trend setter

Evaluation Report

Improved Biogas Refuelling Infrastructure

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A report for City of Stockholm Environment and Health Administration, December 2005

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1 INTRODUCTION

1.1 Background

One way to promote use of clean vehicles is to increase the number of tank filling stations for biogas (and of course other types of alternative fuels). One measure in the Trendsetter program "Clean Public and Private Fleets" focused on increasing the number of fuel station. One main goal for sub measure "Improved biogas refuelling infrastructure" was to (within Trendsetter) built four (4) new public tank stations for biogas in Stockholm.

1.2 Objective of this work

The objective of present study was to (by interviews) map out differences between different distribution techniques, identify problems at filling stations and estimate sales figures and trends. In practice – figure out the function of biogas infrastructure and ask responsible persons at filling stations about theirs opinion about this issues, with respect to reliability and availability.

1.3 Number of Biogas Filling Stations

During the latest year, uses of biogas have increased rapidly in Sweden. There are, in December 2005, five public biogas stations in Stockholm. At the same time, there are 59 public stations for the whole Sweden in total.

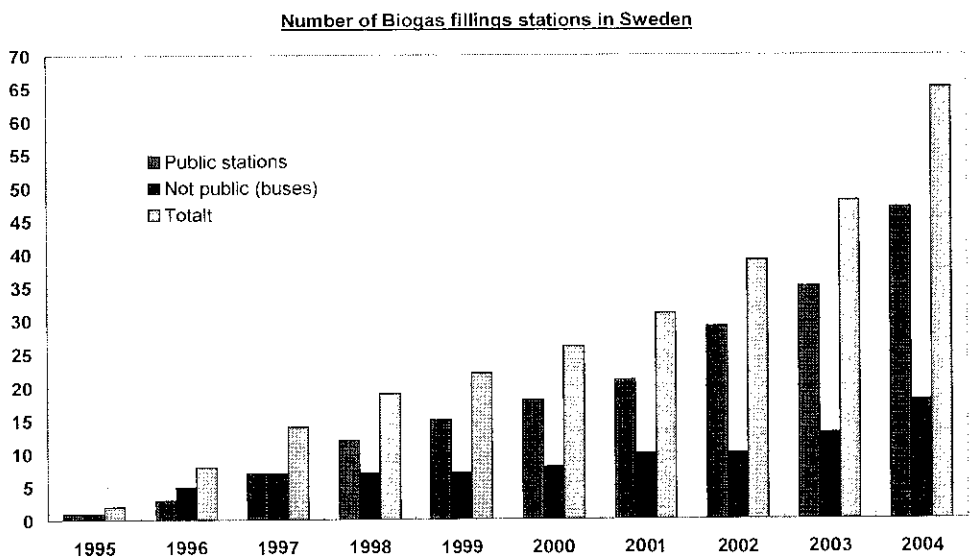

Figure 1. Number of gas filling stations in Sweden divided in public and not public station

During the time period from 1995 to 2004, the ratio between biogas and fossil CNG gas, for use as vehicle gas, have increased. During the same period the total amount of sold gas have increased very fast. This trends continue after 2004.

