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Association québécoise de la production d'énergie renouvelable

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Sustainable energy development : The Swedish Model

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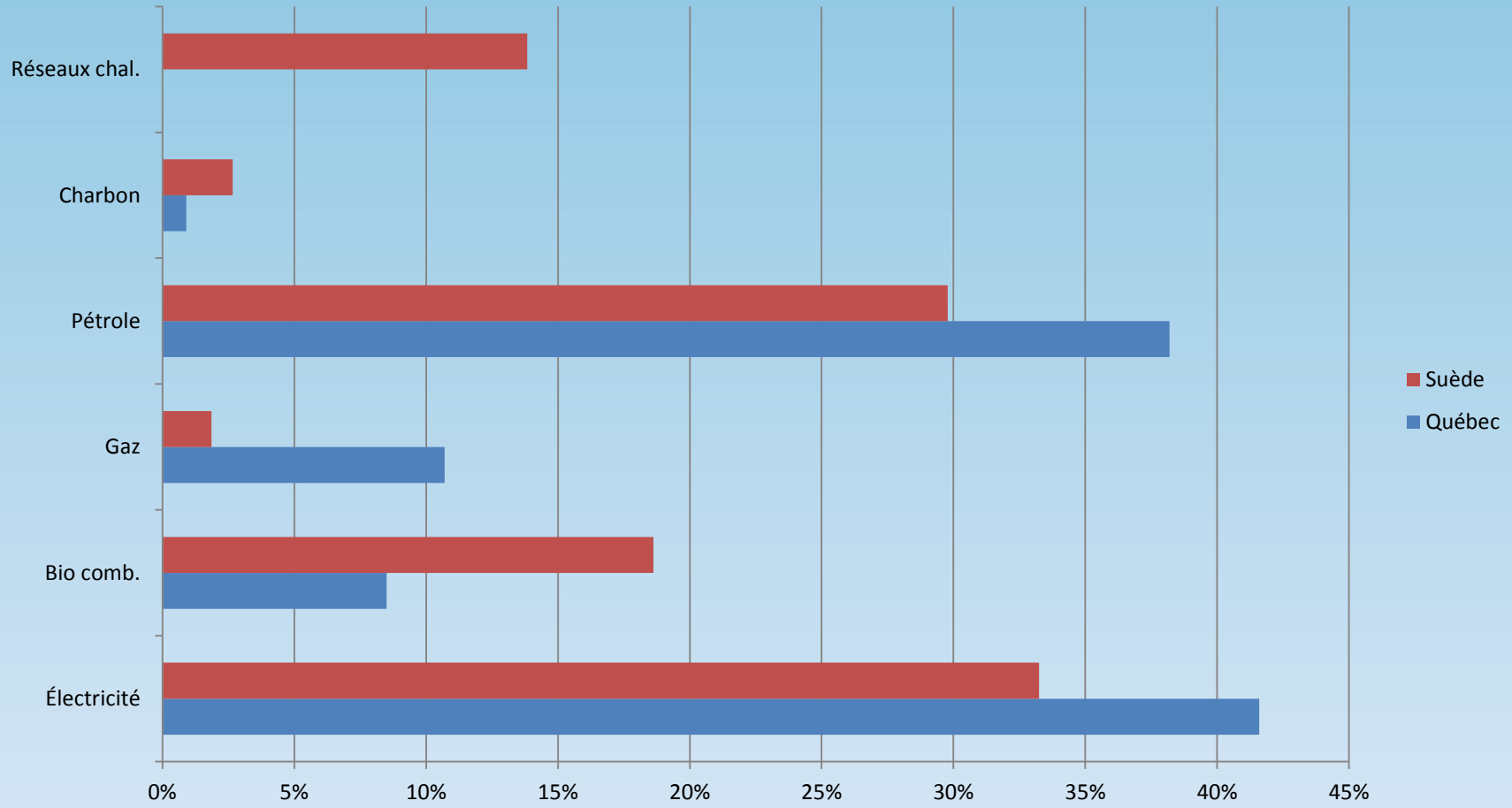
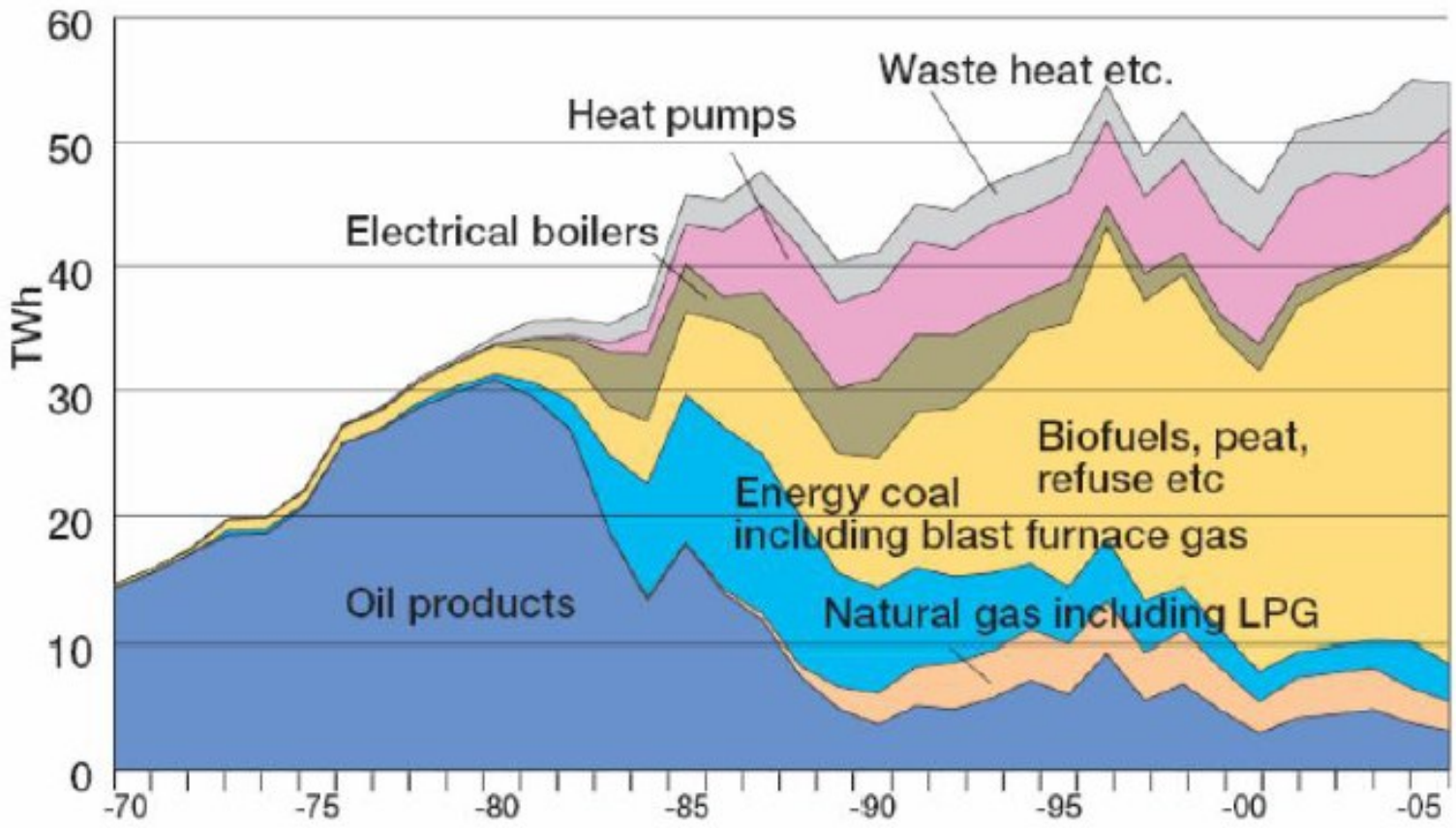
A few figures

