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A Strategy for Energy-Efficient Buildings



Swedish Environmental Advisory Council
Memorandum 2004:2

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To the Minister of the Environment and the Chairman of the Swedish Environmental Advisory Council

The Environmental Advisory Council advises the Government on environmental matters. The activities of the Council during the Government's present term of office are intended to contribute to the strategic debate on our long-term approach to achieving the Swedish environmental objectives and our international commitments, and also to provide the Government with day-to-day advice on current environmental policy issues. Strategic discussions take place in two clusters, viz:

1. Environmental policy for ecological transition, which deals with how to decouple economic growth from environmental degradation.
2. Environmental policy for sustainable use and management of natural resources.

In 2004 a group comprising members of the Environmental Advisory Council examined issues concerning improved energy efficiency, particularly in buildings, as part of the discussion on ways of decoupling economic growth from environmental degradation. The group comprised Svante Axelsson, Secretary-General; Professor Christian Azar; Professor Åke Bergman; Åsa Domeij, MP; Stefan Edman, writer; Professor Thomas B. Johansson; Anna Jonsson, student; Professor Anna-Lisa Lindén, Johan Trouvé, District Superintendent; Ines Uusmann, Director-General; and Professor Barbara Wohlfarth.

This memorandum sets out proposals for a long-term strategy and ideas for specific ways of implementing that strategy. The main thrust of our work has been to identify long-term strategies and we have not been able to give a detailed description of the various specific measures or their impact in this memorandum. Some of the measures have already been examined before, whereas others may require further analysis before a decision is made.

A reference group of researchers and practitioners in the field has also been involved in this study. The reference group comprised Stefan Camitz, Director; Hans Eek, Architect; John Holmberg, Associate Professor; Professor Björn Karlsson; Hans Nilsson, Consultant; Anders Nylander, Consultant; Agneta Persson, Consultant; Bertil Pettersson, Director-General; Stefan Sandesten, Managing Director; and Maria Wall, Assistant Professor. Egil Öfverholm, Director at the Swedish Energy Agency, has also contributed information and comments.

The memorandum was discussed at a seminar attended by representatives from the Swedish Energy Agency, the Liaison Office for Sustainable Development, the Ministry of Industry, Employment and

Communication and the Ministry of the Environment, as well as members of the reference group.

Kristina Olsson, Secretary and Siv Näslund, Administrative Director, both at the Secretariat of the Environmental Advisory Council, have participated in the preparation of this memorandum.

The Environmental Advisory Council members' group and Jan Bergqvist, Vice-Chairman, have decided to submit this memorandum containing recommendations for the Government regarding improved energy efficiency in buildings to Lena Sommestad, Chairman of the Environmental Advisory Council.

Jan Bergqvist
Vice-Chairman

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This memorandum is accompanied by a discussion document, memorandum 2004:2B (in Swedish only), which can be ordered from the Environmental Advisory Council.

Improving energy efficiency for sustainable welfare – basic tenets and rationale

The Government and Parliament share the aim of achieving an ecologically, economically and socially sustainable society in Sweden. A central principle in this process is to decouple economic growth from environmental impact. One way of doing this is to improve energy efficiency. Energy is a resource that is central to our welfare and a policy for improving energy efficiency is therefore a key factor in achieving sustainable development.

Climate represents a great challenge. It is becoming increasingly obvious to the international community that energy systems will have to be transformed. Some EU member states, such as Germany and the United Kingdom are leading the way. It is becoming increasingly evident in the emerging economies that new energy solutions are needed to satisfy demand and to solve environmental problems. Improved energy efficiency is an important means of achieving this change. If serious climate change is to be avoided, carbon dioxide emissions in the EU must be reduced by 60 – 80 per cent over the next 50 years. Improved energy efficiency is essential to achieve these targets.¹

At the same time, the European energy market is being harmonised. This has meant that electricity prices have to some extent become harmonised as well. In the future the European electricity grids will become even more interconnected, which will result in further price harmonisation. This, combined with rising oil prices, will make it increasingly important to improve energy efficiency from an economic point of view as well.

From a domestic policy viewpoint there are also a number of **sound arguments for taking action to improve energy efficiency:**

- Reduced energy use means fewer environmental effects and fewer health problems.
- Reduced energy costs in the public and private sectors can create increased scope for welfare commitments and investments.

¹ The Dutch presidency of the EU has stated in a draft climate targets document that global emissions need to be reduced by 15 – 20 per cent by 2050, and by 60 – 80 per cent in industrialised nations over the same period, depending on the assumptions made as to the trend in developing countries. *Exploring climate regimes for differentiation of commitments to achieve the EU climate target*, Dutch National Institute of Public Health and the Environment (RIVM). In a post-Kyoto study, the Swedish Environmental Protection Agency has said that industrialised nations need to reduce their emissions by around 85 per cent to hold global warming at 2°C. This is estimated to represent stabilisation at a concentration of 450 ppm CO₂, or 550 ppm greenhouse gases in the atmosphere.

