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decarbonated AIRport regions
18 - 19 June 2013

Stockholm Study Visit

18-19 June 2013

AGENDA

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Elisabeth Celsing, Head of the Environmental Department, Swedavia, Arlanda

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Åsa Sahlqvist, Environmental Advisor, Swedavia, Arlanda

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Christina Sares, Environmental Advisor, Swedavia, Arlanda

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Fredrik Jaresved, Head of Public Affairs, Swedavia, Arlanda

Study Visit Conclusions
Dan Wolff, Consultant, Eurotran

Jens Plambeck (Stockholm PTA)

The main objective of this Study Visit is to look at the environmental situation at Stockholm Arlanda Airport. As regards environmental issues around the airport, the role of the Transport Administration is to provide green solutions for transport to and from the airport.

Introduction to the Stockholm Study Visit

Dan Wolff, Consultant, Eurotran

Milestones in Swedish history

3 September 1967: Sweden switches from driving on the left-hand side of the road to the right in order to become a bit more conventional. This shows that even challenging steps can be taken overnight.

June 1994: Sweden confirms its membership of the EU

18 June 2008: FRA-law adopted (confirming Millennium conspiracy theories)

19 June 2010: Princess Victoria (finally) gets married

TOM TOM's 2012 Congestion Index places Stockholm amongst the most congested cities in Europe. The clichés about low density in Sweden should be forgotten: Sweden is in fact a country confronted with dramatic congestion problems in certain areas. Warsaw, Vienna and Paris are not doing that well either.

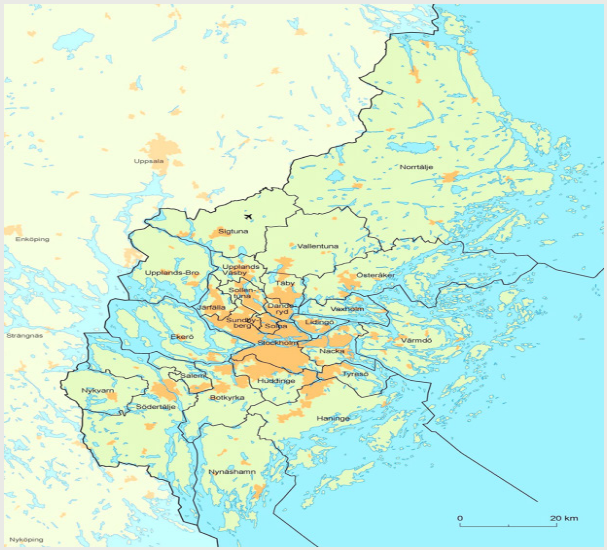
It is often said that Sweden can afford to buy costly tools to decarbonise its transport. We have a good example of such a prejudice in the recent purchase by Google of the electric output of an entire 72 MW wind farm in Maevaara, Sweden. They will buy this electricity for the next 10 years to run their data centre in Finland. Not only is it 'cool', but companies also receive tax benefits for using green power. Google has announced that it plans to remain carbon neutral and it has also recently acquired 48 MW of energy from a wind farm in Oklahoma.

However,

- Money cannot buy everything
- Swedavia has managed to implement low-cost measures with high effects.

Introduction to Stockholm Region

Hans Brattström, Regional Planner, Regional Growth, Environment and Planning Department, Stockholm County Council



A growing region

The Stockholm region is growing fast, achieving 2 % annual growth for the past five years. No wonder there is congestion in public transport. If there is continuous growth, Stockholm County will have 3.3 million inhabitants by 2050.

Facts about Stockholm County

- 2.1 million inhabitants
- 22 % of Sweden's population
- 960,000 households
- 6,500 square km
- 26 municipalities
- City of Stockholm: 880,000 inhabitants

- Annual growth 1.5-2.0 % (30,000 people per year)
- Own parliament: County Council Assembly
- Independent taxation and decision-making powers
- Responsible for healthcare, culture, regional and sustainable development & public transport

Regional planning in Stockholm

The Regional Development Plan (2010-2030) was adopted in May 2010. The Regional Development Plan is not binding and needs to be accepted by the municipalities in order for the strategies presented in the plan to be implemented. Stockholm County Council invited neighbouring counties to participate in the planning process. The aim of the plan is to increase the integration of cities in the region by improving transport and infrastructure.

The Regional Development Plan is polycentric with a regional centre and 8 sub-regional cores. It integrates the Stockholm airport system (Arlanda, Bromma[1], Skavsta[2], Västerås[3]) and the airport city concept.

Emission cap for Arlanda Airport

The total amount of CO_2 emissions from aircrafts within the LTO-cycle (Landing and Take-Off Cycle), all activities at the airport and all transport to and from the airport of passengers, employees, cargo and supplies must not exceed 1990 levels.

1 Bromma is a city airport.
2 Skavsta is a low-cost carrier airport
3 Västerås is a minor airport

Over time the share of emissions from aviation and surface access has changed. The share of CO_2 emissions from surface access has increased since 1990 and now accounts for more than 50 % of emissions. This might lead to a forced reduction in air traffic and calls for cooperative actions to reduce CO_2 emissions from surface access.

A number of **actions have been taken to reduce CO_2 emissions:**

- The Arlanda Forum was established in 2007. This is a regional forum that focuses on improving accessibility and enhancing international connectivity.
- Action programme and a Letter of Intent signed by all relevant stakeholders in 2008. A new letter of intent to improve public transport and CO_2 emissions is planned.
- SATSA – an EU-funded project (2009-2011) was also successful thanks to the Letter of Intent. It enhanced accessibility to Arlanda and reduced CO_2 emissions from surface access by:
    - improving the use of existing rail infrastructure
    - improving accessibility by train and bus
    - promoting traveling by public transport
    - reducing the environmental impact of road transport

Outcome:

- A commuter train service from Stockholm and Uppsala to Arlanda was introduced in 2012
- A change in modal split: public transport share is now more than 50 %
- Generalisation of biofuel for buses and low-emission taxis
- Improved coordination between public transport operators, adjustments of bus services, incentives for employees to use public transport

There are two major infrastructure projects underway in Stockholm:

- The rail City link connecting the Northern and Southern parts of the City
- The Western Bahn Path (road connecting the Northern and Southern parts of the region)

Questions & Answers

Sergi Alegre Calero (El Prat): Were CO_2 emissions going up?

Wim de Kinderen (Brainport): Was the emission cap a driver for action? Did you use new technologies or apply current ones?

Question from the audience: How is the cooperation organised between the counties? Is it easy to cooperate with each other? Do you have different opinions?

Jens Plambeck (Stockholm PTA): We have mainly used existing technology but packaged in a different way. We have used taxis to promote renewable fuels. Some of the things now in place were not in place when we started.

Hans Brattström (Stockholm County Council)

- The government approved a third runway only if certain conditions were met. The environmental cap was one of these conditions. It is related to the Environmental Act which contains binding conditions. If emissions exceed the limits then actions have to be taken.
- There has been continuous cooperation. We have been doing long-term projections and common modelling for the regions. The crucial issue is how to use these planning concepts developed together. Each county needs to integrate them in its own planning concept.

THEME 1: GROUND TRANSPORTATION IN STOCKHOLM AND ARLANDA REGION

Theme 1.1 Strategic Planning for Public Transport

Jens Plambeck, Director of Strategic Development at Stockholm PTA

As Hans Brattström stated, cooperation is key. Without it nothing would be possible between counties and municipalities.

Public transport has been open to commercial traffic since 2012 but private operators have difficulties competing with subsidised traffic. Stockholm PTA purchases subsidised traffic through public procurement (tendering). Since the early 1990s, private traffic suppliers run all public transport: Arriva, Keolis, etc.

Stockholm County Council Public Transport Authority

1. Authorises commercialised traffic (sporadic)
2. Provides subsidised public transport through:

- Storstockholms Lokaltrafik, SL
  - Bus (450 lines); target: 75 % with biogas by 2016
  - Metro (7 lines)
  - Train (9 lines)
  - Tram (4 lines)
- Waxholmsbolaget, WÅAB
  - Boat
  - Mobility service
  - Special local bus lines
  - Taxi service for persons with disabilities

Quick facts about Stockholm PTA

- 50 % of Sweden's public transport
- 40 % overall market share (since 2008) – 78 % during morning peak
- 725,000 passengers make 2.5 million trips per day
- 75 % customer satisfaction
- Zone-based prices
- Funding: 50 % taxes and 50 % fares

- Costs: EUR 1,400 million per year
- Investments: EUR 500 million per year
- 14,000 employees: 600 at Stockholm PTA

Main challenges for Stockholm PTA

There are 30,000 new inhabitants per year, slightly more than was calculated before. An earlier prognosis was 20,000 new inhabitants per year and therefore long-term planning for infrastructure expansions are partly undersized.

The population is ageing and there will be a higher demand for expensive taxi services for persons with disabilities. Public transport also needs to remain accessible.

Today, 50 % of all travellers are affected by congestion and one third of the population is unsatisfied with the congestion situation. Congestion and the lack of capacity will lead to high risks of delays in parts of the network and low average speeds in parts of the bus network. Congestion on roads makes traveling by car less attractive. Large investments in infrastructure and traffic are needed. Politicians within the council agreed on what to do and this is a very important step. Despite the political divide, there is an agreement on what needs to be developed, but not on how to fully finance all the projects.

New commuter train line Stockholm – Arlanda – Uppsala

Operations started in December 2012 after tough negotiations with the private rail infrastructure owner Arlandabanan AB. Passengers pay an extra fee related to maintenance costs for providing the stop at Arlanda station.

Cooperation between Stockholm and Uppsala County Councils has provided higher traffic flows. Now the train runs every 30 minutes in the daytime and every 60 minutes in the evening. During peak hours there are trains every 6 minutes. The new commuter train line has improved accessibility from the whole county to Arlanda and Uppsala.

Citybanan: new tunnel for commuter trains under Central Stockholm

Today there are only two tracks going through central Stockholm for national, regional and local trains. It is therefore impossible to run more trains on the existing tracks during peak hours. There are high risks of interferences that can affect not only Stockholm, but also much of the national rail services.

The new tunnel for commuter trains is being built under central Stockholm and is being financed by the Swedish Transport Administration, County councils and municipalities from Mälardalen region. As of December 2017, the tunnel will provide increased traffic for commuter trains and other types of trains.

Plan for a new regional train network

Six counties in the greater region of Mälardalen are working together to increase regional traffic.

Regional trains are operated by the state-owned national company (SJ) on both a commercial and subsidised basis. The traffic range and services are not in line with the regional demand. Higher subsidy rates and better services are currently being considered.

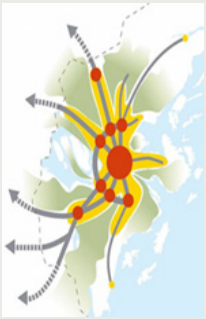
The counties are considering operating regional trains through public procurement (tendering). The aim is to increase regional accessibility, commuting opportunities and the attractiveness of the region.

Improved cross-connections via Arlanda Corridor Bålsta - Sigtuna - Märsta - Arlanda - Norrtälje

Existing bus traffic in the corridor is slow and not very attractive. Bålsta, Märsta and Arlanda are hubs in the public transport system as both regional and commuter trains stop there.

The Swedish Transport Administration, together with local municipalities, is investigating the possibility of improving road transport between Bålsta and Arlanda. Stockholm PTA expects a faster and more attractive corridor that provides opportunities to expand public transport and, in the long term, a trunk bus line at least between Bålsta and Arlanda.

Improved connections from the Northeast



Today, there are limited possibilities to travel with fast and direct public transport from the northeast part of Stockholm County to Arlanda. Stockholm PTA is currently investigating ways to improve public transport connections.

One solution is to introduce new bus lines. The road network and geography provide few possibilities to construct fast and attractive lines that can reach enough passengers and provide high services.

Another alternative is to build a new local train line from the narrow gauge rail network Roslagsbanan to Arlanda. The cost-benefit analysis indicates that the construction costs are too high compared to the benefits.

Strategy to increase traffic flow

Congestion is a big problem in downtown Stockholm but also in the semi-central sector and on major roads. Stockholm PTA has developed a strategy to improve traffic flow for bus lines using the trunk network (affected by heavy congestion).

Similar work will begin on the trunk bus network in the rest of the county in cooperation with municipalities and the Swedish Transport Administration. One of the difficulties is to agree on who should pay for the new bus lanes. The Swedish Government has announced that money could be set aside for this purpose, but it requires municipal co-financing.

