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DRAFT

SUSTAINABLE DEVELOPMENT

- COOPERATION, SYSTEMS AND SYNERGIES

The world's cities are growing exponentially. People are choosing the cities over the countryside regardless of whether they live in a large or a small country, or one that is rich or poor. For the first time in human history there are more people living in cities than in the countryside. However, this development is making demands. In Sweden, for example, the metropolitan areas need to restructure in order to cope with the pressure, while the smaller cities need to readjust in order to not fall behind. The trend towards urbanisation is clear in Sweden, – where industry is changing to more service-intensive sectors, – but it is also the case in all the world's major cities. And the development will continue within the foreseeable future.

What is it going to be like, and how are we going to cope with this migration and the development it requires? What decisions need to be taken today to create a sustainable tomorrow? What do decision makers at local, regional and national levels have to consider when the strategies for the future are being selected?

Architects and technical consultants have an important role in society when it comes to analysing, creating, developing and transferring knowledge. They are using their know-how to formulate solutions to different problems. A lot of technology for sustainable solutions is already available today, although further research and investment is necessary for continued development. Together with politicians, officials and citizens we are taking on the challenge of making Swedish society sustainable over time. Today's decisions don't just affect existing society, but also set the parameters for the reality and opportunities for the future. We are ready for the challenge – are you?

The Swedish Federation of Consulting Engineers and Architects – is the trade and employer organisation for architects and technical consultancy firms within cityplanning, development and industry. Our member companies include those that have the expertise and experience to create the sustainable society. This report was compiled by three of our experts – Stellan Fryxell, Tengbom, Agneta Persson, WSP and Susanna Bruzell, Tyréns. With their different perspectives they have collected facts and given their picture of the situation. They have also summarised the most important steps towards sustainable urban development. The report was available in connection with one of our seminars in Almedalen 2011.

Stockholm, July 2011

Lena Wästfelt

MD, Swedish Federation of Consulting Engineers and Architects

IMPORTANT STEPS EN ROUTE TO SUSTAINABLE URBAN DEVELOPMENT

This publication has been produced to illustrate the need to move from words to actions. We have all the facts and know what challenges we are facing. The solution lies in increased cooperation and comprehensive system solutions to create synergies and a sustainable development in a society where people want to work, live and reside.

1. We must use our resources much more effectively. Our environmental problems are far more serious and extensive than the corresponding initiatives that are currently being put in place to solve them. We are borrowing more than ever of the limited natural resources that will provide future generations with the potential to survive. Our fossil fuel dependence cannot continue to increase.

2. Trends must be reversed and our energy usage reduced and made more efficient. Despite our growing awareness and concern, the global environmental impact is continuing, with increasing greenhouse gas emissions as a consequence of increasing energy usage.

3. Our investments in infrastructure, as well as research and development must increase. Investments in infrastructure have been decreasing in relation to GNP for a number of years, both in Sweden and Western Europe as a whole. Not least energy production and transmission, along with traffic and transport solutions, have many important functions for the sustainable society.

4. We have to adapt cities, infrastructure and buildings to future conditions. It demands that we have to both reduce our impact on the climate and adapt to the climate-related changes that are unfortunately nevertheless expected to take place, as well as design a future energy system.

5. Sustainable development through cooperation, systems and synergies. Sustainable development requires a systemic approach and that we utilize the synergy effects that are available. And it requires much more cooperation between individuals and organisations, publicly, privately, locally, regionally and globally.

WE ARE LIVING BEYOND OUR MEANS

Industrial society has contributed to society's development and prosperity. Higher standards of living, better health, good education etc. are positive changes. However, industrialisation has also entailed a major strain on the planet and over-exploitation of its finite resources. Put simply, the level of consumption and energy usage is much too high in relation to what the natural environment can endure. People's ways of living, the use of fossil fuels and devastation of forests is a severe drain and is leading to a changed climate. In turn this is jeopardising living conditions on Earth.

Researchers talk about critical ecological boundaries for the planet with regard to climate changes, stratospheric ozone, changes in land use, use of fresh water, biodiversity, acidification of the sea, nitrogen and sulphur emissions into air and water, atmospheric aerosols and chemical pollution. The boundaries for climate changes, biodiversity and the nitrogen cycle have already been exceeded[1].

