



Renewable Energy in Sweden – an Overview

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RENEWABLE ENERGY CONFERENCE: DEVELOPMENT AND SUSTAINABILITY

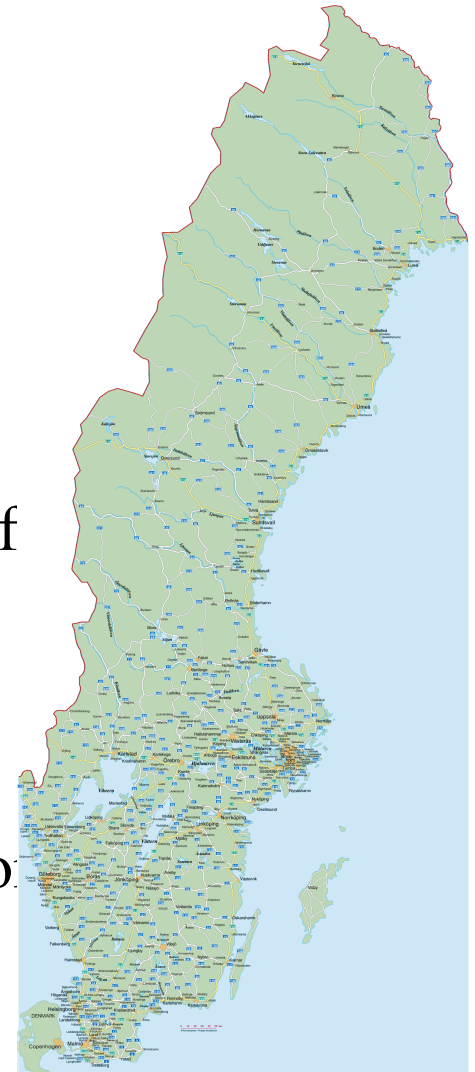
Vilnius 10 June 2008





Characteristics...

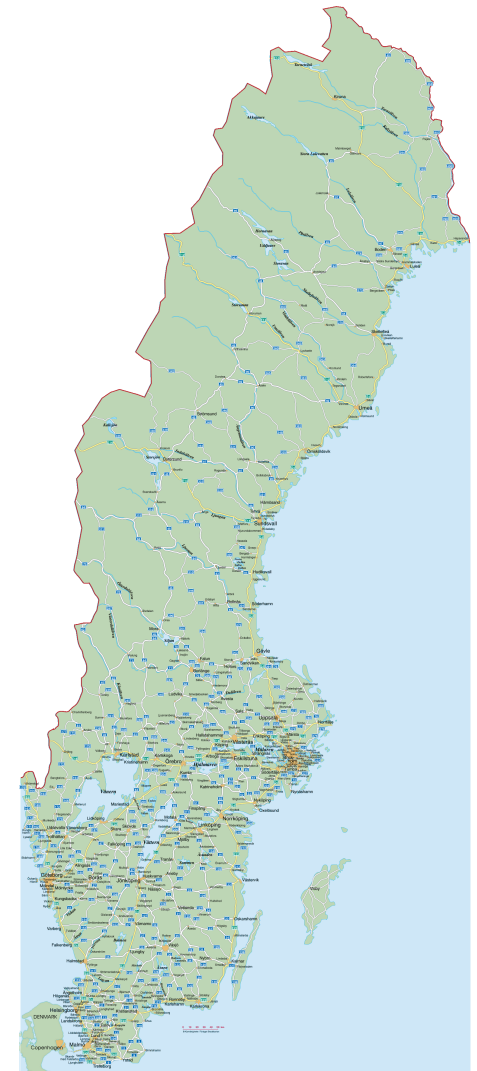
- Cold Climate
- Large Sector of Energy Intensive Industry
- Large Area
- Large Automotive Industry for Small Country
- Large Hydro and Biomass Resources
- Large District Heating Sector

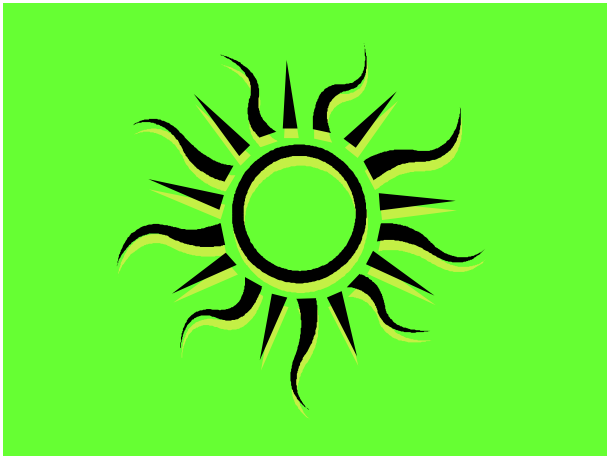




Situation today

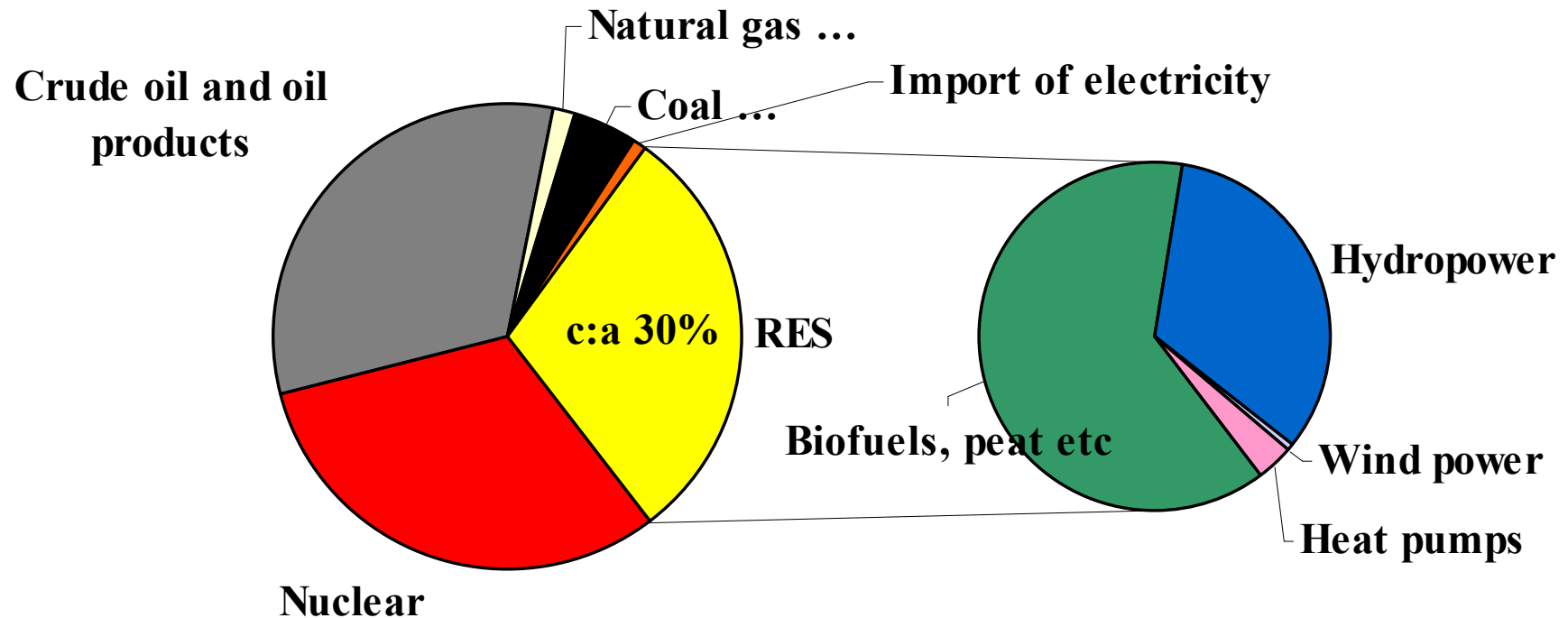
- **Almost fossil-free electricity production**
- **Low CO₂ emissions per capita and GDP**
- **Energy-efficient industry**
- **High thermal standards in buildings**
- **CO₂ taxes and other policy incentives**