- Systematic improvements in energy efficiency throughout Swedish society can provide growth and employment opportunities in the sectors and companies concerned.
- A larger domestic market for energy efficiency can help to generate export potential.
- Greater energy efficiency can help to secure the energy supply.

The ever-ongoing political debate concerns ways of ensuring that the collective economic resources of the nation will suffice for all the social welfare objectives we wish to achieve, particularly with regard to schooling and the health and care services. The overall aim is naturally to create the right conditions for sustainable economic growth.

An issue specific to the publicly-funded welfare sector is that policy makers have to choose between raising taxes and optimising economic resources by using them more efficiently.

We here wish to argue in favour of more efficient energy use, a particular aim being to achieve ambitious climate and environmental targets, although greater energy efficiency will also cut costs and create opportunities for investment in social welfare and other goals.

Less effect on the environment and human health

The choice of energy type (coal, oil, petrol, diesel, uranium etc) and the quantity of energy used affects the environmental burden in the form of climate impact (CO_2), CH_4 etc), air pollutants (SO_x , NO_x , aerosols, O_3 etc), acidification (SO_x , NO_x), water pollution, eutrophication, oil spills and radioactive waste. Emissions also impact on public health.

Environment and health effects also entail a high cost to society. If we reduce our energy consumption, the resulting damage will diminish, as will the cost to society.

Resource-efficient hub of the welfare system

Energy is used for heating, air conditioning, lighting, operation of electrical appliances, industrial processes etc. All products require energy for their manufacture, operation and transport. The production of services usually requires energy too. Energy consumption is a cost to consumers, trade and industry and the public sector.

By making sound investments we can achieve equally good or better welfare while reducing energy consumption. Investment in energy efficiency can reduce costs for a long time to come. Investments in efficient equipment can be recouped in 3 – 5 years, and the equipment itself may have a much longer technical lifespan (often 5 - 15 years²).

² For example, it is estimated that the technical lifespan is five years for brown goods, small electrical appliances and computers, 10 years for light fittings and white goods and 15

Investments in improving energy efficiency in buildings may take somewhat longer to recoup, but in return often have an even longer lifespan than investments in equipment (often 30 – 60 years)^{3 4}.

This provides scope for reducing expenses, eg, in the public sector economy.⁵ Many local authorities can cut their energy consumption and use the savings to employ more teachers and carers, for example.

Stimulating environmentally-driven growth

Systematic energy improvements throughout Swedish society will bring an increased demand for know-how, material, technologies, installation, services etc, and offer potential for growth and employment in the sectors and companies involved. These services are often purchased locally and may therefore boost local trade.

Export growth potential

A larger domestic market for energy-efficient technology and services offers good potential for export to countries that are also striving to reduce their energy consumption and greenhouse gas emissions. By issuing a number of new directives in this field, the EU has placed the spotlight on improving energy efficiency. Trade in environmental technology (energy conservation, water and soil conservation, better vehicles, fuels and buildings), is one of the fastest growing sectors of the global economy.⁶

The enterprises and countries at the forefront have the opportunity to export and earn money. If nothing is done, Sweden risks losing market share to German and the United Kingdom, for example.

years for water heaters and ventilation systems. Individual components may have a shorter lifespan, however. (*Energianvändning i bebyggelsen, Energiframsyn Sverige i Europa* ("Energy consumption in buildings, Energy foresight Sweden in Europe") pp 8 and 11.)

³ The "climate screen" (ie, the main body of a building) has a technical lifespan of about 30 – 60 years. (*Energianvändning i bebyggelsen, Energiframsyn Sverige i Europa*, p 7.)

⁴ See also *Lönsamma sätt att spara energi, en lathund, flerbostadshus och lokaler* ("Profitable ways of saving energy, a brief guide, apartment buildings and commercial premises"), Sparkraft, 2000.

⁵ It is sometimes argued that full environmental effect by will not be achieved by improving energy efficiency since the cut in costs will provide financial scoop for consuming more of the same or of another resource that may have an environmental impact ("rebound" effect). The usual response to this criticism is that however someone gaining greater budget resources chooses to use the surplus, the freedom to reallocate those resources is nonetheless created. Thus, the environmental effect is dependent on how those budget resources are used.

⁶ In 2002 Swedish environmental technology companies exported goods and services worth almost SEK 15 billion. Export growth in the environmental technology sector was up 8.4 per cent on the previous year. Swedish Trade Council report on Swedish exports of environmental technology in 2002. German exports of energy-efficient products rose by an average of 9.0 per cent in 2002, compared with an average rise of 3.9 per cent for other exports. Franzjosef Schafhausen, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin, Environmental Advisory Council meeting, 6 February 2004.

