

Waste solutions in a sustainable urban development





Hammarby Sjöstad – a beacon of sustainable urban development

The project began with the aspiration to become the host for the 2004 Olympic Games. A very ambitious environmental concept was therefore developed. Although Stockholm and Hammarby Sjöstad was unsuccessful in its bid to host the Olympics, this city district has evolved to become one of the finest examples of sustainable urban development in the world today. Every year, thousands of visitors come from all corners of the globe to draw inspiration from the attractive architecture and technological solutions. Envac's underground waste transportation system is a critical part of the district's sustainability programme.

In this document, we hope to illustrate how Envac's solutions have been integrated into residential environments and the environmental lifecycle for the benefit of the residents and our environment.



High environmental goals led to ...

The City of Stockholm has imposed stringent environmental requirements on buildings, technical installations and the traffic environment.

A specific environmental programme was drawn up for Hammarby Sjöstad with the aim of halving the total environmental impact in comparison with a district built in the early 1990s. The strict environmental requirements demanded completely new

environmental solutions. The Hammarby Sjöstad project office employed a new methodology under which staff from different administrations/authorities sat in the same premises, right from day one of the project.

The work has been conducted on an interdisciplinary basis, thereby substantially accelerating the decision-making process and enabling the project to run extremely smoothly.

Environmental goals

Land usage

Sanitary redevelopment, reuse and transformation of old brown field sites into attractive residential areas with beautiful parks and green public spaces.

Energy

Renewable fuels, biogas products and reuse of waste heat coupled with efficient energy consumption in buildings.

Water & sewage

As clean and efficient as possible – both input and output – with the aid of new technology for water saving and sewage treatment.

Waste

Thoroughly sorted in practical systems, with material and energy recycling maximised wherever possible.

Transportation

Fast, attractive public transport, combined with car pools and beautiful cycle paths, in order to reduce private car usage.

Building materials

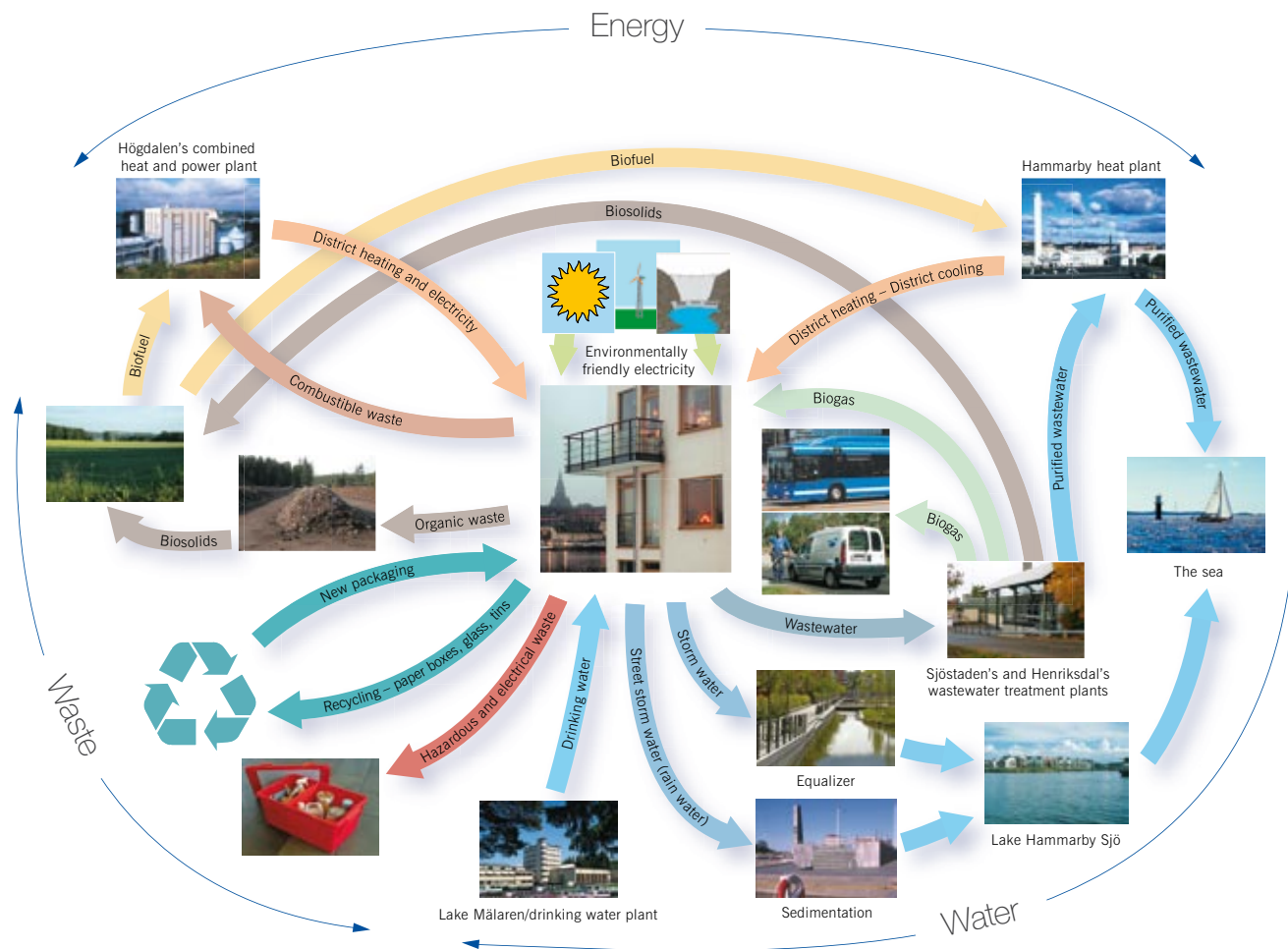
Healthy, dry and environmentally sound.