Large share of RES in TPES

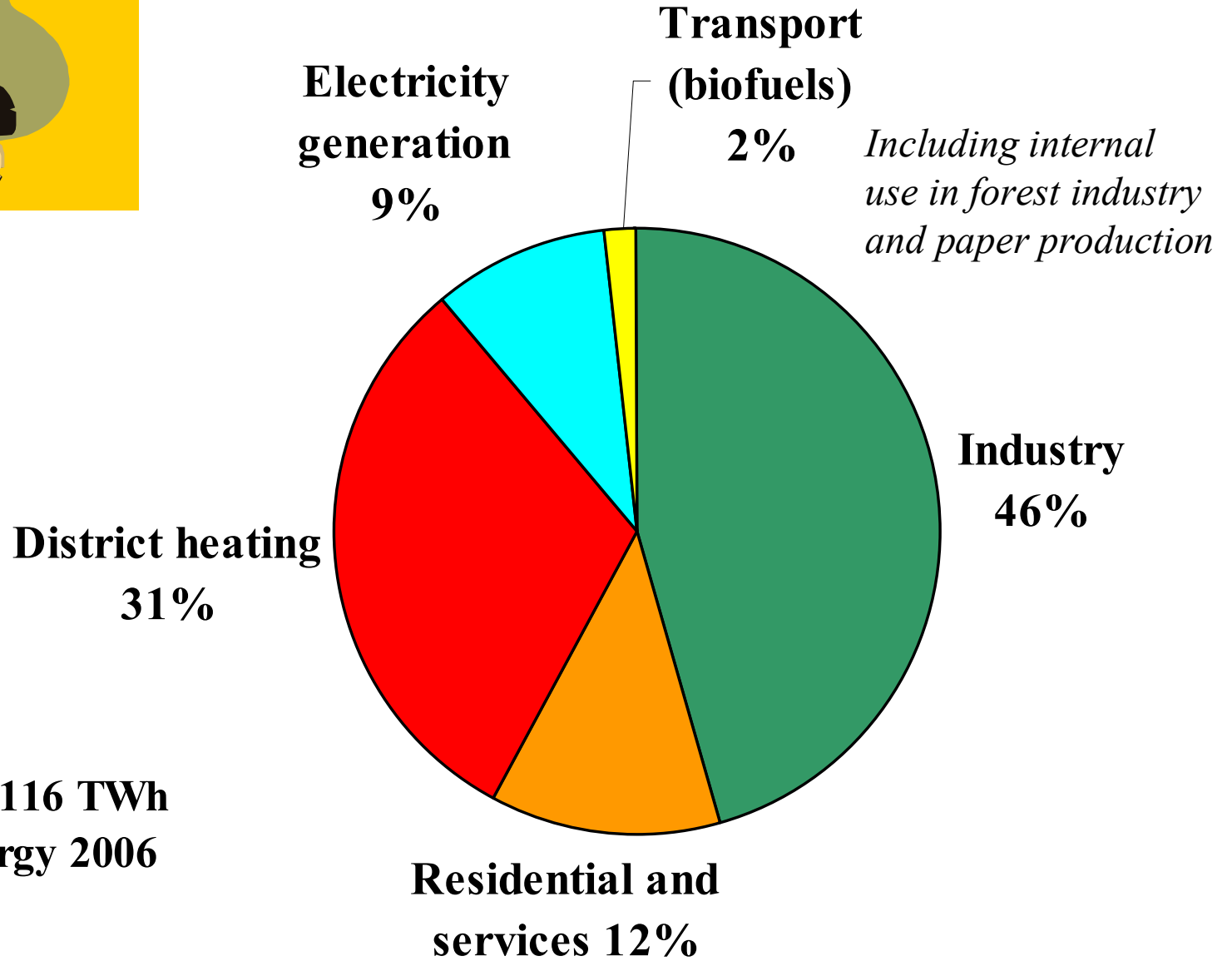
Statistics for 2006



N.B. Share of Renewable Energy varies year to year;
depending on rainfall, cold winter etc.



Bioenergy 2006

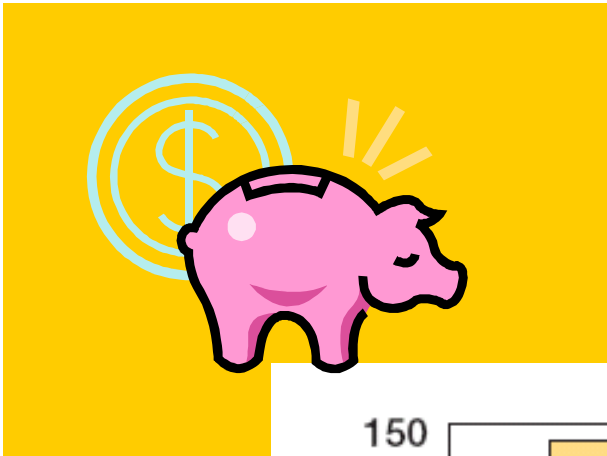


**Totalt 116 TWh
bioenergy 2006**

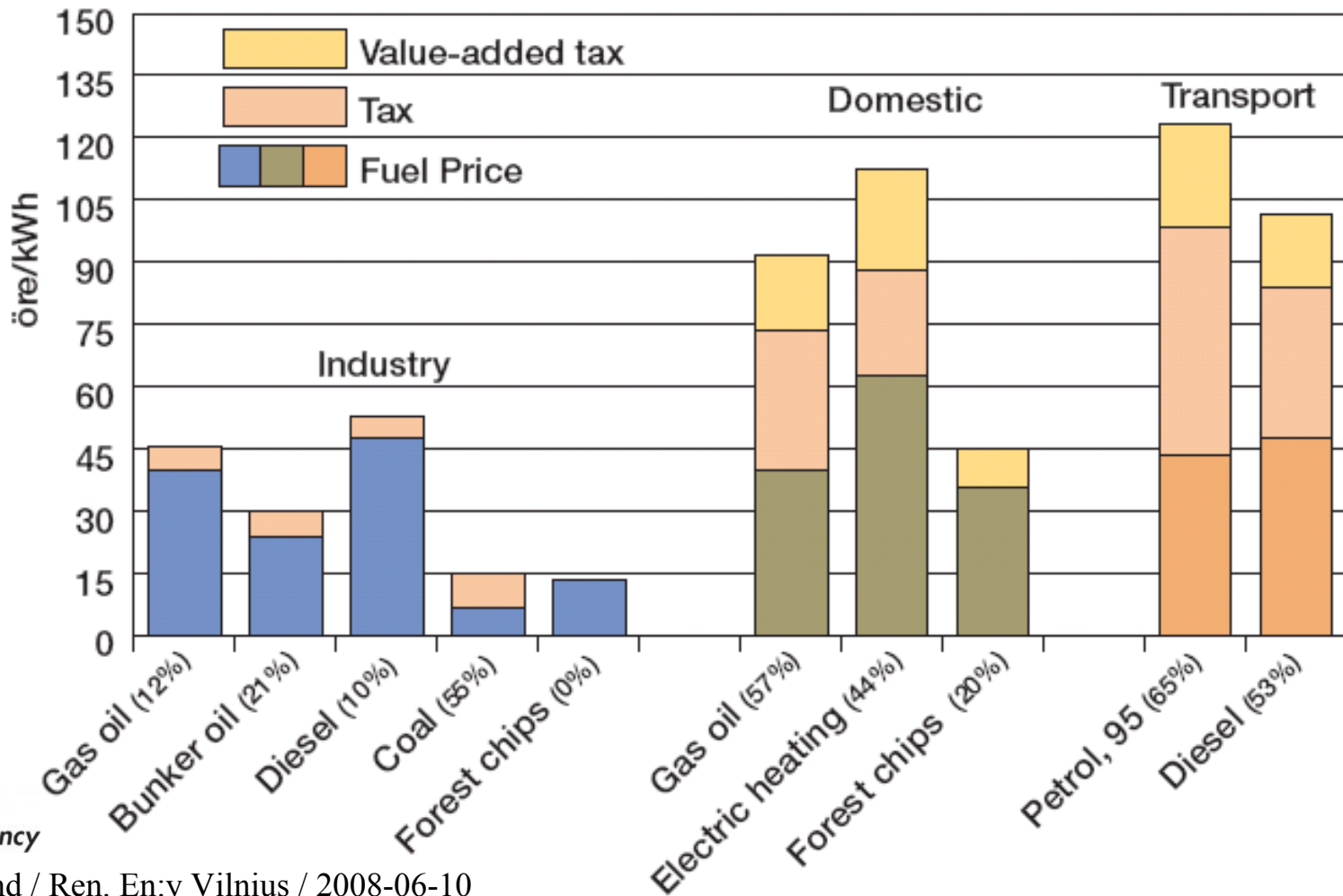


Instruments: Market Based and General

- **Carbon Dioxide taxation since 1991**
- **Emissions Trading**
- **Green Certificates**
- **Wind Power Policies**
- **Tax Reduction on Biofuels for Transport**
- **Information and Education**
- **Innovation and RD&D**
- **Phase-out of Specific Subsidies**