In the Stockholm region, Stockholm PTA controls traffic, but does not finance bus lanes or road infrastructure. Stockholm PTA finances only some bus terminals and new rail systems that it owns. The municipality therefore prefers new tramways, railway lines and metros instead of new bus lanes.

New Trunk Network Strategy

The **New Trunk Bus Strategy 2013** should be available by the end of the year. One of its goals is to provide better access to the region's nine cores (of which Arlanda is one). The following issues are currently being defined:

- Potential trunk routes, existing, new and modified
- Number of passengers needed for choosing between bus, tram, metro and train (boat not included)
- Claims for minimum average speed and dwell time at stops
- Guidelines for distance between stops

- Guidelines for frequency of service (if possible, operating around the clock)

The concept for the Stockholm trunk network:

- Distinctive design (trunk vehicles are blue)
- Clear and logical network (easy to memorise)
- Sustainable network over time
- High number of travellers (though high travel itself does not automatically qualify a trunk line)
- Connect municipal centres directly to central Stockholm
- Cross-connect major transport hubs, civic and regional centres

New model of tendering contracts

Contractors used to get paid depending on kilometres, hours and number of vehicles. Now, they only get paid per transported and verified paying passenger. The aim is to make contractors more interested in improving the efficiency of public transport and providing a higher level of service to passengers.

Q&A

Léa Bodossian (ARC): Does the need to cope with the increase in population impact the airport's access strategy? How will that growth affect traffic to the airport? I am impressed by the fact that 50 % of costs are covered by fares. In Paris, only 17 % of costs are covered by fares and that was the case for not having clean buses. Can you afford clean buses?

Ron Nohlmans (Eindhoven): Will there be direct routes through the centre? Will there be hubs?

Question from the audience: Is the 40 % modal split (for public transport) for the region or just for the city of Stockholm?

Jens Plambeck (Stockholm PTA)

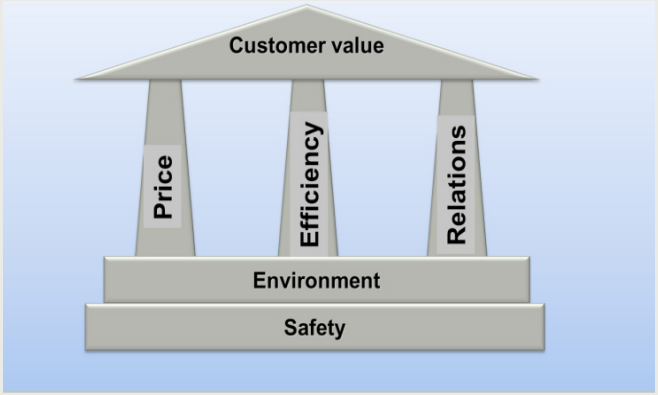
- Yes, we have to look at how the different parts are developing. The increased costs have to meet the environmental requirements (75 % of buses have to function on biogas by 2016). We have to make sure that we have a high degree of accessibility.
- There are sub-regional hubs which have to be connected. We have traffic lines into Stockholm already. We have to see how inhabitants travel and map this information. We try to provide transport without passing

through the centre.

- The 40 % modal share is for the city of Stockholm.

Theme 1.2 Regional Cooperation for Arlanda Accessibility

Fredrik Jaresved, Head of Public Affairs, Swedavia, Arlanda



Swedavia owns and operates 10 airports in Sweden. Sundsvalls airport was handed over to the region last year. Swedavia's objective is to create possibilities for sustainable growth through good connections to, from and within Sweden. Safe and sustainable airports are the foundation of Swedavia's business model which aims to obtain customer satisfaction and value.

Facts about Stockholm Arlanda Airport

- 19.6 million passengers (in 2012): largest airport in Sweden
- 16,800 employees (all the companies situated at the airport)
- 80 airlines
- 180 destinations
- 200,000 take-offs & landings
- 195,000 tonnes of freight & mail (150,000 tonnes of freight)
- Over 100 shops, restaurants, cafes and other service functions
- 16,500 parking spaces
- 53 gates

- 250 companies
- GDP of about EUR 2 billion on an annual basis

Stockholm Arlanda airport has 4 terminals. Terminal 5 is the biggest and carriers using Arlanda as a hub (SAS, Norwegian, and Star Alliance) are located in this terminal. Terminal 2 is for international traffic and, due to the growth in traffic, it has been reorganised to support the different airlines. These airlines have a different business model and are doing point to point traffic (Sky Team and OneWorld).

Stockholm Arlanda is currently working with private entrepreneurs in developing the land near the airport to create an airport city.

There are **three priority areas for the development of Stockholm Arlanda Airport**

- Become the Scandinavian hub. Stockholm Arlanda Airport is competing against Oslo and Helsinki. Stockholm aims to be the most attractive region in Europe. Therefore, good accessibility to other regions is needed.
- More satisfied travellers (Stockholm has a 70 % satisfaction rate and aims to reach 80 % in the coming years)
- Efficient operation

Arlanda: a Scandinavian hub

Arlanda is turning into a Scandinavian hub for both air and ground transport. Regional cooperation was needed in order to achieve this goal. A Letter of Intent was signed on 22 September 2008 with the purpose of increasing accessibility to Stockholm Arlanda Airport and reducing carbon emissions from ground transport. Since then, the market share of public transport to and from the airport has increased from 45 % to 51 % in the first quarter of 2013.

Regional cooperation: a win-win situation

International trade constitutes more than 50 % of Sweden's GDP, so the country needs good international connections. Regional cooperation:

- is key because Swedavia does not control other players
- generates opportunities to maximize regional benefits and,
- provides better planning conditions to avoid environmental disturbance. This is especially true for local authorities around the airport and for the airport as well.

Swedavia, as an airport operator, plays in the same league as regional authorities and has priority when it comes to funding opportunities and developing airport accessibility.

Examples of regional cooperation

- **Arlanda Forum**: initiated Letter of Intent which, amongst other things, resulted in a new train connection to Arlanda that opened up in 2012
- **Municipalities of Arlanda**: the four closest municipalities surrounding Arlanda are developing a common vision to take advantage of the airport's development
- **Mälardalsrådet** : cooperation between regions in and around Stockholm, focusing on infrastructure investment and connections to Stockholm Arlanda Airport
- **Arlanda Logistic Network** : working on aviation freight to and from the airport to reduce emissions and increase efficiency
- **Stockholm Access** : promoting more international flights to Arlanda Airport

Q&A:

Uli Koehler (Mitteldeutsche Airport Holding): The number of employees seems rather low in correlation to the number of passengers.

Franz Jöchlinger (Vienna):

- How many airline employees do you have? How many employees does SAS have?
- Could you give us more information on the development of the curved approaches? How many airlines use this? Which cooperation groups also include citizens?

Ron Nohlmans (Eindhoven): How was the Arlanda Forum organised?

Gaby Mols (Eindhoven Airport): Was the reduction mainly in the carbon footprint? Do you have agreements with airlines? Doesn't Arlanda have problems with nuisances?

Question from the audience: How do you decide on investments?

Léa Bodossian (ARC):

- Do you have special fees or discounts for airlines? We are here to make policy recommendations, but you are

saying that trade-offs are not really a problem.
- Can you expand further on the Arlanda Forum?

Fredrik Jaresved (Swedavia):

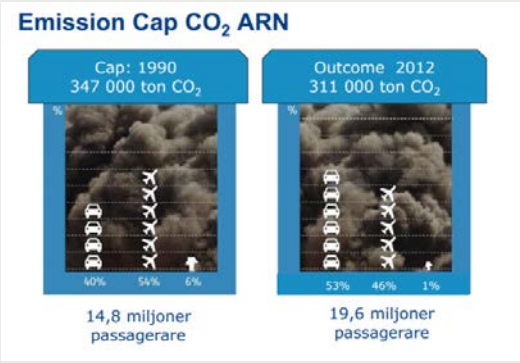
- There are 850 employees at Swedavia at Arlanda Airport and last year we had 19,6 million passengers. At the airport area there are 16, 800 employees at different companies.
- There hasn't been that much growth in domestic transport, only on long-haul routes. Bus and train services have a good share. Stockholm Arlanda is gaining in long distance and lacking in short distance. When there will be investments in better train connections, the number of passengers on domestic flights will go down. We need to give passengers good connections to the airport. International traffic will continue to grow (62 % international passengers in 2012), but domestic traffic will stay the same. The European market is important but other markets in Asia and America are also important and connections are growing faster to these continents than those to Europe.
- We have tested curved approaches and published guidelines, but this manoeuvre is not available during peak hours because the transport authority does not approve straight approaches on one runway and curved approaches on another one. We have to prove to the transport authority that this is safe. We will not be able to have curved approaches before 2018. 30-40 % of airlines use the curved approach.
- The cooperation groups presented do not include citizens, but we have groups to discuss, for example, noise issues, with people living near the airport.
- We have the taxi system and infrastructure for renewable fuels. We have been able to lower emissions from taxis. We are working with airlines to introduce green approaches which reduce CO2 emissions and curved approaches which are used to avoid noise and cut time.
- We have discounts on landing fees depending on the amount of NOx and noise produced by the airplane, but not on the CO2 emissions.
- Arlanda Forum is not a formal forum. We have informal discussions and put controversial issues on the table. We sometimes converge to common grounds. The parties bring the issues discussed to their organisations and then take decisions.

Theme 1.3 Improved and CO_2-Effective Airport Surface Access

Thomas Kreij, Head of Ground Transportation, at Swedavia, Arlanda

CO_2 reduction: ground transport

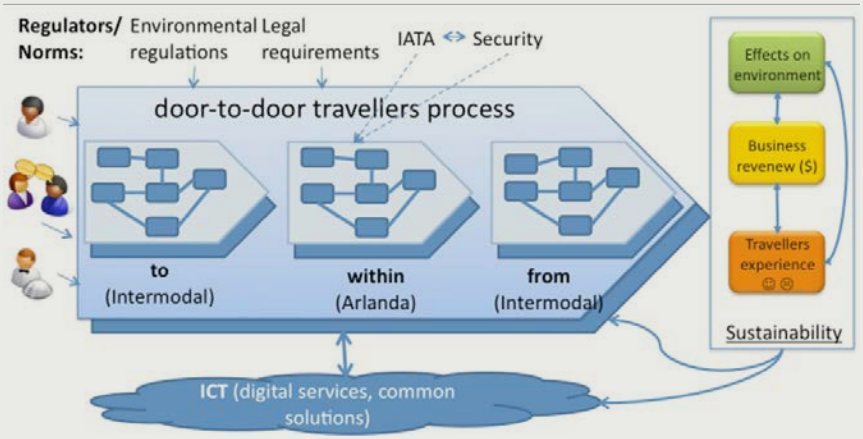
Arlanda has reduced emissions from ground transport: –15,900 tonnes from 2011 to 2012. This creates a window of opportunity to include new flights.



Stockholm Arlanda Airport organises four meetings per year with transport companies to influence their behaviour. Swedavia has negotiated a reduction of transport fees for employees using public transport to and from the airport (e.g. reduction for airport staff using Arlanda Express).

Bus services in Sweden were deregulated in 2012 and Swedavia is hoping to get new operators to start services at the airport.

There is a travel planner, developed in cooperation with Samtrafik, indicating the destination and how to get there. Stockholm Arlanda is working on developing a door-to-door concept. Passengers can check in at the major bus stations and drop off the bag at Arlanda's automatic baggage drop point.



Self-service baggage drop (SBD) point (Terminal 5)

This is a two-step process for the traveller that involves:

- Printing of tags at the kiosk (self-tagging is a prerequisite)
- Putting the bag in a SBD.

Clean buses

Stockholm Arlanda is the only airport in the world with biogas buses. Nine biogas buses have been purchased and nine more buses will be changed during 2012-2013. These will be hybrid buses powered with FAME. Biogas is not chosen due to the need for flexibility, technical aspects and availability of biogas. Only clean vehicles are purchased (excluding special vehicles). A biogas-powered vehicle emits 50-90 % fewer greenhouse gases (carbon dioxide and unburned methane) than conventional technology (gas or diesel). Emission variations depend on how the gas is produced and how efficient the engine is. Approximately 80 % of the fleet at Arlanda are clean cars.

Eco-taxis serving the airport

Since 2005 Stockholm Arlanda Airport has had separate queues outside its terminals for eco-taxis. When the separate queues were introduced, only 1 % of taxis registered at the airport were eco-taxis. Today 100 % of the taxis serving the airport are eco-taxis (environmental cars according to the Swedish definition. hybrids or renewable fuels). Priority in picking up passengers is based on the environmental efficiency of the individual taxi. If it is not an eco-taxi it cannot pick up passengers at the airport. This policy has had positive effect on the whole region.

