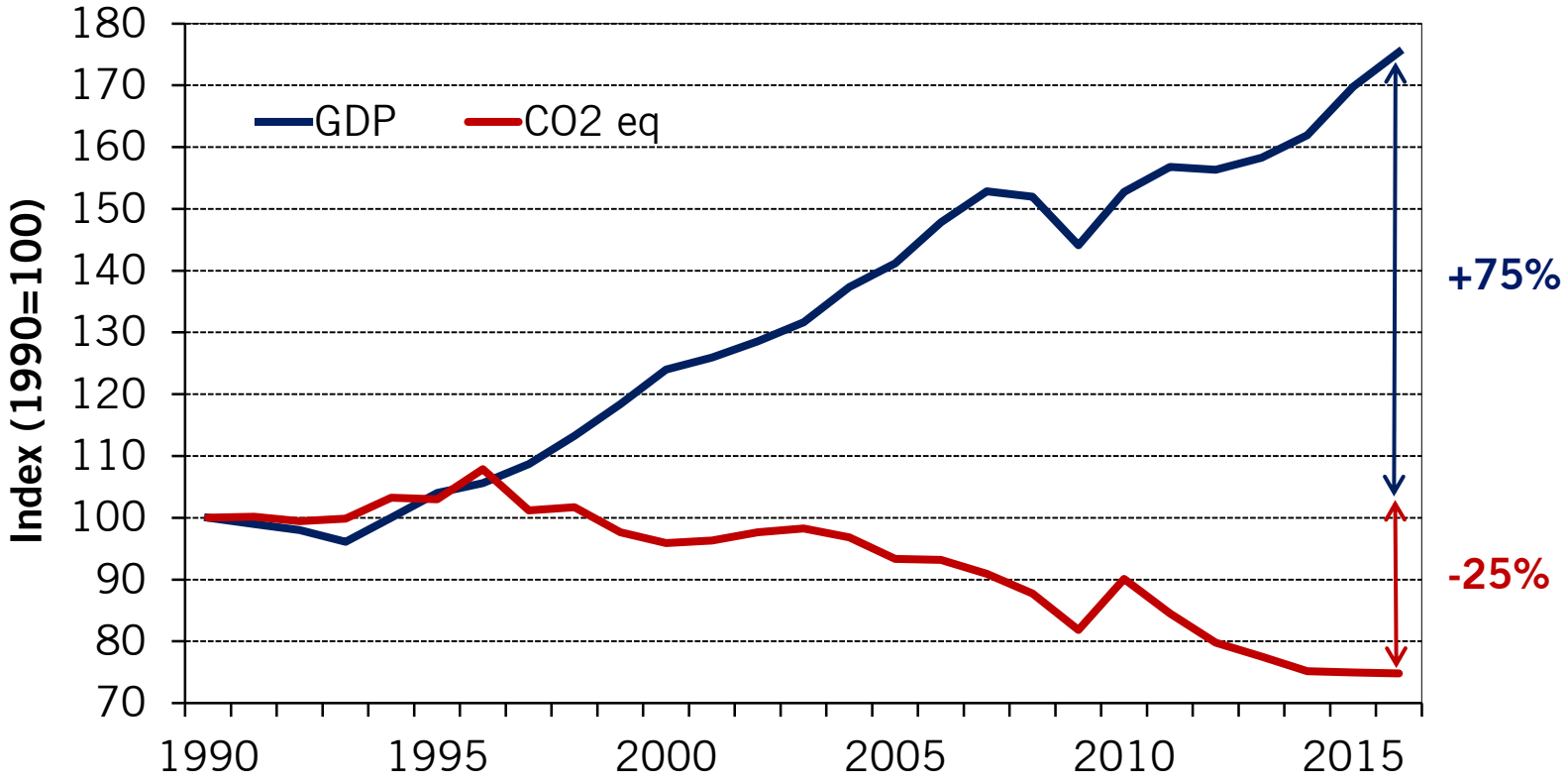
## A long history that started in1924

- **Taxation of energy – two components**
  - Energy tax on fuels (1924 gasoline; 1937 diesel; 1957 heating oil and coal; 1985 natural gas; 2013 biofuels blended in gasoline and diesel) and electricity (1951)
  - Carbon tax on fossil fuels (1991)
- **Two levels of carbon tax,** per tonne fossil carbon
  - High for motor fuels and heating fuels in households and service
  - Low for heating fuels in industry – raised step by step
- **No carbon tax on installations covered by EU ETS (EU Emissions Trading Scheme,** incl. major part of heavy industry, heat and power installations)
- **Carbon tax –** key driver behind Sweden's success in cutting emissions

# Development of the Swedish Carbon Tax

- **Two levels of carbon tax, per tonne fossil carbon**
  - *High* for motor fuels and heating fuels in households and service: *29 $ in 1991; 132 $ in 2017.*
  - *Low* for heating fuels in industry: *7 $ in 1991; in 2017 outside EU ETS 106 $, no carbon tax within EU ETS industry.*
  - Lower tax level has been the prerequisite for the high level.
- **Towards one single price on carbon**
  - Step-by step raising the lower level for industry outside EU ETS; lower level fully abolished in 2018.
  - Heavy industry mainly within EU ETS – another economic instrument which puts a price on carbon.

