



Biomethane as vehicle fuel

Experiences from the Biogas West project

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Represents 13 municipalities in the Göteborg region

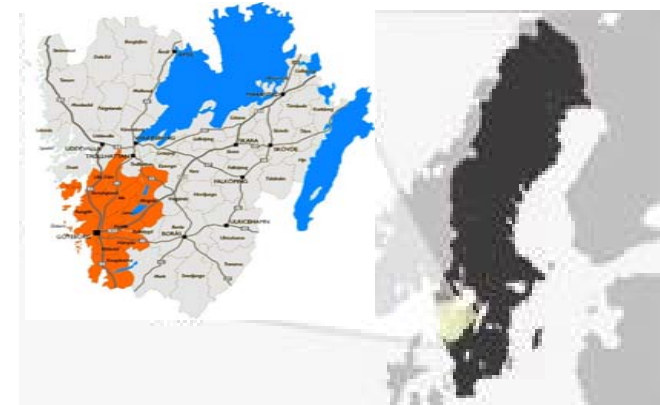
A regional company for business development

A neutral and non-profit company

- Strong economical growth
- Diversity trade and industry
- High level of employment



- The **third largest region** in Sweden and consists of **49 municipalities** of which **Göteborg** is the biggest.
- Scandinavian *transport and logistics* centre with Scandinavia's biggest port in Göteborg.
- Västra Götaland has varying environments, rich cultural heritage and diversity and unique natural values and a strong environmental awareness.
- There are also several centres for applied research and development.
- Co-operation with trade and industry has a strong tradition.



The region	Västra Götaland
Number of inhabitants	1 507 182
Size (in km ²)	24,000
Mayor city	Göteborg