Biogas station

- The biogas station was inaugurated in November 2010
- Improved infrastructure for renewable fuel at the airport

Q&A

Uli Koehler (Mitteldeutsche Airport Holding):

- What type of fuel is biofuel?
- Can it be used by normal cars or do we have to change something?

Question from the audience: Do the employees have to pay for transport and parking spaces?

Léa Bodossian (ARC): The taxi system did not live up to our expectations. We saw one line of electric taxis but no signs referring to eco-taxis. The taxis were sorted by brands and taxi drivers were trying to convince passengers to get into their cars.

Ron Nohlmans (Eindhoven): In Vienna passengers can leave their luggage at the rail station in the city centre. How do you perform the security checks at Arlanda when you drop off the luggage?

Elisabeth Celsing (Swedavia): We have 85- 95% biogas in the bio gas station.

Thomas Kreij (Swedavia):

- - Biofuel should be understood as a renewable fuel.
- - There is a transponder in each car that allows the system to keep track and a certificate is granted in accordance with that. Taxi-drivers have to show proof of what they have put in the car (audits).
- - There are no free parking spaces at Arlanda. There is an 80 % discount for private commercial operators.
- - All taxis are eco-taxis since 2012. We have to improve the marketing of this product and put up a sign indicating that they are eco-taxis.
- - There is a security check at the airport. In the past, passengers were able to check-in in the city centre, but the process has been stopped.

Theme 1.4 Striving for Environmentally Friendly Airport Coaches

Christian Monstein, Technical Manager at Flygbussarna Airport Coaches AB

Facts about Flygbussarna

- 8 airports and 9 cities in Sweden (Stockholm region is the largest)
- 24/7 operation
- 4.4 million customers
- 400 employees
- 70 buses qualified for eco label, “Bra Miljöval”
- Started in 1989
- Fully commercial on a highly competitive market
- ISO 9001 and 14001 certified

Current Initiatives

RME (part of the FAME fuels) was introduced in 2003. It is made out of rapeseed grown in Sweden. It is a viable option at the moment to lower fossil emissions. It is a fossil-free fuel that reduces carbon dioxide by up to 60 %.

Eco-driving is a concept based on three pillars:

- Education and continuous coaching
- IT system on board
- Financial bonuses for drivers based on performance

The benefits are reduced fuel consumption, increased passenger comfort and reduced dents and wear on the fleet.

There are many **eco-labels** in Sweden (Bra miljöval and Naturskyddsföreningen – Swedish Society for Nature Conservation) that are recertified on an annual basis. They offer high standards with strict specifications based on passenger km.

Future possibilities

Electrification is the aim (pure electric vehicles or hybrid ones). It is important to know what source of electricity is used. The company has to look closely at the infrastructure part when it comes to electrification and standards.

Flygbussarna tested a bus (EBUSCO) to Arlanda and Bromma airports. The bus can run up to 250 km on one charge and it takes 2.5 hours to charge the battery. Tests with Volvo Hybrid buses will be undertaken at the end of the year to see how these fit with the company's operations.

The bus has a place in handling transport to and from the airport even if different modes of transport are available. Flygbussarna believes that customers buy tickets based on price, not on the environmental impact.

Q&A

Question from the audience: Buses on long distances need a lot of charging time. How would you handle that?

Wim de Kinderen (Brainport): Did you approach Volvo or did they approach you?

Christian Monstein (Flygbussarna Airport Coaches AB)

- We have different logistical arrangements. For Arlanda airport, electric/hybrid vehicles could be an option. The tickets bought by customers are the basis for investment. More change can be seen on short lines.

- Volvo buses have been used since the beginning of Flygbussarna's services and we have talked about the introduction of the new hybrid buses for a long time

Theme 1.5 Public-private financed Arlanda railway

Ulf Lundin, Chief Executive Officer at Arlandabanan AB (owner of the Arlanda railway line)

History

- Stockholm Arlanda Airport opened in 1960 for international flights.
- From 1962 all international flights moved from Bromma City Airport to Arlanda.
- In 1984 domestic jet traffic was moved from Bromma to Arlanda.
- By the early 1990s all domestic routes had moved from Bromma to Arlanda.
- Land transport options: only private cars, taxis and buses.

1980s

In the early 1980s, the concept was developed to build a double track railway between Stockholm and Arlanda to:

- cater for the increasing number of air passengers,
- reduce the burden on roads (unpredictable travel time by bus, taxi and car),
- reduce harmful pollution. (CO2 and NOx).

In the late 1980s, the Swedish Rail Administration started planning a railway line between Arlanda Airport and the existing rail system.

1990s

In 1990, the Swedish Rail Administration presented its project to the Government:

- Arlanda Airport would be linked to the national rail network
- Allow long-distance trains to stop at Arlanda
- Integrate the new railway line with the rest of the rail network

Financial crisis in the early 1990s

The bank crisis in Sweden 1990–1994 affected the property market, financial market and banking sector

- Limited public funding available for investments in infrastructure
- Need for alternative financial solutions and introduction of users' fees in the transport system at large

Users' fee systems decided in the 1990s

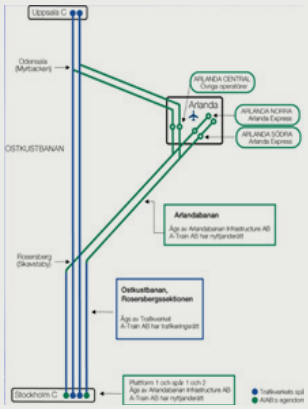
- Öresund bridge (between Sweden and Denmark)
- Toll road system in Stockholm and Gothenburg
- Country road bridges (replaced car ferries)
- Svinesund bridge (between Sweden and Norway)
- Arlandabanan
- Arlanda Express was inaugurated in 1999.

Shift to Public Private Partnership 1991-1993

The project was examined further with the aim of establishing a Public Private Partnership (PPP) together with the private sector which would take risks in financing, construction, and operation.

Tendering process 1993-1995

The tendering process was completed in 1994. The Arlanda Link Consortium submitted the winning bid. The Consortium formed the A-Train AB company to manage Arlandabanan and operate the facilities (responsible for its own costs for all services, works, supplies, financing required, operation, maintenance, repairs) until 2040.



Arlandabanan Infrastructure AB

In 1994 the Swedish State/Government set up a limited company with the task of coordinating the State's varying interests, implementing the tendering process for Arlandabanan and monitoring the State's rights and obligations in accordance with the

agreement concluded.

Arlandabanan:

- double track
- 3 stations at the airport
- 1 station in Stockholm

Financing and obligations

The tendering process included a grant from the State (SEK 850 million) and an interest-free Government loan (SEK 1 billion) on the condition that the company share the benefits. The Swedish state was responsible for land acquisition and archaeological investigations. The total cost was about SEK 6 billion.

There are no commercial guarantees from the state. The company has to guarantee operation every 15 minutes and allocate capacity to other companies.

Passenger figures: 4.5 million passengers today.

Lessons learned from PPP

The financial model works well. The infrastructure was transferred to the State (Arlandabanan Infrastructure AB) and only traffic rights remain with A-Train. A-Train is free to set the price of Arlanda Express (shuttle service for passengers) and tracks (other train companies using Arlandabanan).

The owner of A-Train is responsible for financing during the concession period. It transformed the loan into equity after 11 September 2001 to cover losses and avoid bankruptcy. A-train delivers excellent services when it comes to punctuality and customer satisfaction, but there is less political freedom for intervention on the market (the price of avoiding financial responsibility).

Q&A

Ron Nohlmans (Eindhoven): Who owns the trains?

Sergi Alegre Calero (El Prat): Who are the investors? What is their annual profit?

Ulf Lundin (Arlandabanan AB):

- The trains are leased and a fee is paid to the owner, Macquarie.
- A fund was set up by the Macquarie Group. Last year the fund had SEK 1.30 million in profit, but still had a lot of past losses and paid no taxes. The Swedish state will get a share of the profits this decade.

Theme 1.6 Coordination of Sweden's public transport

Gerhard Wennerström (Chief Executive Officer at Samtrafiken)

The Swedish public transport market

The Swedish public transport market is totally deregulated. The main purposes are to:

- Make people shift from car to public modes of transportation,
- Reduce the environmental impact from transportation, and
- Stimulate operators to develop attractive journeys

About Samtrafiken

Samtrafiken collects and compiles traffic data and makes it available in journey planners and for free use by traffic companies and for various information purposes. Traffic operators are therefore able to provide travellers with information about reliable and convenient journeys including several modes of transport (all domestic buses, trains, boats, ferries, tramways, underground trains and air travel).

The Swedish approach to travelling

The best benefits for travellers come from available and coordinated transport, transparent prices and a variety of offers and service levels. Public transport will be the first choice for travellers if it is **seamless, convenient and price-worthy** (not always equivalent to low fares).

How are traffic companies supposed to act on the Swedish transport market to be successful?

- **Compete** using their creativity to offer travellers best value for money through different products and price competition.
- **Cooperate** to secure **unified** information and **available** intermodal journeys.
- **Open-access** competition is promoted with the aim of offering more alternatives for travellers as new companies enter the market. Operators focus on high performance and efficient use of resources to maximise their revenues by promoting attractive offers.

The key to successful cooperation

Samtrafiken allows passengers to benefit from coordination of traffic data and timetables. In Sweden, on a regular weekday, about 3 million individual journeys are made with about 100,000 services, calling at 53,000 stops. The majority of these services are organised and run by Samtrafiken owners and partner companies. Altogether the 56 Samtrafiken companies operate more than 95 % of public transport services, and 36 of them are the owners of Samtrafiken (partners).

In order to promote cooperation and coordination, Samtrafiken connects the players on the transport market through two annual events:

1. Samtrafiken Conference:

- Allows people from the transport market to meet and **socialise**.
- Creative discussions are promoted through lectures and seminars on **best practices** and lessons from other markets.
- In recent years invited speakers from other industries have led workshops about **customer focus, competition and cooperation**. This is the best way to learn lessons from other industries.

2. Samtrafiken annual planning conference and 4 annual workshops.

- The Target group consists of planning staff from traffic companies who meet to coordinate public transport.
- In the workshops, participants decide on connection times and how to deal with travellers during disruptions. Participants also agree on suitable places for smooth changes between different companies and transport modes.

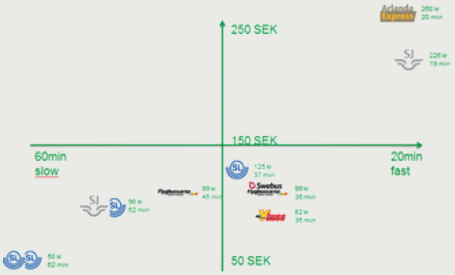
- As a result of the workshops, **national plans are determined and published.**

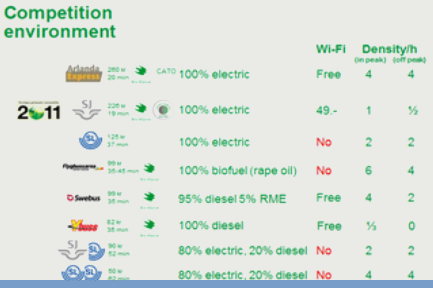
Samtrafiken's mandate rests on three pillars:

1. the open-access legislation passed in the Public Transport Act. Traffic companies are requested to submit information to a National System for Traffic Information (one of the very few requirements of the Public Transport Act)
2. Samtrafiken is appointed by the Swedish Transport Agency to run the National System for Traffic Information.
3. Full support from owners and partners.

Samtrafiken runs the National System for Traffic Information

Input (including timetables, location of stops and conditions for connections) to the **National System for Traffic Information** comes from traffic companies. The production team at Samtrafiken processes the submitted files and compiles them before exporting them to output channels. The exported information is made available in journey planners and open-data sources. The National System for Traffic Information is financed by traffic companies. They pay a fee related to the amount of traffic data submitted. The use of traffic data is free of cost and accessible to anyone.





Arlanda Airport: competition time and price

Price correlation to product and offer is not the most important element. The most important element is **how passengers experience the journey.**

Companies can compete on environmental issues. First only Arlanda Express and SJ had the environmental label, then buses were also awarded

the label. The environmental label is not based on fuel, it is based on passengers (the load factor is key).

WIFI makes the difference between transport modes and it will be a factor that everybody will have in a couple of years. Density can be another factor, but is not always a good choice.