... new solutions integrated into its own eco-cycle

The unique planning process resulted in new and integrated environmental solutions whereby the resources provided by one player are utilised by another.

Hammarby Sjöstad has its own eco-cycle, the Hammarby Model, which outlines environmental solutions for waste, energy, water and sewage.



Energy

- Combustible waste is converted into district heating and electricity.
- Bio fuel from nature is converted into district heating and electricity.
- The heat from the treated wastewater is converted into district heating and district cooling.
- Solar energy is converted into electrical energy or used to heat water.
- Electricity shall have been awarded with the "Good Environmental Choice" eco-label or an equivalent label

Water & Sewage

- A pilot sewage treatment facility has been built to evaluate new sewage treatment techniques.
- Biogas is extracted from the digestion of sewage sludge.
- The post-extraction sludge - the bio solids - is used as a fertiliser.
- Rainwater from courtyards and roofs is not drained to the wastewater treatment plant, but is piped to Hammarby Sjö.
- Rainwater from streets is treated locally/settled and then drained into Hammarby Sjö, not to the wastewater treatment plant.

Waste

- An automated waste disposal system, with different refuse chutes, block-based recycling rooms and area-based waste collection points, helps residents segregate waste at source.
- Combustible waste is converted into district heating and electricity.
- Organic waste is converted/digested into bio solids and used as fertiliser.
- All recyclable material is recycled: newspapers, glass, cardboard, metals, etc.
- Hazardous waste is incinerated or recycled.

Demands for environmentally sustainable waste handling led to ...

The principal environmental objectives for waste management were to reduce the total amount of household waste, reduce waste collection by heavy traffic and introduce source separation.

In order to achieve these objectives, initiatives were introduced to create simple, accessible and hygienic waste management systems.

One major difference was that, unlike previous waste management systems, it was decided to make the new system so attractive that its central location in the residential district would be acceptable. This is why the Envac inlets in many of the blocks have been installed in easily accessible locations and are clearly visible. Not only does this make them a natural convergence point for residents, it also provides a social check on how the system is used.

For that reason, many Envac inlets have been installed in central courtyards, right next to playgrounds, bike sheds and gardens.