Biogas Facts

Biogas has a wide range of biomass feedstock

Cities



Sludge
Household waste
Industry waste

Agriculture



Manure
Rest-products
Energy crops

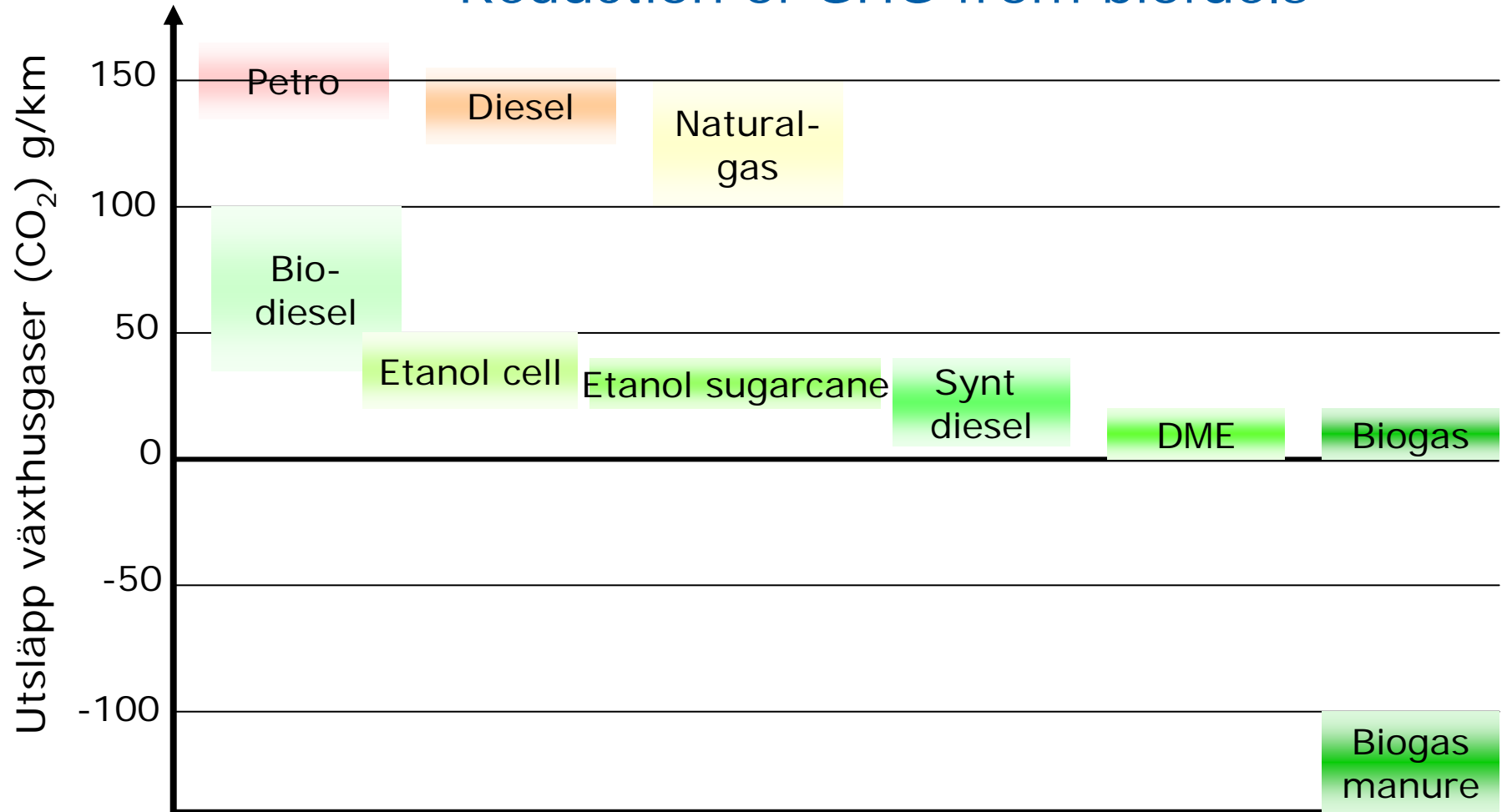
Forest



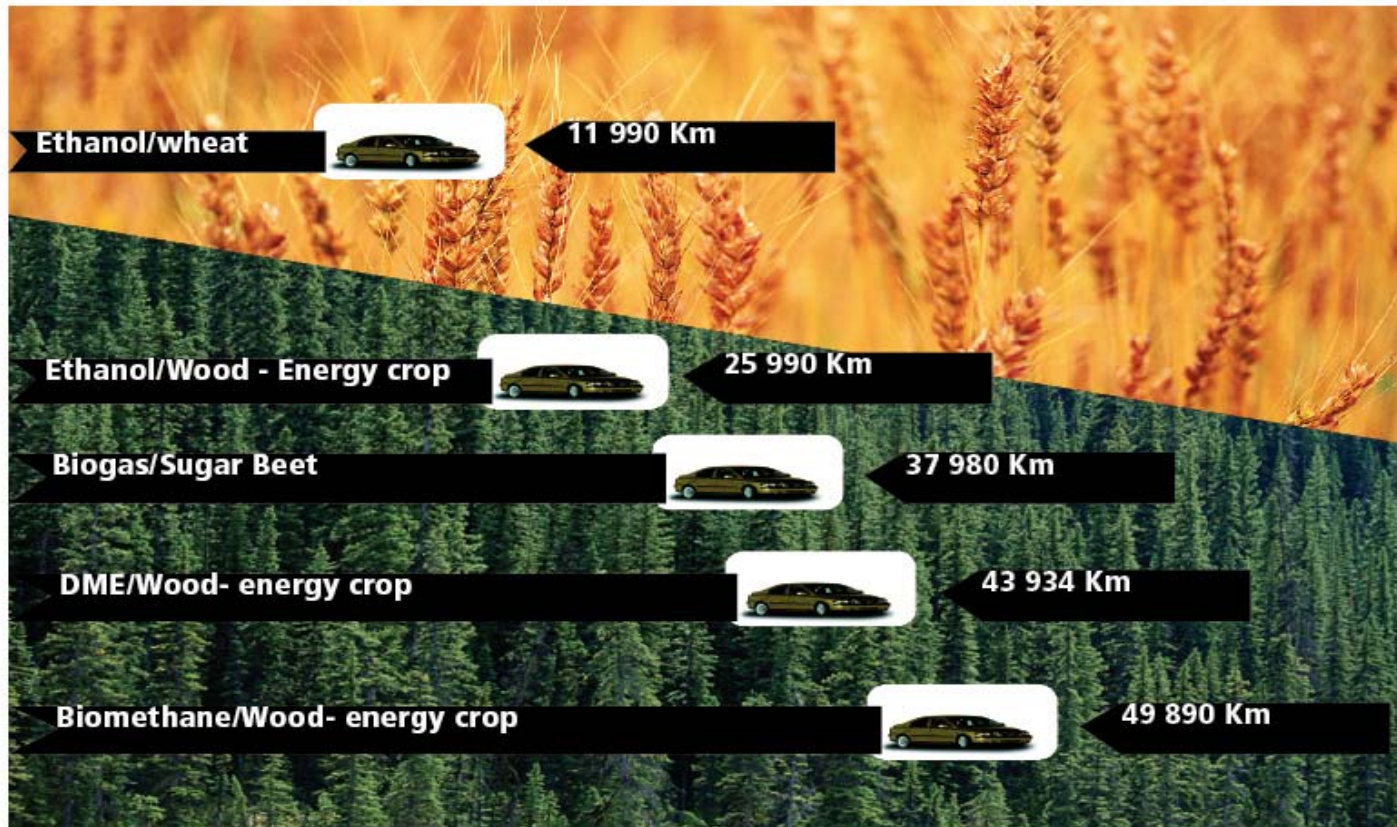
Waste & rest-products from forest



Reduction of GHG from biofuels



How many km can a car be driven on one hectare biomass?