Competition using vending machines and intermodal ticketing

Examples of how the compiled data is used

The national door-to-door journey planner Resrobot

Journey alternatives are shown in order of departure time and the fastest option is shown first. Travellers can modify the choice, as the planner allows different modes of transport to be excluded. For example, for journeys from Stockholm to Arlanda, there are five options, from four different companies, within ten minutes.

Data from the system is used as input for major ticketing sites

This is the base for the **Resplus-ticket**, which is a nationwide ticket used across different modes of transport. The Resplus-ticket is available in different forms, as a regular ticket, email for self-print or sms-ticket for mobile phones.

Traffic data is available for anyone in combination with information from other sources

The purpose is to create a customer-specific application by compiling different data. Users have to register on **Trafiklab.se** to get free access to traffic data. The only limitation is that the data cannot be used for the construction of ticketing sites.

Q&A

Léa Bodossian (ARC): Your conclusion was that Arlanda Express is a fantastic product and that customers are not necessarily that rational, but when you arrive at Arlanda airport Arlanda Express is the only visible choice. The most logical options are Swebus and Flygbussarna, which are less expensive.

Dan Wolff (Eurotran):

- You are owned by other organisations and you depend on them. What happens if there is a new competitor that is not one of your owners? Are there any guarantees of fair access to the database?
- Do you display the actual CO2 emissions of each mode of transport on the website?

Question from the audience: Who founded the company and who are the owners?

Gerhard Wennerström (Samtrafiken):

- Companies pay for the exposure that they get. Swebus is new in the airport business and it is extremely difficult for them to get passengers.
- According to our contract, we need to give equal treatment to everyone.
- The load factor is low in Sweden. As there are many rural areas, it is difficult to have a high load factors on buses. We cannot show CO2 emissions for the 3 or 4 passengers taking a particular bus.
- SJ needed to increase the number of passengers and wanted a system that could interconnect with long-distance trains by using a single information and ticketing system. It was purely a business decision to increase business for SJ and other transport companies.

Workshop

Thomas Fylkehed planned eight groups to discuss the answers to the four questions below:

- What are the most important driving factors in your life when it comes to choosing public transport?
- What are the most important conditions that you believe will affect people choosing public transport to and from an airport in general?
- How can Stockholm PTA and Swedavia Stockholm Arlanda Airport improve the transport offer in order to increase the use of public transport to and from Arlanda?
- What good practices are the most important in providing attractive and efficient public transport?

Group Work

- Each group had to answer one question (two groups for each question) by selecting five statements and writing them down on a post-it note.
- The group leader then put the post-it notes on the designated board for each question.

- All participants received 12 marks to vote for the best answers

Reporting/Conclusions

Thomas Fylkehed summarised the results and indicated which ideas/answers received the highest number of points (see annex II).

Q&A

Maarten van den Nieuwenhof (Eindhoven): What points surprised you and what confirmed your opinion?

Thomas Fylkehed:

- We thought that we had a good ticketing system, but it seems that it can be further improved, according to participants' remarks.
- When planning public transport, cars should only be 1.2 times faster than public transport.

THEME 2: ENERGY SUPPLY

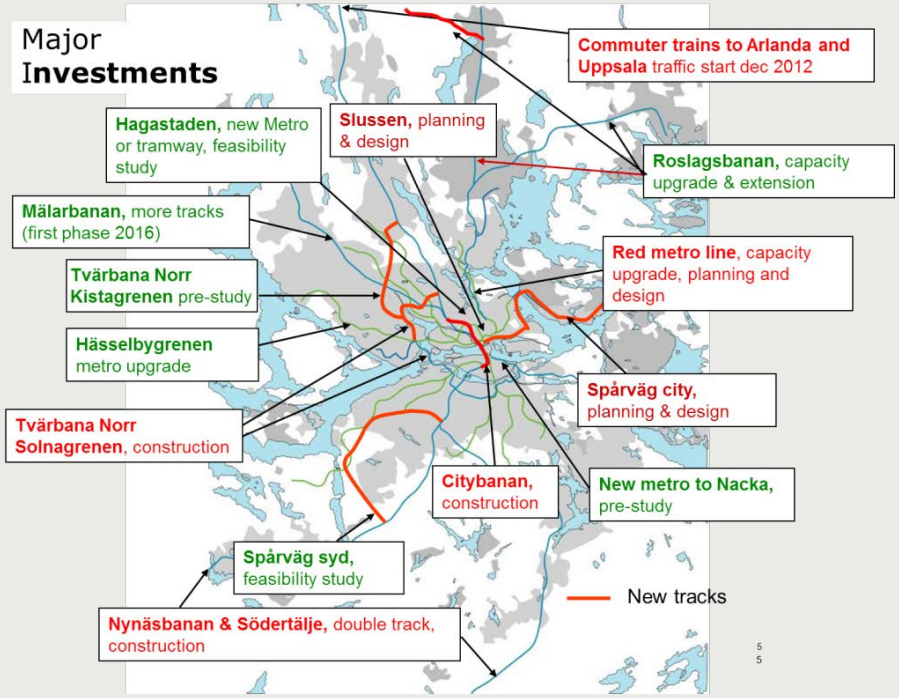
Theme 2.1 Environmental work in public transport

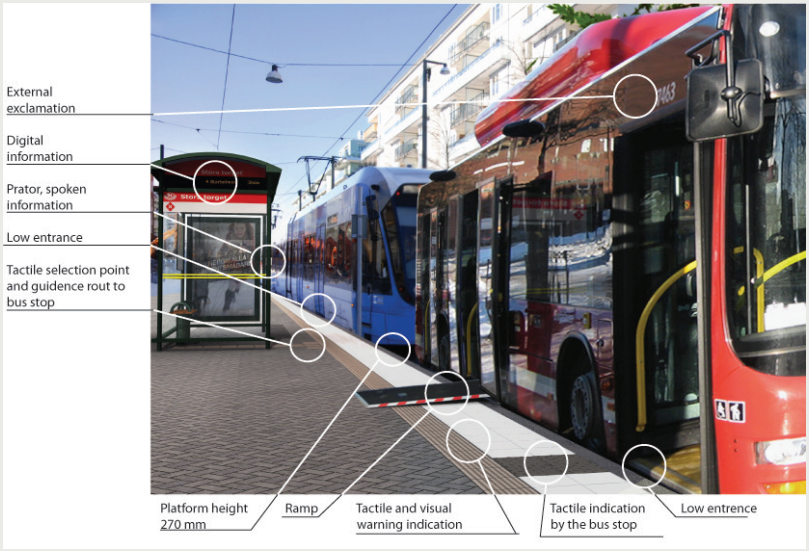
Stefan Wallin, Director of Sustainable Development at Stockholm PTA

Environmental and Social Challenges

The **transport system is congested** due to the increase in the number of inhabitants and elderly persons (need for housing and infrastructure).

The **number of people with special needs is increasing**. In the future one in every four inhabitants of the region will be a retired person, so there is a real need to invest and develop the region. It is therefore necessary to invest money into making the transport system more accessible (buses, trams, external loudspeakers on buses, fitting most bus stops with a button giving information on demand, lowered entrances). Special transport services for people with disabilities are costly.





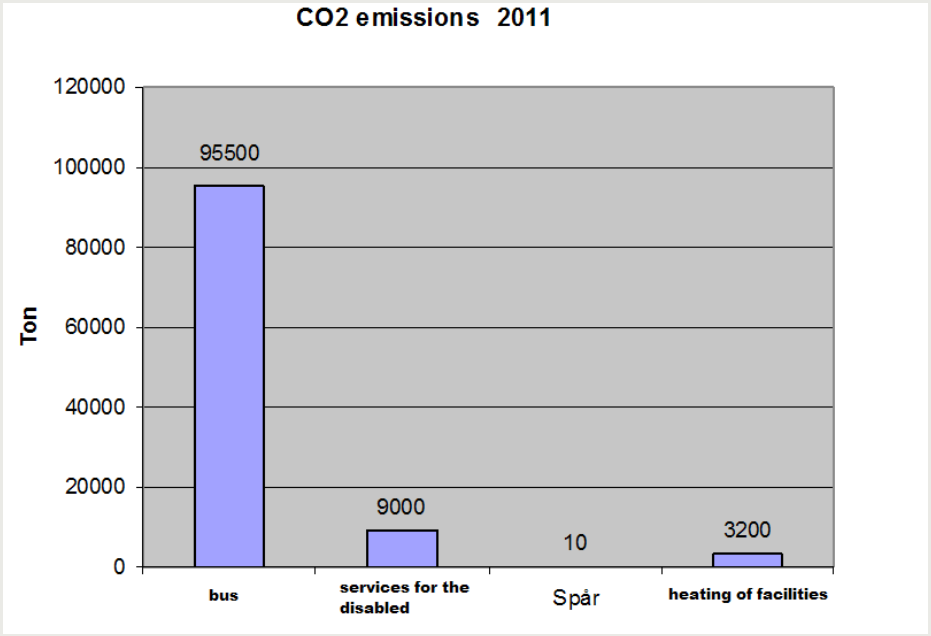
The increased use of private cars has **negative effects on health and the environment**. Public transport also causes environmental problems. The negative effects come from:

- Nitrogen oxides and particulate matter
- Noise, a rapidly increasing problem in urban areas
- Hazardous chemicals (e.g. for getting rid of graffiti)
- Emissions causing climate change, mainly CO_2

Targets and Strategies

The majority of Stockholm PTA's services operate on renewable energy. For example, all rail service operations use energy from wind or hydropower. The next step is to lower energy consumption.

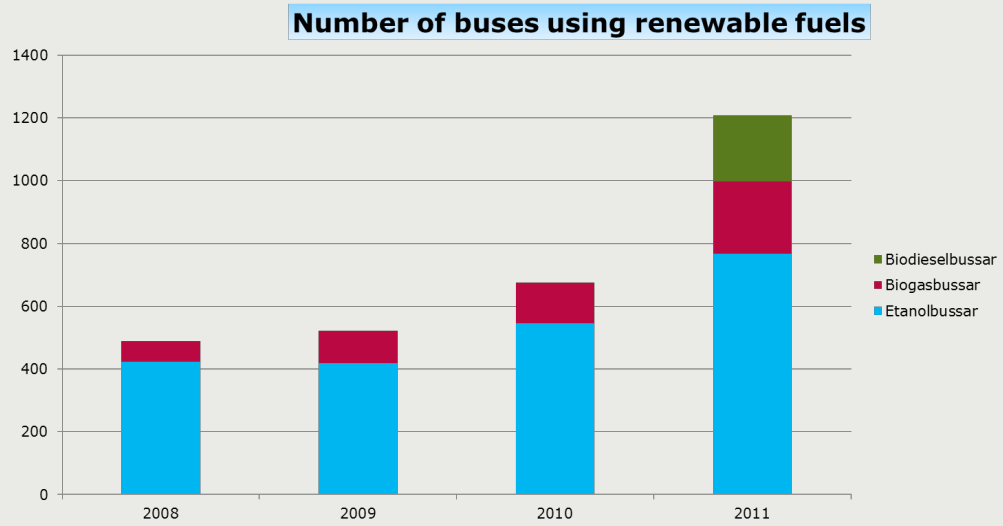
Stockholm PTA does not want to sit back and wait for the 'perfect solution'. The perfect solution may never come, or there may be more than one perfect solution. The company believes that it is better to start working with the best available solutions today so as to gain experience and knowledge. Stockholm PTA will also engage in projects for future solutions, such as fuel cells.



Examples of targets

- Increase the share of energy from renewable sources from 80 % to 90 % by 2020
- 100 % energy from renewable sources by 2030
- At present 63 % of the 2100 buses run on renewable energy
    - 75 % by 2016
    - 90 % by 2020
    - 100 % by 2030

Stockholm PTA believes that ethanol and biogas are the most suitable fuels for the company's purposes. The Transport Administration has considerable experience of using both and considers that they are adequate for the bus fleet. All buses in Stockholm city centre (environmental zone: diesel prohibited) are fuelled with ethanol or biogas, which are cleaner than diesel.



The Way Forward

The Strategy for sustainability was approved by politicians in spring 2013 and will be an addition to the guidelines that have to be used when contracting or purchasing vehicles. In 2014, Stockholm PTA will run tests with partly/fully-electrified buses.

Congestion Taxation in Stockholm

The congestion charging system consists of 18 checkpoints around the inner city. A congestion tax is charged when driving into or out of the city between 6:30 a.m. – 6:29 p.m. on weekdays. It is managed by the city of Stockholm.

