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In a unique and innovative approach, the Swedish municipality of Lerum will build noise barriers that can produce solar energy, as project co-ordinator Henrik Bengtsson details

Noise pollution is a major environmental and health problem in the municipality of Lerum, in the west of Sweden. Indeed, exposure to noise is a considerable environmental problem in many parts of Europe. Although noise is not regarded as life threatening in the same way as many other environmental problems, noise management is of increasing importance to human health and the quality of life. Millions of people in the European Union suffer from unacceptable noise levels. More than two million people in Sweden are exposed to traffic noise exceeding 55 decibels (dB), one of four guideline values for traffic noise in Sweden.

The Swedish municipality of Lerum is situated in the expansive Gothenburg region and is divided by major thoroughfares for both road and rail traffic, which means that noise is one of the greatest environmental problems in Lerum. In 2003, noise mapping was undertaken and the 'Lerum study' concerning the health effects of noise from road, rail and air traffic was conducted in 2005. The study shows a higher incidence of hypertension and medication for hypertension with increasing road traffic noise among men, especially among those who had lived for more than ten years in their present homes. The results are adjusted for age, smoking, heredity factors, BMI and noise at work. With additional noise mapping, the whole geographic area of Lerum is now covered according to noise pollution. Based on the noise mapping and the scientific study, a thematic complement to the general plan regarding noise was completed and needs for noise abatement was pointed out.

Lerum aims to be Sweden's leading green municipality by the year 2025, or sooner. In addition to tackling noise pollution, the

municipality aims to invest in energy-saving and renewable energy technology in order to cut its emissions of greenhouse gases.

In a unique and innovative approach, the municipality will build a 400-metre noise barrier with Sun energy production for the district heating system. This has never been done before. By doing this, Lerum takes care of the noise problem and gets an additional benefit; heat production.

The municipality of Lerum is implementing the project together with Lerum Fjärrvärme AB, The Swedish Transport Administration and SP Technical Research Institute of Sweden.

Demonstrating innovative noise barriers

The main objective of the 'NOISUN' project is to demonstrate innovative noise barriers that produce solar energy for distribution to local district heating systems. This will be achieved by installing and evaluating specially adapted solar collectors at major road and rail thoroughfares in Lerum. Sub-objectives of the project include:

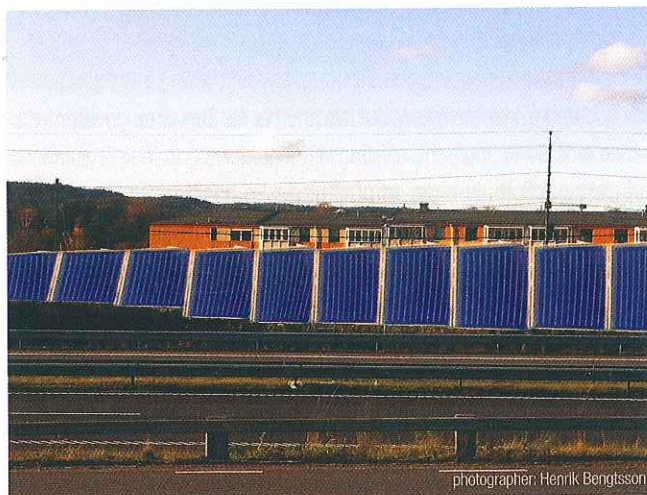
- Demonstrating an optimal design for noise barriers with solar heat production adapted to both the road and rail environments;
- Demonstrating an optimal technical solution for connections to the district heating system and compatibility between solar energy provision and other energy sources in the energy system;
- Testing and demonstrating the technical solutions in a full-scale facility along a stretch of the main western railway line and the E20 motorway through Lerum;
- Measuring and optimising the contribution of solar energy production to the district heating system; and
- Evaluating the socio-economic effects of the facility, based on noise reduction and solar energy contributions to the energy system.

Expected results

The project will lead to a number of primary quantitative environmental improvements. Based on the preliminary placement of a 400m noise barrier, affecting some 250 properties, the results will be as follows:

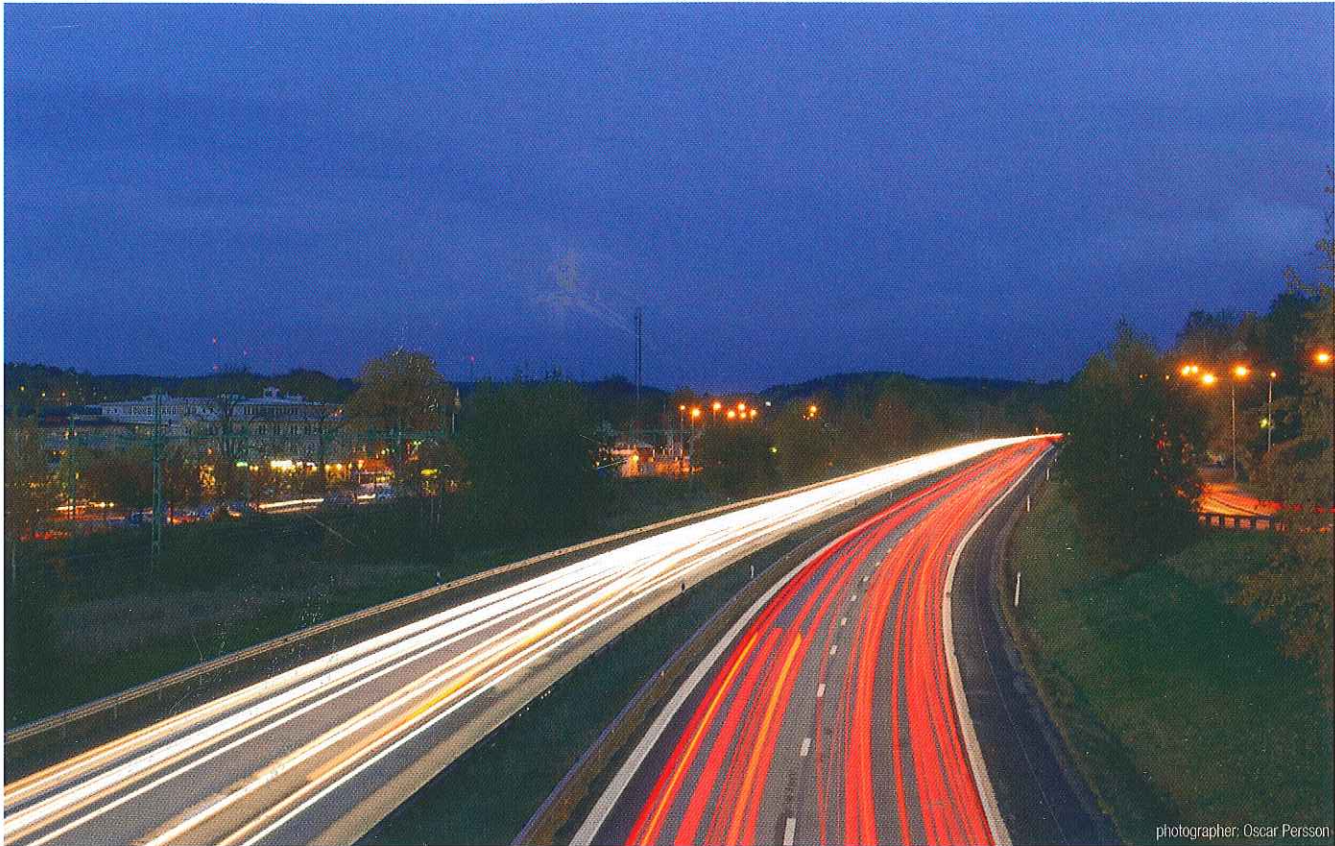
Noise:

- A 5-10 dB reduction in noise levels, from 65 dBA (A-weighting) down to 55-60 dBA (an 8-10 dB reduction is perceived as halving the noise level); and
- A 60-90% reduction in the number of citizens and properties experiencing sound levels above 55 dBA.



photographer: Henrik Bengtsson

Photomontage showing a noise barrier installation



photographer: Oscar Persson

Energy:

- Production of 400,000kWh per year of renewable energy;
- A saving of 440m³ per year of woodchips;
- A saving of 20,000kWh of electricity (required to produce woodchips);

The municipality of Lerum

Almost 39,000 people live in Lerum; mainly young couples and families move here, with 50% aged between 25-65 years old and 30% under 25.

The aim of the municipality of Lerum 'to be Sweden's leading green municipality by 2025 or sooner' builds on three fundamental points: sustainability, creativity and influence.

Sustainability is always a factor in everything we do. It can be seen in the municipality's work towards increasing the number of green and energy efficient buildings, ecological food in day nurseries, schools and elderly homes, car pools, travel policies for employees to decrease emissions, energy saving by using LED-lights in our streetlights and much more.

The municipality has to provide:

Childcare, education and schools, leisure and culture, help and support for the elderly and disabled, health and social care, environment and health, housing, planning and infrastructure, advice and benefits, handling of garbage, waste and water, fire and rescue. The municipality of Lerum is one of 13 municipalities in the Gothenburg Region Association of Local Authorities, known as GR.

- A saving of 200 tonnes of CO₂ emissions – some 130 tonnes of biomass (trees) can remain in the forest and thus bind CO₂; and
- A saving of additional CO₂ by reducing the need for forestry and transportation of biomass.