Source:
Lund
University

The benefits for the society

Reduced emissions of GHG

Better air quality in the cities

A sustainable agriculture

A sustainable waste treatment system

Less dependence of oil

A new industry creating new jobs



Driving forces

market development for biogas and vehicle sales

- No taxes on biogas and lower taxes on CNG
- Increased prices for petrol and diesel
- State subsidies for vehicles, fuelling stations and production plants
- Reduced tax with 40 % for company cars* , free street parking in several cities
- Governmental organisations- 75 % clean vehicles, municipalities change policies for fleets*

*clean vehicles

The Biogas Väst co-operation project in Westsweden

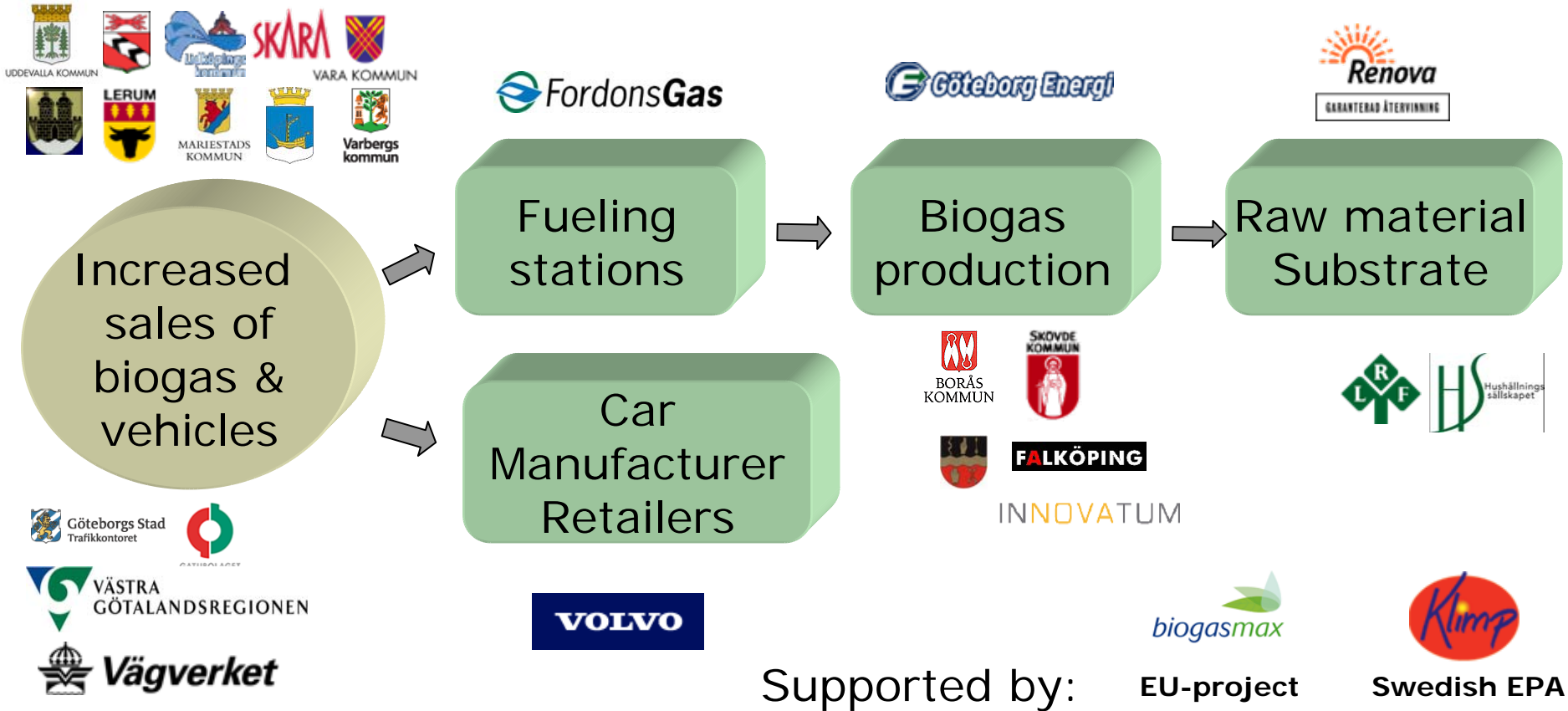


Market development

- Production
- Distribution
- Vehicles

Purpose: To develop a new industry

Biogas chain – partners in Biogas West



Supported by:

EU-project

Swedish EPA

Vision for Biogas Väst 2020

Biomethane can replace 20 % of fossil fuel
in transport sector

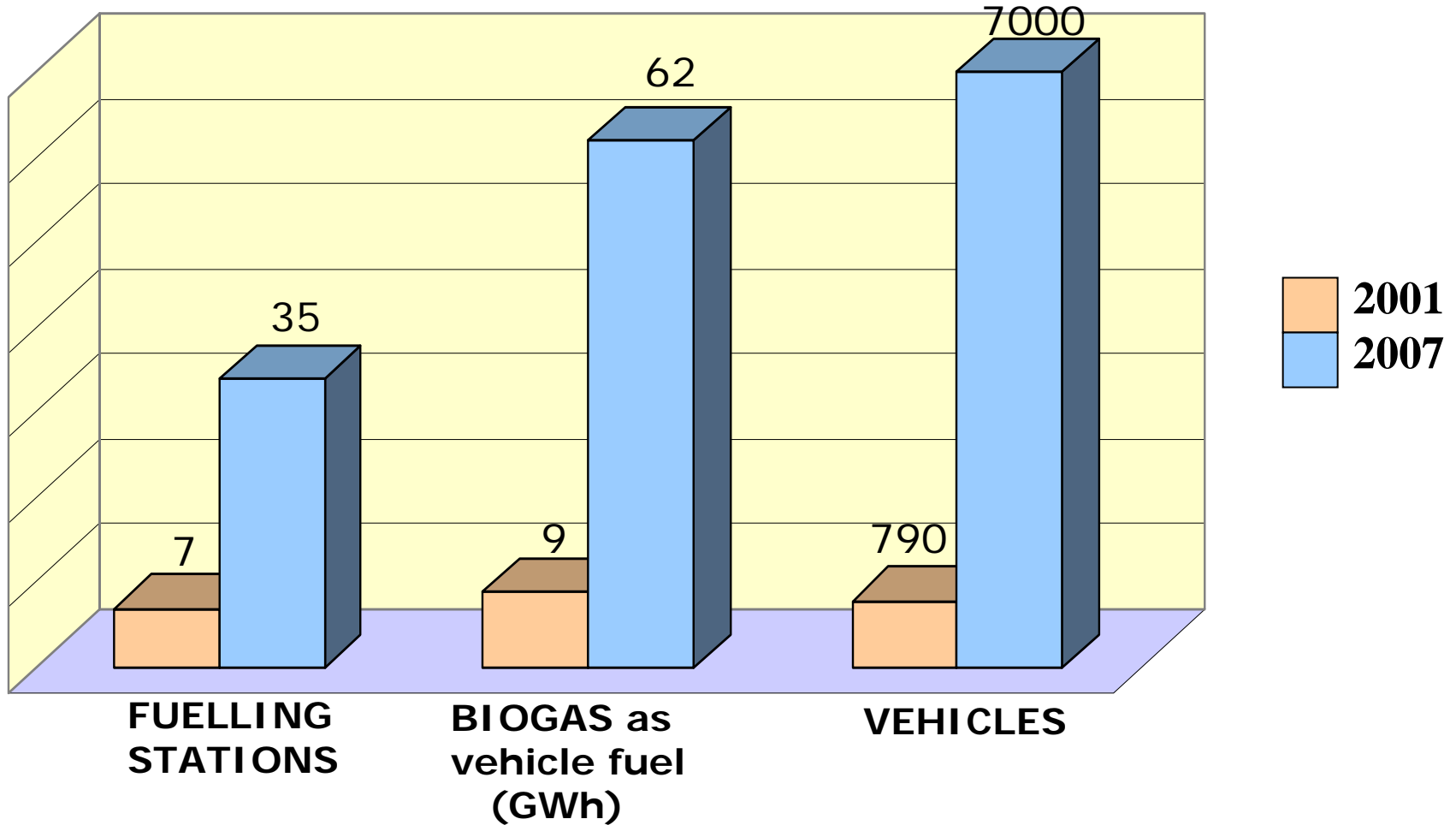