The charging system is based on automatic registration without barriers or stops. The license plates of all vehicles are photographed and registered. Approximately 65 % of all payments are done through automatic debiting on specified accounts or internet shops.

The congestion charging system was introduced as a test in 2006 and initially 89 % of inhabitants were against the idea. The trial made it possible for everyone to see the benefits for themselves and the congestion zone became permanent.

The system had a dramatic effect and there was a reduction of one in every four cars (17-18 % decrease in the number of cars).

- System availability is 99.9 %
- Tax decisions once a month
- Congestion tax deductible
- July is a free month
- Penalty fee (50€) – maximum once per car and month

Q&A

Dan Wolff (Eurotran): Do you actually make money from the system? Where do you invest the money?

Ron Nohlmans (Eindhoven): Do you take into consideration third world food production when it comes to renewable fuels?

Stefan Wallin (Stockholm PTA):

The city makes money and uses the revenue for the operation of the congestion charge system. The city receives about SKR 4.5 billion from the system, and this money is used to improve public transport.

The fuel is sustainably produced and there are certain rules that have to be respected.

Theme 2.2 Energy efficiency at airport

Elisabeth Celsing, Head of Environmental Department, Swedavia, Arlanda

Swedavia's (at that time LFV) decision to be a climate-neutral company has created a clear focus on reducing carbon dioxide emissions and investing in projects that yield maximum climate-related benefits. Since 2002, Swedavia has more than halved its carbon dioxide emissions. Most of the emission reduction (65 %) is due to purchases of 'green' electricity. Other steps include energy savings and replacing fossil fuels with renewable ones.

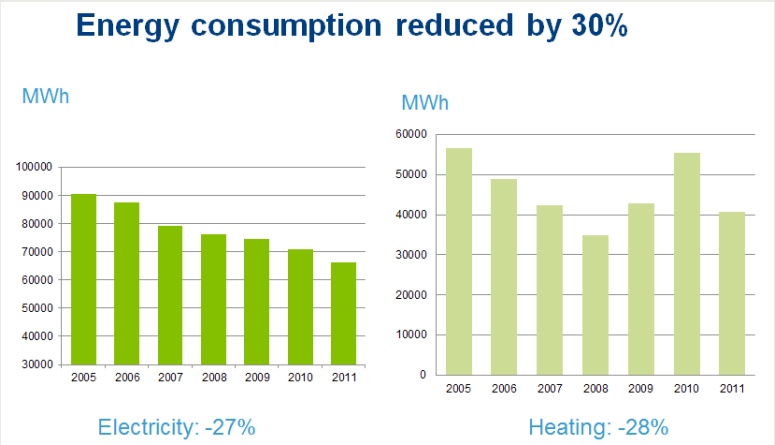
Environmental Focus Areas: Energy

Energy consumption at Arlanda Airport is at the level of a small Swedish city, about 250,000 MWh of electricity and heat per year. That is the equivalent of 14,000 electrically heated single family homes.

Swedavia aims to reduce its energy consumption by 2 % per year. This can be achieved through:

- Energy guidelines,
- Energy forums,

- Investments in energy-efficient technology,
- Environmental education,
- Operation optimisation, *
- Investments in renewable and recycled energy

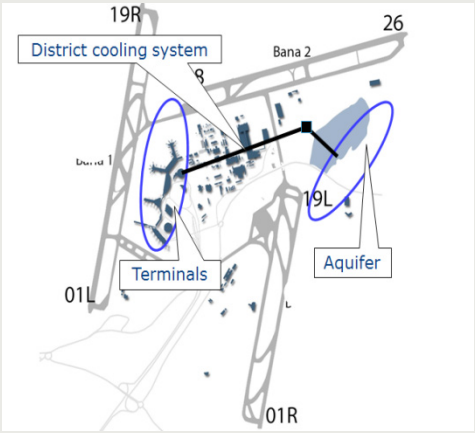


Environmental impact from energy supply

- **100 % green electricity**
  - hydropower 60 %
  - wind power 30 %
  - biofuel 10 %

- **98 % green heating**
  - district heating 85 %
  - Aquifer 15 %

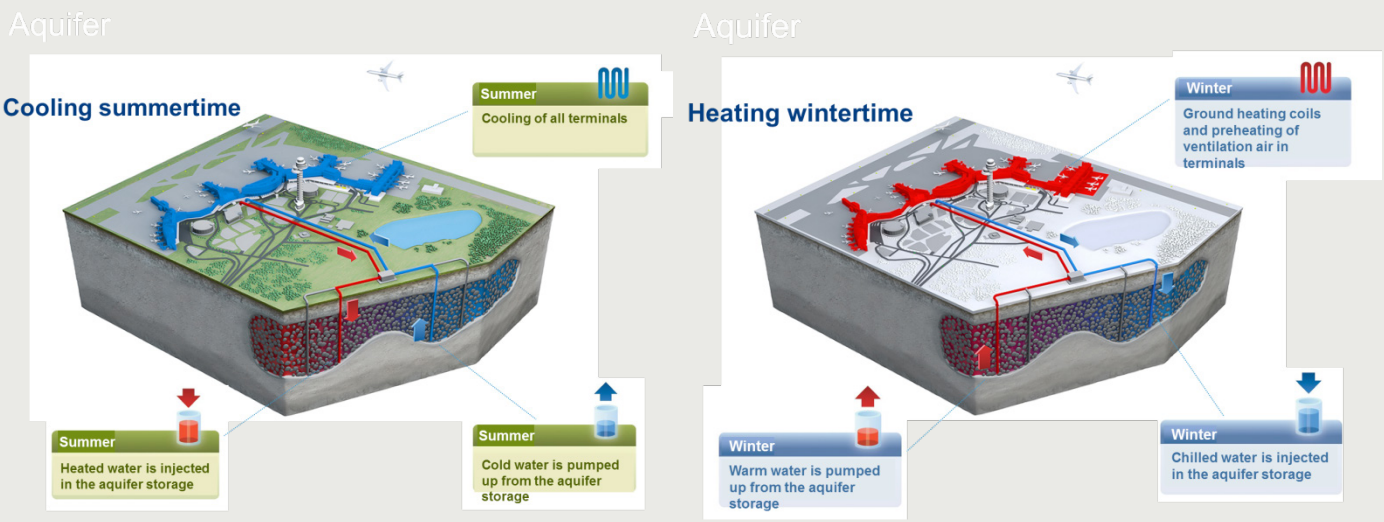
- **Green Cooling**
  - Aquifer



The Aquifer: A Sustainable Solution

The Aquifer is the world's largest energy storage unit.

- 15 % of heating from aquifer storage
- 65 % cooling from our own renewable energy source
- Local chillers replaced



The Aquifer reduces:

- Electricity: 3-4 GWh
- District heating: 10 GWh
- Usage of cooling agents
- 7000 tonnes of CO_2 (system effect)

The use of the Aquifer reduces energy costs by about EUR 1 million per year. Stockholm-Arlanda Airport obtained local funding and a return on investment was achieved after 6 to 7 years. In summer the Aquifer cools the ground water, takes it up to cool the buildings and then sends the water in the warm part of the boulder. Swedavia aims to use the Aquifer for all airport facilities.

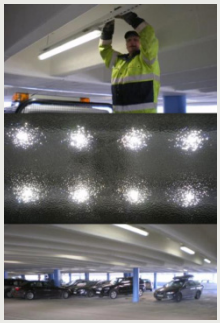
10,000 LED units installed

- >50% lower installed load
- Reduced energy costs by 2.5 MSEK per year
- Lower service and maintenance costs
- Failures less than 0.1 %
- Better climate
- Satisfied customers

Lighting

Stockholm-Arlanda has the first LED installation car park (Terminal 5). This reduces energy consumption by up to 80 % and the payback time is 4 to 5 years.

Steering of lighting and engine pre-heaters in different areas



- Airport staff at the **ramp tower** can control the lighting remotely and adjust it to where the aircraft is parked.
- Staff at the **park** can control the lighting depending on the use of parking spaces.
- Starting the engine heaters for snow removal vehicles can be planned according to the weather.

Demand-controlled ventilation

Ventilation is optimised according to operational needs and depending on the time of day. Air flow is regulated according to air quality and temperature. Electricity savings:

- Reduced air flow by 30 %
- Reduced electricity for air blow engines by 50 % or 150,000 KWh per year per terminal

Elements of success

- DEDICATED UNIT WITH ENERGY IN FOCUS
- Commitment of all employees
- Optimisation of energy systems
- New and efficient technology
- Capacity to invest
- Everything has been done on commercial grounds and without special funding.

Q&A

Gaby Mols (Eindhoven): How did you convince the Board of Directors to create an Energy Department?

Elisabeth Celsing (Swedavia, Arlanda):

It was necessary to save money and there was a clear business case.

As part of Swedavia's strategic focus, we have an environmental goal to reduce the energy used at Stockholm-Arlanda Airport. This is necessary in order to have the ability to grow while complying with CO^2 targets.

THEME 3: CARBON NEUTRALITY

Theme 3.1 Environmental Work and Operating a Climate-Smart Airport

Elisabeth Celsing, Head of Environmental Department, Swedavia, Arlanda

At present, aviation accounts for 2 % of the world's carbon dioxide emissions, but a lot of people believe that the percentage is higher. Aviation accounts for 5-6 % of Sweden's carbon dioxide emissions.

Flying is the most efficient long distance public transport system. A trip from Stockholm to Cyprus requires a single tank of fuel. A Boeing 737 uses 68 litres of fuel per passenger for a 3,000 km trip.

Flying is sometimes the shortest way to a destination. For example, the distance from Stockholm to Paris is 1,500 km by air and about 1,800 km by car. Flying is a means of transport that it is very important for exchanges.

Flying non-stop can save 25 % in fuel and emissions compared to transferring planes.

Sustainable developments

Swedavia and Stockholm-Arlanda Airport focus on sustainable development. Social development, economy and environmental concerns are equally important to customers. Swedavia takes all these 4 factors into account when making decisions.

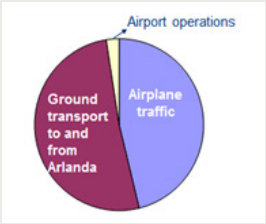
Environmental affairs are part of Swedavia's strategy

- **Sustainable airport group:** Swedavia was the first major Swedish company to become climate neutral
- **International and national legislation**
- **Image/attitudes** are of strategic importance for future business growth

CO_2 emissions

Stockholm-Arlanda Airport has tough requirements for reducing CO_2 emissions

Emission cap in the environmental permit (30-40 conditions)



Stockholm Arlanda Airport has an environmental permit with about 30-40 conditions. The condition regarding the "emission cap" includes emissions from own operations but also emissions from ground transport and Landing and Take Off-cycles for aircrafts are included in the emission cap even though the airport does not have full control over it. The ceiling is 347 000 tonnes of CO2 and represents the emissions in 1990 and is not allowed to be exceeded even if the number of passengers increases. A lot of efforts have been made to reduce emissions since the third runway was inaugurated in 2003. In 2011, the airport had an increase in passengers that led to an increase in the number of flights and higher emissions.

At present, emissions from the airport's own operations amount to 1 %. The airport has applied for a new permit that does not conflict with the company's mission, which is to provide flight infrastructure.

Target of zero CO_2 emissions from airport operations

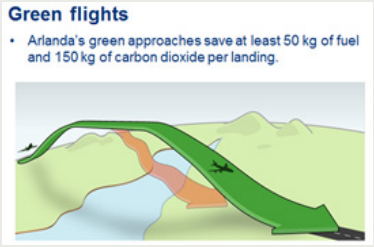
Arlanda needs to reach the target of zero CO_2 emissions from fossil fuels by 2020. Emissions from its own operations (heating, electricity, fuel for vehicles and fire exercises) have already been reduced by 60% since 2003.

One of the biggest challenges is reducing CO2 emissions from heavy vehicles. Arlanda had a snow sweeper prototype running on biogas last winter and the results were impressive. The next step is to convert all heavy vehicles for biofuel and building a biogas station on Airside. As of 2014, Arlanda will have the first heavy vehicles running on biogas.

Activities

- Renewable energy sources (electricity and heating)
- Energy saving activities (electricity and heating)
- Environmental vehicles and fuels
- Environmental car policy for the cars used at the airport
- Biogas / Diesel RME
- Biogas buses and cars (50 biogas and 50 hybrids). 18 buses owned and operated by Swedavia and 9 hybrid/ biogas buses
- Eco-driving
- Biofuel prototype of snow ploughs (used in Kiruna)
- Encourage suppliers and partners

Airport Carbon Accreditation at the highest level



Arlanda's emission cap is not applied anywhere else in the world. According to the emission cap, the airport cannot exceed the CO_2 emissions limits set in 1990. The third runway has been operational for the past ten years, but Arlanda has to control its compatibility with the emission cap.