Nowadays we talk a lot about sustainable development. Development that encompasses ecological, economic and social aspects. The most well known definition of sustainability derives from the so-called Brundtland report from 1987[2]. It establishes that sustainable development is development that provides for today's needs, without jeopardising the prospects for future generations to satisfy theirs.

- **Ecological sustainability** entails using the natural environment and its resources in such a way that there are no negative effects for future generations.
- **Economically sustainable** development creates jobs, access to good-value housing, trade and business opportunities, that are in line with and contribute to ecological and social sustainability.
- **Socially** sustainable development entails a well functioning society with basic provision of food, housing, welfare, education and work, but also factors such as democracy, security and equality, along with preservation of our cultural heritage.

[1] Rockström et al (2010) Planetary Boundaries: Exploring the Safe Operating Space for Humanity. Ecology and Society 14(2): 32.
[2] Report of the World Commission on Environment and Development: Our Common Future 1987.

In this report we have taken the environmental challenges as our starting point. The Earth's population is living beyond its means and use of resources is continuing to increase. Ecological footprint is a measure of the land and sea area that is required to generate the renewable resources that human beings need to be able to deal with/absorb the waste and the residual products that they produce, among which is the carbon dioxide surplus. The ecological footprint is displaying a clear trend. In 2007 the ecological footprint exceeded the Earth's so-called biocapacity by 50%. Overall, the footprint has doubled since 1966. A large proportion of this is due to carbon dioxide emissions, which in turn are largely due to energy usage[3]. However, the contribution to the overall ecological footprint varies greatly between different countries. If everybody lived as people do in Sweden the world would need to be three times its size. However, Sweden is far from being worst. In economic terms it could be said that humanity is no longer living solely on the returns/interest the earth provides, but has also started to consume its capital.

The world's energy supply is still dominated by fossil energy sources. They account for more than 80% (oil 34%, coal 26% and natural gas 21%). The proportion of renewable energy (included hydroelectric power) is 13%. This has been basically unchanged for the last ten years. The fossil dependency is the same within the EU, renewable energy sources account for only 10% of energy supply. The USA's energy usage per capita (90,000 kWh/year) is twice as high as Europe's (43,000 kWh/year). 95% of global transportation uses internal combustion engines powered by fossil fuels. During 2004 energy for transport amounted to 26% of total global energy usage.

In the industrialised part of the world energy used for transportation is continuing to increase by around 1% per year, with passenger transport using 60 – 75% of the total. In the developing countries use of energy for transportation is increasing by some 3 – 5% per year.

The concentration of greenhouse gases in the atmosphere has increased by 38% since industrialisation. Half of the increase has been during the last 30 years. CO2 is the most important greenhouse gas caused by human activity, and annual emissions increased by 80% between 1970 and 2004. In the USA an average of 19 tonnes of carbon dioxide is emitted per person per year, within the EU it is 9 tonnes and in Sweden it is 5.3 tonnes[4]. North America has 5% of the world's population and accounts for approximately 20% of global greenhouse gas emissions. About 30% of the world's population lives in southern Asia, accounting for only 13% of global greenhouse gas emissions.

Emissions of greenhouse gases vary substantially between different countries depending on factors including life style, standard of living, climate, infrastructure, sources of energy and land use. The largest increase in carbon dioxide emissions comes from electricity production and road transport and total global and European energy usage is continuing to increase. Besides the impact on the climate system, there will also continue to be major consequences for the natural world, including diminishing biological diversity. *The Intergovernmental Panel on Climate Change* (IPCC) says that emissions of greenhouse gases must be cut to 1 tonne per person globally by the end of this century to avoid exceeding the so-called two degree target for global temperature increase.

The climate changes will involve major challenges. Higher temperatures, more precipitation and rising sea levels will affect the physical environment through flooding, landslides and increased wear on constructions, but also health problems through new diseases and heat waves. Even if we substantially reduce emissions right now, changes in the climate will continue due to the inertia of the climate system. Humanity must consequently *both* reduce its impact on the climate and adapt to the climate-related changes that are unfortunately nevertheless expected to take place.

[3] WWF, Living Planet Report 2010, page 8
[4] OECD in figures - 2008 edition, www.oecd.org

AMBITIOUS GOALS – BUT ARE THEY SUFFICIENT?