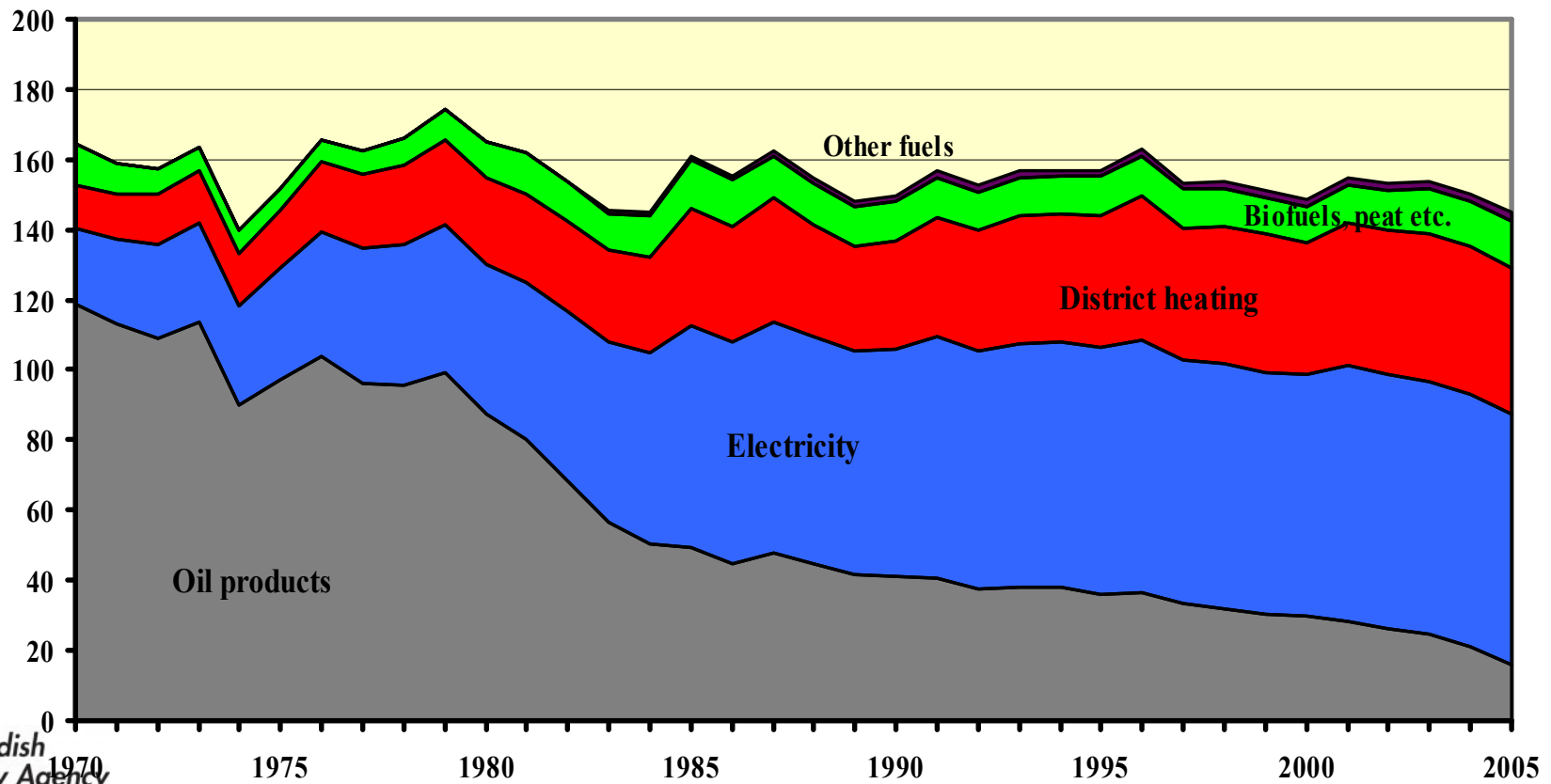
Energy Taxes & Prices





Energy Taxes & Prices

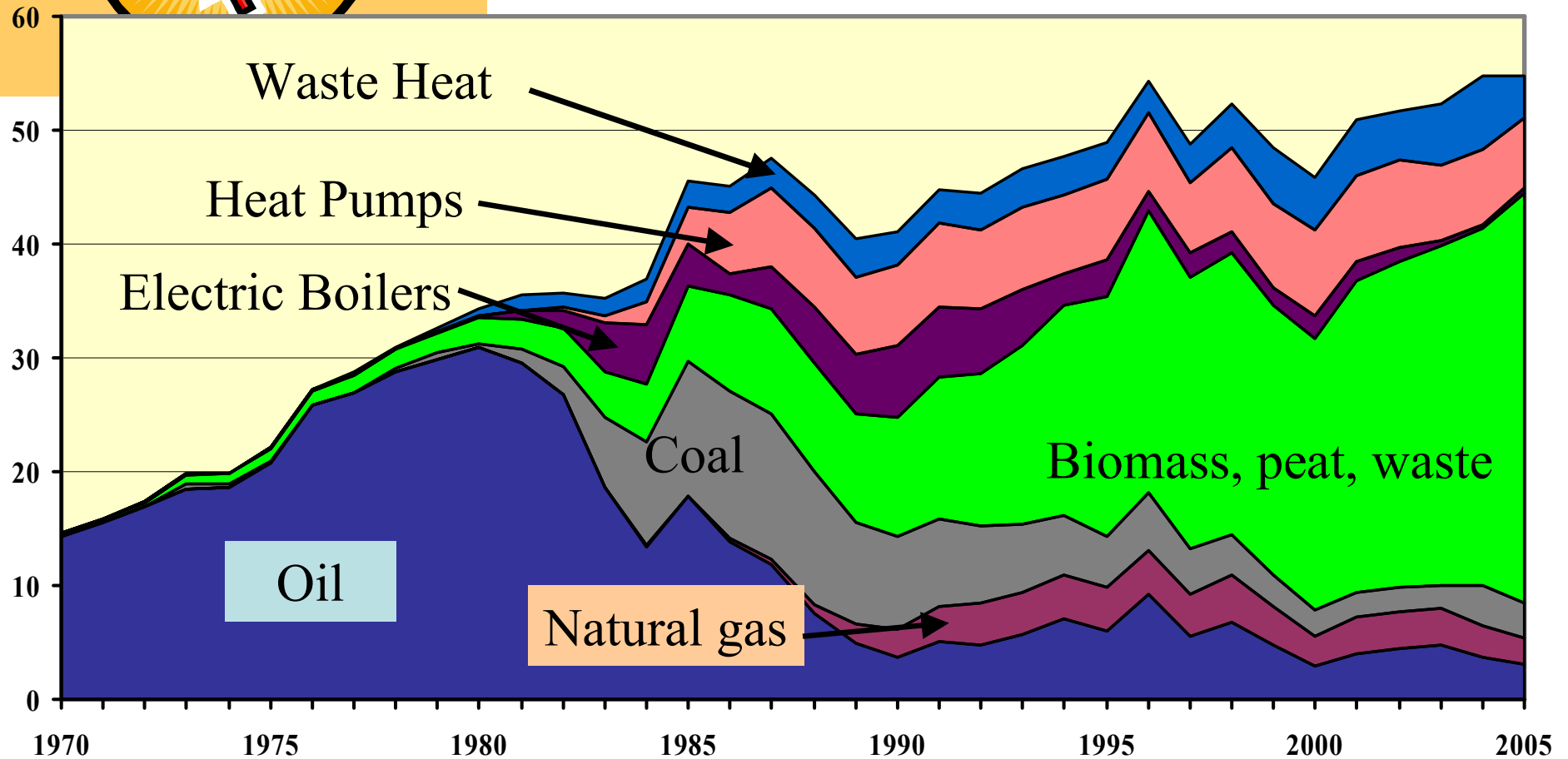
Buildings, total energy use

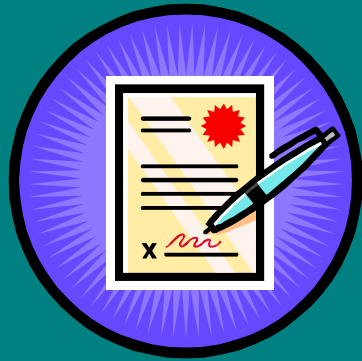




Energy Taxes & Prices

District Heating, by fuel (TWh)

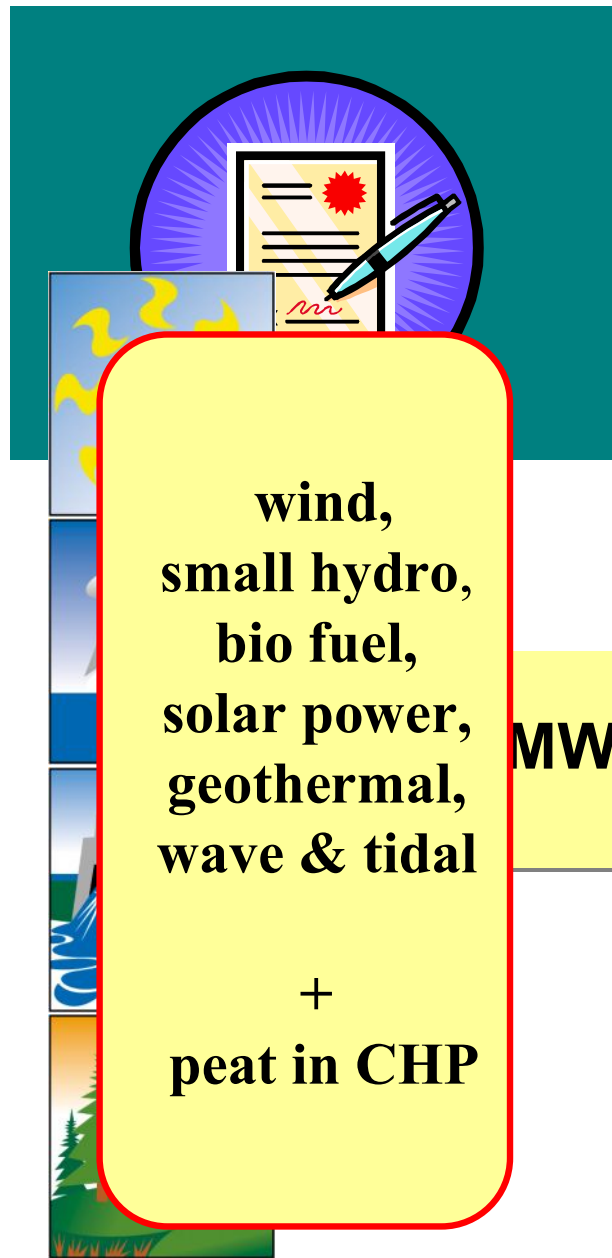




Renewable Power - Electricity Certificates

- **Green certificate trading system for renewable electricity**
- **Target: + 10 TWh electricity from new renewable energy sources (excl. existing large scale hydro power) by 2010**
- **Increased ambition: +17 TWh by 2016 to a total of 23,5 TWh by year 2016**
- **No financing from state budget**
- **To stimulate cost effective expansion and competition**