The global agreement does not allow an increase in CO2 emissions from aviation after 2020. Arlanda uses emissions-based aviation charges. The charges are therefore lower for companies using quiet aircrafts with fewer emissions. CO2-emissions not included.

The VINGA project

- The goal of the project is to use the best available technology to reduce emissions and noise around the airport.
- The project evaluates ways to take-off and land with as little environmental impact as possible.
- Cooperation between: LFV, Swedavia, Airbus, Novair and Quovadis
- The project was awarded the 2013 Environmental Award at the ATC GLOBAL EXCELLENCE AWARDS in Amsterdam

Ground transport to and from the airport

As part of Arlanda's efforts to reach the emission cap, the company has set a 50 % target for the share of passengers using public transport to and from the airport. In the fourth quarter of 2012 Arlanda reached 51%.

Land and Water

Goals and activities:

- follow current permissions and conditions (a lot of conditions regarding water)
- minimise the effects on land and water
- reduce the use of dangerous chemicals
  - cooperate with suppliers to find more environmental-friendly alternatives (mainly for de-icing)

De-icing chemicals

Swedavia uses the best available de-icing chemicals:

- Propylene glycol for aircrafts
- Formiate for runways

The goal is to collect 90% of the de-icing fluids**.** Some of the de-icing fluids are recycled and reused while others are used as sewage treatment. The remaining de-icing fluids are purified in ponds through the addition of oxygen.

Waste

Swedavia's target is to recycle at least 50 % of the waste by 2016. At the moment some of the waste is burned and the energy is used for heating.

Noise

Arlanda works actively to make noise pollution perceived as acceptable in relation to the benefit of aviation. The Noise Management Plan includes all the airport operation activities and regular meetings with neighbours. Arlanda has a noise insulation programme for houses around the airport.

Public opinion about Arlanda's environmental work: yearly survey.

Arlanda's target is to have a 90 % acceptance rate when it comes to the general public's experience of aviation and the airport's environmental impact. The airport asks passengers/the public about Arlanda's environmental work once a year.

ACA 3+ neutrality

All of Swedavia's airports are accredited at the highest level of the Airport Carbon Accreditation programme (3+ neutrality). This is clear proof of the exceptional work Swedavia is carrying out to reduce greenhouse gas emissions.

Success factors

- **Strategic focus for many years (emission cap, environmental targets, ACA as frameworks)**
- **Energy saving projects to decrease emissions and increase the use of renewable fuels**
- **Stakeholder engagement (e.g. Eco-taxi system, Letter of intent)**
- **CO_2 management and cooperation between different departments (e.g. Arlanda Energy, ground transport)**
- **Staff commitment to environmental issues: from the CEO to the people working in different areas**

Q&A

Gaby Mols (Eindhoven): How can you manage to have an increase in the number of passengers using public transport and, at the same time, increase the income from parking?

Marius Nicolescu (ARC): What about a congestion charge for vehicles at the airport?

Question from the audience: Do you have bird strikes?

Uli Koehler (Mitteldeutsche Airport Holding): Does the CO2 emission cap limit your economic development?

Elisabeth Celsing (Swedavia, Arlanda):

- We are giving good parking opportunities to avoid kiss&ride and are working with the municipalities to make people think twice before choosing kiss and ride. The result has been positive as 51% of travellers use public transport which has not prevented us from increasing the parking revenues.
- We have applied for a new permit, and there will be negotiations in September. We will continue working with the CO2 plan, but unless airplanes use biofuels, this will remain a problem. Even if the number of passengers has increased, we have managed to reduce emissions. The goal is to reach zero emissions by influencing things we can control. At the moment the issue of heavy vehicles is one of the challenges. After 2018 there are severe restrictions in our current permit to fly south of Arlanda to and from the third runway and this an other reason why we are applying for a new permit.

Fredrik Jaresved, Head of Public Affairs, Swedavia, Arlanda

- A lot of people who come to the airport by car are kiss&ride travellers and they do not pay anything to park.

Besides, K&R means 4 journeys instead of 2. This is why Swedavia provides people using their cars with good opportunities to park at the airport. We have differentiated prices based on the distance to the airport. The closer passengers park, the more they pay. Swedavia is replacing car parks close to the terminals with buildings and rents them out.

- The law governing congestion charging in Stockholm cannot be applied at the airport. We have tried to use the laws governing parking. The lawyer indicated that the airport charge needs to be paid by the person driving the vehicle, not the person owning it.
- We have bird strikes, but green areas are not a problem. We already have natural lakes

Theme 3.2 Mapping and calculation of CO2 emissions

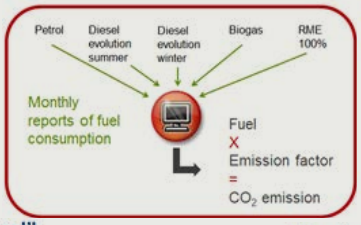
Åsa Sahlqvist, Environmental Advisor, Swedavia, Arlanda

According to the ACA scheme, mapping and calculating CO2 emissions consist in the following sections:

- **Control:** includes everything Swedavia controls such as own operations (vehicles, fire exercises)
- **Guide:** includes operations that Swedavia has no control over, but that it can guide (operations of airport companies)
- **Influence:** includes emissions from the operations of companies as well as freight and post deliveries

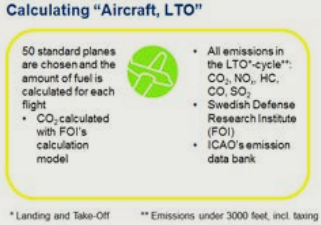
Mapping Control

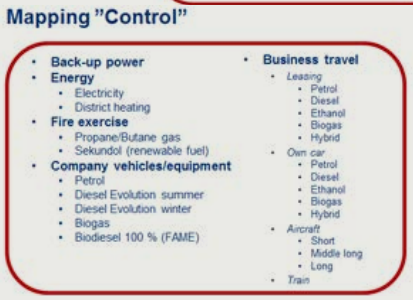
Example: calculating company vehicles. Arlanda measures fuel consumption monthly using the emission factors specified for Swedish conditions.

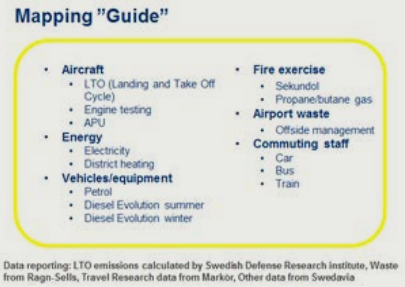


Mapping Guide

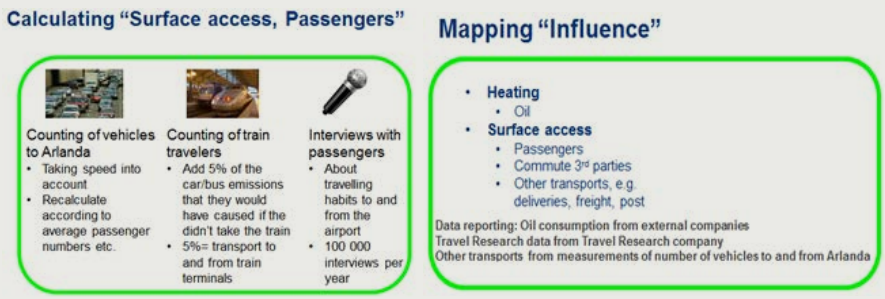
Example: calculating aircraft landing and take-off cycles. The Swedish defence agency (FOI) calculates this annually in accordance with the ICAO method. 50 standard planes are chosen and the amount of fuel is calculated for each flight. CO_2 emissions are calculated using FOI's calculation model.







Mapping influence



Example: Calculating surface access. Arlanda counts the number of vehicles that travel to the airport during one month and then divides this according to the modal split and distance.

Experience so far

Swedavia has a consistent way of mapping and calculating CO_2 emissions. People are used to reporting data in the system, but Swedavia needs to improve the system for external data. Arlanda has all the data it needs, but progress could be achieved as regards calculations.

Conclusions:

- It is advisable to use third party models since a verifier checks the calculations
- Consistency is important and Swedavia will continue to use and improve models
- Data, models and methods can and should always be further refined and developed. Swedavia tries to develop models and calculate emission factors the same way for all airports.

Q&A

Uli Koehler (Mitteldeutsche Airport Holding):

- Do you consider surface access as being under your control?
- Do you take into account people who come to the airport without flying (hotel, conference...)

Gaby Mols (Eindhoven):

- Why do you use LTO in the guide section and not in the influence section?
- What was the argument for the guide and influence sections? Does Arlanda update the emission factors? Are

you using one basic emission factor or are you changing it every year?

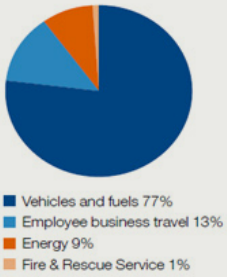
Dan Wolff (Eurotran): How does Swedavia influence the ACA calculation? Is it possible to have it tailor-made for your organisation?

Åsa Sahlqvist (Swedavia, Arlanda)

- Swedavia can only **influence** surface access. It **cannot decide** how passengers travel to the airport.
- Yes, we consider non-passengers in our models
- In the future new systems might lead to a more efficient turnaround. We only have one emission factor that is updated regularly.
- The ACA model is based on the Green House Protocol (international standard). We are members of ACI. The ACI Board wanted an environmental label for airports and our former airport director supported this work.

Theme 3.3 Climate neutrality

Christina Sares, Environmental Advisor, Swedavia



Stockholm-Arlanda Airport takes responsibility for its environmental impact. All the airports operated by Swedavia are included in Sweden's national basic infrastructure and have been certified at the highest level of Airport Carbon Accreditation (ACA) Scheme (level 3+ neutrality). Swedavia is thus the airport group that has worked the most to develop climate-smart airports.

Climate Neutral Company since 2006

Swedavia is the first major company to become climate neutral due to its management and the need to make the CO_2 emissions visible and generate investments in new technologies.

- Clean Development Mechanism-projects for CO2 offsets
- Compensate all CO2 from Swedavia's own activities
- Spread costs within the organisation according to share of CO2 emissions

Basic criteria for choosing carbon offsets

Carbon offsetting has to generate genuine reductions and contribute to sustainable development. The money invested should bring about change that could not have occurred otherwise. Emissions need to be verified by a third party and need to be traceable.

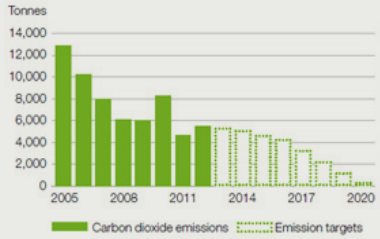
Swedavia offsets emissions through Clean Development Mechanism projects regulated under the United Nation's Kyoto Protocol. These projects contribute to the development of third world countries. Arlanda has invested in the following CDM projects:

- **Sri Balaji:** Biomass power plant in Andhra Pradesh, India, using agricultural waste as fuel.
- **Yinyi:** Wind farm project in the Ningxia province of Northern China.
- **Yangjiayao**: Wind farm project in Northern China.

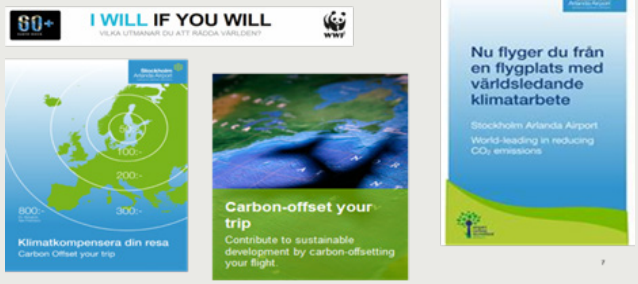
Emission targets

To become climate neutral airports need to calculate emissions, set targets and develop a plan to achieve these targets. Afterwards they can communicate on the measures taken.

The car renting companies and all the hotels near the airport are also climate neutral.



Communication



Q&A

Dan Wolff (Eurotran): What makes you optimistic that you can decrease the tonnes of CO2 at a relatively fast pace in the future?

Fredrik Jaresved (Swedavia): How much do we pay for offsetting?

Question from the audience: Why have you decided to buy energy from China, and not from Sweden?