Target 2009

65 fuelling stations



16 000 gas-powered vehicles

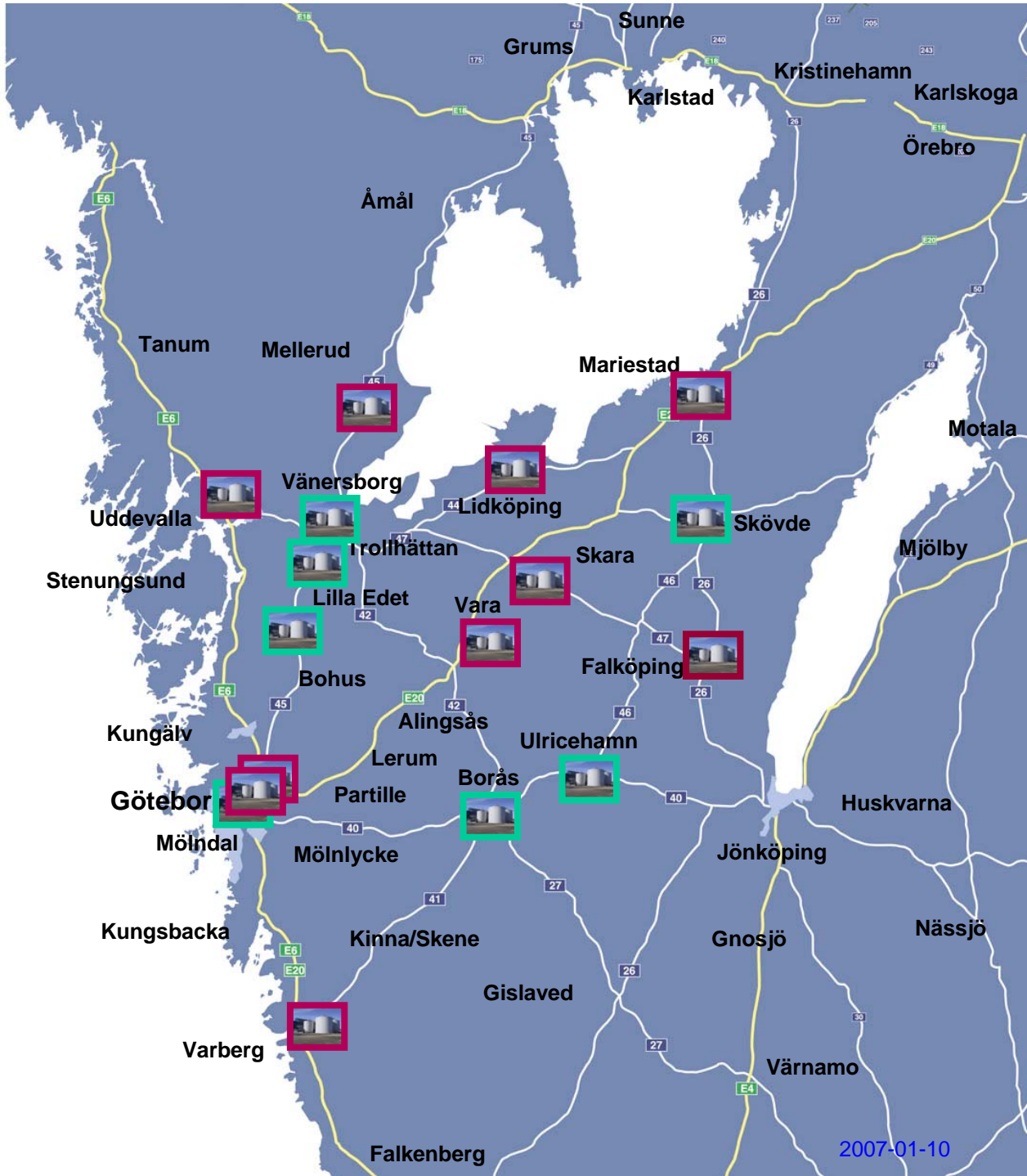
Biogas & CNG replace 33 m. litres petrol/diesel