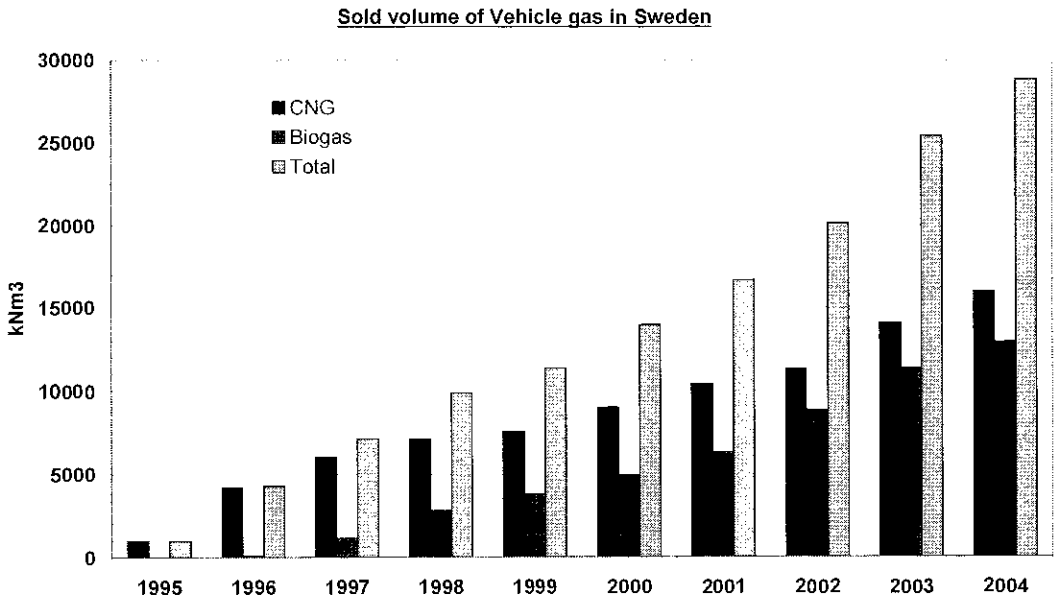

Figure 2. Sold volume of gas for vehicles divided between CNG and Biogas

1.4 Number of Biogas Vehicles

In the Stockholm area, the numbers of light duty biogas vehicles have increased from 450 year 2002 to 835 by year 2004. During the same time period, the number of heavy-duty biogas vehicles has increased from 10 to 32.

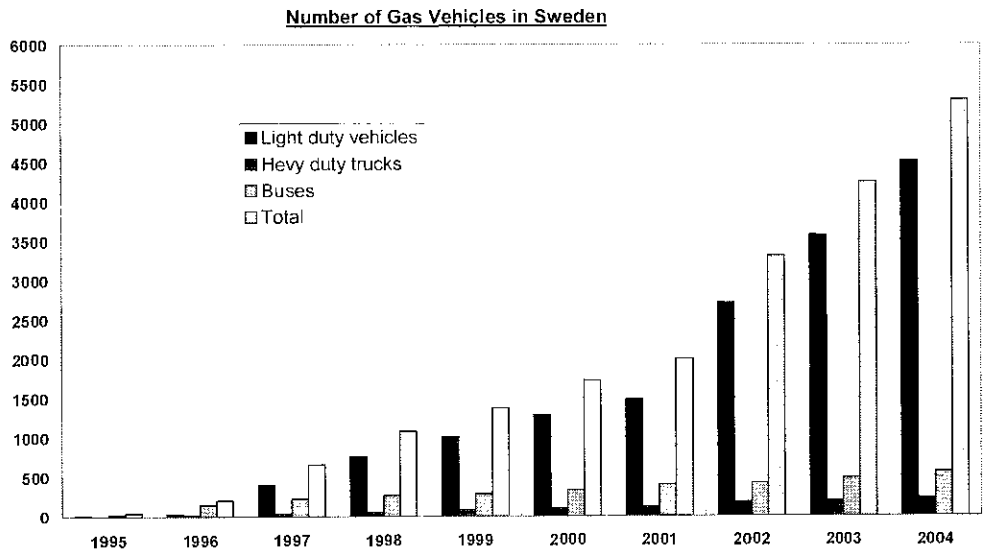

Figure 3. Number of gas vehicles in Sweden

2 RESULT

Three of four of the planned new public biogas tank station have been built within Trendsetter, sub measure "Improved biogas refuelling infrastructure". The reason why filling station number 4 (Norr Mälarstrand) not has been built yet, due to juridical and legal aspects. All construction materials have been purchased.