- **To enable future international harmonisation**

Principles of the certificate system



MWh

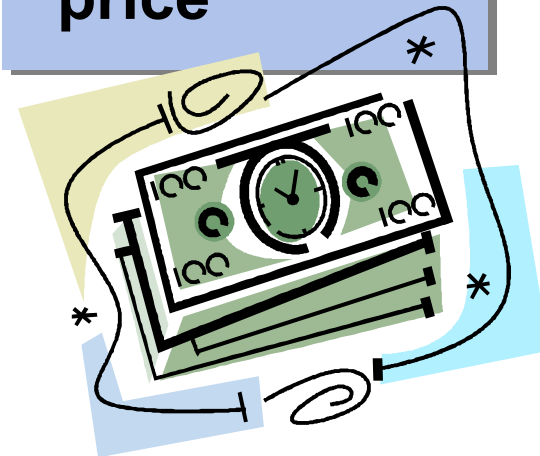
Certifi-
cates

Electricity

Total Revenue

Certificate
price

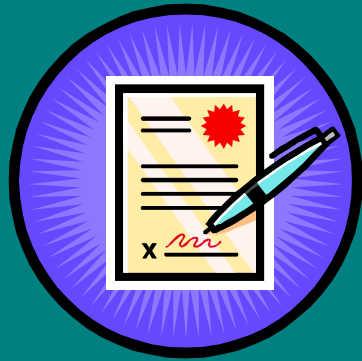
Electricity
price





Basic facts of the electricity certificate system

- **The system started the 1 of May 2003**
- **The system will run to the end of 2030**
- **Producers of renewable electricity receive certificates from the state for a maximum of 15 years**
- **Obligation for suppliers and some end-users to acquire certificates (quota obligation) in proportion to supplied or consumed electricity**
- **Applies to electricity production and use in Sweden**