Socio-economic:

- A reduction in the costs associated with noise of €70,000 – €105,000 per year; and
- As a result of reduced noise levels, an overall increase in the value of properties in the project area of 5%.

Lerum; a suitable location for noise barriers

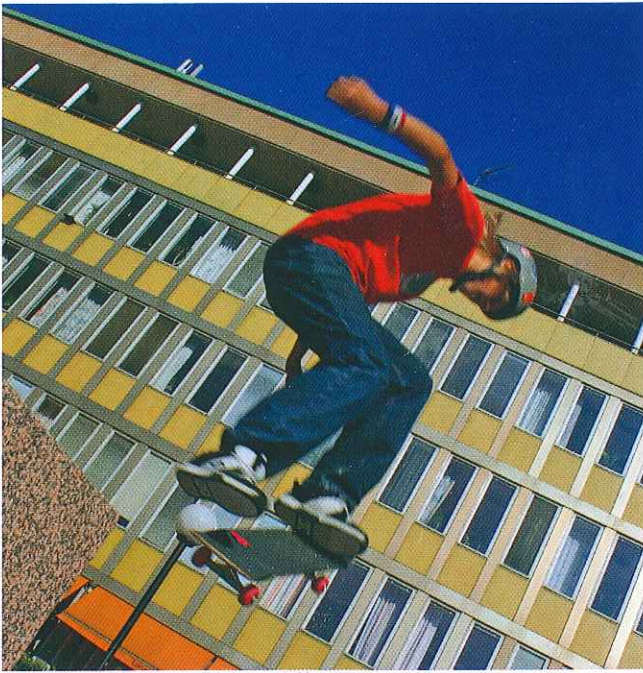
To date, the project has made an analysis of a few different places in the municipality in order to choose the most suitable location for the facility. The most interesting site is central Lerum for several reasons: many people live in the vicinity; there are good ground conditions; access to an accumulator tank; and many people passing the site on the motorway or railway.

The project has found solutions concerning how the energy from the solar collector facility can be stored and how the solar collector facility and the district heating system can work together.

Many factors contribute as to choose Lerum for the location of the facility:

- Many people are exposed to high noise levels from both the E20 and the main western railroad line;
- An accumulator tank is available, which increases the ability to receive and store the heat of the day;

URBAN ENVIRONMENT



photographer: Per Næslén

- The plant can be made larger than in other investigated sites; and
- The demonstration plant will be well-exposed.

The biggest challenge is to manage the instantaneous power to the district heating network when the district heating boiler doesn't need to produce as much energy, e.g. a Sunday afternoon during the summer.

It is technically inappropriate to transport heat through the return line to the existing accumulator tank, as this increases the return temperature. Higher return temperatures lower the efficiency of the heating plant when the effect of the smoke gas condenser decreases with higher return temperatures. This means, the energy gained from the Sun will be lost through poor utilisation in the existing heating plant.

One solution would be to produce hot water at about 60°C and connect to the district heating accumulator tank via a separate culvert. Another solution is to produce hot water at about 75°C and connect to the district heating network flow line (that goes out to the houses).

Calculations conducted by partner SP Technical Research Institute of Sweden show that, from an energy perspective, it's better to connect the facility to the district heating network flow line,

'NOISUN' project

- Associated beneficiaries:
- SP Technical Research Institute of Sweden;
- Lerum Fjärrvärme AB;
- The Swedish Transport Administration;
- Duration of project: 39 months (01.06.2012 – 28.02.2016);
- Total budget: €1,556,376;
- EC contribution: €569,113.

Facts about LIFE+ Environment

LIFE is the EU's financial instrument to support environment and nature conservation projects throughout the EU, and in certain non-EU countries.

LIFE+ Environment Policy & Governance is one of three thematic components under the LIFE programme.

The European Commission has approved funding for 113 new environmental innovation projects in 18 countries under the LIFE+ Environment Policy & Governance programme 2011.

These projects will demonstrate new methods and techniques for dealing with a wide diversity of Europe's environmental problems.

because of heat losses during transport in a separate line to the accumulator tank. The option to use a separate culvert is also considerably more expensive.

The conclusion from the above is that we will focus on a solution where the solar collector facility is connected to the district heating network flow line.

We are now investigating the security aspects, such as proximity to high voltage installations and railroad tracks, pressure waves from passing trains, wind and snow loads.

The next step is to conduct noise calculations in the residential area and gather information about the perceived noise disturbance, in order to evaluate the result of the noise barrier measures.

A building permit from the community planning department will also be needed, before construction of the facility can begin. Construction is planned to begin at the end of next year.

We hope that the project will attract visitors from all over the world, as exposure to noise is a considerable problem in many cities and investments in energy saving and renewable energy sources have to be made.

We want to share our knowledge and the experience we get of combining noise barriers with solar energy production.



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