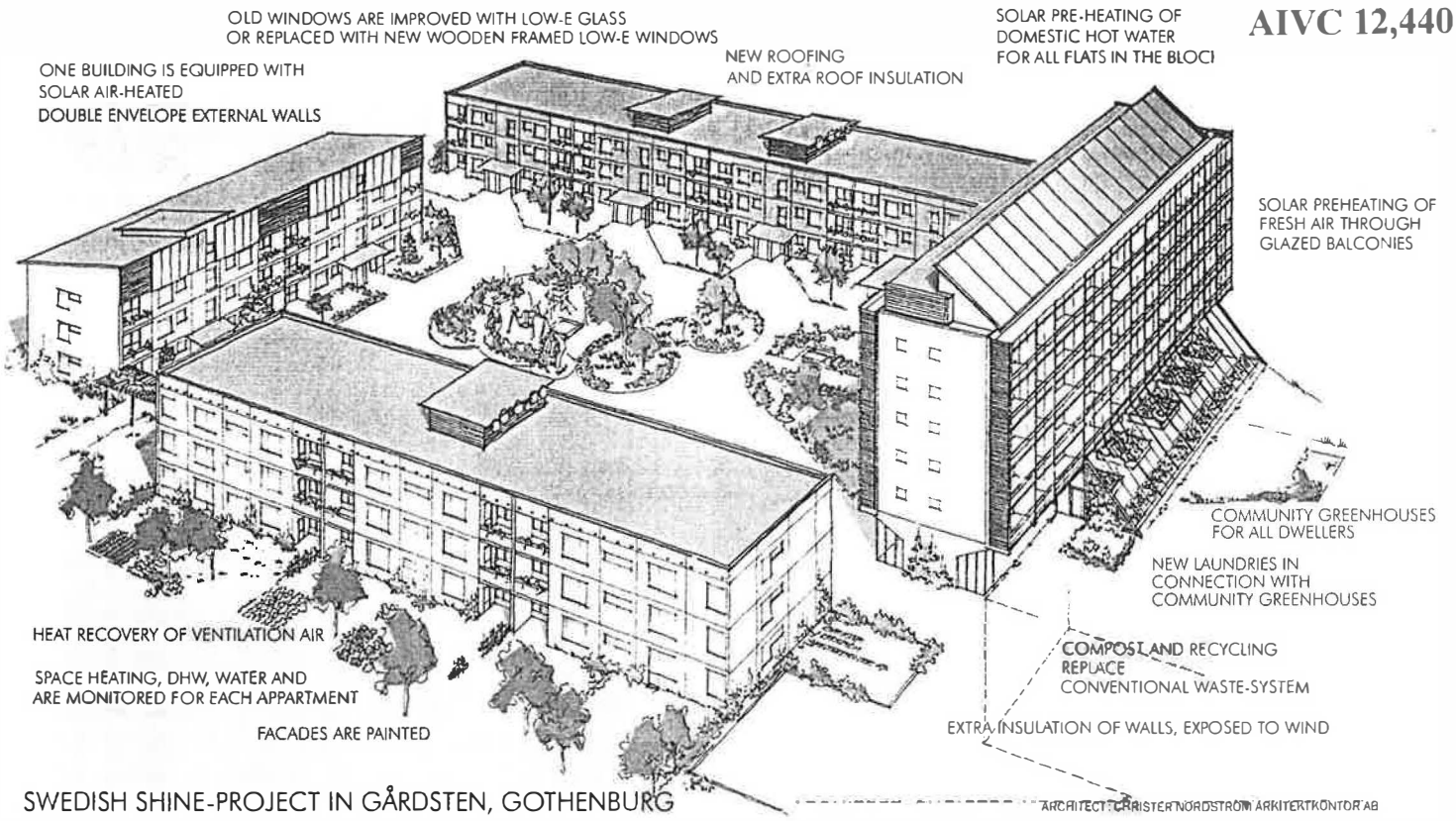


SWEDISH SHINE-PROJECT IN GÅRDSTEN, GOTHENBURG

By Jan-Olof Dalenbäck

Buildings from the 70s are renovated:

Solar heated water is more than retrofit insulation of

A comprehensive technical and social refurbishment of a housing estate built in the seventies is carried out in the Gårdsten project. Well thought out traditional measures are combined with new energy technology which was initiated through participation in an EU project which, in turn, is based on IEA collaboration.