The number of biogas vehicles has (both buses and light duty vehicles) growth fast during the latest years and this trend seams to continue. Also the ratio between biogas and gasoline used onboard vehicles have been increased (for vehicles with flexi fuel function between gas and gasoline). Increases of number of vehicles and increase of ratio between biogas and gasoline have resulted in an increased sale of biogas in the Stockholm area.

The numbers of light duty biogas vehicles operating in Stockholm area have increased from 450 year 2002 to 835 by year 2004. During the same time period, the number of heavy-duty biogas vehicles has increased from 10 to 32.

2.1 Distribution of Biogas in Stockholm

Three types of distribution of biogas are used in the Stockholm area. In all cases, the distributor of biogas has on-line readings of gas fuel level at the different filling stations. This means that the distributor "fills up" filling station without any more information from the actual filling stations personal. In practice – distributors are responsible for the logistic of biogas distribution. In the past, this system did not work properly but all problems have been solved stepwise over time.

- Pipeline [from production to fuel station]
- Gas Tank Lorry [filling storage tanks at filling stations from a tank lorry]
- Gas Platform [a truck deliver gas platforms to filling stations]

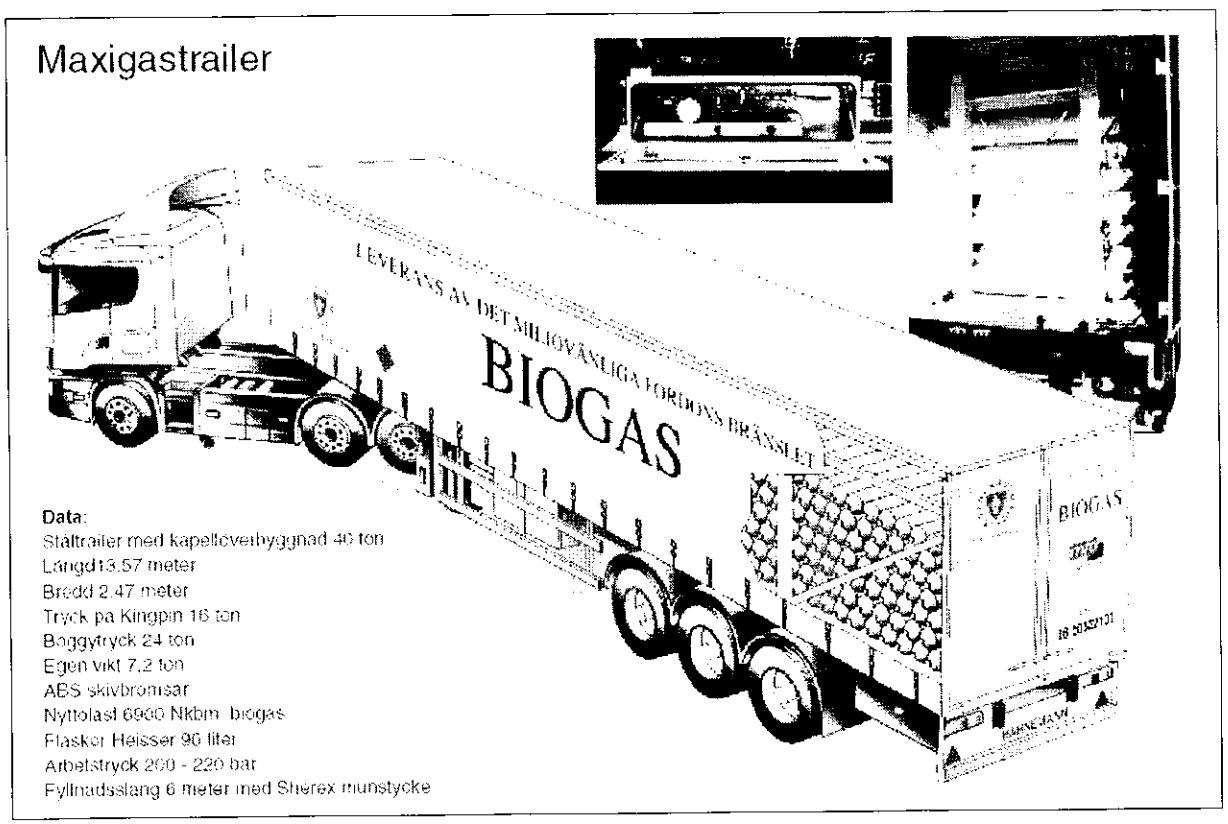

Figure 4. Gas Tank Lorry with a capacity of 7.000 Nm^3 biogas

Figure 5. Gas Platform. Containing 1.900 Nm^3 biogas

One benefit with the gas platform system compared with distribution by gas tank lorry due to time aspects. Filling up a station using tank lorry takes up to 5 hour. Exchanging a platform takes 10 – 20 minutes in total. Except high personal cost in the case of long filling times, there are a lot of practical problems such as crowding at parking place areas etc. If the distance from biogas production plants to the actual filing station is long (driving distance) it can be better to use the tank lorry system since the volume of biogas is high.

Almost all-new biogas filling stations uses the platform system and older existing stations convert from tank lorry to platform distribution.

2.2 Handling and Storage of Biogas on Filling Stations

2.2.1 Statoil

There are three (3) Statoil filling stations that provide biogas in Stockholm.

- Statoil Arlanda Airport [TRENDSETTER - station]

This filling station uses the platform system for gas distribution. Started to sell biogas in April 2005. The gas sales increase fast which may due to increased number of biogas taxis and biogas buses at Airport. Three biogas buses are used for transportation of passenger to and from airport to parking places. The increased number of biogas taxis may due to a new queue system at the airport – If you drive a taxi which are defined as a "clean vehicle" – you can pass the queue without waiting (VIP-system).