Environmental objectives for waste management in Hammarby Sjöstad

- The amount of household waste that is generated must be reduced by at least 15 weight percent from 2005 to 2010.
- The amount of waste taken to disposal sites must be reduced.
- Hazardous waste must be sorted separately and the amount of this waste must be halved.
- There must be a highly efficient system of source separation of waste.
- 80 weight percent of food waste must be sent to biological treatment plants where nutrients and energy contained in the waste can be recovered.
- Transportation of waste in the area must be reduced.

... an automated waste collection system from Envac

Hammarby Sjöstad will comprise more than 11,000 apartments on the southern shore of Lake Hammarby (most of them constructed in the 2000s) and more than 2000 apartments on the northern shore

(constructed in the 1990s) when construction has been completed in the area in 2016.

All buildings around the lake will be connected to an underground waste transpor-

tation system, bringing the total number to four by completion date. These will manage the household and commercial waste from the both shores.



District	No. of flats	Envac system	Waste fractions	Start date for first phase
Norra Hammarbyhamnen/Barnängen	3000	Stationary	Rest	1982
Sickla Udde/Sickla Kaj	2050	Mobile	Rest Food waste	2000
Hammarby Gård	2100	Stationary	Rest Food waste Newspapers	2005
Lugnet/Henriksdalshamnen	3000	Stationary	Rest Food waste Newspapers	2007

Investment in a waste handling system

The decision to install Envac's underground waste management system expresses a long-term commitment with regard to both the financial and ecological benefits. Main features of the Envac systems: freeing up of space inside and outside buildings, reduction of heavy traffic and reduction of waste management costs will benefit both the building contractor and the residents.

Joint ownership

Just as in many other places in Sweden, the property owners in Hammarby Sjöstad jointly own the facility through a joint-property association. The City of Stockholm compensates the joint-property association by charging a greatly reduced rate (as compensation for reduced collection costs). Envac Service is commissioned by the joint-property associations with the responsibility for operation and maintenance of the facilities.



Create new values

For the environment. Less noise and reduced exhaust and carbon dioxide emissions due to reduced transport needs, stops, and loading/unloading.

For waste minimization. Users can be supplied with a personal card or transponder making it possible to record and measure each time they use the waste system.

For source separation. Higher accessibility for user, supplying neat and convenient waste inlets for different fractions.

For the working environment. A better working environment for the waste collectors. No lifting, no pulling and no risk of infection or cuts because all physical contact with the waste has been eliminated.

For hygiene. Creates cleaner, more attractive residential areas and work places.

For the economy. The higher investment cost is offset by the significantly lower operating and maintenance costs, and the considerable space savings.

For accessibility. Always accessible by the user – 24 hours a day, 365 days a year.

For user satisfaction. Installation after installation shows much higher user satisfaction than with traditional waste collection.

Recycling demands, environmental awareness and technology

The three fractions typically handled in Hammarby Sjöstad by Envacs vacuum system

Combustible waste



Combustible waste is transported to the Högdalenverket plant in southern Stockholm where it is incinerated and recycled as heating and electricity

Heat & energy



Organic waste



Food waste is transported to Sofielund in Huddinge where it is composted and turned into soil. The ultimate aim is for food waste to be converted into biogas and bio-fertilisers.

Biosolids & biogas



Newspaper



Newspapers are delivered to paper recycling companies and then sent on to paper mills where they are turned into new paper.

Newspaper



Since the collection of packaging materials is not a local government issue in Sweden, but the responsibility of the individual companies producing the materials, Hammarby Sjöstad has had to plan for two different storage and collection systems.

Inlets connected to Envac's vacuum system

Mixed refuse, organic food waste and, in most areas, newspapers too are collected with the help of Envac's vacuum system. Ideally, the inlets are centrally located in the courtyards. However, in some places the inlets are installed in entrance halls and in refuse rooms.

Block-based recycling rooms

The packaging material is collected in conventional bins using lorries (rear loaders). The bin (each packaging fraction has at least one bin) is placed in a separate recycling room in the building, from where it is manually wheeled out to the waste collection vehicle in the street.