	QUEBEC	SWEDEN
Area	1 667 441 km²	441 369 km²
Population	8,0 M hab.	9,1 M. hab.
GDP/cap $us	32 765 in 2009	43 406 in 2009
Energy consumption		
Per annum	454 TWh in 2009	387 TWh in 2009
Rates (electrical power)		
Industrial	0,046 @ 0,12 $us	0,096 $us
Residential	0,070 $us	0,21 $us

Breakdown of Energy Sources

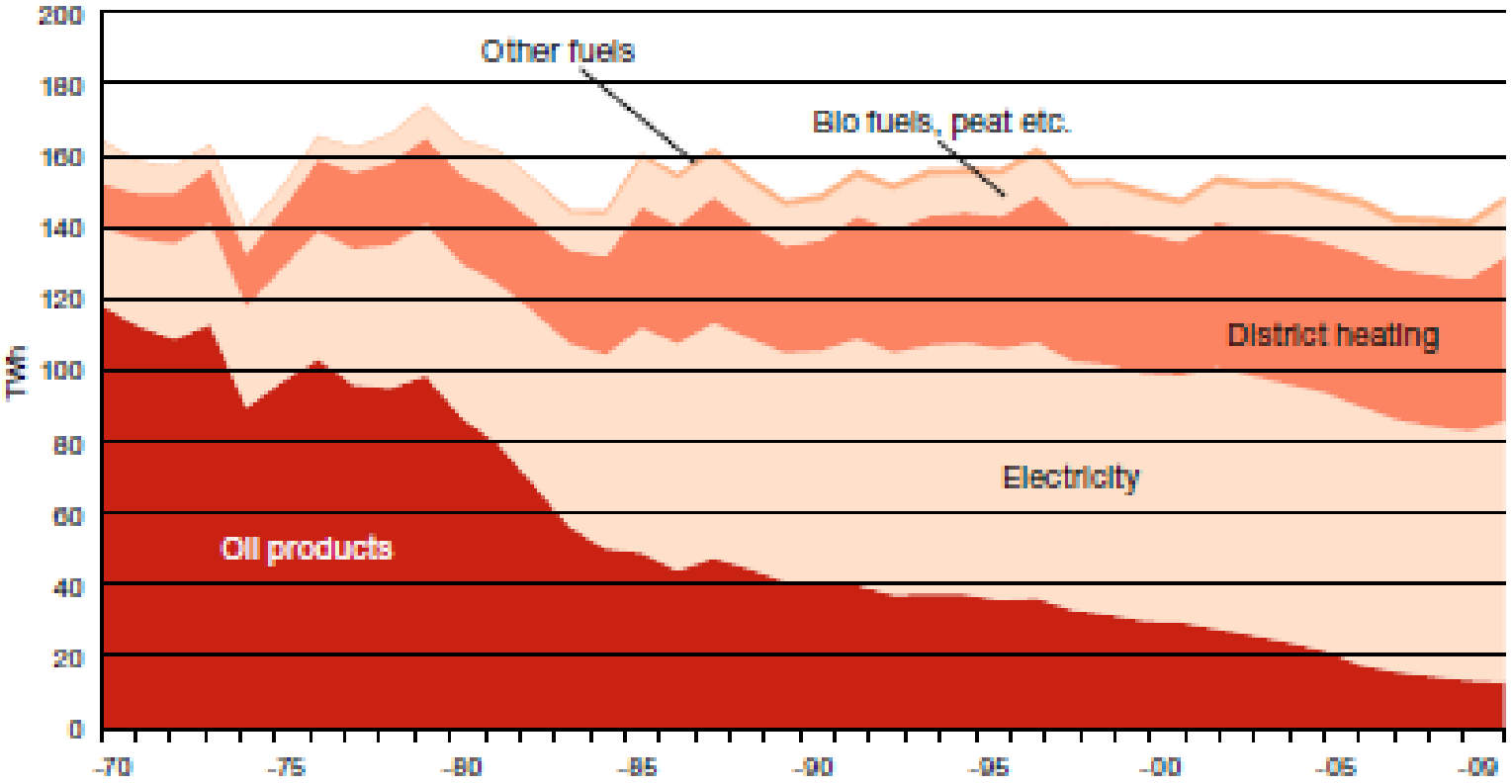


Energy Sources for Heating Networks



SOURCE: STATISTICS SWEDEN; ADDITIONAL PROCESSING BY THE SWEDISH ENERGY AGENCY

Figure 13 Final energy use within the residential and service sectors etc, 1970–2009



Source: Statistics Sweden and the Swedish Energy Agency.

GOVERNMENT OBJECTIVES

Sweden's vision is in line with the European Union's 20-20-20 plan

- 20 % reduction of greenhouse gas emissions
- 20% improvement in energy efficiency **vs BU**
- 20% renewable energy in national energy balance

SWEDEN'S OBJECTIVES FOR 2020

- Share of renewables in energy balance to go from 40% to at least 50%
- Have at least 10% of renewables in transportation
- Reduce greenhouse gas emissions by 40% as compared to 1990 (UE objective -17% vs 2005)
- Reduce power intensity by 20% through energy efficiency measures
- Increase wind power to 30TWh
- Reduce dependency on fossil fuels

MEANS

Increase the share of renewables in energy balance

- % of electric power with Green Certificat
- Tax on carbon
- Regulatory measures
- CLIP and KLIM programs
- Setting of national objectives

Green Energy Certificates - EL CERTS

- Instituted in 2003 to increase share of renewables
  - » Obj. 2003 +10 TWh for 2010 vs 2002 (70 TWh)
  - » Obj 2007 17 TWh for 2016 vs 2002
  - » Obj 2009 25 Twh for 2020 vs 2002
- Power companies + certain consumers must increase the percentage of green power used 2011=17%
- 1 MWh delivered to the grid = 1 credit (15 yrs or 2030)
- At resale time, value of credits is set according to market
- Power rates increase with quota
- Credits are cancelled each year

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Taxation

Table 2 Energy tax revenues, 2009, million SEK

Energy source or carrier	Energy tax	Carbon dioxide tax	Sulphur tax	Total
Petrol	13 895	11 037		24 932
Oil products	6 605	15 803		22 408
Crude tall oil	1			1
Other fuels	91	1 449		1 540
All fuels			56	56
Electricity	19 915			19 915
Waste				609
Production tax, nuclear power*				4 031
Total	**40 507**	**28 289**	**56**	**73 492**
Proportion of national tax revenue				*9,3%*
Proportion of GDP				*2,4%*

Source: Swedish Tax Board, Swedish National Financial Management Authority, Statistics Sweden.
*This tax is on power output at production level. It must not be confused with the energy tax on electricity paid by consumers.