The housing estate Gårdsten in Göteborg is a large estate built in the seventies which is run down both physically and socially. Many flats are empty. But comprehensive refurbishment has now been put in hand. This is carried on in collaboration between the housing company, researchers and the EU. EU provides the finance for energy technology measures in which solar heat is utilised, such as replacement of roofs by roofs with integral solar collectors. The reason that the EU is taking part at all in the Gårdsten project is due to the involvement of the undersigned and the architect Christer Nordström in the EU project SHINE.

The turnkey contractor for the refurbishment of Gårdsten which began in the spring of 1999 is Skanska. It is expected that the first part will be ready in the spring of 2000, and the whole project with its 255 flats will be finished by the spring of 2001.

Conditions

The Gårdsten estate consists of two types of buildings of precast construction: balcony access blocks of flats of five storeys and three storey staircase entry blocks of flats. All buildings have flat roofs and mechanical extract and supply (FT) ventilation. The estate is heated by district heating. The whole estate consists of 1000 flats, but the area comprised in the project contains 255 flats in three balcony access buildings and seven staircase entry buildings, with a total residential floor area of 19,000 m^2.

Work began in the summer of 1997 with the formation of a project group that was given the task of making investigations and producing a programme to provide the basis for tender documents.

Investigation of energy and water use gave the following initial position:

District heating – 5000 MWh annually – 270 kWh/m^2 annually.
Electricity – 980 MWh annually – 52 kWh/m^2 annually.
Water – 47,800 m^3 annually – 190 m^3/flat annually.

In order that relevant energy measures may be proposed and the possible savings in energy estimated,

cost effective facades

comprehensive investigations were made. Radiator heat, ventilation losses, use of hot water and distribution losses were measured. BV2, a newly developed calculation tool, was a valuable complement to more traditional calculations.

Proposed measures

The programme of work in the EU project SHINE was used as the point of departure in the investigations in the Gårdsten project, and the views of the tenants were also obtained. The final proposal for measures was a combination of traditional and new technologies.

To put it simply, the measures may be said to have been evaluated with reference to a base alternative that had to be carried out because of neglected maintenance. After that, the additional cost of an alternative measure was related to its added value in the form of greater energy saving, so that in this way the best measures may be chosen. A remark that may be made in this context is that solar heating of hot water was found to be more cost effective than retrofit insulation of facades and replacement of windows.

Buildings

All buildings are given a new roof-covering. Balcony access buildings get new pitched roofs comprising integral solar collectors. The attics are insulated. The roofs of staircase entry buildings are retrofit insulated and are given new roof coverings.

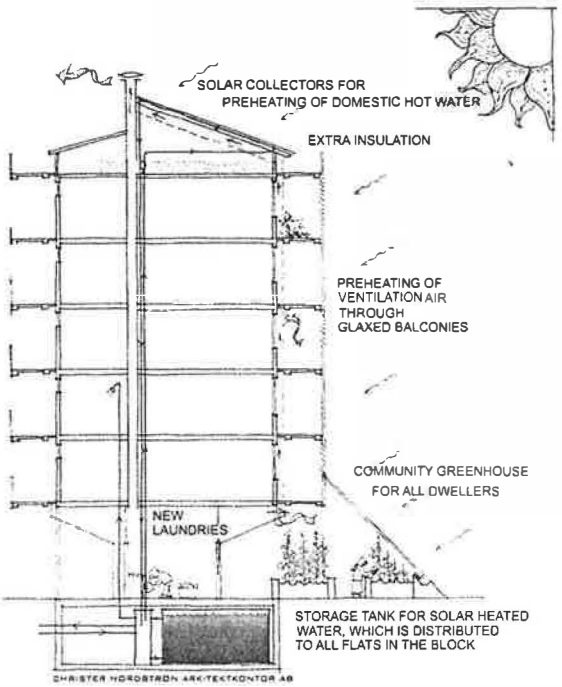
Damaged windows are replaced by windows of greater energy efficiency, and other windows are given a new low-e inner pane. The gables of the balcony access buildings are particularly exposed to weather and wind and are given a new surface finish with additional insulation. The edges of foundation rafts in the staircase entry buildings are insulated to increase comfort on the bottom storey. It is further proposed that the balconies in the balcony access buildings be glazed and an air based solar heating system in combination with additional insulation be installed in a southerly staircase entry building, both to be partially financed within the EU project.