Christina Sares (Swedavia):

- These are the CO_2 goals. We depend on the weather when it comes to CO_2 emissions. We have not communicated that much on airport neutrality, but have done so on our own measures. We have tools on our website that allow passengers to offset trips and travel carbon-neutral. In the past we have sold carbon offset at all information desks at the airport and we had "green carpets" that gave priority to passengers offsetting their flights.
- We wanted to use CDM certified projects. Investment in Sweden can occur even without our money. CDM project require us to invest and transfer technologies in other countries In China, we replaced the coal technology and have created a cleaner energy sector.
- EUR 41 000 (2 324 tonnes) for Arlanda and EUR 99 700 (5 610 tonnes) for all airports (11) in 2011

Theme 3.4 Renewable jet fuel

Fredrik Jaresved, Head of Public Affairs, Swedavia

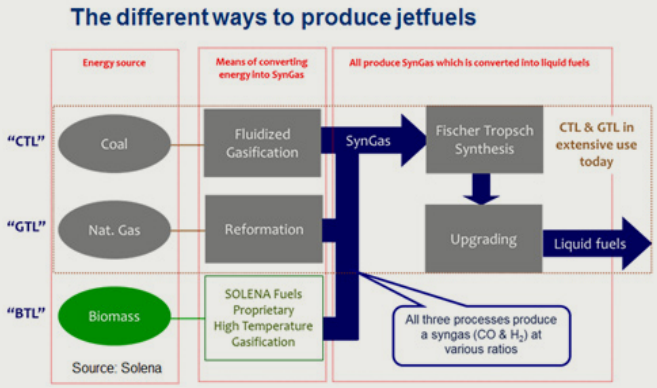
Where are we with renewable Jet fuel?

Sustainability in aviation involves the use of renewable fuels. At first, people thought that producing renewable fuels for the aviation industry would take a lot of time. This was not the case and the technology to produce renewable jet fuel is already available, but commercial production is lacking.

In fact, several airlines have done successful flights with different renewable jet fuels.

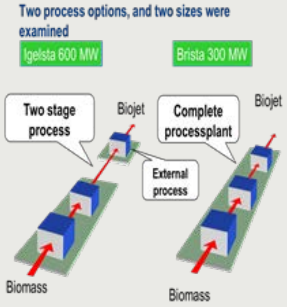
Amongst the different technologies for the production of renewable jet fuel, only the Fischer-Tropsch process is approved to use for commercial flights (and with a blend of maximum 50%; the rest should consist of regular JET A-1 fuel). This is a technology that has been there for many years and South Africa has been producing fuel from coal using this process.

Swedavia has financed a study on the possibilities of starting commercial production of renewable jet fuel in a bio refinery. The aviation industry considers that this fuel risks being expensive and nobody would want to buy it. Swedavia therefore decided to test this theory.



Swedavia wants to transform biomass into liquid, but the gasification process is not easy. Solena is one of the companies that offer this type of technology. Swedavia commissioned the study on renewable jet fuel before contacting Solena. A common financial agreement has been signed between Varmeforsk and Swedavia requiring each entity to finance 50 % of the study. The Swedish Institute of Defence (FOI), Fortum, Nikomb Synergetics, Grontmij and Preem took part in the study.

The process creates a lot of heat that has to be reused in order for the process to be efficient. The fuel production plant needs to be located close to a community to obtain an additional income and near a forest to collect waste products without harming the environment.



- For the two stage process, **Igelsta** could be the best location
- For the complete process, **Brista** could the best location. A refinery needs to be constructed in the production plan

Financial and commercial potential

A renewable jet fuel plant is commercially viable, but there are a lot of risks in being the first to produce renewable jet fuel. Swedavia was impressed with the results of the study and communicated them in and outside of Sweden. Swedavia has also sent the results of the study to researchers who cannot find anything wrong in the calculations.

Location	Brista	Igelsta
Biomass	289 MW	611 MW
Electrical balance	-2 MW	-2 MW
Heatproduction	97 MW	182 MW
Nafta- and dieselproduction	60 MW	205 MW
Biojet, 50 000 ton/year	75 MW	75 MW
Investment	5,1 Mrd kr	7,4 Mrd kr
Biojet production cost	8280 kr/m³	5000 kr/m³

Jet A-1 fuelprice: about 6000 SEK/m³, at oilprice $67 per barrel.

Results of the study

Swedavia could match the different companies together to advance the work on renewable jet fuel because, at the moment, no company has complete competences. Solena already has an agreement with British Airways to build a renewable jet fuel plant using household waste.

Solena is doing feasibility studies to see if it proceeds with investment in a plant in Sweden. Holmen, a Swedish company producing paper that has forest waste, is working with Solena. In fact, forest waste is a high-margin product in comparison to paper, which is a low margin product.

Scandinavian airlines have shown great interest in the process and are willing to purchase the whole bio fuel production. If all pieces fall into place, large scale bio jet fuel production could be a reality within 5-10 years. At the moment, only labs can produce bio jet fuel on a small scale.

Q&A

Ron Nohlmans (Eindhoven):

- Isn't there a risk that companies will use the whole tree instead of waste for this process?
- How have oil companies reacted?

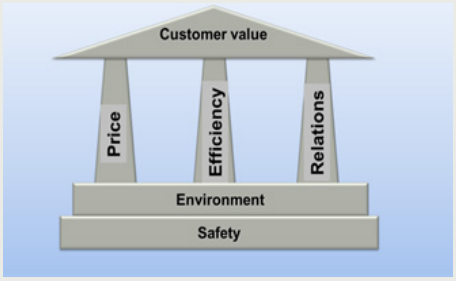
Franz Jöchlinger (Vienna): Can you use algae?

Fredrik Jaresved (Swedavia):

- There are low risks. It is not really efficient because you can use the tree for other purposes such as construction material.
- Oil companies have been reluctant to commit. They are making a lot of money right now and taking things further means taking a lot of risks.
- Algae have the most potential as they do not compete with food. Algae can be grown in hot climates, but not in Sweden. We have more forest waste and it is more reasonable to use local resources.
- Airlines have said that engines would not be able to handle bio jet fuels, but now they want to buy this type of fuel. Within the framework of ETS, airlines can cut costs and purchase rights.

Study visit conclusions

Dan Wolff, Eurotran



- The 2 charts above confirm that there is a **consistent approach** by Swedavia and Stockholm PTA to put customers at the centre (or the top) of its economic model, while the environment remains in the foundations of this model.
- The workshop confirmed the risks and opportunities embedded in an international democratic process such as the DAIR project. People may have found difficulties in agreeing on the answers to the workshop questions so they used synonyms or went into details. It is easier for 1 person to take a decision. However, in a group people exchange ideas, benchmark and get a little bit more subtle answers.
- It is a revealing experience to **confront quotes** from Paris Study visit and Stockholm visit regarding individual journeys and customers' choices, carbon-offsetting schemes or innovation. Some contradictions are interesting. The same actually applies to the opinions expressed by speakers of this very study visit.

TOPICS	PARIS	STOCKHOLM
Individual journeys and customers' decisions	**Mariëlle Prins**: "*Individual journey means personalisation of your journey*"	**Hans Brattström**: "*As individuals we choose different actions, but we really need to be aware of this and have discussions in order to find incentives to change habits. We need to achieve a mental shift".*
		Christian Monstein: *"Customers buy tickets based on price, not on the environmental impact."*
		Gerhard Wennerström: *"Customers are not rational, they make emotional decisions."*
Carbon-offsetting schemes	Professor **Calumm Thomas** said: "*Instead of paying offsetting schemes to some part of the world, we should see if it is possible to set up a carbon compensation scheme that allows for local improvements that benefit the local population. People living close to the airport could have the opportunity for example to be provided with low carbon electricity or better insulation for houses. When these schemes are voluntary, people will be much more inclined to pay if they knew that the money went to the* ***local*** *industry".*	**Christina Sares** referred to carbon-offsetting schemes and unveiled a practice whereby passengers who were offsetting their journey would get access to priority lanes at airport security checks.

Looking to the future	Professor **Calumm Thomas** referred to *"next practices" rather than best practices*	**Fredrik Jaresved**: *"Nobody wants to be first, everybody wants to be second."*
		Stefan Wallin: "*Stockholm PTA does not want to sit back and wait for the 'perfect solution'. The perfect solution may never come, or there may be more than one perfect solution. The company believes that it is better to start working with the best available solutions today so as to gain experience and knowledge. Stockholm PTA will also engage in projects for future solutions, such as fuel cells".*

- Concerning the choice of DAIR participants, Gerhard Wennerström was apparently right. 100% of the participants came to the airport with Arlanda Express even though they knew for a fact that it was the most expensive choice.
- The dAIR project combines the different approaches related to innovation: it is about learning from the mistakes and the advancements of partners.
- Local actors in airport regions are confronted with both obligations imposed upon them and real choices that they can make. Cooperation belongs to both categories. In the case of Stockholm, **"coopetition"** would be even a better word (cooperation + competition)

OBLIGATIONS	OPTIONS	
• Cooperation • Emission cap • Congestion charge • Competition (Swebus) • Ecotaxis • No diesel for buses downtown	• Cooperation • Eco-taxis (initially optional) • Eco-driving • Biogas • Electrification of busses • Subsidise public transport for airport employees • LED, Aquifer, Demand controlled ventilation	• Performing journey planner • WIFI in public transport • Biojet fuel • Carbon offsetting: VIP Treatment in queues

Carbon offsetting: VIP treatment

We all hate queuing at the security check. Therefore, we should think of different VIP treatments possible at the security checks/check-in desks/drop-off desk which would come at a low price for the airport manager:

- Priority lane
- Being able to take an appointment at a given time to go through the checks
- Free WIFI at the airport

These privileges should compensate for lower CO_2 emitted by passengers for their flights or their access to the airport (proof of use of public transport, carbon offsetting, ownership and use of electric vehicles...). For the airport, it would have the advantage to show that travellers can **experience** seamless security checks/check-in/luggage drop-off provided that they make an effort in terms of CO_2 emissions. Besides, other travellers standing in the queue will come to realise the advantage of such an effort.

Success factors

Speakers gave inspiring tips to explain the success of Stockholm in addressing CO2 issues both from airport operations and from land access perspectives:

- Strategic focus for many years (emission cap, environmental targets, ACA as frameworks)
- Stakeholder engagement (e.g. Eco-taxi system, Letter of intent)
- CO2 management and cooperation between different departments (e.g. Arlanda Energy, ground transport)

- Senior management ready to dedicate staff and time to address specific issues
- Staff commitment to environmental issues: from the CEO to the people working in different areas
- Capacity to invest AND action on commercial grounds and possibly without public funding

