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Report summary - Follow up of environmental impact in Hammarby Sjöstad: Sickla Udde, Sickla Kaj, Lugnet and Proppen



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When planning work on Stockholm's new city district, Hammarby Sjöstad, began, the overall goal set was that the district's environmental impact should be 50% lower than that produced using the technology level current in the early 1990s.

The production of the Environmental Impact Profile (EIP) was initiated to enable the environmental impact of human activities, material manufacturing, construction and operation to be calculated, and hence, Hammarby Sjöstad's goal fulfilment to be monitored. This tool was developed by Grontmij AB in cooperation with the City of Stockholm, using financing provided by the Ministry of the Environment via the Local Investment Programme (LIP) secretariat in Stockholm, between 1997 and 2002. The City of Stockholm and Grontmij AB are the joint owners of the model.

The Environmental Impact Profile is based on defining the most relevant activities from an environmental viewpoint and quantifying them in the form of emissions to the air, soil and water, together with both the resources used by the consumption of non-renewable energy products and water consumption. The Environmental Impact Profile in this follow up report studies these factors throughout the production stage, the operations stage and, to some extent, the site clearance phase, and in comparison with a referent.

Details of the following environmental impacts are presented:

- Emissions into the air, soil and water in the form of the following Environmental impact categories:
 - Greenhouse effect (g CO₂ equivalents)
 - Acidification (mol H⁺ equivalents)
 - Overfertilisation (g O₂ equivalents)
 - Ground level ozone (g C₂H₄ equivalents)
- Radioactive waste (cm³)
- Resource use in the form of the consumption of non-renewable energy raw materials (kWh), and water consumption (m³). Production of pure water and processing of wastewater is included in the water usage figures.

This study is restricted to the areas of Sickla Udde, Sickla Kaj, Lugnet and Proppen in Hammarby Sjöstad where information has been obtained from the developers. Input data for the Environmental Impact Profile has been obtained from a total of 23 blocks with 14 different developers. Data has been gathered from the developers with regard to the amount of construction materials used, the source data for calculating heating, electricity and water usage, and certain information regarding technical solutions employed in the buildings.

The Environmental Impact Profile always compares the project in question with a referent, because environmental impact criteria and their units of measurement are relatively new concepts and there are no reference frameworks for the vast majority of the parameters. The reference level used to measure the anticipated reduction in environmental impact in Hammarby Sjöstad is the technology level current in the early 1990s, when planning work on the city district began.

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An Environmental index is part of the EIP and shows the relative difference between the reference value and the actual value for the following environmental impact categories: greenhouse effect, ground level ozone, acidification, overfertilisation and radioactive waste. The relative difference in environmental impact between the referent and Sickla Udde, Sickla Kaj, Lugnet and Proppen, calculated per apartment, is shown in Fig. 1.

The graphs show that the total environmental impact for buildings, building plots and zones has fallen by ca. 32-39% for emissions into the air, soil and water (environmental index) in comparison with the referent. The primary reduction has been in the environmental impact from buildings and zones. If buildings alone are taken into account, the improvement is one of ca. 40-46%.

The index for consumption of non-renewable energy raw materials shows a reduction of ca. 28-42% for buildings, building plots and zones, and a reduction of 30-47% if buildings alone are studied.