The stationary system

The mainstay concept is the use of underground pipes to transport waste and the use of air to do the heavy work.

The airborne waste is easily transported under the streets to a reception centre that is located on the outskirts of the area.

Lorries can access the full containers without any problem and transport them to

the recycling centres, landfills or incinerator facilities.



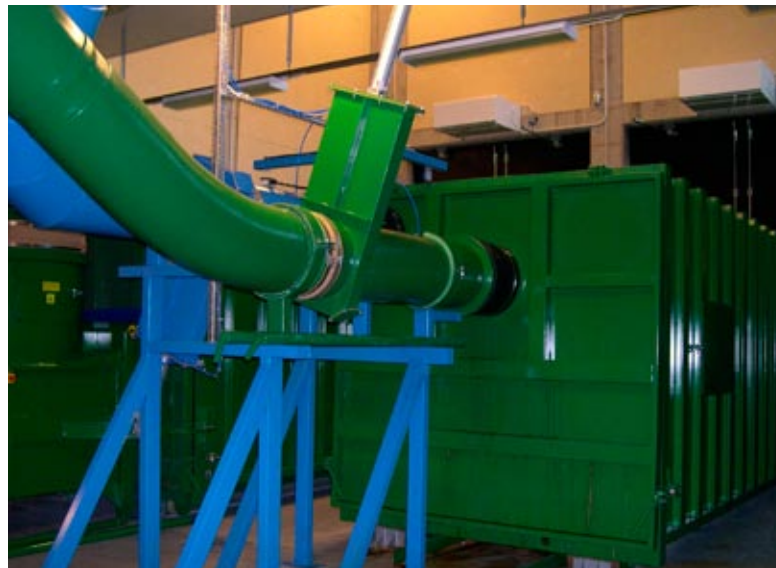
Most stationary systems supplied today are designed for source separation.

1. Waste is disposed off into ordinary refuse chutes. One for each fraction.
2. The waste is stored for a short while on a valve, which opens when the computer-controlled emptying process starts. One fraction is emptied and collected at a time.
3. All waste fractions are transported through the same pipe system at a speed of 70 km/h.
4. Fans create the partial vacuum that sucks the waste to the collection station.
5. The waste is guided to the correct container.
6. The transport air is cleaned through filters before being released.
7. The largest fractions are compressed.



In the collection station, the air used for transportation is separated from the waste/recyclables and filtered before being released to the atmosphere.

Compactors are used for efficient loading of containers at the station. The full containers are then picked up by a hook-lift vehicle (see photo above).



A compactor is used to compress the waste in the container (above left).

A series of fans create the necessary negative pressure in the pipe system (above right).

Each stationary system has a control room (left).

A so-called F Container is used for the food waste. The waste is sucked straight into the container (the green pipe). The air is conveyed through a filter at the top of the container and exits the container through the blue pipe (right).