# Real GDP and Domestic $CO_2$eq Emissions[1] in Sweden, 1990–2016




[1] In accordance with Sweden's National Inventory Report, submitted under the UNFCC and the Kyoto Protocol. $CO_2$ = approx. 80 % of total $CO_2$eq emissions. Preliminary data for 2016.

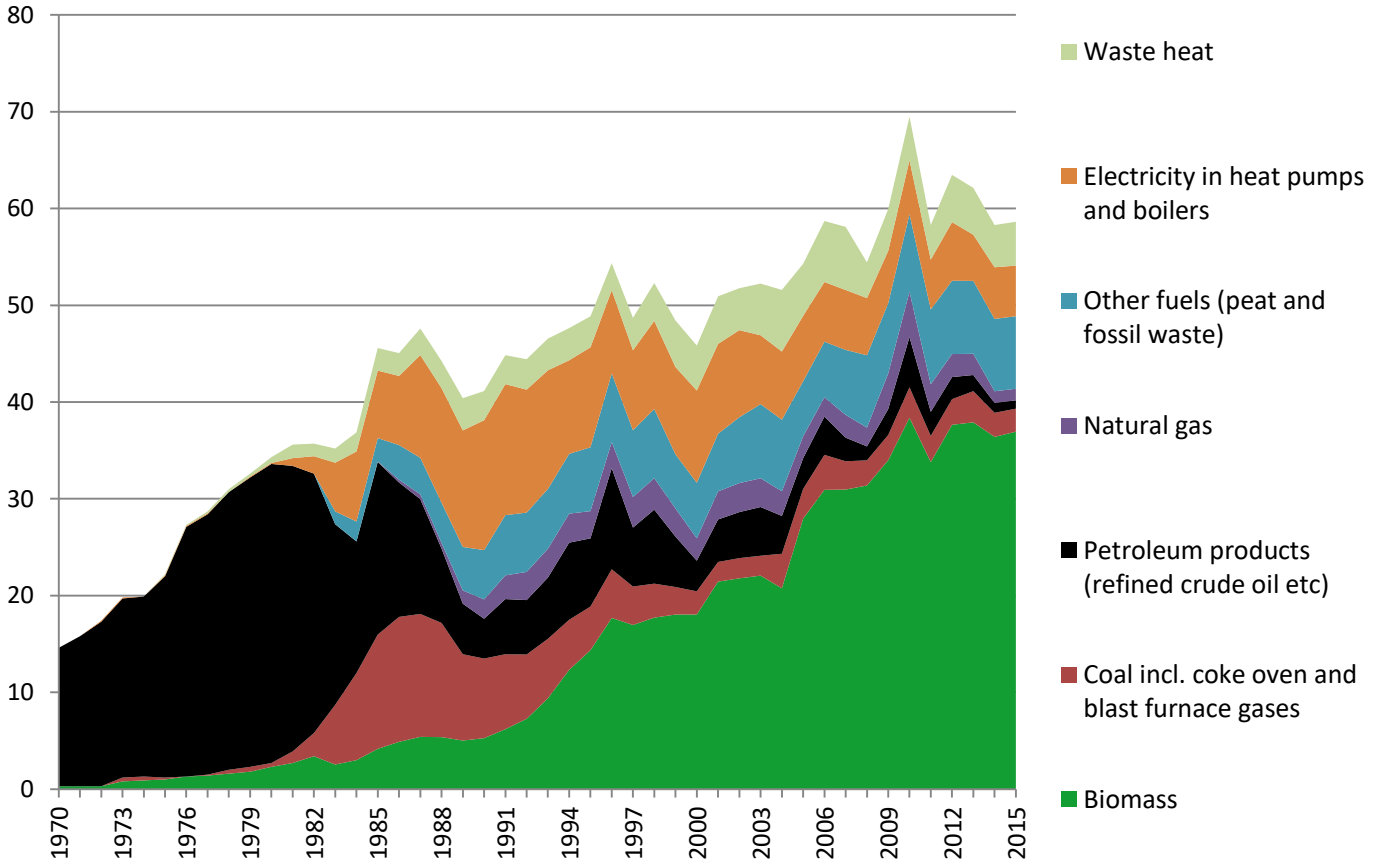
***Sources***: Swedish Environmental Protection Agency, Statistics Sweden