Ambitious social goals are in place for sustainable development. The Kyoto Protocol is an international environment- and climate agreement that was concluded in December 1997 in Kyoto, Japan. The agreement entails reducing annual global emissions of greenhouse gases by 5.0% between 1990 and the period 2008 – 2012. Representatives for the countries that signed the climate convention meet every autumn at special, so-called, Conferences of Parties. The next meeting will be held in Durban in South Africa. However, after 2012 there is still no agreement between the world's countries.

In 2007 the EU decided to reduce the Union's emissions of greenhouse gases by 20%, to increase the proportion of renewable energy to 20% and to make energy usage 20% more efficient by 2020 compared with 1990. As a result of this, Sweden's Parliament has adopted national targets to reduce carbon dioxide emissions by 40% and to increase the proportion of renewable energy to at least 50% of the total energy usage in 2020. A target of 20% more efficient energy usage by 2020 has also been set. The target is articulated as a sector-wide objective to reduce energy-intensity by 20% between 2008 and 2020.

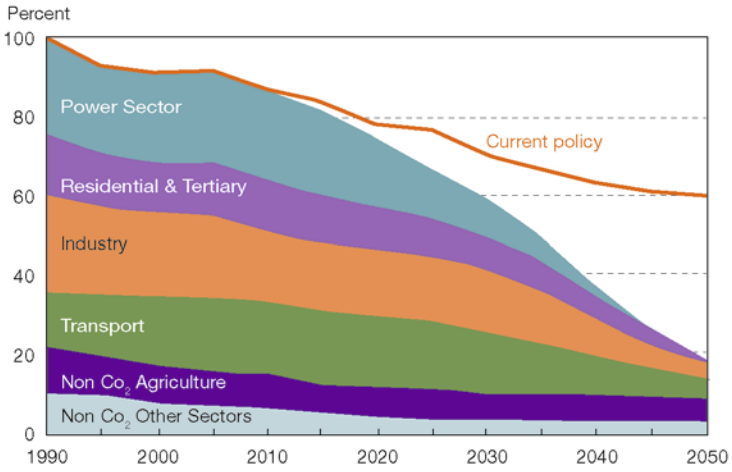
The EU has also proposed that carbon dioxide emissions in the Union must be reduced by 80% by 2050. One important Swedish target is the fifteenth national environmental objective, "Good Built Environment". One of the sub-objectives here is to halve energy usage in buildings by 2050 and by 2020 to reduce energy usage in buildings by 20% compared with 1995.

Besides the major challenges within climate and energy there are also other environmental issues that must be given priority. These issues have been made concrete in Sweden's 16 national environmental quality objectives, and the objectives are linked in various ways to the development of a sustainable society, e.g. non-toxic environment, good built environment, good quality groundwater.

It is important that the environmental quality objectives are met, both for people's health and for the environment. The objectives must be achieved by 2020 (apart from Limited Climate Impact, 2050), however, the situation is looking critical for several of them. To reverse the trend and to achieve the targets, they need to be more integrated in the planning, and measures have to be implemented to a greater extent than is the case today.

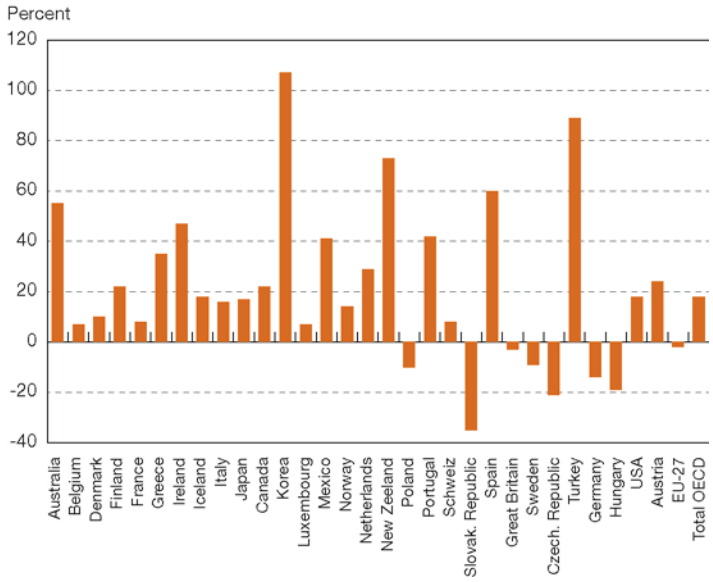
THE GRAPHS – POINTING IN THE WRONG DIRECTION

The ambitious targets must be put into practice more effectively. Energy usage and emissions of greenhouse gases are increasing globally. The EU's Energy Efficiency Plan 2011 shows that it is not possible to achieve the Union's target for reduced carbon dioxide emissions solely with the current control measures. If the 2020 targets are to be met we also have to place more focus right now on the 2050 targets. Otherwise, there is a risk of lock-in effects being created that will make it impossible to fulfil the long-term objectives.