The mobile system

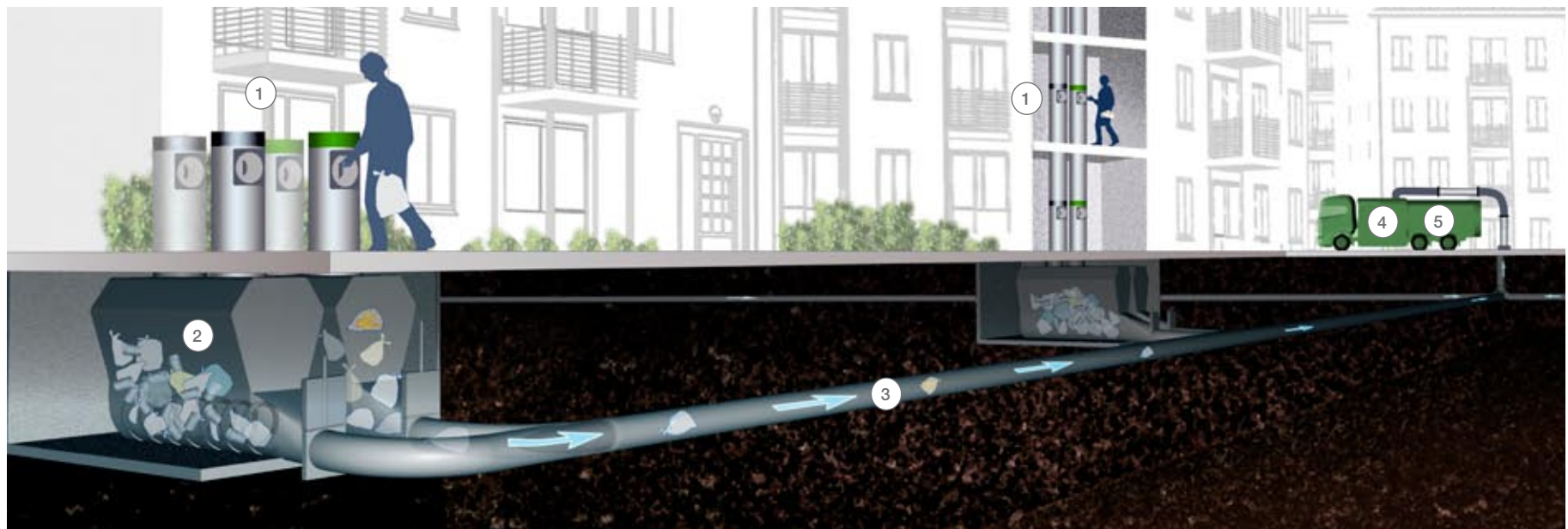
A mobile waste collection system ends up in underground tanks that are emptied by suction vehicles.

For the people who live or work in the area, a mobile system functions in precisely the same way as a stationary system. Waste bags are placed in inlets located indoors or outdoors. The waste is stored in a closed

tank below ground. The storage tanks are linked together by docking points via an underground network of pipes.

The docking points are strategically located so that collection vehicles do not

need to drive into constricted areas, such as backyards and narrow lanes.



Mobile systems are suitable for small residential areas

1. The waste is thrown into a disposal chute. It is possible to extend the system by adding more inlets, e.g. inlets for more fractions.
2. Containers are emptied one at a time and the process is computer controlled.
3. All waste is sucked through the same system of pipes at a speed of 90 km/h.
4. A vacuum pump creates the pressure that conveys the waste via the docking point to the vehicle.
5. The air is passed through filters to remove any impurities before being expelled outdoors.



The mobile system is highly suitable for small residential areas. Not all properties have to be connected to the system, making it more flexible in this respect than the stationary system. Mobile waste systems may also advantageously be installed in older buildings.

The inlet can also be integrated into buildings, e.g. next to entrance halls (above left).

Centrally-located inlets, clearly visible for all residents, help ensure the system is used correctly (right).

Docking points discreetly installed at street level (left).

The stationary system at Norra Hammarbyhamnen/Barnängen

The first residential area to be built in Hammarby Sjöstad was Norra Hammarbyhamnen.

The first phase of the vacuum system became operational back in 1982. There are now some 2300 households connected to the system, including the more recently built area called Barnängen. This was connected in 2003.

In Norra Hammarbyhamnen, inlets have been installed in the courtyards and inside the buildings. During the construction phase in the early 1980s, the vacuum system was modified with separate inlets and containers in the terminal to allow for the collection of both mixed waste and organic food waste. However, until today the city of Stockholm has not initiated a separate collection of organic waste in the area, wherefore the food waste is incinerated along with the waste fraction instead.

The terminal building is located inside a rock shelter but is still easily accessible for lorries collecting and delivering the containers.