- ✓ The responsible person for this filling station is satisfied with handling of biogas (handling, storage and distribution).
- ✓ The sale of biogas is about 10.000 Nm^3 per month and the increasing trend is very strong.
- ✓ One (1) platform is used but there will be necessary to increase to two (2) platforms in the very near future. The platforms are exchanged at about ones a week.
- ✓ The function of filling system and distribution is satisfactory (small problem during start up period but all problems are now solved)
- ✓ No extra costs at filling station (In practice less expensive compared with other liquid fuels)
- ✓ The availability for biogas at this filling station is high. Number of times not able to provide biogas have been very few.

- Statoil ICA Express Hammarby Sjöstad Nya [TRENDSETTER - station]

This gas filling station is provided with biogas via a pipeline from Henriksdals (sewage treatment) purifying plant. Beside biogas for vehicle use, biogas is also used as a (city gas – for kitchen gas cooker etc) in the residential quarter in the newly built Hammarby Sjöstad.

- ✓ The responsible person for this filling station is satisfied with handling and distribution of biogas.
- ✓ During start up period there have been problems as ice-plugs in pumps and filters. This happened more easily in wintertime. However, the problem with ice, occur more and more seldom and is not any problem anymore.
- ✓ The sale of biogas is about 10.000 – 12.000 Nm^3 per month and with an increasing trend.
- ✓ The availability for biogas at this filling station is high. Number of times not able to provide biogas have been very few

- Statoil ICA Express Nynäsvägen

This filling station is not a Trendsetter station and the biogas is provided to the station by the older system, delivery by tank lorry.

- ✓ The responsible person for this filling station is satisfied with handling of biogas (except for distribution, se below)
- ✓ One major problem with distribution with tank lorry is that filling time is very long. Normally it can up to 5 hours to fill up the filling station.(with the new system using gas platforms it takes about 10 – 20 minutes).
- ✓ The long filling time from the tank lorry causes practical problems as crowding at the parking place etc.
- ✓ The sale of biogas is about 15.000 – 22.000 Nm^3 per month and the increasing trend is very strong.
- ✓ A lot of garbage trucks, taxis and distributor companies use this filling station for filling biogas. In case of low gas fuel level at this filling station, personal, contact big customer groups and guide them to alternative filling stations.
- ✓ One small (can be big) problem is that this filling station only two have "filling mouthpiece", which can break down.