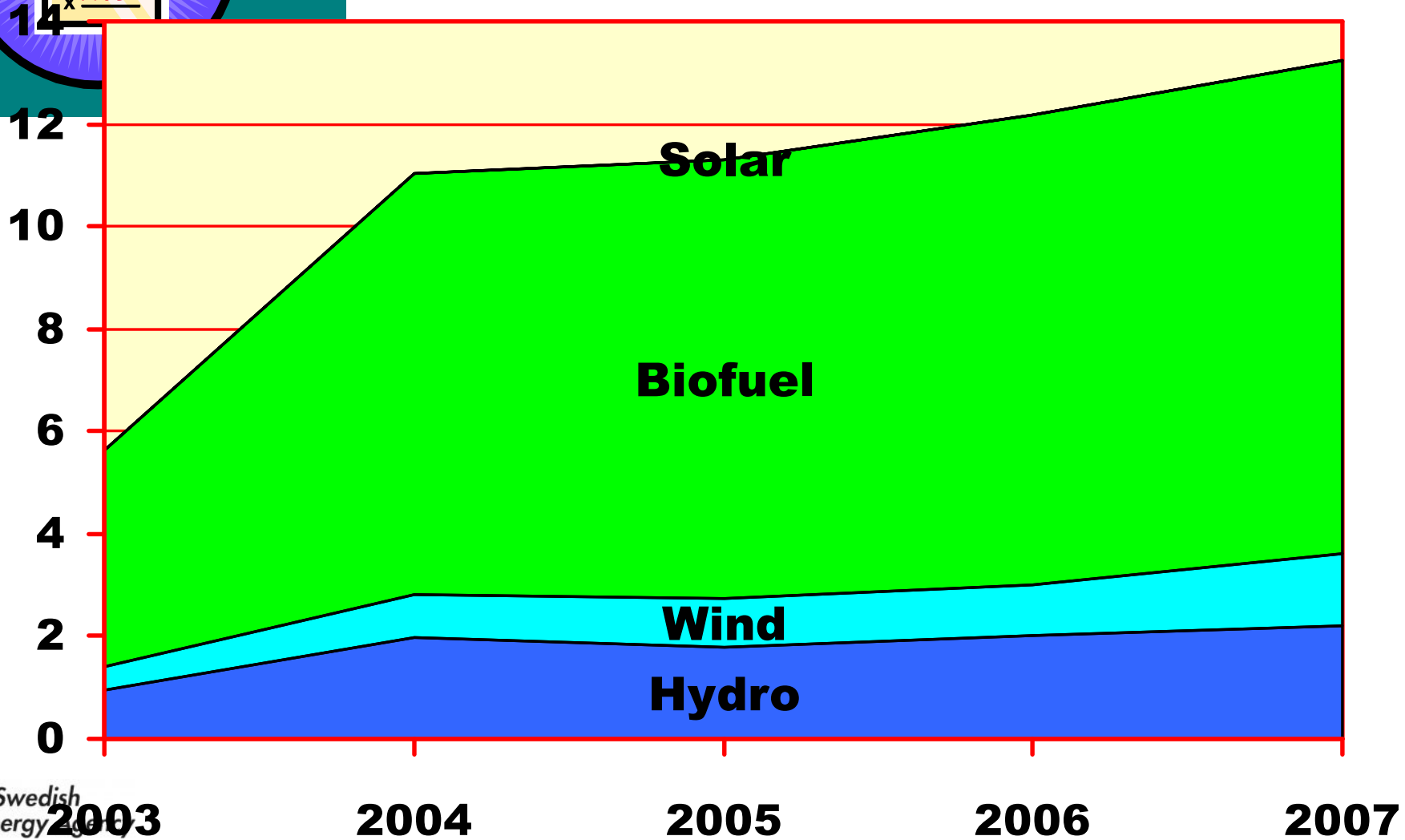
Experiences from the first years

- **The system has worked technically well**
- **Creates stable rules and conditions for existing power plants**
- **Stimulates cost efficiency and new production**
- **The market players have adopted to the new system**
- **The system needs to be long term, for new investments as well as the market**

Production statistics



Renewable Electricity (TWh)

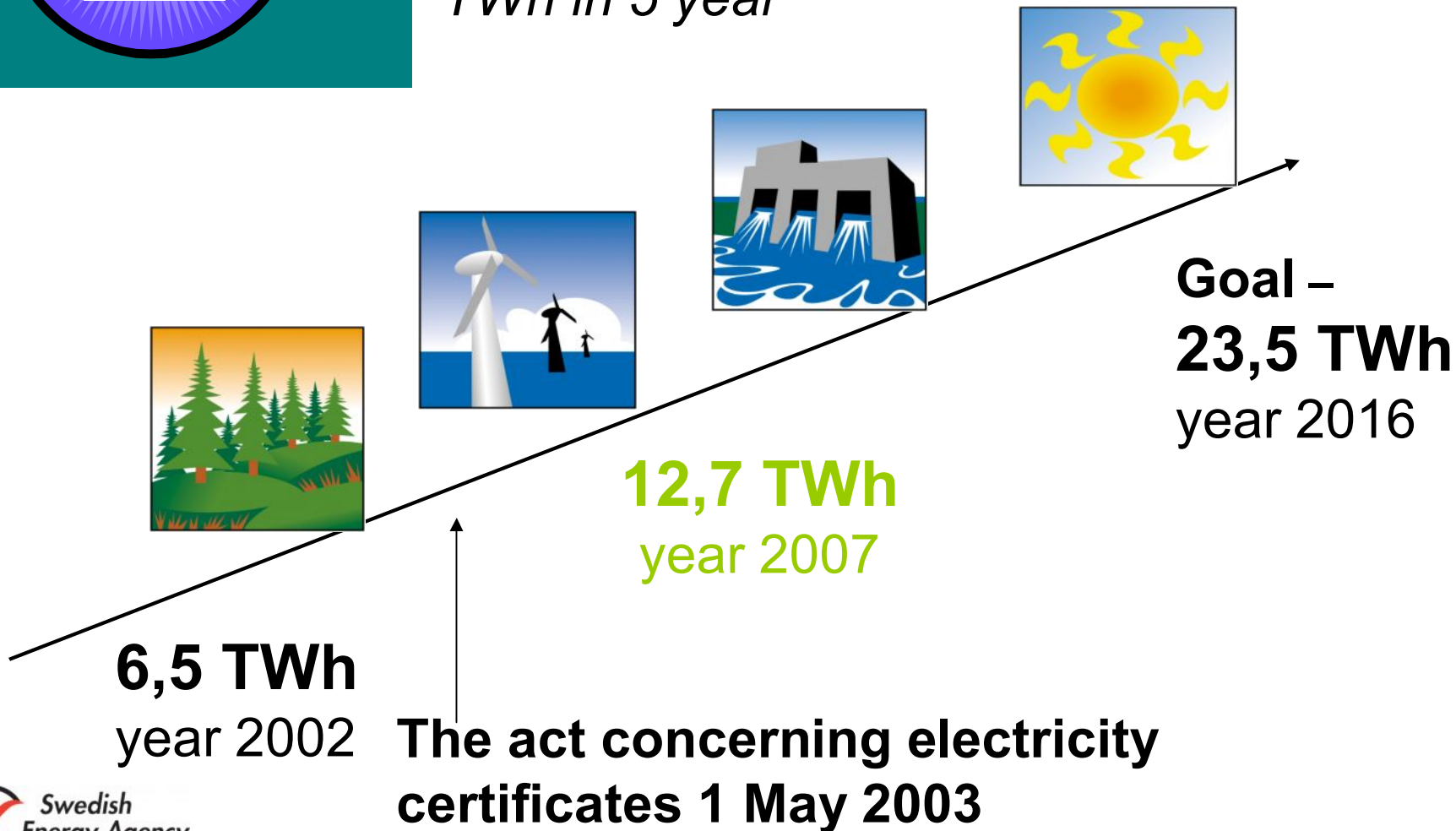


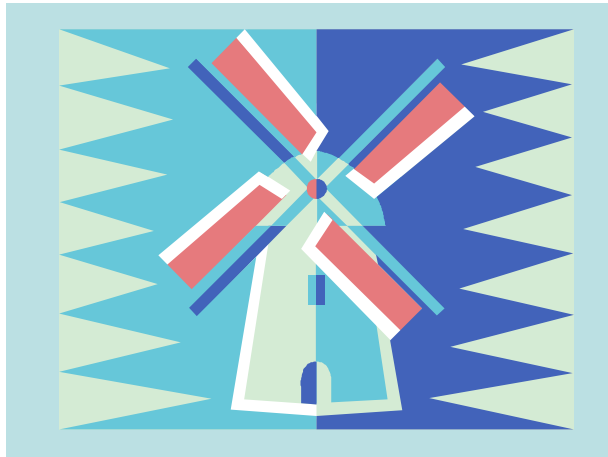
Swedish Energy Agency



On the way....

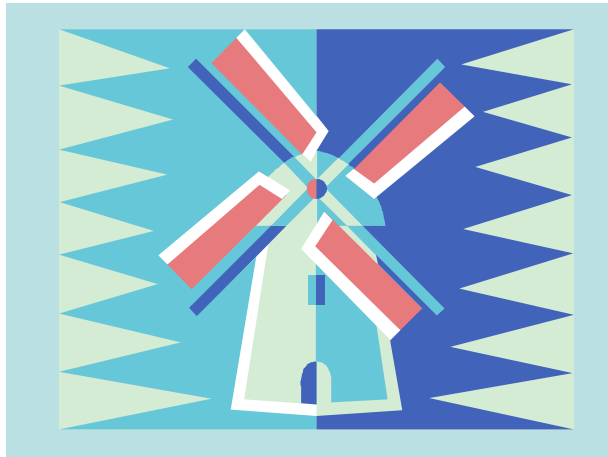
Earlier support systems increased the renewable electricity production with 1,5 TWh in 5 year