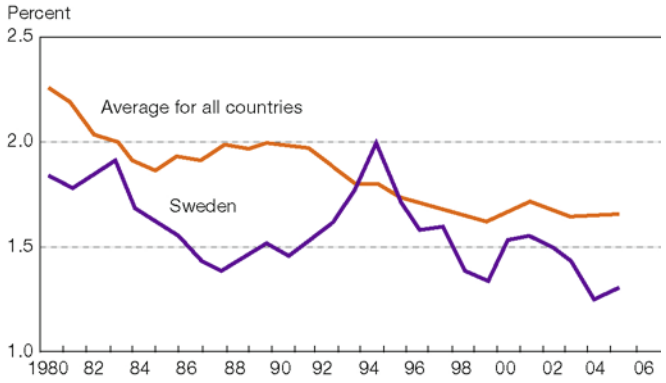
The diagram shows that we cannot achieve the long-term objectives for reduced carbon dioxide emissions with the current control measures and pace.

Unfortunately, a lot of graphs and trends are still pointing in the wrong direction. Despite increased awareness, the world's energy supply is still more than 80% *dependent on fossil fuels*, at the same time as overall energy usage is increasing.



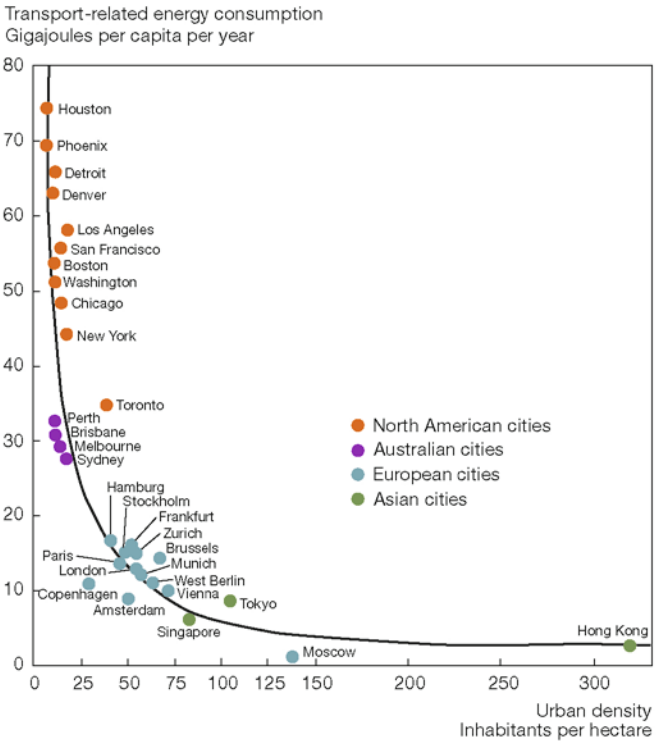
Example 1: The OECD countries emitted some 16% *more greenhouse gases* in 2006 than in 1990, the USA some 17% more. The EU, on the other hand, reduced its emissions by 2% and Sweden by some 8%.

The diagram shows reduction in CO2 emissions in % in the EU and the OECD between 1990 and 2006.



Example 2: *Investments in infrastructure have been declining for a number of years* in Western Europe and in Sweden, in relation to GNP. At the start of the 1980s, 2% of GNP was invested in new infrastructure in Sweden. However, by 2006 the investments had fallen to around 1.4% of GNP. Moreover, Sweden has one of the lowest investments in the EU in terms of maintaining infrastructure, counted as a proportion of GNP.

The diagram shows new investments in relation to GNP.



Example 3: *Cities are growing even faster than their populations.* In the last three decades the population in, for example, Stockholm County, has increased by around 25%, the number of cars by about 65%, road traffic by 80% and travelling on public transport by 35%. Housing has become far more geographically dispersed while workplaces are more concentrated in the city[5]. Since the middle of the 1950s, cities in Europe have expanded geographically by an average of 78% while the population has grown by 33%. American cities have an even larger geographic spread than those in Europe and Asia, and use considerably larger amounts of energy.