Development 2001-2007 in West Sweden





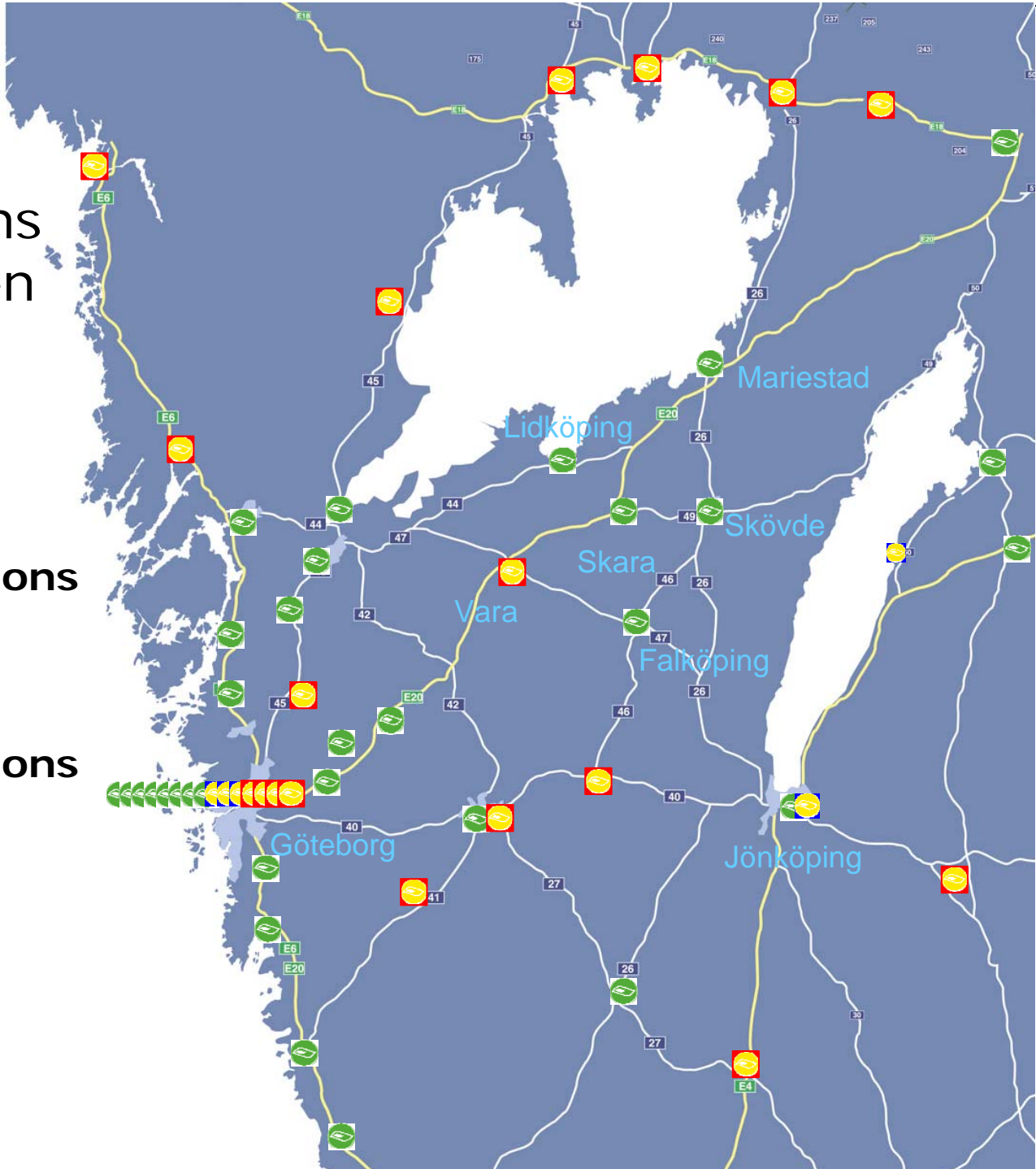
Biogas plants for vehicle fuel in West Sweden

-  Existing biogas plants
-  Planned biogas-plants



Fuelling stations in West Sweden

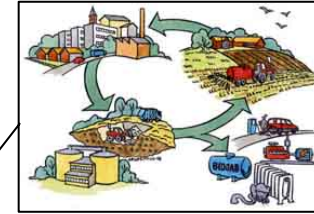
-  Today
30 public stations
4 bus stations
-  2008/2009
22 public stations



Vision A region in world class



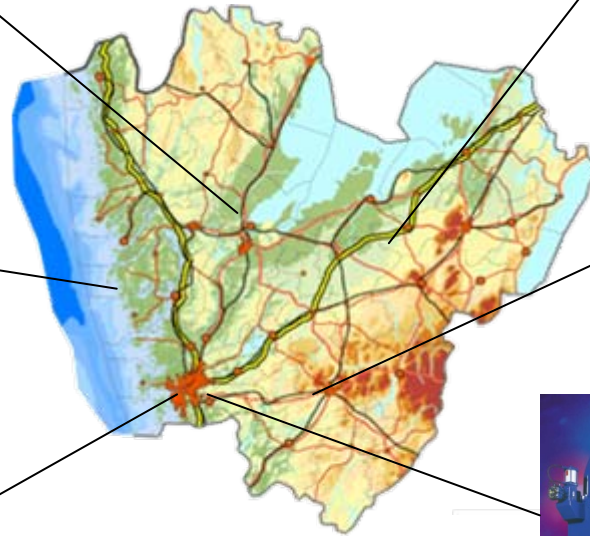
R&D liquified biomethane



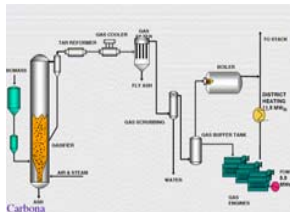
Development of biogas system in agriculture