Table 3 General energy and environmental taxes from 1st January 2010, excluding VAT

	Energy tax	CO_2-tax	Sulphur tax	Total tax	Tax öre/kWh
Fuels					
Gas oil, SEK/m³ (<0,05 % sulphur)	791	3 013	-	3 804	38,2
Heavy fuel oil no. 5, SEK/ m³ (0,4 % sulphur)	791	3 013	108	3 912	38,9
Coal, SEK/tonne (0,5 % sulphur)	336	2 622	150	3 108	41,1
LPG, SEK/tonne	155	3 170	-	3 325	26,0
Natural gas, SEK/1000 m³	256	2 256	-	2 512	22,8
Crude tall oil, SEK/ m³	3 804	-	-	3 804	38,8
Peat, SEK/tonne, 45 % moisture content (0,3 % sulphur)	-	-	50	50	1,8
Domestic waste, SEK/tonne of fossil carbon*	160	3 840	-	4 000	16,1
Motor fuels					
Petrol, unleaded, environmental class 1, SEK/l	3,06	2,44	-	5,50	60,8
Diesel fuel, environmental class 1, SEK/l	1,33	3,01	-	4,34	43,6
Natural gas/methane, SEK/ m³	-	1,35	-	1,35	12,3
LPG, SEK/kg	-	1,67	-	1,67	13,1
Electricity use					
Electricity, northern Sweden, öre/kWh	18,5	-	-	18,5	18,6
Electricity, rest of Sweden, öre/kWh	28,0	-	-	28,0	28,2
Industry					
Electricity use, industrial processes, öre/kWh	0,5	-	-	0,5	0,5

Source: Swedish Tax Board, additional processing by the Swedish Energy Agency.
* The proportion of fossil carbon in domestic waste is assumed to be 12,6 % by weight.

Regulatory Measures

- Limit type of motorized vehicles permitted in certain cities
  - E.g. : Downtown Stockholm

    Only environmentally friendly vehicles allowed

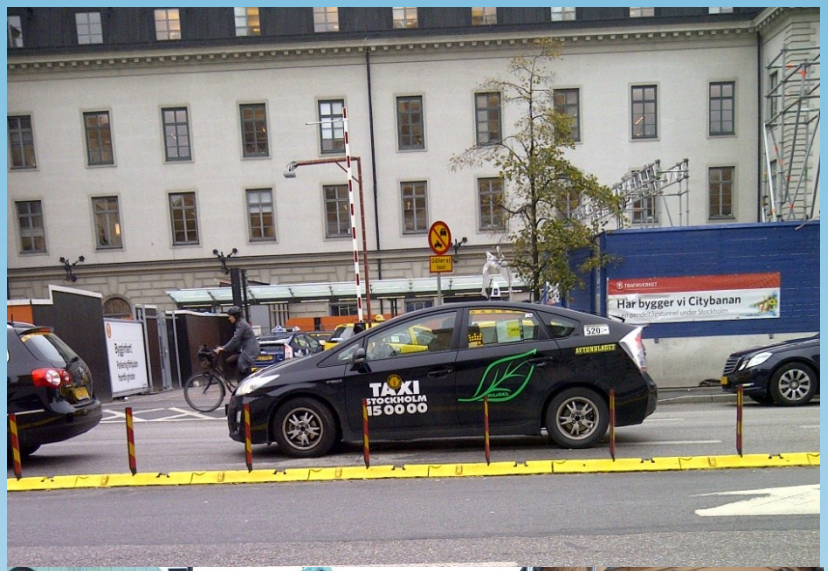
    Buses + trucks : mostly powered by biogas