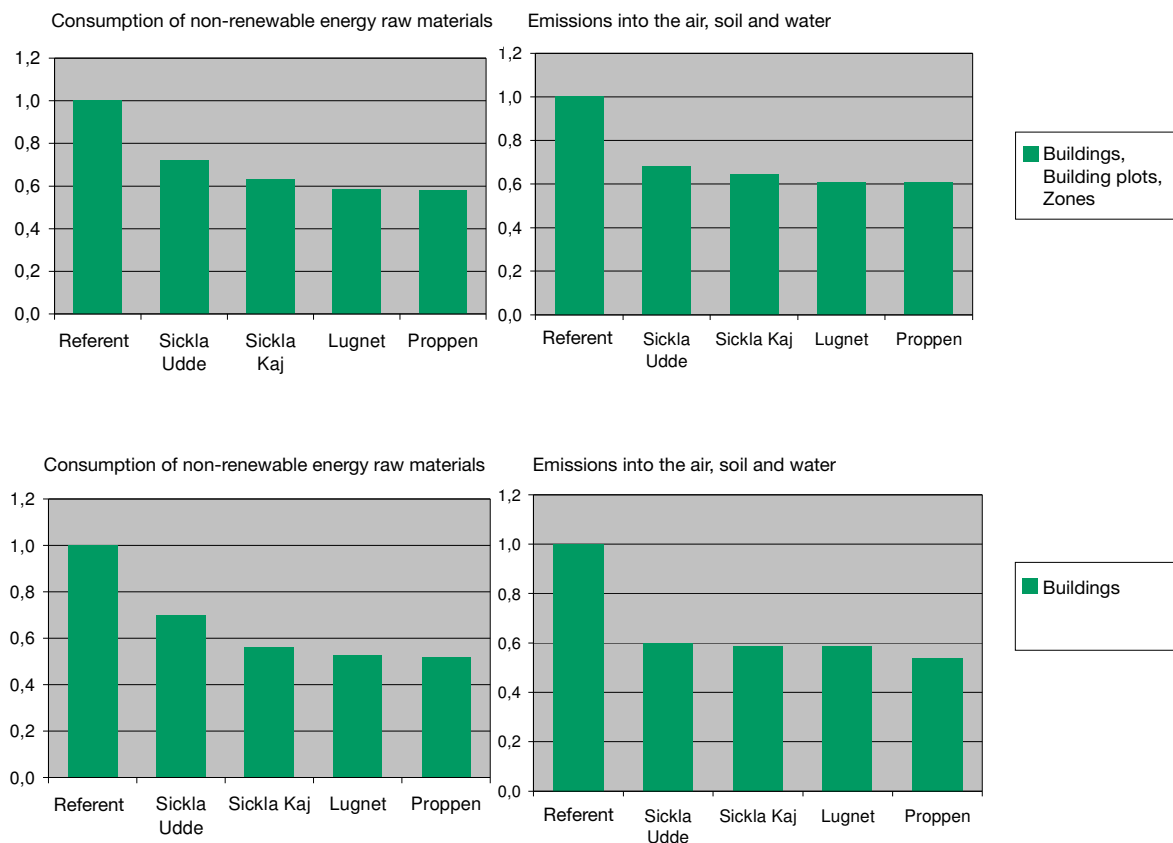


Fig. 1. Environmental index for Sickla Udde, Sickla Kaj, Lugnet and Proppen for emissions into the air, soil and water and index for consumption of non-renewable energy raw materials for buildings, building plots and zones (the two upper graphs) and for buildings (the two lower graphs), calculated per apartment.

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Fig. 2 shows the environmental impact for the referent, Sickla Udde, Sickla Kaj, Lugnet and Proppen for buildings, building plots and zones, calculated per apartment per year. The environmental impact refers to the production and operation phases for buildings, building plots and zones, and the site clearance phase for buildings. The graphs show a reduced environmental impact for all four phases in comparison with the referent. The primary reduction has been in the environmental impact from buildings and the zone. The building plot has a comparatively small environmental impact. Overfertilisation has decreased by ca. 49-53%, ground level ozone by ca. 33-38%, and water consumption by ca. 41-46%. The greenhouse effect has decreased by ca. 29-37%, acidification by ca. 23-29%, consumption of non-renewable energy raw materials by ca. 28-42%, and radioactive waste by ca. 27-40%.

Environmental Impact Profile per apartment per year, broken down by the production, operation and site clearance phases for buildings, building plots and zones for the referent, Sickla Udde, Sickla Kaj, Lugnet and Proppen.