Facts – Norra Hammarbyhamnen/ Barnängen

Length of pipe system	ca 5500 m
Capacity	3.1 tons waste/day
No of fractions	one: rest
No of inlets	200
Apartments	3000

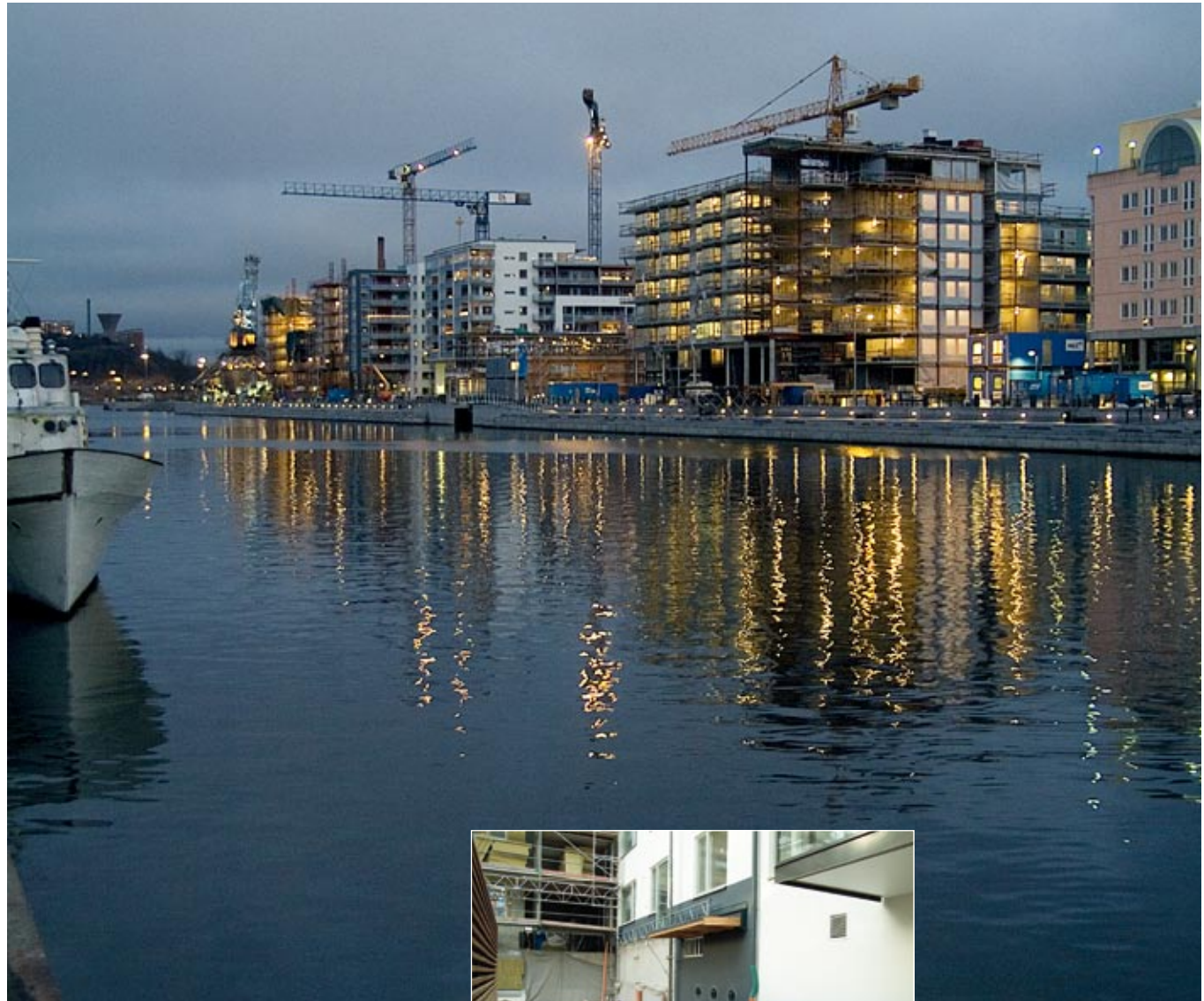


The stationary system at Hammarby Gård

The first buildings in Hammarby Gård were connected to the Envac system at the end of 2005. The terminal was officially opened by Viviann Gunnarsson, the deputy mayor of Stockholm and Environmental Commissioner, in January 2006.