    Taxis : 801 biogas

    338 ethanol

    126 hybrids


TAXI
KUZ413T


Här bygger vi Citybanan
TAXI
STOCKHOLM
15000


Biogasbussen – en del av kretsloppet.
Weehaa!
Från 249 kronor.
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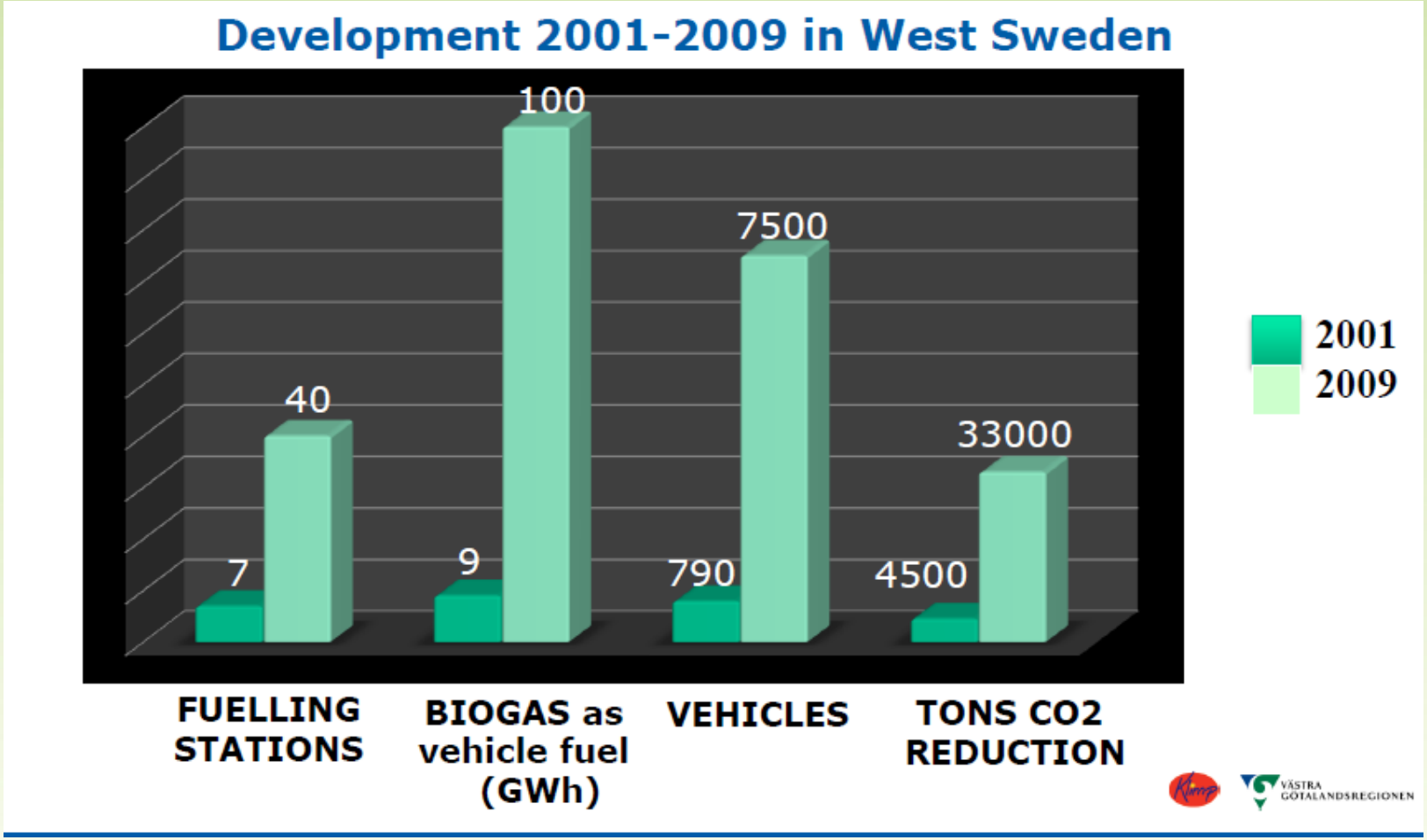
The Biogas Sector

- Water purification (1930)
- Anaerobic digestion of sludge and use of energy to power heating networks (1940)
- Increase in demand with 1972 oil crisis (150 water treatment plants are anaerobic digestion based)
- First biogas buses (1990)
- European regulations banning subsurface containment of organic wastes (2005)
- Objectives for reducing greenhouse gas emissions (20-20-20)
- Industry and government share a common vision to create market

Programs Instituted

- LIMP (SEPA) 1999-2008
- CLIMP (SEPA) 2003-2012 622 M SEK
  - 1000 projects submitted for 1G SEK, 200 retained
  - Support for fueling stations
- 40% tax reduction for biogas powered business vehicles
- Several cities offer free parking to biogas powered vehicles
- Governments and municipalities move to biogas powered vehicles
- Green certificate for power production