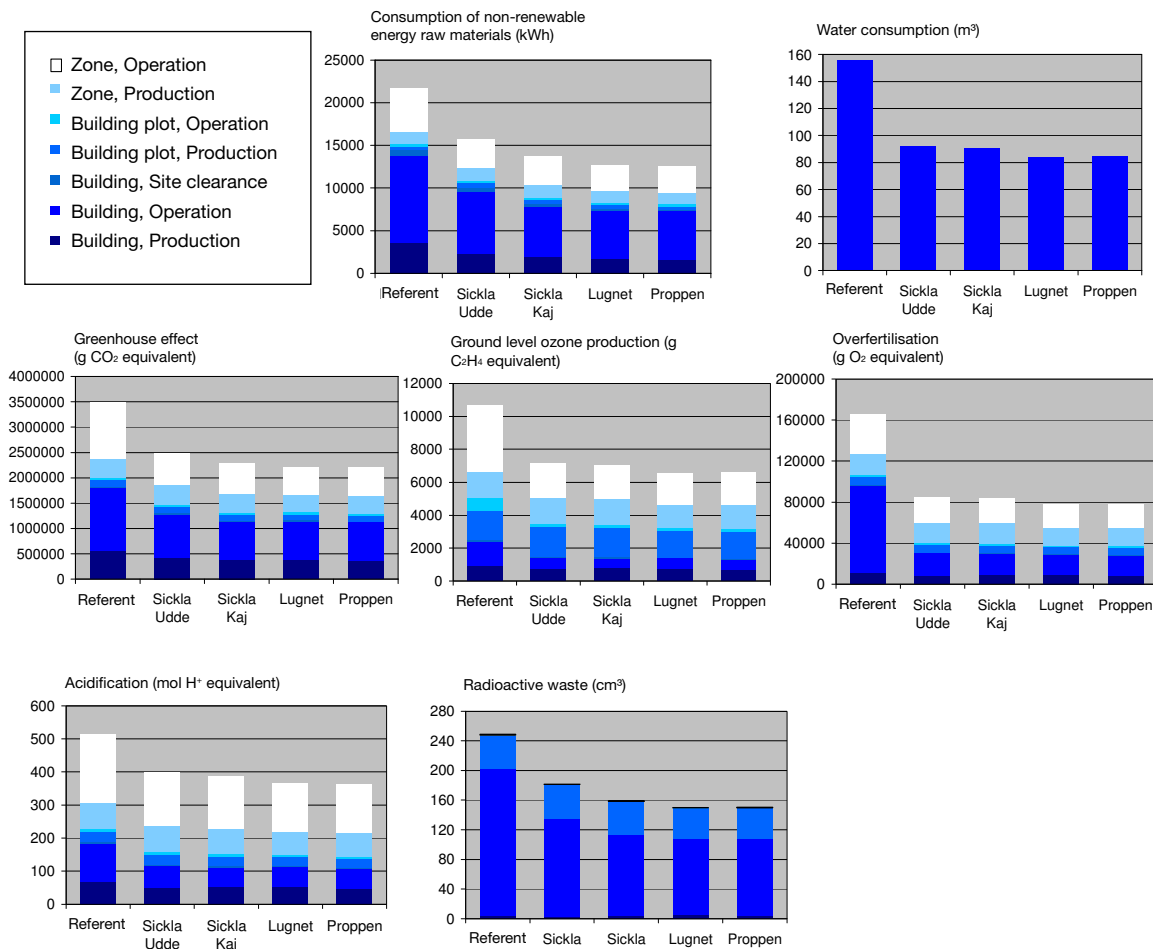


Fig. 2. Environmental Impact Profile per apartment per year for buildings, building plots, and zones, broken down by the production, operation and site clearance phases. The graphs show a comparison between the referent, Sickla Udde, Sickla Kaj, Lugnet and Proppen.

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Environmental Impact Profile per apartment per year for the buildings, broken down by the production, operation and site clearance phases for the referent, Sickla Udde, Sickla Kaj, Lugnet and Proppen.