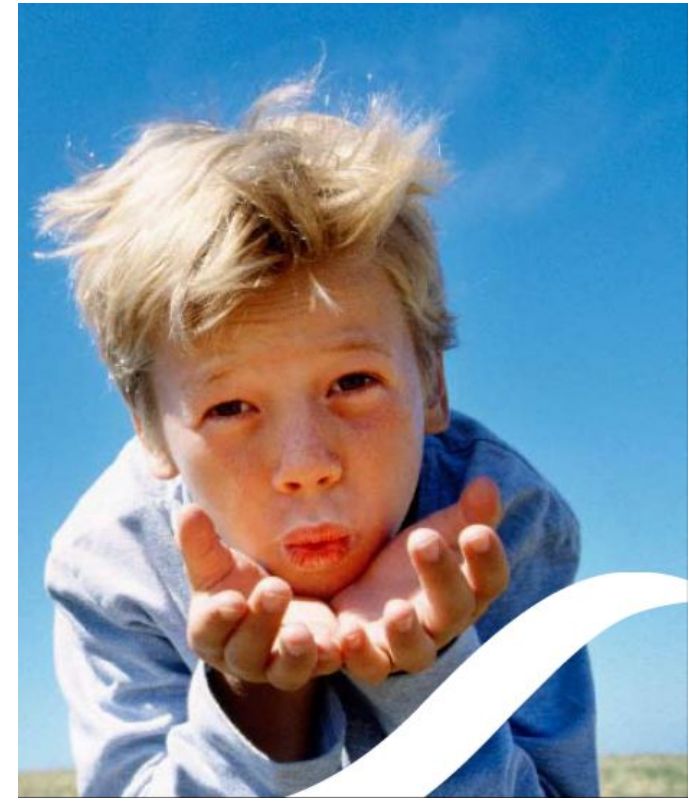
Wind Power

- Strong focus on wind energy
- Grants for planning
- Reduced property tax
- Simplified permission procedure
- National centre created
- Continued support to pilot plants
- Investigation on grid issues



The Swedish Energy Agency

- The Swedish Energy Agency is the expert authority appointed by the government to promote the development of wind power.
- The agency is taking a holistic approach to encouraging the rapid expansion of wind power.





The Swedish Energy Agency

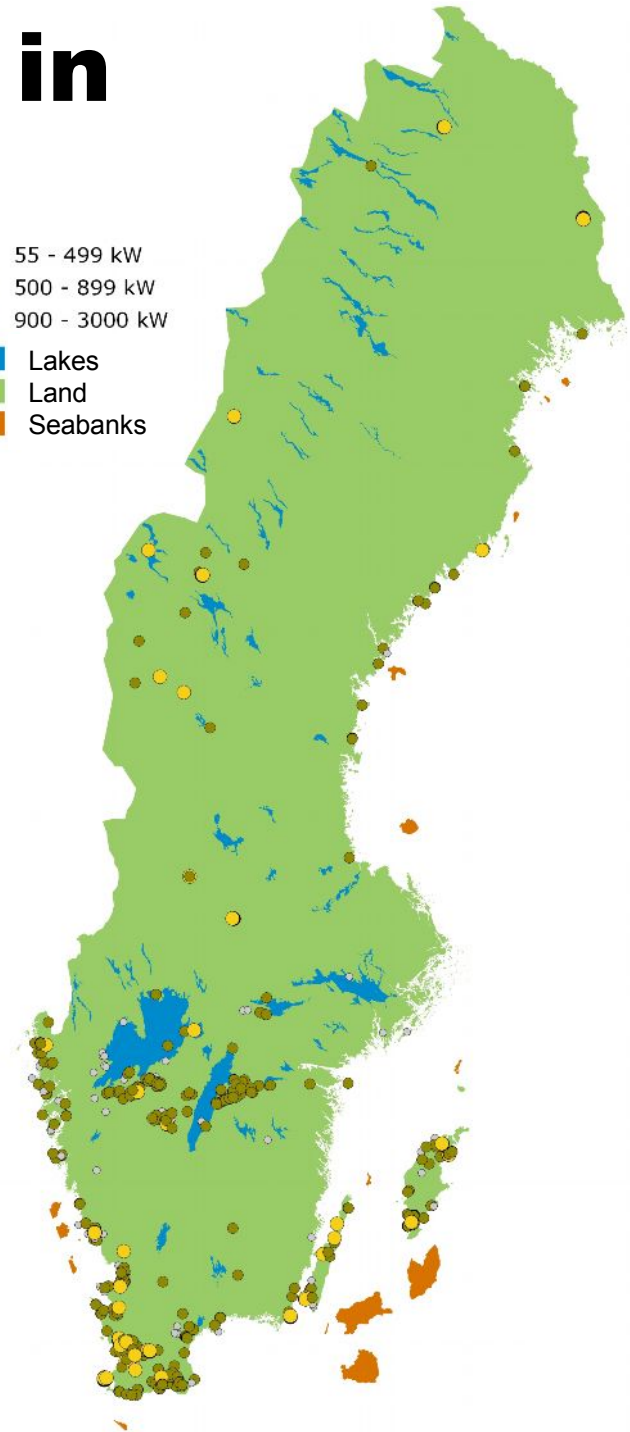
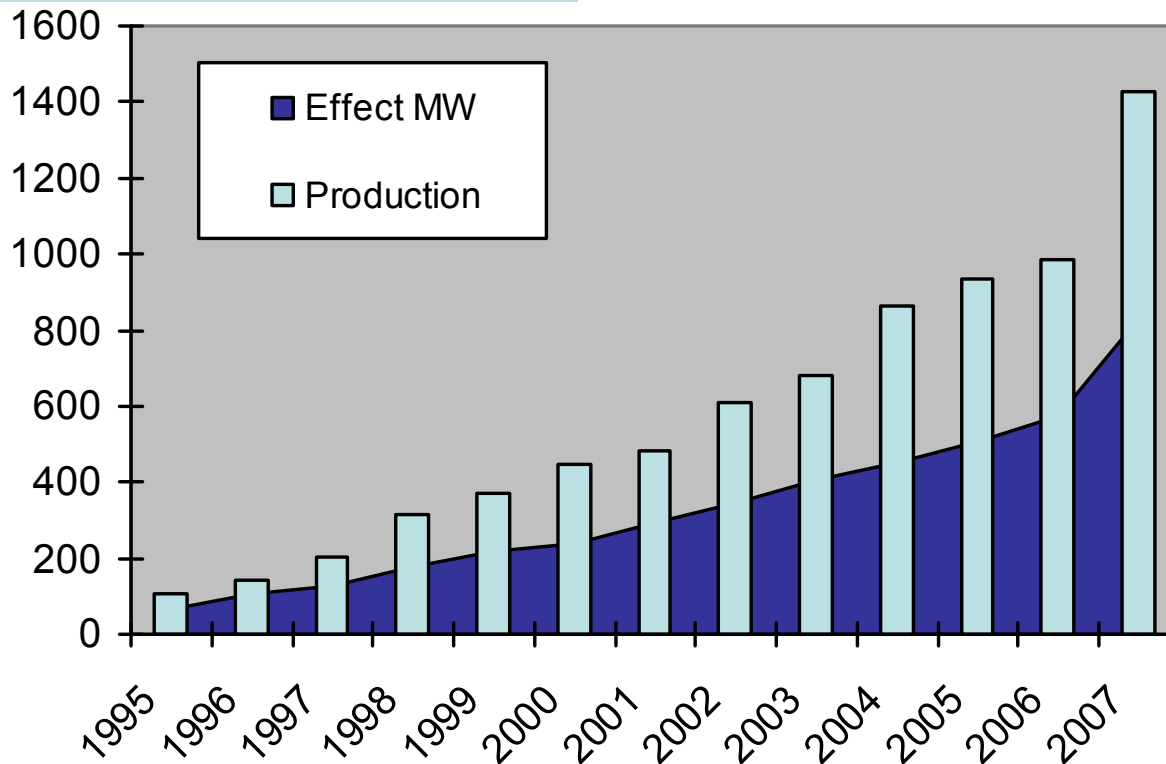
- Supports and runs:
 - Research
 - Wind pilot projects
 - Education
 - Information
 - Physical planning
 - Network for information





Wind power in Sweden

- ◉ 55 - 499 kW
- 500 - 899 kW
- 900 - 3000 kW
- Lakes
- Land
- Seabanks





A new planning goal



The Swedish Energy Agency has proposed a planning target of 20 TWh of wind power on land and 10 TWh at sea, a total of 30 TWh to 2020.