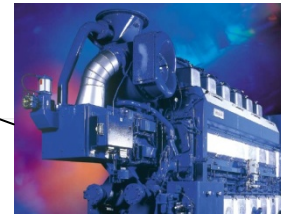
Coast shipping on methane



Waste Refinery R&D Waste



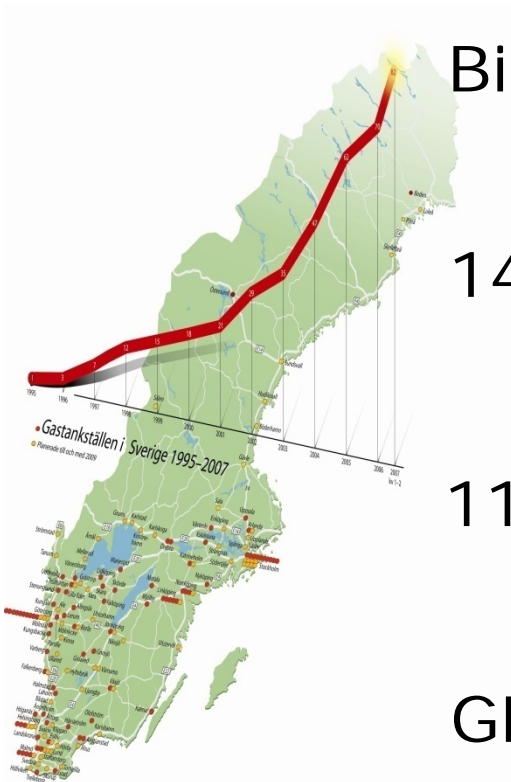
R&D - gasification



R&D - gas-powered engines



Biogas in vehicles Sweden 2007



Biomethane/CNG replace 64 milj. liter petrol

14 500 gas-powered vehicles

115 fueling stations for CBG/CNG

GHG reduction 101 000 ton CO₂

Are there any gas powered-vehicles?

Light duties



15 models from :

Iveco
FIAT
Ford
Mercedes
VW

Passenger cars



15 models in Europe from:

Citroën
FIAT
Ford
Mercedes
Opel
Peugeot
Volvo Cars
VW

Busses



Models from:

Ekobus
Irisbus
Iveco
MAN
Mercedes
Volvo

Trends and markets

A new generation gas-powered cars

Biogas/natural gas in diesel engines (dual fuel)

Fueling stations for liquified bio methane/natural gas

Up-grading plant for liquified biometan

Gasification for biometan production

LNG & LBG - Shipping



A new generation bi-fuel cars



VW PASSAT

VW deliver a new gas-powered car in 2008!

- Turbo & Compressor
- Down-sized engine
- Make use of the high octane number



- Low fuel consumption
- Longer distance powered on methane gas

Methane gas in diesel engines – Dual fuel



AB Volvo has a new diesel-engine fueled by 90 % biomethane & 10 % biodiesel!

Engine with diesel efficiency!

This opens for a quite new market

- HD vehicles for goods transport
- Public bus transportation, local & regional

Infrastructure for liquified methane

The h.d. vehicle market need, in the long-term, a fueling infrastructure for liquified methane gas

Around 25 fueling stations has to be built in Sweden

The fueling stations can deliver both liquified and compressed methane gas

We need to co-operate in Europe to build this infrastructure!



Production of liquified biomethane

Cryogenic up-grading can replace traditional techniques (scrubbers, etc) but only at bigger biogas plants >30 GWh!

The biogas is cooled down (-163 °C) to liquified state

Two products: liquified biomethane and liquified carbon dioxide



Shipping – a new market

There are some driving forces for LNG in ships and in the longer term LBG !