Annex I: Contact Details of Speakers

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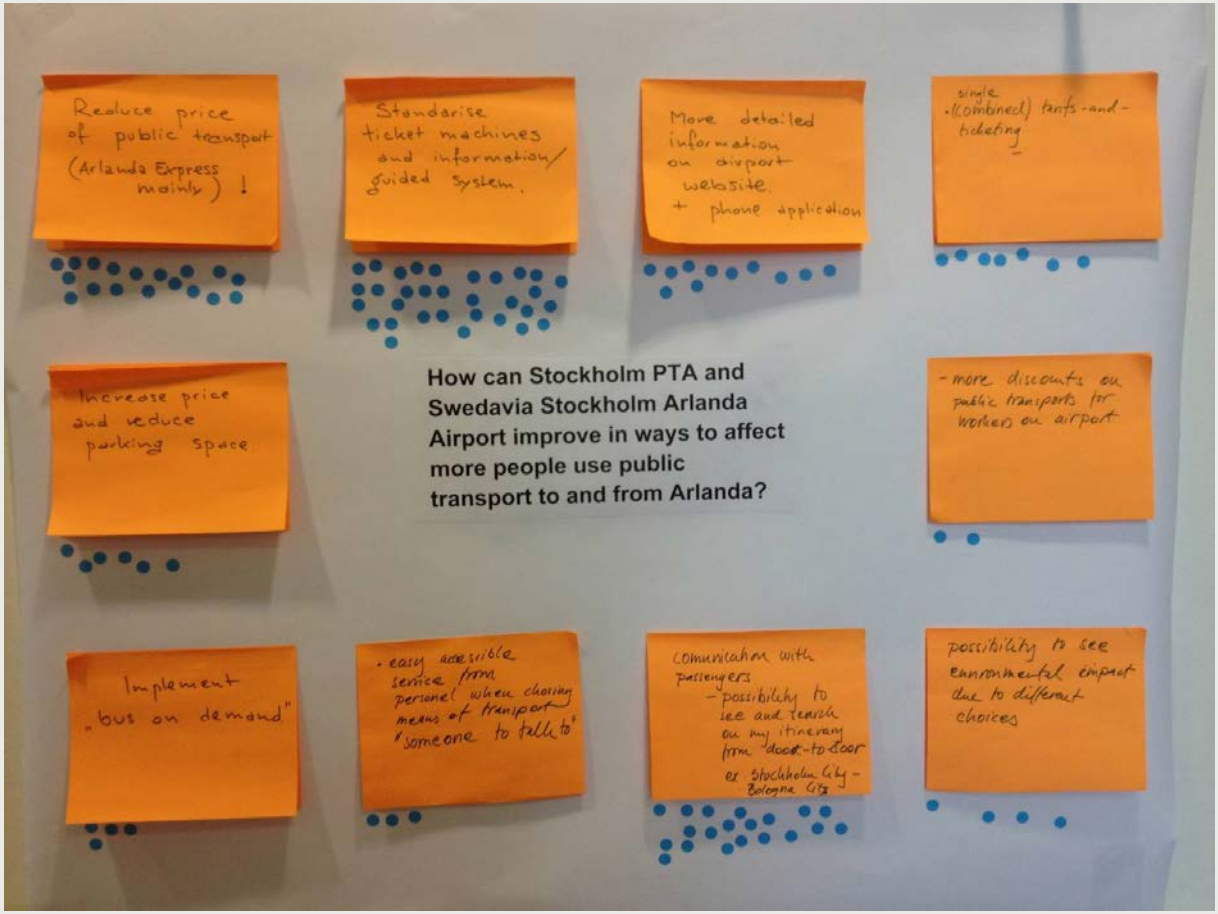
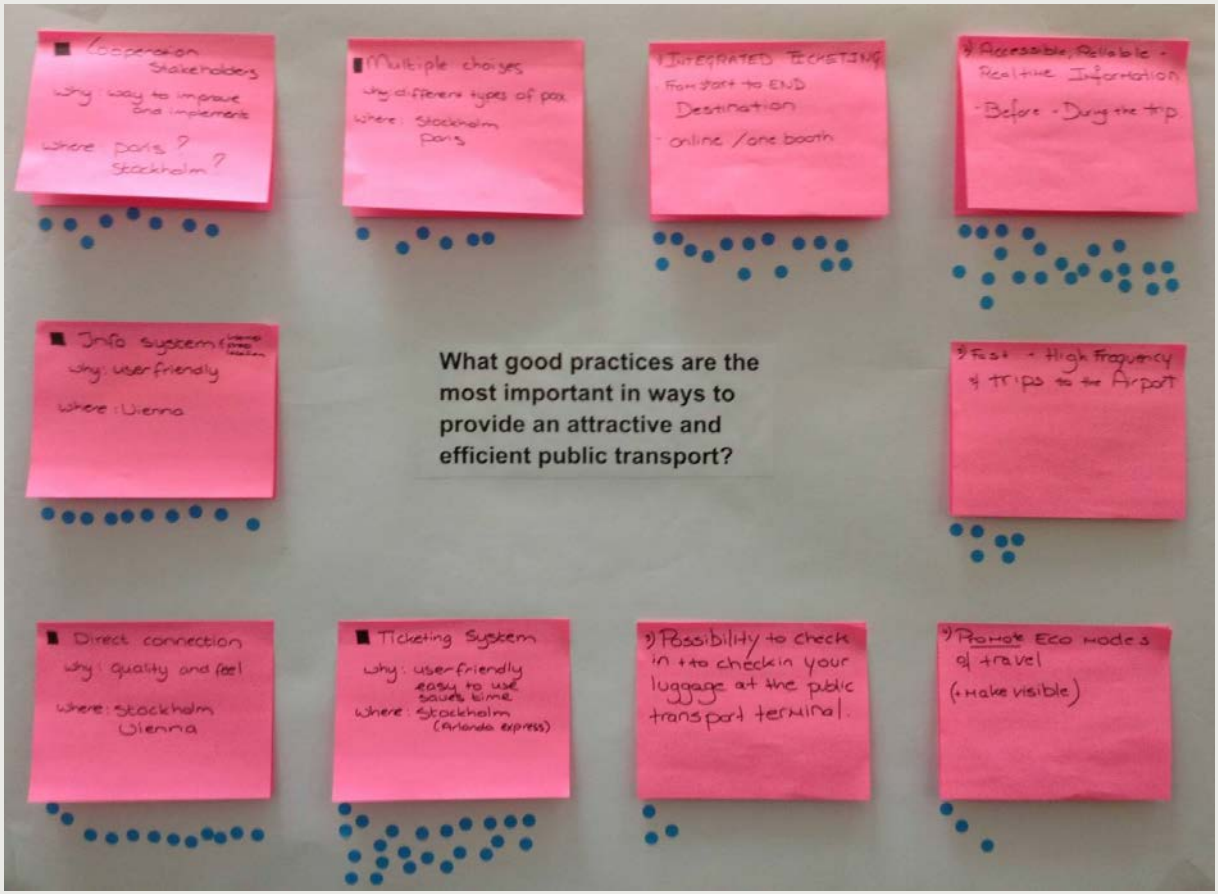
Annex II: Results of the Workshop



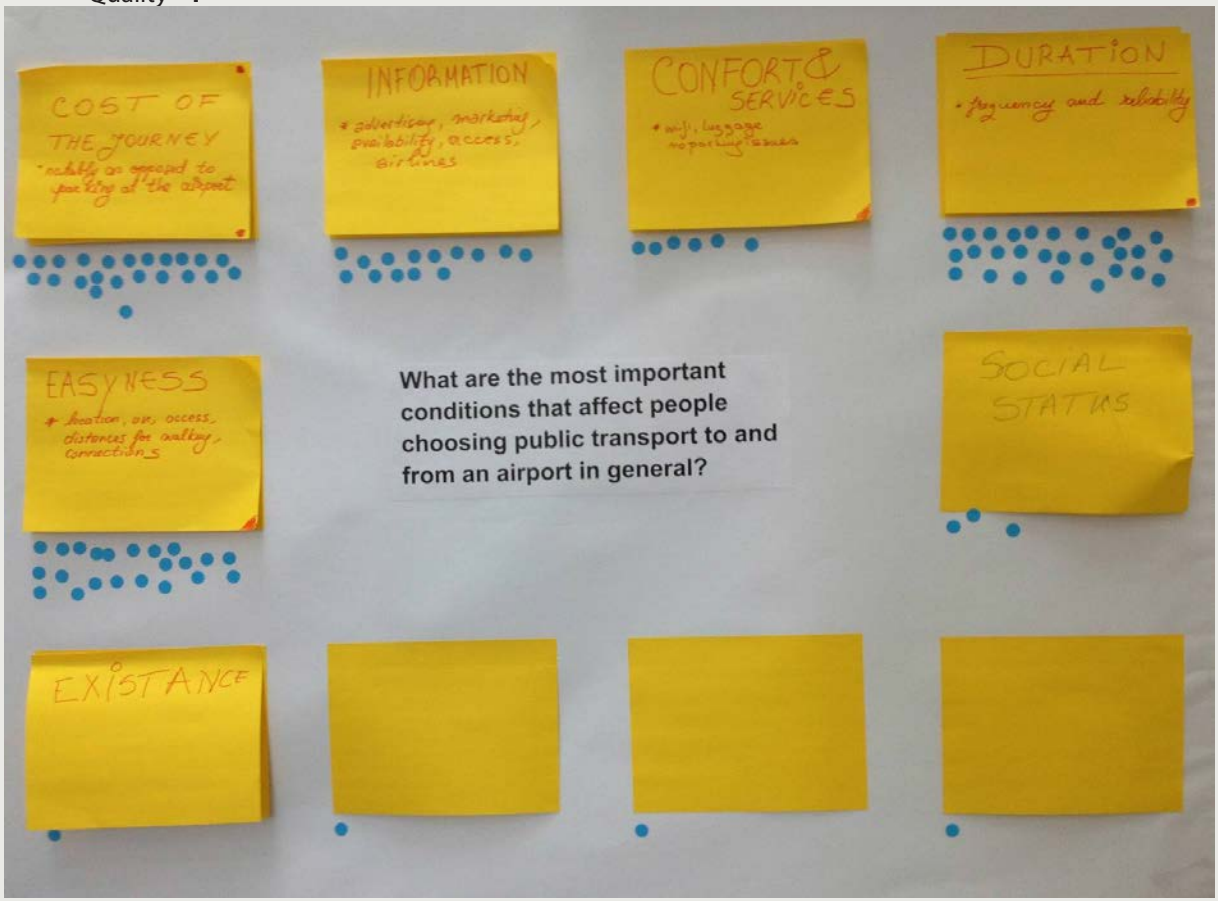
- Standardise ticket machines and information system – **33**
- Communication with passengers: possibility to see and search for your door-to-door itinerary – **20**
- Reduce the price of public transport (Arlanda Express) – **18**

- More detailed information on the airport website + phone application – **11**
- Single (combined) tariffs and ticketing – **7**
- Increase the price and reduce the number of parking spaces - **6**
- Possibility see the environmental impact of different choices – **4**
- Easily accessible personal service (i.e. someone to talk to) when choosing a means of transport – **3**
- Implement a bus-on-demand system – **4**
- Better public transport discounts for airport workers– **2**



- User-friendly ticketing system (easy to use) – **33**
- Easily accessible, reliable & real-time information, before & during the trip – **23**
- Integrated online ticketing from start to end destination – **15**
- Direct connections - **12**
- Greater cooperation with stakeholders as a way to improve and implement – **8**
- Multiple choices, different types of passengers – **6**
- Fast & high frequency of trips – **6**
- Promote eco-friendly modes of travel & make them visible – **3**
- Possibility to check-in at public transport terminal (including luggage) – **3**

- Travel time & reliability – **35**
- Price – **27**
- Accessibility – **21**
- Availability of information (e.g. timetables) – **15**
- Comfort e.g. vehicle, connections – **6**
- Environmental impact – **5**
- Attractiveness – **2**
- Quality - **1**



- Cost of the journey, notably as opposed to parking at the airport – **23**
- Ease-of-use, location, access, distance for walking, connections – **22**
- Duration, frequency and reliability – **18**
- Information, advertising, marketing, availability, access, airlines – **14**
- Comfort & services, Wi-Fi, luggage, no parking issues – **6**
- Social status – **3**

Annex III: Bus tour at Arlanda Airport


sodexo

Annex IV

PRESS RELEASE – SWEDEN'S GREEN AMBITIONS EXPLORED BY EU PROJECT

Stockholm, Sweden 24 June 2013 – The project gathers politicians, delegates from local and public authorities and from airports in order to discuss the means to decrease carbon emissions at and nearby their airports. For all participants, coming to Stockholm was a milestone since Stockholm Arlanda is a frontrunner of the carbon neutrality status in an industry Airport Carbon Accreditation (ACA) scheme.

"Last year we celebrated a very important mark, we have surpassed 50% in percentage of passengers using public transport to get to the airport," said Frederik Jaresved, Head of Public Affairs at Swedavia.

"The Swedish case, through Arlanda is a role model to us, and the interesting question then is how to do better when you are already doing so well," noted Sergi Alegre, Vice Mayor of El Prat (Barcelona Airport). During the study visit, the local organisers have invited the people in the region that can best describe what were the steps taken by Stockholm to become an environmentally friendly airport such as switching of renewable fuels which led to a 50% decrease of the emissions at Arlanda.

A key feature in the area is the regional cooperation which increased the accessibility to the airport.

"We couldn't be happier to be in Stockholm these days and explore how it is possible to achieve both carbon neutrality, but also a high rate of public transport usage. It is important to us to look to export more of this model into the rest of Europe, since it is clearly a successful one," said Vladimir Vystiska Mayor of Unitce – Prague Airport Region)

The project will continue to identify problems and solutions in airport areas over a three year period, helping both

public authorities and airport operators to understand the larger framework that is surrounding air quality at airports

The project partner regions of the D-AIR project are: City of Eindhoven, Eindhoven Airport N.V, Airport Regions Conference, Agglomerations Community Lands of France, Stockholm Public Transport Authority, Stockholm-Arlanda Airport/Swedavia, City of Leipzig, Economic Development Office, Mitteldeutsche Airport Holding AG, City of Vienna, Environmental Department, Province of Bologna, City Council of El Prat de Llobregat, Transport Malta, Mazovia Voivodship and Prague Airport Region.

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