Fueling Stations Now

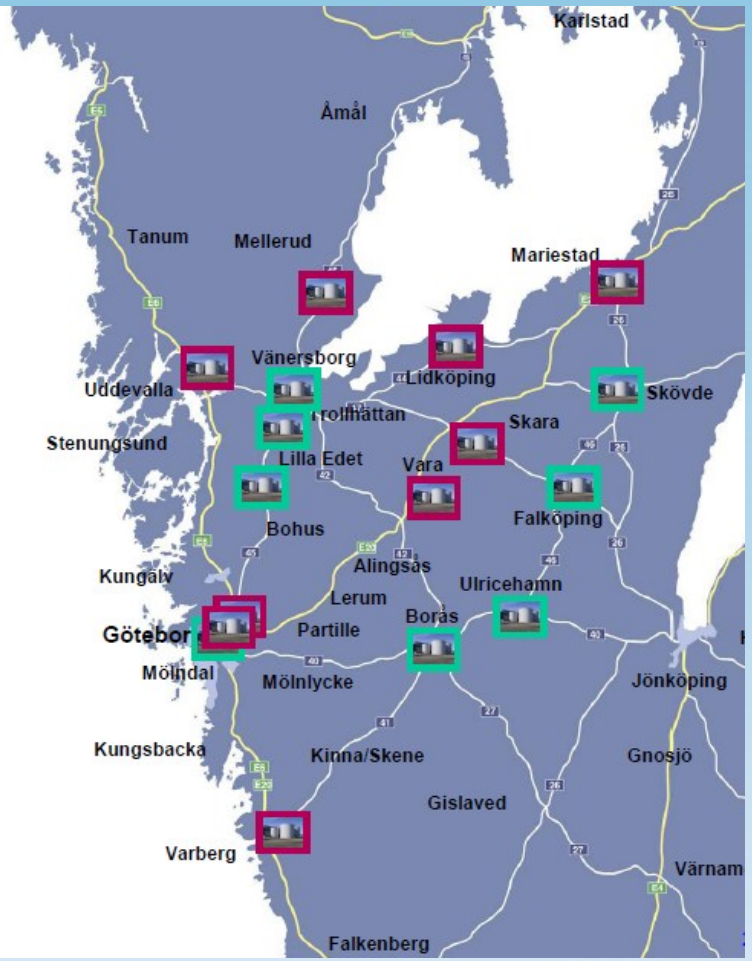


Production Sites

Biogas plants for vehicle fuel in West Sweden

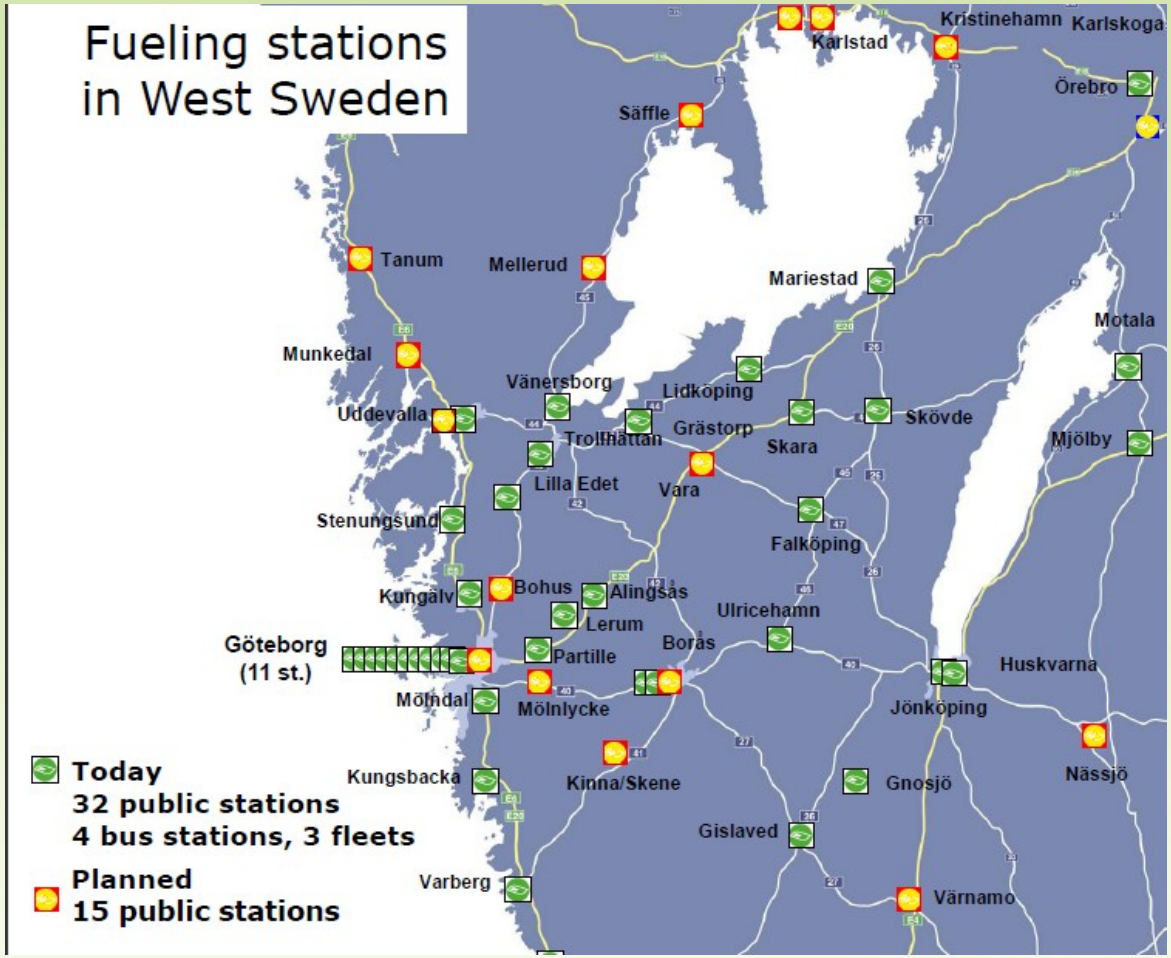
Existing biogas plants

Planned biogas-plants



2001 – 9 GWh