Better air quality

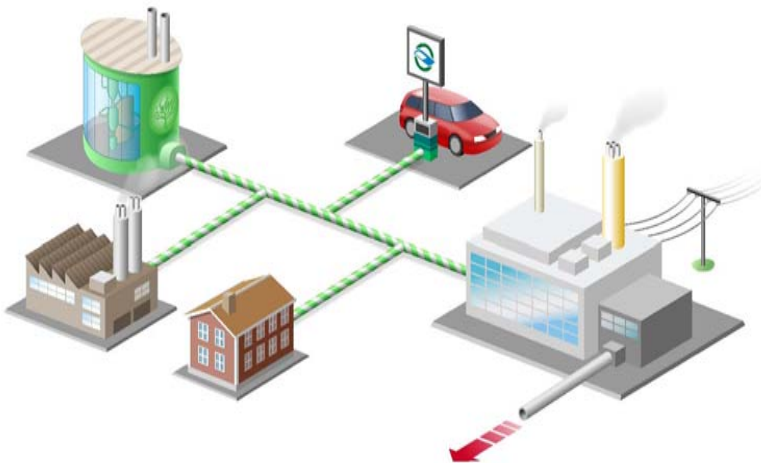
Reduced green house gases

Trading with green house gas emissions

Fuel economy



Biomethane from wood



GoBiGas

Göteborg Energi AB plans a gasification plant for biomethane 2012

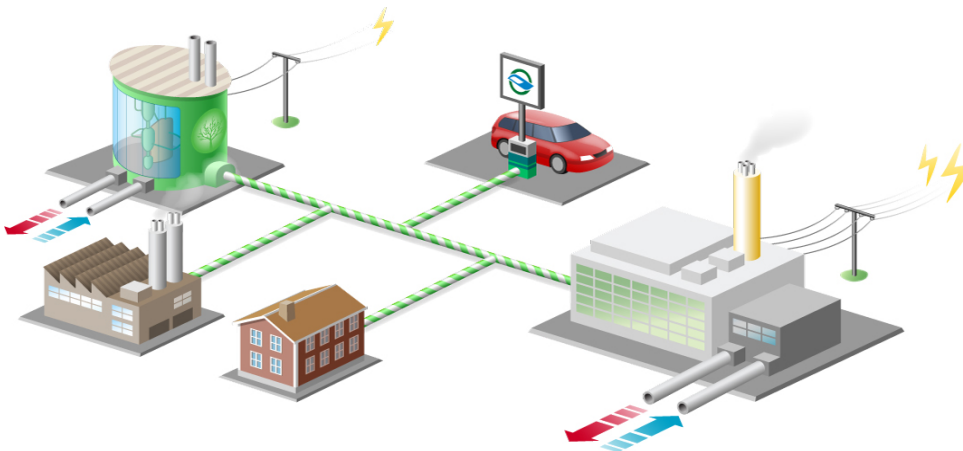
Commercial scale – 0,8 TWh biomethane

Research plant at Chalmers
November 2007

System efficiency comparison

Gasification

70 % biomethane
 20 % district heating
 10 % energy losses

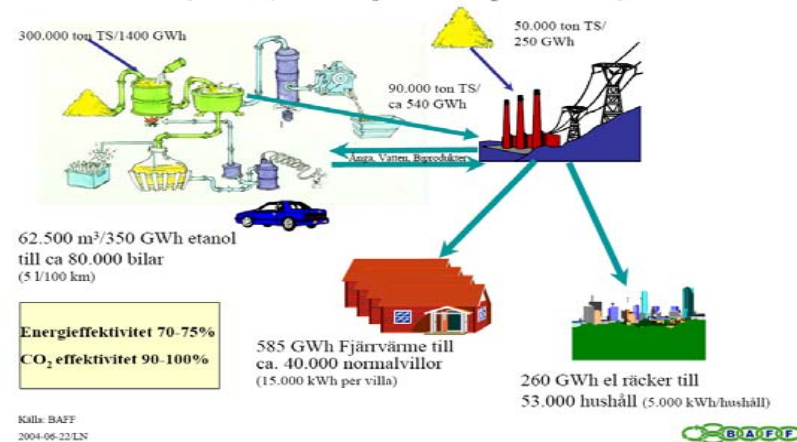


Source: Göteborg Energi

Ethanol

21 % ethanol
 16 % electricity
 35 % district heating
 28 % energy losses

BIORAFFINADERI OCH ENERGIKOMBINAT (etanol-, el- och fjärrvärmeproduktion)



Source : BAFF



Biomethane could by 2030 replace 25-35 % of fossil fuels used for road transports in Europe

1 400 000 km natural gas grid in 32 countries

Biomethane can be distributed in the gas grid to the consumers

A wide range of biomass feedstock & high efficient production both from digestion and gasification

600 000 CNG vehicles already in traffic

2000 existing fueling stations for CNG and CBG

Liquified biomethane will play a important role



Thanks for your attention!

Biogas Väst

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