In addition, the bottom storey in the balcony access buildings is rearranged to accommodate new laundry rooms, communal premises and a greenhouse in order to improve social conditions.

Ventilation

As regards ventilation, the options were installation of heat recovery (lower heating costs) or conversion to an extract system with new fresh air intakes (low first cost). The proposal was installation of heat recovery in the staircase entry buildings and conversion to extract ventilation in the balcony access buildings. The extract systems in the balcony access buildings are designed with a base flow of fresh air through the glazed balconies, supplemented by carbon filter fans in kitchens.

Buildings	New roof coverings (integral solar collectors) Windows (energy windows/low emission panes) New gable facades – balcony access buildings Glazing of balconies – balcony access buildings (SHINE) Insulation of edges of foundation raft – staircase entry buildings (comfort) Air based solar heating system/cavity walls – one staircase entry building (SHINE)
Ventilation	Mech. extract & supply ventilation in staircase entry buildings →Mech. extract and supply ventilation with heat exchanger (SHINE) Mech. extract and supply ventilation in balcony access buildings →Mech. extract ventilation (+ carbon filters)
Hot water	Solar collectors for hot water (SHINE)
Heating system	Balancing
Electrical equipment	New low energy white goods Occupancy detectors, low energy bulbs New laundry room equipment New fan units
Management	Central surveillance Individual metering (electricity, water and heat)



Plan for the balcony access building.

Heating and domestic hot water systems

It is estimated that the proposed measures will reduce the heating load from 270 to 160 kWh/m² annually. For the area concerned, this means that the need for district heat will decrease from 5000 to 3000 MWh annually, which reduces running costs by around SEK 1m annually. The way the future heat load is broken down into radiator heat, ventilation losses, hot water and distribution losses is shown in the diagram (see next page).

Existing radiators are balanced. The balcony access buildings are also provided with integral solar collectors, for preheating domestic hot water, in conjunction with renovation of the roof .

Electrical equipment

As regards electric load, this is estimated to decrease by 20–30% per flat. Most of the white goods are from the seventies, and these are therefore replaced by new and more energy efficient units. Stairwells and other communal premises are fitted with occupancy detectors and low energy bulbs, and the ventilation systems are equipped with new fan units with low VAS numbers. The new laundry rooms are also provided with new low energy laundry equipment.

Management

In order to evaluate this EU project and to monitor future function of the heating system, a central surveillance unit with the associated measuring equipment is installed. A se-

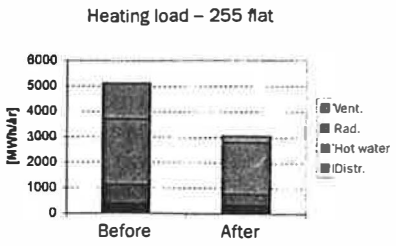
Estimated cost	SEK 1000/flat	MSEK
Neglected maintenance	270	68.9
New investment	64	16.3
EU-SHINE measures	53	13.5
Total	**387**	**98.7**

parate system that registers the use of both electricity and water and the room temperature in each flat as the basis of individual billing is also installed. Individual measurement of heat was a requirement of the client in spite of the fact that the expected saving in energy is seldom in proportion to the cost.

First and running costs

The total first cost is estimated to come to almost SEK 100 m, or just under SEK 400,000 per flat. Measures to make up for neglected maintenance clearly represent the largest cost item. The energy related measures come to ca SEK 20 m, of which the additional expenditure of SEK 13.5 m is the basis for the EU grant.