Onshore 20 TWh

Offshore 10 TWh

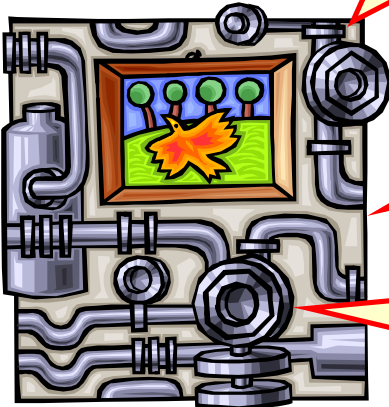
This means that the number of wind turbines needs to increase from just under 900 to 3,000–6,000 depending on power output.



Policies & Measures for Biofuels and Cars

Research, Development & Demonstration

Tax Strategy for Alternative Fuels



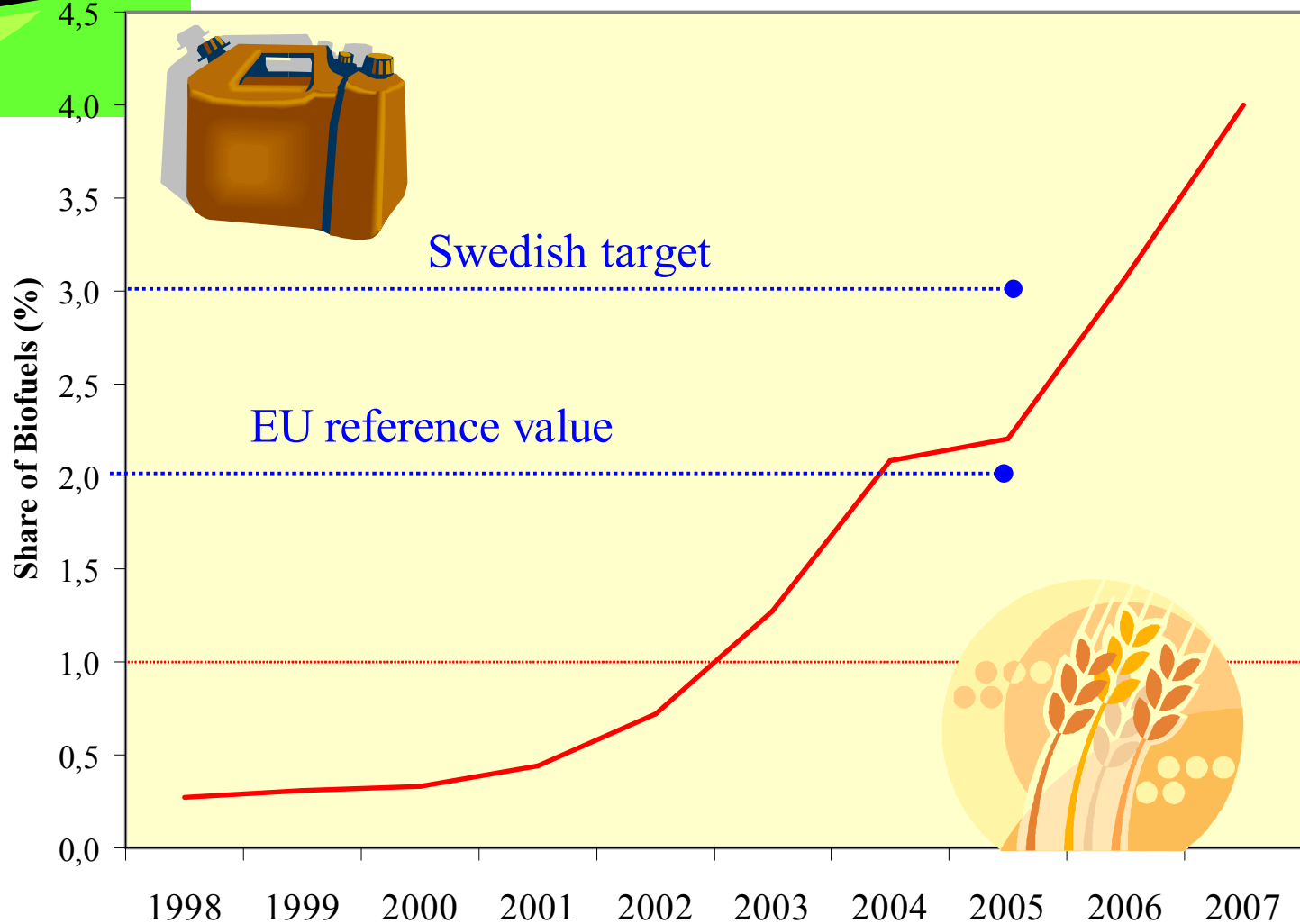
Obligation for filling stations to provide biofuel

Bonus for buying an eco-friendly car

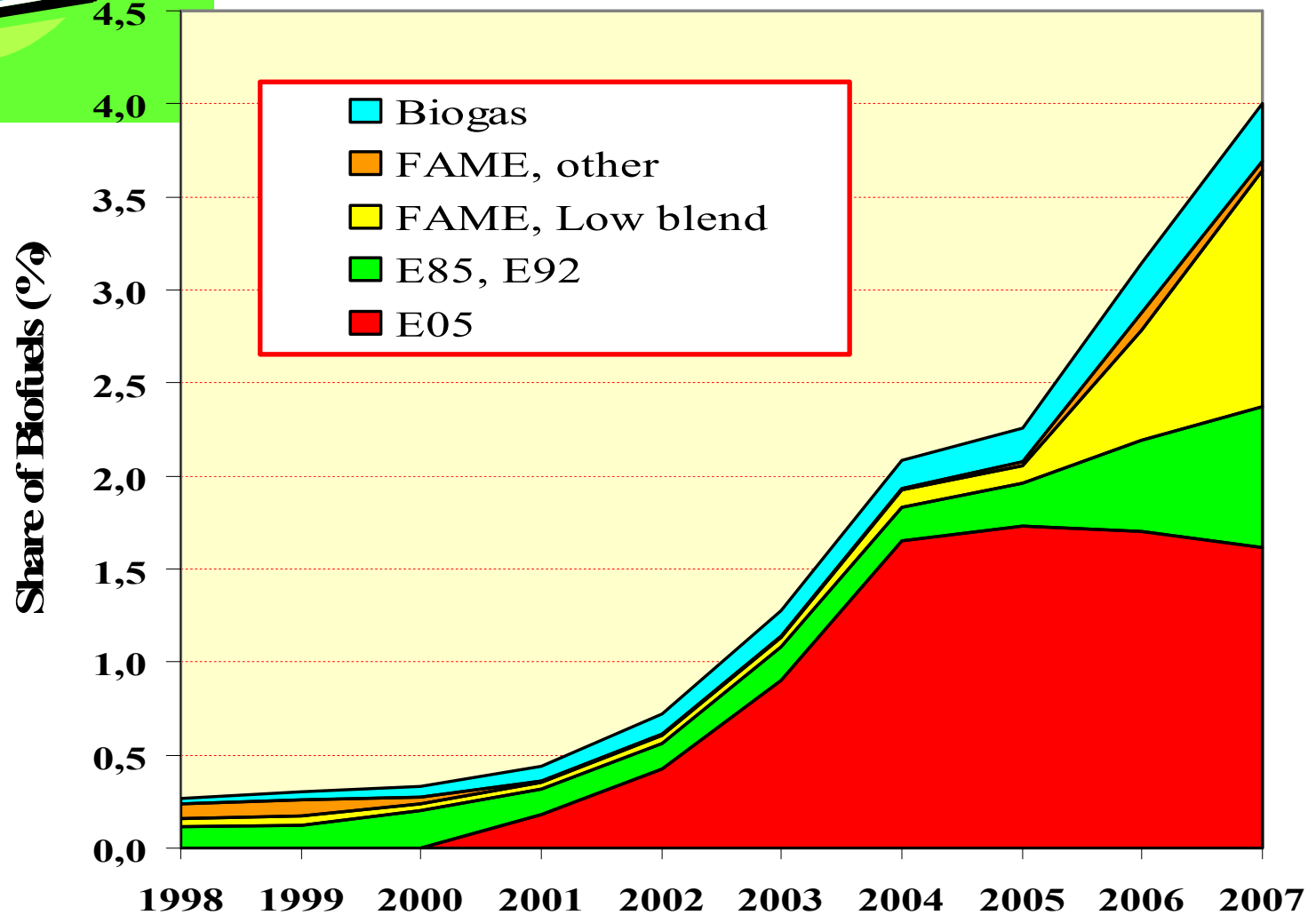
Reduction of benefit attributed to eco-friendly cars for tax purposes