A secure energy supply

Improved energy efficiency can help to secure the energy supply. At present a great load is placed on the electricity supply system at times of peak consumption. Lower energy use will make it possible to reduce peak load. Lower consumption will also reduce our dependency on imported oil and gas. Greater energy efficiency makes it easier to ensure an adequate supply of energy in times of crisis.

Hence, higher energy efficiency and a commitment to that end will have positive effects on the environment, public health, the finances of individuals, the national economy, welfare and energy supply.

The focus of the discussion below is on energy consumption in the housing and service sectors. This totals around 155 TWh, out of Sweden's total annual energy consumption of some 400 TWh.⁷ Normal year-adjusted electricity consumption accounts for approximately 70 TWh of annual energy consumption in the sector.⁸ Total end-use electricity consumption in Sweden is around 130 TWh.⁹

Can energy consumption really be reduced?

Can we really reduce energy consumption while still producing as good, or better, welfare, measured in terms of housing standards, medical care, care of the elderly and education, for example?

We have already done so. Between 1970 and 2000 total energy consumption in Sweden increased only marginally.¹⁰ This occurred even though the population grew during the period by just over one million people, the heated net floor area increased by approximately 30 per cent¹¹ and sales by Swedish industry increased by some 50 per cent.

⁷ *Energiläget i siffror 2003* ("Energy consumption in figures 2003"), p 5, Swedish Energy Agency. Energy consumption in the sector totalled 156.5 TWh in 2003, representing some 39 per cent of Sweden's total end use of energy. *Energiläget 2004* ("Energy consumption 2004"), Swedish Energy Agency. An additional 122 TWh is used if conversion losses are included as they break down according to the report *Allt eller inget – systemgränser för byggnaders uppvärmning* ("All or Nothing – system limits for heating buildings") Swedish Energy Agency and Ångpanneföreningen AB, 2004.

⁸ *Energiläget 2004*, p 22 Swedish Energy Agency. Normal-year adjusted use of electricity for heating increased from 4.7 to 29 TWh between 1970 and 1990. Since then normal-year adjusted use of electricity for heating has fallen somewhat, totalling 23.2 TWh in 2002. *Ibid.*

⁹ *Energiläget 2004*, p 18 Swedish Energy Agency.

¹⁰ Note that primary energy consumption has risen if the number of Swedish kilowatt hours of electricity is calculated in the same way as in other countries, ie, as if it had been generated at condensing plants.

¹¹ Net floor area increased by around 22 per cent between 1978 and 2002. *Energistatistik för småhus, flerbostadshus och lokaler – sammanställning avseende åren 1978 – 1987* ("Energy statistics on houses, apartment buildings and commercial premises – figures for 1978-1987"), statistical notices, E 16 SM 8901, Statistics Sweden, 1989. Energy statistics on houses, apartment buildings and commercial premises – figures for 1989-1990, statistical notices, E 16 SM 9203, Statistics Sweden, 2001. Energy statistics on houses, apartment buildings and commercial premises – figures for 1999 and 2000, statistical notices, EN 16 SM 0104, Statistics Sweden, 2001. *Tätorter 2000* ("Urban Areas 2000"),

One factor behind this trend was the oil crisis, which had repercussions in the major housing construction projects in the early part of the period in the form of improved heating efficiency, for example.

Technological developments to date, and still ongoing, make it possible. Insulation, heat exchange, new types of window, fine tuning of energy systems etc. enable us to achieve more efficient heating of commercial premises and homes. A number of calculations and examples of best practice show that we can systematically reduce our energy use for heating and our use of electricity over the coming years:

- *Energiframsyn* ("Energy Foresight") has shown that if we systematically choose the most energy-efficient components when refurbishing and modernising buildings, we will be able to halve annual energy consumption in **existing buildings** in around 50 years.¹²
- There are examples of extremely energy-efficient **construction of new buildings**. For instance, there are new houses whose energy purchase requirements are half as great as for an average existing house, and there are terraced (row) houses without any separate heating system at all, known as "passive houses".¹³
- The Business Leaders Initiative on Climate Change (BLICC) suggests that we can use tried and tested technology to reduce energy consumption by 50 per cent, both in **newly-constructed buildings** and in **existing buildings**, and that halving energy consumption in existing housing and commercial premises would yield an annual saving in operating costs of around SEK 40 billion.¹⁴
- Energikontor Sydost and Linköping University conducted a joint project with eleven companies, a power company and Oskarshamn Municipality to examine the potential for improving energy efficiency and a change over to renewable forms of energy. The conclusion was that average **companies**, making a reasonable investment, could improve the efficiency of their energy

statistical notices, MI 38 SM 0101, Statistics Sweden, 2002.) Agneta Persson of Åpanneföreningen AB (a firm of technical consultants) and Ingrid Munkhammar of Statistics Sweden, consider the estimate of a rise of some 30 per cent in net floor area between 1970 and 2000 to be reasonable.