Approximately half of the 2095 apartments scheduled for connection to the Envac system were connected by the end of 2007. The system handles three separate fractions – mixed waste, newspapers and food waste. The vacuum system also serves quite a number of small local businesses, including restaurants and shops, freeing up space in these commercial premises – space that can be put to better use.





Facts – Hammarby Gård

Length of pipe system	ca 4600 m
Capacity	4.3 tons waste/day
No of fractions	three: rest food waste paper
No of inlets	203
Apartments	2100

The collection terminal on Textilgatan is a compact and functional building that blends in well with the other industrial architectural styles of nearby buildings, such as the thermal power plant that recovers heat from sewage water.



The stationary system at Lugnet and Henriksdalshamnen

The entire district, with a total of 3000 apartments, will be connected to a waste vacuum terminal that will be located either in Henriksdalsberget next to Lugnet's service road junction or down by Lake Hammarby.

This district is being built in three stages. Stage 1, Lugnet – 650 apartments ready for occupancy in 2007–2008. Stage 2, Henriksdalshamnen, construction of 900 apartments starts in 2008 for occupancy in 2009–2010. Stage 3, the area along Henriksdalsberget after rerouting of the motorway has been completed. Construction of 1450 apartments due to start in 2011 and ready for occupancy in 2013–2016.

The entire district, with a total of 3000 apartments, will be connected to a waste vacuum terminal that will be located either in Henriksdalsberget next to Lugnet's service road junction or down by Lake Hammarby. Plans are to install a pipe network and terminal in collaboration with the City of Stockholm. It is also hoped a structure can be devised that will enable Envac to be responsible directly to the property owners for the facility as a whole. It is also proposed



that Envac assumes operating responsibility for a period of 25 years. Connections to the main network and inlets are paid straight to Envac by the property owners.

The Envac system will handle three fractions (mixed waste, newspapers and food waste). Furthermore, a number of public waste paper bins along the path by Lake Hammarby will be connected to the system.





Facts – Lugnet/Henriksdalshamnen

Length of pipe system	ca 2400 m
Capacity	3.8 tons waste/day
No of fractions	three: rest food waste paper
No of inlets	54
Apartments	3000



The mobile system at Sickla Udde and Sickla Kaj

There was some uncertainty over the pace of development for Hammarby Sjöstad when it was announced that Stockholm and Hammarby Sjöstad would not be hosting the 2004 Olympic Games.

And since there was no great demand for housing in the area, it was decided to invest in a mobile waste system at Sickla Udde instead of a stationary.

Initially, the intention was to use the mobile vacuum system to handle three separate fractions – mixed waste, food waste and newspapers. After a while, it became apparent that the mobile system was experiencing difficulties with the pneumatic conveyance of newspapers. It was therefore decided to temporarily close the newspaper fraction. Instead, newspapers are now collected along with other packaging from the recycling rooms in each building.

The mobile vacuum vehicle collects each fraction once a week. The docking points are located along the major thoroughfares. This reduces the number of heavy vehicles in the residential area.





Facts – Sickla Udde and Sickla Kaj

Length of pipe system	ca 3350 m
Capacity	3.5 tons waste/day
No of fractions	two: rest and food waste
No of inlets	180
No of docking points	8
Apartments	2050



Information to users

It is vital to keep users regularly updated and well informed about how all source separation systems work and how they should be used.

Information to residents in Hammarby Sjöstad is provided in two ways:

GlashusEtt is the name of the eco centre in Hammarby Sjöstad where residents can take hazardous waste for correct disposal and get information on what to do with the various kinds of waste. All residents collect their biodegradable bags for food waste from the GlashusEtt centre. People moving to Sjöstaden are always presented with a welcome package that contains a waste information guide.



Envac and the property owners provide residents and users with regular information. Envac also has staff on the boards of several of the joint-property associations and is therefore well able to provide immediate answers to questions and requests concerning waste collection in the area.