The diagram shows urban density in relation to energy usage.

[5] Stockholm County Administrative Board; balance

There is a general connection between energy usage and urban density. Consumption of land and transportation in the cities is growing faster than the population growth, in itself, justify. Furthermore, the North American life style frequently stands as a model for global urbanisation.

INVESTMENTS THAT PROVIDE OPPORTUNITIES

Over half of the world's population lives in cities. Migration into cities is constantly increasing. In Greater Stockholm it is equivalent to 35,000 people a year (while construction of only 7,750 homes started during 2010). Globally, the migration constitutes more than seventy thousand people every day. While cities occupy only 2% of the world's land mass, urban activities produce 80% of all carbon dioxide emissions[6]. The ideals and ideas according to which cities are built are therefore absolutely crucial, and holistic thinking is required to link up the parts. It involves whole cities, i.e. not just buildings, but also the city's infrastructure, transport system etc. But the inhabitants` life styles are also crucial as they contribute to increasing/decreasing emissions of carbon dioxide and the need for non-renewable energy. With new buildings it is easy to take the right approach, but existing buildings and urban structures must also be adapted to achieve the correct solutions in relation to climate change.

The city is the solution! It is in and around cities that it is possible to address climatic and environmental challenges in new ways. An environmentally friendly city has a sustainable energy system based on efficient energy end use in buildings, transportation and infrastructure, district-heating, closed cycles that utilize waste heat, waste, waste water etc. There is a major incentive to create cities with efficient use of resources and where transportation and use of infrastructure is both effective and attractive, where land is used optimally and where the impact on water and the natural environment is limited. The city must also contain green spaces that safeguard biological diversity and ecosystem services. This requires increased investments, careful planning and improved infrastructure. Buildings must be designed to ensure that energy usage is limited through low heat losses, low cooling load, efficient use of heating, cooling and electricity. This requirement is not reflected in the National Board of Housing, Building and Planning's building regulations, and it needs to be made more stringent. A number of municipalities and some private developers are already applying lower levels, on a voluntary basis.

Despite the fact that use of resources is decreasing in relative terms (i.e. per "production unit"), we can observe that the total use of resources is increasing due to increased growth and increase in the population. Many energy and climate solutions are to be found in improved technology, synergies in system solutions, further expansion of the infrastructure, an efficient transport system and properly planned house-building. The built environment (not just the individual buildings) requires sustainable overall solutions – that form synergies in solutions for society, housing, infrastructure and technical systems. This is necessary to facilitate their full potential in terms of efficiency and productivity, saving natural resources and reducing maintenance costs. Cooperation and synergies require more, and more coordinated, solutions, as well as better new construction and energy efficient transport vehicles. By creating synergies between different solutions we can achieve a comprehensive approach.

[6] Climate Change: The Role of Cities, UNEP, UN Habitat, 2009

Areas that should be included in urban planning are:

✓ SOCIAL FUNCTIONS

Fundamental needs such as food, housing, welfare, education and work, but also other factors such as democracy, security, equality and preservation of our cultural heritage. The physical environment can contribute to social functions through, among other things, creating safe and secure meeting places and environments that stimulate contact between people.

✓ URBAN FUNCTIONS

The city as a whole (not just its buildings), as a well-functioning structure with a sense of aesthetic values, land use, function, social and economic environment, energy efficiency, density and variation, adaptation to the location etc.

✓ TRAFFIC AND TRANSPORTATION

Attractive, environmentally friendly and energy efficient public means of communication, a safe traffic environment for pedestrians and cyclists, accessibility for everyone, avoidance of traffic barriers etc.

✓ LANDSCAPE

Attractive areas for play, green spaces and parks, biological diversity, protection of sensitive habitats and species, plantations, trees and water environments in the public sphere, protected residential yards, shaded locations, local management of storm water, the opportunity for public life and meetings, secure and energy efficient lighting.

✓ BUILDING DESIGN

Energy efficient buildings, passive heating and cooling, sound, recyclable material and minimum quantities, maximum use of non-polluting/non-toxic materials and substances, environmentally-conscious building sites, optimisation of construction in relation to local conditions etc.

✓ ENERGY

Efficient energy end use, renewable energy generation, efficient distribution, storage and use, district heating and district cooling, combined production of power, heat and cooling, passive energy systems etc.