2.2.2 Shell (Aga)

One Shell filling station provides biogas in Stockholm.

- Shell - Kista [TRENDSETTER - station]

This station uses the platform system for gas distribution.

- ✓ The responsible person for this filling station is satisfied with handling of bio-gas, but say that the gas content in platforms is to small. This Means a lot of heavy duty transports for relatively small amount of gas.
- ✓ There have been problem with distribution of gas (due to data transfer between fuel level meter at filling station and distribution central). However, these problems are now solved.
- ✓ The sale of biogas is about 12.000 Nm^3 per month and the increasing trend is very strong and much higher than expected.
- ✓ The availability for biogas at this filling station is high. Number of times not able to provide biogas have been very
- ✓ High consuming customers (as garbage trucks and so on) often use the bigger Bromma filling station.
- ✓ Some customer complains over gas prices. They expected lower fuel costs when the decided to buy gas vehicles.

2.2.3 OKQ8

One OKQ8 filling station provides biogas in Stockholm

- OKQ8 – Årsta

This filling station is not a Trendsetter station and the biogas is provided to the station by the older system, delivery by tank lorry. (almost the same answer as Statoil ICA Express Nynäsvägen)

- ✓ The responsible person for this filling station is satisfied with handling of biogas (except for distribution, se below)
- ✓ One major problem with distribution with tank lorry is that filling time is very long. Normally it can up to 5 hours to fill up the filling station.(with the new system using gas platforms it takes about 10 – 20 minutes).
- ✓ The long filling time from the tank lorry causes small practical problems as crowding at the parking place etc. (the driver of the tank lorry have to stay with his truck)
- ✓ The sale of biogas is about 15.000 Nm^3 per month and the increasing trend is very strong.
- ✓ A lot of garbage trucks, taxis and distributor companies use this filling station for filling biogas.
- ✓ One small (can be big) problem is that this filling station only has one "filling mouthpiece", which can break down. From time to time, customers drive out from the filling station without demounting the filling hose. This causes a stop for some hours (up to 15 h).
- ✓ The availability for biogas at this filling station is high but for a few times the filling station has not been able to provide biogas. This due to increase in numbers of biogas customers.

2.2.4 Preem (Aga)

One Preem filling station shall provide biogas in Stockholm in the near future

- Preem - Norr Mälarstrand [TRENDSETTER - station]

The construction work of this filling station has been stopped due to legal and juridical aspects. People living in the residential quarter close to the planned filling station and an owner of a café appealed against the given permit for construction of this station (the permit was given by the city of Stockholm). The appeal due to a lot of different aspects such as safety, changing in the coast line and to the fact that the city of Stockholm some years ago made a policy statement that says – no filling stations in the city core. The court (Länsrätten) accepted the appeal – that means that the construction permits not is valid any more. Preem appealed against this juridical decision and will try to bring the case to the next court (Kammarrätten) The court will give an juridical decision in beginning of 2006 (If they accept Preems appeal or not).

3 FUTURE

Since the number of gas vehicles increase by over time it necessary to increase the number of filling stations. In Stockholm area a lot of new stations are planned in the very near future.

- Bilia – Haga Norra – January 2006
- Statoil – Järfälla – Mars – 2006
- OKQ8 – Mörby – April – 2006
- OKQ8 – Skärholmen – April – 2006
- Norsk Hydro – Värtahamnen – July – 2006
- Statoil – Södertälje – July – 2006

Figure 6. Gas filling stations in Stockholm area. Existing station are marked with green dots and planned with red.

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7 Kent Jansson, Shell Kista

8 Ulrika Karlsson, OKQ8 Årsta

9 Björn Hage, Preem

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