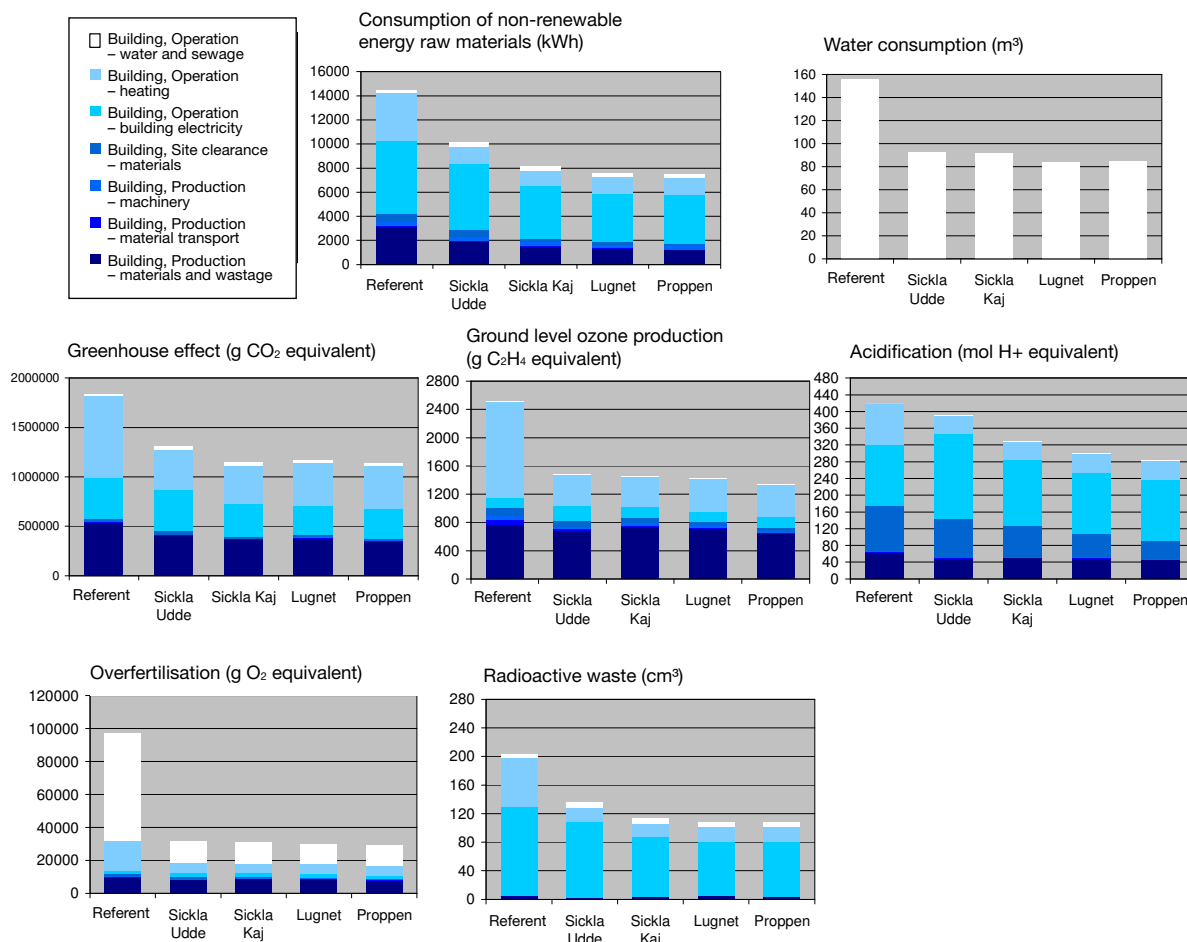


Fig. 3. Environmental Impact Profile per apartment per year for buildings, broken down by the production, operation and site clearance phases. The graphs show a comparison between the referent, Sickla Udde, Sickla Kaj, Lugnet and Proppen.

The biggest reduction in the environmental impact from the buildings has occurred with regard to the heating of buildings in the operating phase and in connection with the use of pure water and the processing of wastewater in the operating phase (see Fig. 3).

Buildings' energy consumption during the operating phase is of considerable importance in terms of the building's overall environmental impact. The overfertilisation environmental impact category has shown a reduction of more than half in its environmental impact, with the environmental impact from buildings declining by ca. 67-70%. This improvement is largely due to improvements in treatment techniques at the Henriksdal Wastewater Treatment Plant. A reduction of ca. 29-47% has been noted for other environmental impacts.