2009 - 100 GWh
2012 – 300 GWh

Fueling Stations



Fueling Stations in 2010

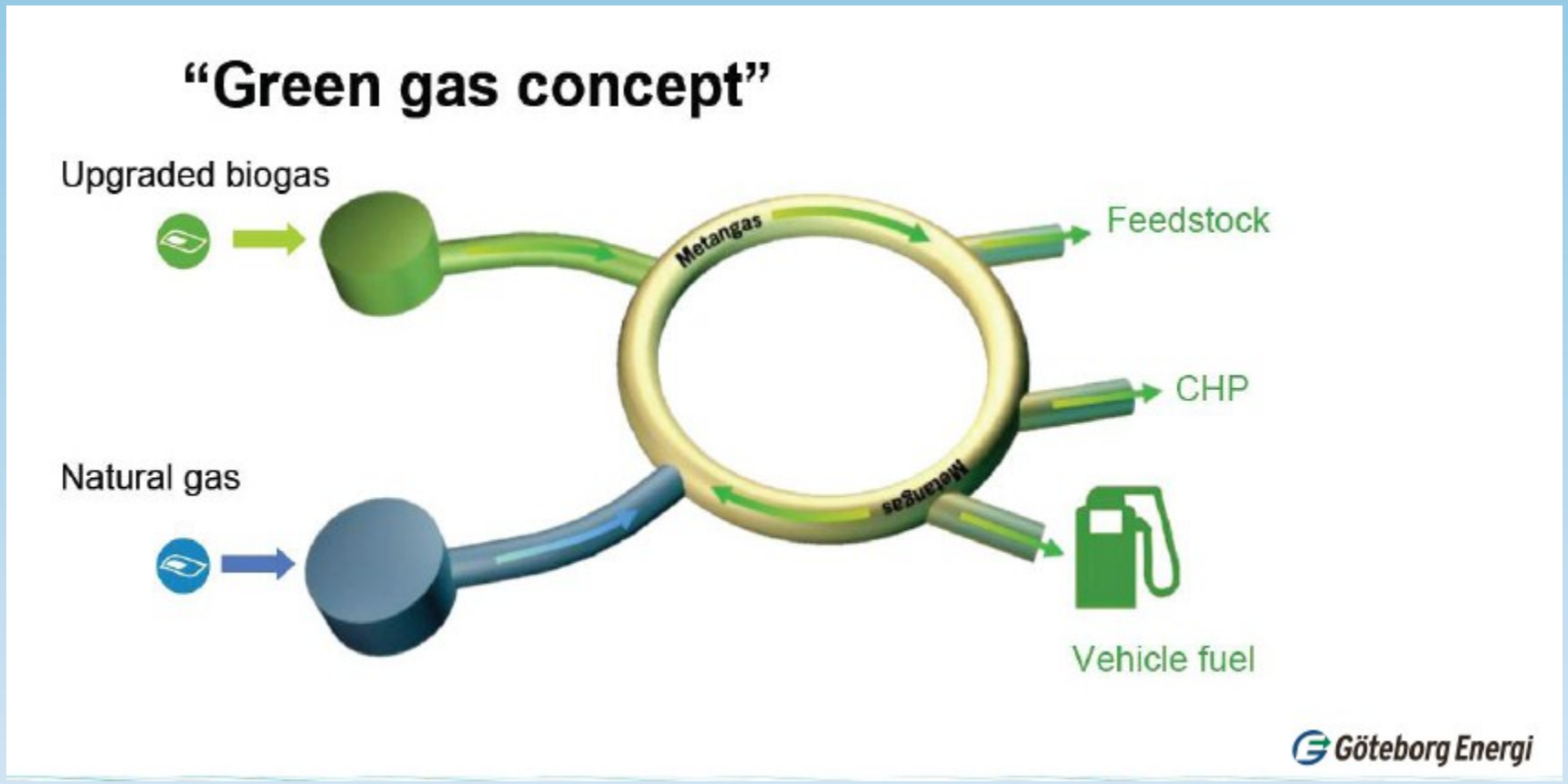
- 129 public stations
- 45 stations for corporate fleets, buses and other vehicles
- Number of vehicles:

32 000

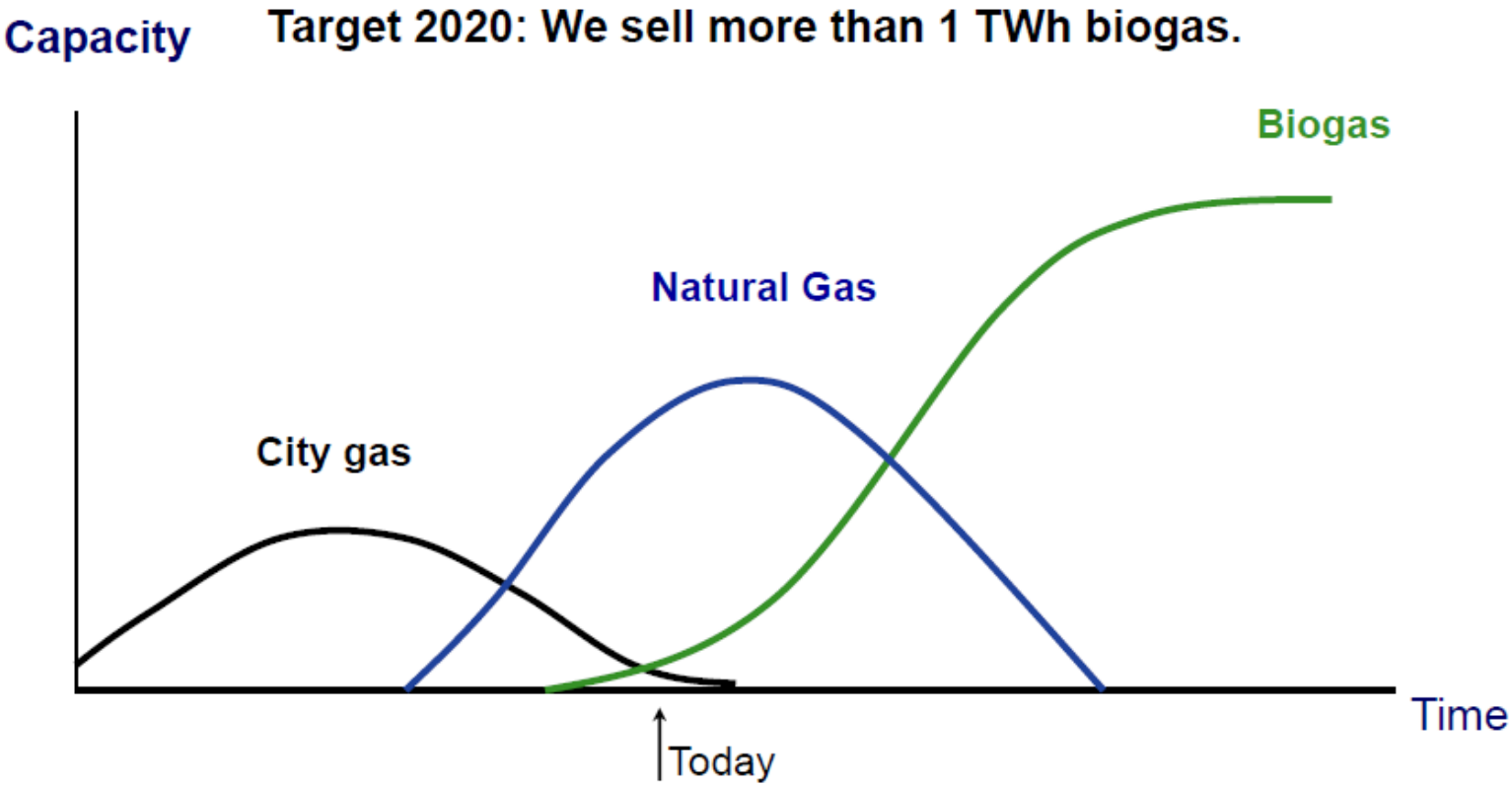
1 400

500

Greening of the Gas Network



Long Term Vision



Successful Initiatives

- Västra Göaland
  - 8 sites dedicated to biogas powered vehicles
  - 50 fueling stations
    - 42 public
    - 4 dedicated to buses
    - 3 dedicated to garbage trucks
  - 8 000 motorized véhicles use biofuels
  - 19 M litres of diesel/gas no longer required
  - 31 000 t less CO^2 released in the atmosphere/yr.

Definitely

- Sweden is committed to substituting renewable energies to fossil fuels
- Change is fueled by objective of reducing greenhouse gas emissions
- Green Certificats have created a market for renewables
- Concerted vision + government support have given impetus to the market
- Space has been made to develop the biogas sector

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