Facts – Hammarby Sjöstad when fully built year 2016

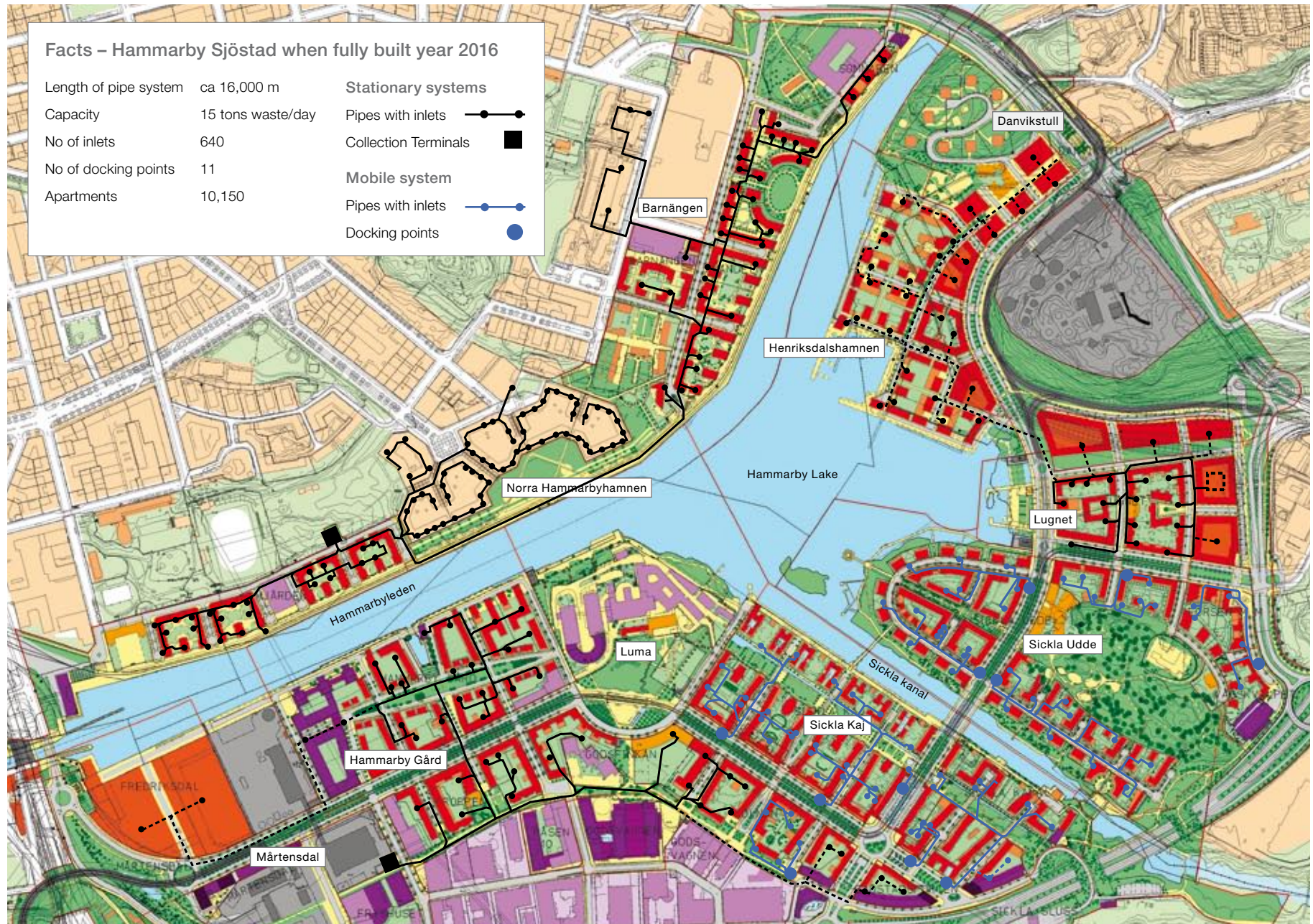
Length of pipe system	ca 16,000 m
Capacity	15 tons waste/day
No of inlets	640
No of docking points	11
Apartments	10,150

Stationary systems

Pipes with inlets	
Collection Terminals	

Mobile system

Pipes with inlets	
Docking points	





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