Each housing estate has its own conditions. It is therefore important to adopt a holistic approach and to study the possibilities of combining different measures. Through the



agency of the *Swedish Council for Building Research*, we have long experience of both energy conservation measures and solar heating applications in blocks of flats. It is however essential to pass this on to the project group and to allow this to have the necessary economic scope. This is cost effective in the long run. ■

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Shine Thermie project no: BU/1051/96
Building owner: Bostads AB, Gårdsten, Man.dir Stina Fransson,
Architect: Christer Nordström, C. Nordström Arkitektkontor AB
'Energy': Jan-Olof Dalenbäck, CIT Energy Management AB

"Solar Energy in Building Renovation", IEA SHC, Task 20, refers to applications of solar heat in renovation. The results have been presented in the form of a folder with 4 information brochures, an introduction and one brochure each on integral solar collectors, glazing of balconies and transparent insulation. In the summer, a fifth brochure describing experiences gained in a number of demonstration projects will be added. International collaboration was headed by Professor *Arne Elmroth* or *Elisabeth Kjellson*, University of Lund Institute of Technology, and *Jan-Olof Dalenbäck*, Chalmers University of Technology, represented Sweden on behalf of the *Swedish Council for Building Research*.

References in English:

"BV²", CIT Energy Management AB, Göteborg,

Nilsson, P-E (1994). "Heating and Cooling Requirements in Commercial Buildings – A Duration Curve Model including Building Dynamics". Document No D27:1994, Building Services Engineering, Chalmers, Göteborg

Solar Energy in Building Renovation. 4 brochures developed within Task 20: "Solar Energy in Building Renovation", IEA SHC Programme. James & James Publishers, UK.

Espoo, Finland
Healthy Buildings 2000

The conference Healthy Buildings 2000 will take place in Espoo, Finland, August 6–10, 2000. The conference venue is Helsinki University of Technology, situated in Espoo just outside Helsinki, one of the European Cities of Culture in year 2000.

The Healthy Buildings 2000 Conference aims at processing the latest knowledge from indoor air quality research, construction techniques and product development into economical and safe solutions for healthier living and working environments. The scope of the Conference covers all building types in all climatic conditions.

The Conference will give practitioners and authorities a rapid state-of-the-art overview of indoor air know-how.

Key note lectures are planned on the following subjects: Indoor air quality, allergies and health, specification and verification of target levels for indoor climate, design and construction of healthy buildings, when and where people are exposed to pollutants. ■

Healthy Buildings 2000, Attn: Ms Leila Sarajärvi, P.O. Box 25, FIN-02131 Espoo, Finland. Phone: +358 9 4355 560, fax: +358 9 4355 5655, info@sisalmayhdistys.fi

International Housing Research Conference in Sweden
Fragmentation an reorientation

26 June –30 June 2000 an international research conference will take place in Gävle, Sweden. The name of the conference is "Housing in the 21st century. Fragmentation an reorientation". The conference is organised by the Institute for Housing Research, Uppsala University under the auspices of ENHR, the European Network for Housing Research.

Nation states are dismantling their general housing policies that consequently are becoming more decentralised and fragmented. A pattern of radically uneven employment affects housing in terms of greater regional diversification but also in form of increased segregation and social exclusion.

Many disciplines

But a shift in approach is also evident. More and more these days, housing policy is co-ordinated with social, health and environmental policies on the local level. This reorientation not only targets classic questions of interest for housing research, but also acknowledges the integral and complexly related character of other issues, e g environmental quality, gender, aesthetics and urban form.

The conference is intended for participants from a wide variety of academic disciplines: sociology, economics, human geography, political science, psychology, social work, history, urban planning, architecture and others.

The core of the conference will be workshops combined with plenary sessions. There will be a special pre-conference seminar for Young Housing Researchers. Abstracts should be submitted by the 15th of March 2000 and completed papers by the 1st of May 2000. ■

Further information:
http://www.ibf.uu.se
conference@ibf.uu.se (Institute for Housing Research, Uppsala University, Box 785, SE-801 29 Gävle, Sweden)