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The greatest reduction in environmental impact can be seen for the buildings and the zone. The activities that have produced the biggest reduction in environmental impact are water, sewage and heating, the technical services for the properties, and the construction materials for the production of the buildings. The developers' extra efforts and investments in order to save energy include extra heat insulation, energy-efficient windows, on-demand ventilation, individual metering of heating and hot water in the apartments, electrically efficient installations and white goods, lighting control, solar panels, solar cells and fuel cells. Some of the buildings have installed heat pumps and heat exchangers for the ventilation air. The developers' efforts with regard to water and sewage include fittings with reduced water flow and low-flush toilets. Great emphasis has also been placed on the choice of eco-friendly building products and the production of certain materials used in Hammarby Sjöstad has also changed in comparison with those used in the referent.

Measures have been taken in recent years with regard to the production of district heating from Fortum's Southern Network. The district heating supplied to Sickla Udde comes from heating pumps and from the incineration plant in Högdalen, where tall oil pitch, biofuels, waste and oils are among the materials incinerated. The biggest changes in the fuel mix from Fortum's Southern Network between 1989 and 1992 and between 1998 and 2002 are the increase in the percentage of tall oil pitch and biofuels and the reduction in the percentage of energy from electric boilers. Improvement measures implemented for activities within the building plot and the zone include the use of low-emission engines and eco-class 1 fuel for machinery and transports.

Personal transport accounts for the biggest reduction in the environmental impact for the zone. The percentage of car journeys for personal transportation has fallen, while the number of journeys made using public transport, particularly the "Tvärbanan" light rail link and the ferry, have increased in comparison with the 1990s, resulting in a reduced environmental impact. Parking requirements and traffic generation are normally calculated using theoretical general models, but a large and long-term project like Hammarby Sjöstad offers the opportunity to compare these theoretical models with "reality". Questionnaire-based surveys of all residents of Hammarby Sjöstad have been conducted on three separate occasions in order to obtain source data on these issues. The referent zone is based on a previous, overall study of comparable city districts, but has been adapted for Hammarby Sjöstad. Table 1 shows the breakdown of residents' everyday journeys.

Transport type	Referent Without ferry & "Tvärbanan"	Current position Hammarby Sjöstad
Car	35 %	21 %
"Tvärbanan" light rail link	0 %	34 %
Bus	50 %	18 %
Bicycle	7 %	9 %
Walking	8 %	18 %

Table 1. Breakdown of residents' everyday journeys. The assumptions are based on the results of a questionnaire-based survey of the Hammarby Sjöstad residents. The values are seasonally adjusted.

The ferry has contributed to an increase in the use of bicycles and walking to/from Hammarby Sjöstad. 24% of all travellers use the ferry.

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Fig. 4 shows carbon dioxide emissions from personal transport by car for the referent in comparison with Hammarby Sjöstad. This shows that the referent produces ca. 475 kg more carbon dioxide emissions per apartment from personal transport by car than Hammarby Sjöstad. For the 5,000 or so completed apartments in Hammarby Sjöstad, this yields a reduction of approximately 2,373 tonnes of carbon dioxide per year.

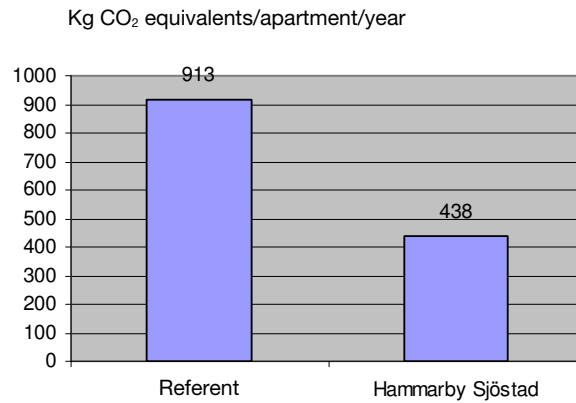


Fig. 4. Kg carbon dioxide per apartment per year from personal transport by car, for the referent in comparison with Hammarby Sjöstad.