✓ WATER AND DRAINAGE

Entails protecting water resources, minimising use of fresh water, reusing grey water; utilizing waste water for production of heat, biogas and nutritive substances; local management of storm water etc.

✓ WASTE MANAGEMENT

Infrastructure for recycling and energy systems; reduction, replacement, recovery, composting, biogas production, incineration for energy production and, as a last resort, landfill.

✓ WORKING METHODS, REGULATIONS AND COOPERATION

- Integrated planning that comprises both physical planning and infrastructure planning, and an environmental programme
- Dialogue with users, purchasers, authorities and the public
- Laws, ordinances and standards
- Life cycle analyses and life cycle costs
- Environment– and profile programme
- Procurement issues

✓ LIFE STYLE

Among other things, involves knowledge, information and communication. It must be easy to act correctly. Technical solutions facilitate changes when individuals take responsibility and make a contribution. For it to be of interest, the individual must be able to ”interpret” and receive clear feedback on value creation.

COOPERATION, SYSTEMS AND SYNERGIES

The idea is not to return to the natural life style of former times. Instead people need to develop the life style and the technical capacity that is available and to thereby become more compatible with the environment and in terms of energy. What is necessary are smart technical solutions and increased investment in infrastructure. A better and more resource-efficient society can be constructed through development and better use of experiences, knowledge and technology that is already available, both for today's society and for the future. Today's decisions set the parameters for future reality and prospects.

Growth can provide conditions for a better environment. Throughout history growth has usually led to an enhanced standard of living. But growth is also a threat to the environment. The risks that accompany climate change are global issues that require a shared, global responsibility. It requires both a reduction in emissions to minimise the changes, and adaptation measures to deal with them. A wide portfolio of technologies will play a major role. This also creates opportunities that bring forward sustainable solutions. Protection of biocapacity and the ecosystem must be given priority in the endeavour to build a stronger, more just and cleaner global economy. A broad spectrum of research is also needed to develop new and existing technologies and solutions. Initiatives in these areas are as important as investments in infrastructure.

To catalyse action and to increase the speed of developments, broad political decisions need to be taken, and responsibility and initiatives need to be taken at national, regional and local level. Nationally, an even stronger agenda is needed, to show the way for reduced energy usage and how new types of solutions are to be realised. The business world must also take part by taking responsibility for actively developing and implementing new concepts and solutions.

Nationally there are also opportunities to influence the EU to go further than the so-called 20/20/20 targets. Such a decision would hasten the transformation to a more sustainable society, at the same time as it would generate opportunities and investments in new technology and solutions, which would in turn benefit Sweden’s competitiveness and growth in the international market.

Internationally, Sweden is already in the forefront in these issues. Experiences and good examples exist within both urban planning and environmental engineering exports. However, further development and better use of environmentally friendly technology that is already available is needed.

New construction and conversion of existing areas are controlled at local level. Local initiatives are therefore needed to strengthen sustainability in new construction, but which also take an overall grasp of the existing structure. Decisions can be taken locally to go one step further in terms of energy requirements, sustainable traffic solutions, waste- and water management and life cycle perspectives, and to consciously create a society where people want to work and live. It is also in the local initiatives that the potential exists for integrated planning through collaborations between administrations, developers, consultants and the business world, which provide opportunities to find the best technical and economic solutions.

There are many good examples. The challenge is to make them obvious, everyday choices. It requires a move from individual pilot projects and demonstration areas to a full-scale focus on sustainable development. It would create preparedness to be able to deal with the challenges of the future, and stimulate us to constantly move the positions forward.

The Swedish Federation of Consulting Engineers and Architects *is the trade and employer organisation for architect's offices and technical consultancy firms within urban planning and industry. This means that a large part of the know-how concerning the development of the sustainable society is to be found within these groups. Valuable synergies are being established between the different technical areas for urban functions, infrastructure, buildings and technical system solutions.*

The Swedish Federation of Consulting Engineers and Architects *is furthermore a member of EFCA (European Federation of Engineering Consultancy Associations) and among other things is part of the Sustainability Task Force. In this context we are establishing new knowledge surrounding sustainability, classification systems etc. for the development of European society.*

The Swedish model, with solid cooperation between the different actors, makes our mode of working unique. Our consultants' expertise enjoys a high reputation both in Sweden, Europe and the rest of the world. Our structured, systematic mode of procedure is beneficial in creating attractive environments where people want to work, live and reside.

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