# Energy input sources for district heating in Sweden, 1970-2015

**District heating in Sweden**

- 2015: 59 TWh (+43 % since 1990); district cooling 0,9 TWh.
- 91 % of all flats.
- **In-put biomass (in household waste, wood scrap etc.) 10 % in 1990; 67 % in 2015.**

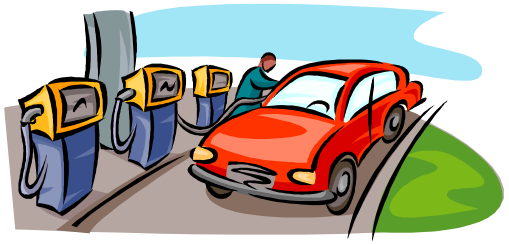
**Source:** Swedish Environmental Protection Agency, own calculations



# Distributional Effects

## *Households*

- **Heating fuels:** The carbon tax has led to the phasing out of fossil heating fuels used by households.
  - Fossil heating fuel use has since 1990 dropped by 85 % and now represents 2 % of Sweden's total greenhouse gas emissions.
  - Replaced by district heating, wood pellets burners and heat pumps.
  - Temporary aid schemes for conversion to renewable heating.
- **Motor fuels**
  - Major challenge remains for a fossil free transport sector
  - Public transport
  - An average household paid approx. 450 € in energy and carbon taxes on motor fuels in 2015 (2 % of total tax paid).



- **General welfare state**
  - Social transfers
  - Increased basic income tax reductions for low and middle income households.

# Distributional Effects

## *Business*

- **Industry within EU Emission Trading Scheme (ETS):** Generally energy intensive.
  - No carbon tax from 2011, lower energy tax.
  - Proposal to reintroduce carbon tax for combined heat and power plants that are also covered by the EU ETS on January 1, 2018 at a rate of 11 % of the general level.
- **Industry outside EU ETS:** Generally less energy intensive.
  - Step-wise increase to general tax level 2011–2018.
  - In general low costs for energy and high costs for labor and capital.
- Large shares of the Swedish industry's use of energy consist of **bio fuels** (36 %, mainly paper and pulp) and **electricity** (32 %) in 2014.
  - No tax on solid bio fuels and residues ; low energy tax on electricity for industry.
  - Steady decline in specific energy use (amount of energy used per monetary unit of value added).
- **District heating** is a significant provider of **space heating for service sector** (offices, shops etc.): **80 % in 2014.** 74 % of in-put is household waste and forestry waste.

# Reduction Obligation Scheme

## *Some more details*

- **GHG reduction percentages of all fossil gasoline and diesel sold/consumed**
  - at least 2.6 % for gasoline and at least 19.3 % for diesel from 1 July 2018
  - at least 2.6 % for gasoline and at least 20 % for diesel from 1 January 2019
  - at least 4.2 % for gasoline and at least 21 % for diesel from 1 January 2020
  - levels post 2020 will be decided at future control stations
- **Penalty** to be paid if % GHG reduction is not met.
- Obligation can be **fulfilled** by
  - blending of all kinds of biofuels into gasoline and diesel
  - the amount of blending is limited by fuel standards and high blended biofuels are excluded from the reduction obligation scheme for state aid reasons (= maximum 10 % ethanol in gasoline, maximum 7 % Fame in diesel and as far as HVO, other HVO than high-blended HVO100).
- In Sweden, the energy tax rate is adjusted to counteract **price increases** in 2018. As obligation levels are further increased in 2019 and 2020, however, prices are expected to increase.

# Average Reduction of Lifecycle Based $CO_2$ eq Emissions for Certain Biofuels

*Figures under current policy system; estimated to be improved by the new reduction obligation scheme*

| Renewable fuel | Reduction |
|---|---|
| Ethanol (E85, ED95 and ethanol for low blending) | 58.7% |
| FAME (biodiesel) | 53,3% |
| HVO diesel | 81.3% |
| Biogas used for transport | 75.8% |

Source: Report from the Swedish Energy Agency: ”Drivmedel 2016 Mängder, komponenter och ursprung rapporterade enligt drivmedelslagen och hållbarhetslagen” (ET2017:12)

Based on fuels used in Sweden in 2016 and reported to the Swedish Energy Agency according to the Act on Sustainability Criteria, lagen (2010:598) om hållbarhetskriterier