Environmental policy for government vehicles

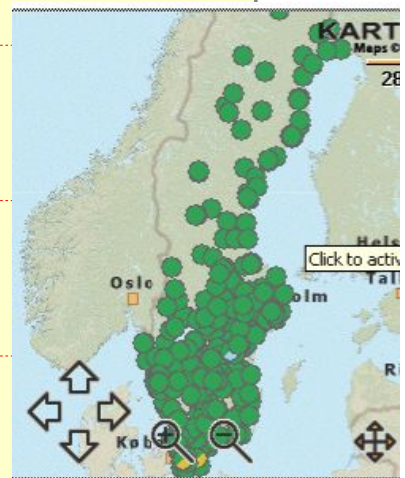
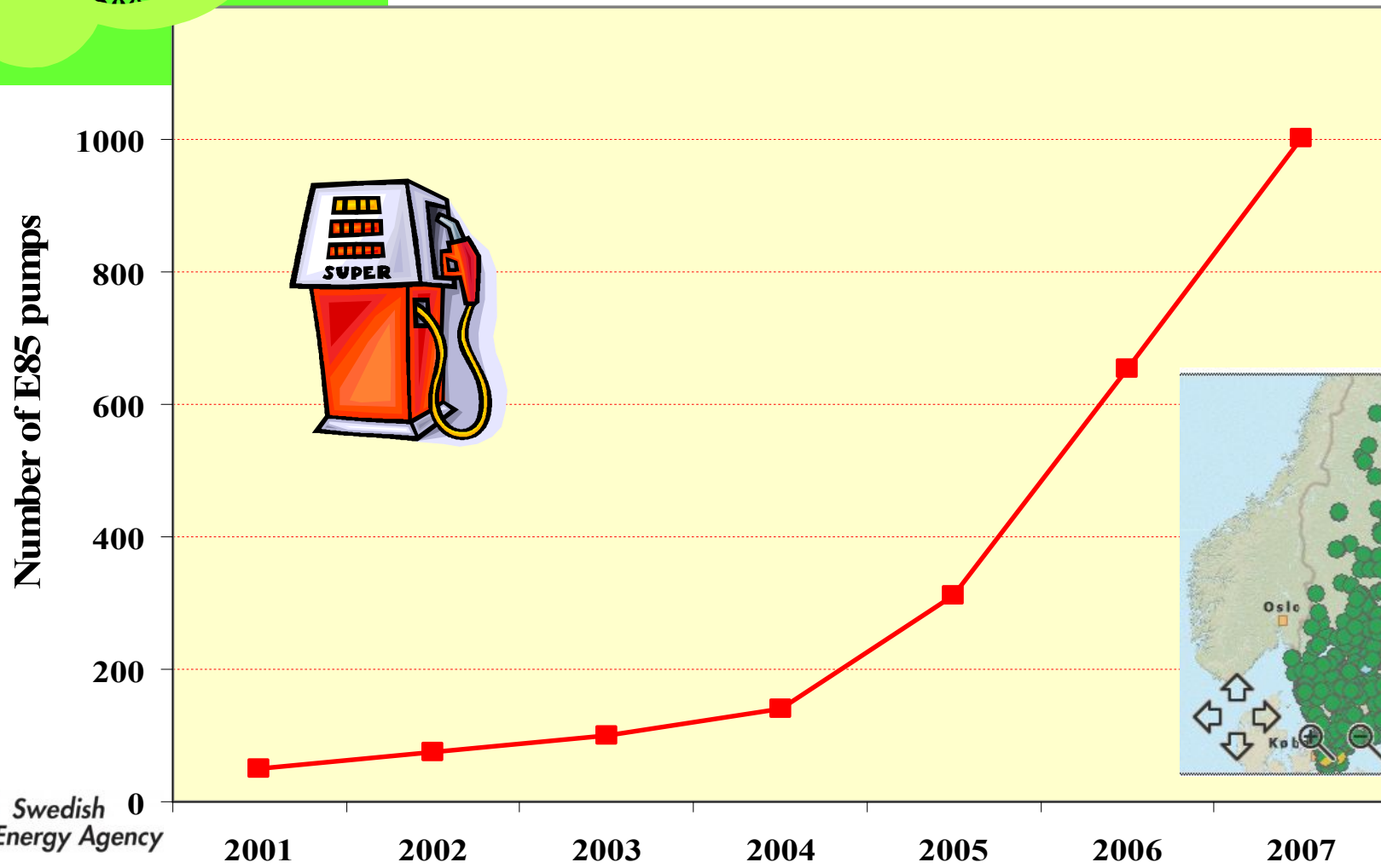
Share of Biofuels since 1998 ...

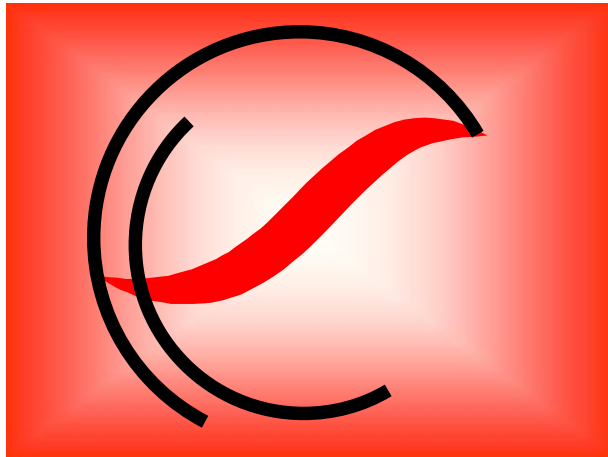


Biofuels per type ...



Pumps for E85

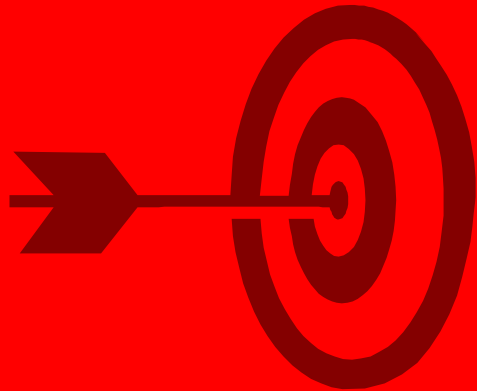




The Swedish Energy Agency

Main government agency in energy policy area since 1998

- Funding of energy RD&D
- Business development and commercialisation
- Electricity Certificate system
- EU Emissions Trading System
- Programme for Energy Efficiency, PFE
- Testlab
- Technology Procurement
- Promotion of Wind Power
- Sustainable Local Government
- Information dissemination
- Emergency authority for oil, gas and heating



Clear overall objectives

The overall objectives of the measures concerning research, development, demonstration and commercialisation are:

- ➔ to build up the scientific and technical knowledge and expertise within universities, colleges, other higher education institutions, government agencies and in the business sector necessary to enable a transition to a long-term sustainable energy system in Sweden through application of new technology and new services, and
- ➔ to develop technology and services that, through the Swedish business sector, can be commercialised and thereby contribute to the transition and development of the energy system in Sweden and in other markets.



Six thematic areas of energy RD&D

- 1. The Building as an Energy System**
- 2. The Transport Sector**
- 3. Fuel-Based Energy Systems**
- 4. Energy-Intensive Industry**
- 5. Power Systems**
- 6. Energy Systems Studies**

SENIOR MANAGEMENT

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