¹² Report: *Energiframsyn i bebyggelsen* ("Energy Foresight in Buildings"), Swedish Environmental Research Institute project *Energiframsyn i Europa* ("Energy Foresight in Europe"), pp 5 and 15.

¹³ Swedish Energy Agency project *2000-talets småhus* ("Houses of the 21st Century"), and terraced houses at Lindås.

¹⁴ Debate article in *Dagens Nyheter* (Swedish daily newspaper) published on 12 January 2004. Investment costs are included and the payback time is short (around 1 – 5 years). (as estimated by Hans Eek of Göteborgs Energi. The electricity price has been set at a notional figure of SEK 0.6/kWh. (as estimated by Jonas Nässén of Chalmers University of Technology).

consumption by 40 per cent.¹⁵ The specific potential for electricity is 48 per cent. DESS (the Commission for Energy Supply in Southern Sweden) has extrapolated the result to all of Sweden¹⁶, finding that the annual potential may then be estimated at 9.6 TWh for electricity and 29 TWh for all energy.¹⁷

- **Systembolaget** (the Swedish Alcohol Retailing Monopoly) reduced its energy consumption for a floor area of 250,000 m² by 70 per cent over 10 years. It achieved this by training operations staff and installing control technology for lighting, fans, pumps, heating etc. The annual net saving may be estimated at around SEK 25 million, ie, SEK 250 million over ten years. Oil consumption was also reduced, and so carbon dioxide emissions also fell sharply.¹⁸
- **Volvo** reduced its electricity consumption at its Hisingen plant by 30 per cent in a short space of time following recommendations made by a group of researchers at Linköping University. The group considers that small and medium-sized Swedish enterprises can reduce their electricity consumption by an average of 30 – 50 per cent using fairly simple means.¹⁹
- **Dalarna County Council** has cut its energy bill by SEK 17 million in 10 years thanks to a long-term energy programme, committed personnel and changes in day-to-day procedures. Falu hospital was the most energy-efficient Swedish hospital in 2000, its consumption being 190 kWh per m² and year.²⁰
- **Nyköping Municipality** is investing around SEK 40 million in computerised control and monitoring systems in 124 properties. One year after the project began 30 properties had been automated and a number of energy-saving measures taken. The target, a 17 per cent energy saving, had been achieved. That figure means that the investment will have paid for itself after just over six years.²¹

Why are these practices not more widespread?

If it is simple and cost-effective in the short and medium term to improve energy efficiency in housing and commercial premises, why is

¹⁵ 70,000 MWh/year.

¹⁶ Not including electricity-intensive industry.

¹⁷ DESS final report, 2003, p 78 et seq.

¹⁸ *EKO energi, Teknikexempel på strategiskt energiärbete* ("Eco-energy – examples of technology to achieve long-term energy saving") Swedish Energy Agency. Additional information supplied by Lars Löfstedt, energy consultant, responsible for the Systembolaget programme.

¹⁹ The potential is for small and medium-sized enterprises not conducting energy-intensive operations. The analysis is based on a comparison between companies in Sweden and elsewhere. Björn Karlsson, Linköping University.

²⁰ *Energivärlden* ("Energy World"), Swedish Energy Agency, 2004.

²¹ *Energivärlden*, Swedish Energy Agency, 2004.

this approach not more common? We consider there to be a number of contributory factors:

- **The energy debate is largely confined to creating new energy sources**, which is supported by, and favours, the energy producers, who are well organised. There has been little examination of the scope for saving money by improving energy efficiency. The companies producing technology and services in this sector are small and poorly organised in comparison with the power companies.
- **The industry consists of small and medium-sized enterprises lacking the resources** to adopt a long-term approach to targeting relevant customer segments.
- **Energy is almost always consumed outside core operations**, and thus never perceived to be the main problem. The cost of energy is only a small portion of total expenses for most actors.²²
- **Fragmentation of operations**, eg, due to outsourcing, makes it difficult to "see the big picture".
- **There are initial investment costs** that a consumer, enterprise, or local authority may find hard to finance, even though the investment will generate cost savings after just a few years.
- **We do not see the bonus effect**; we argue in the traditional way that "we will improve energy efficiency when we can afford it", instead of adopting a life-cycle approach and realising that the opposite applies. This may also be because equipment purchases and operating costs are charged to different parts of a budget.
- **A lack of clear signals from management** at local authorities, housing companies and the State.
- **The building process is fragmented** between a number of stakeholders; short-term cost consciousness at every stage of the process means lower quality.
- There is a **lack of knowledge about traditional energy-saving technology and the potential offered by new technology** in planning, building and maintenance. Users are also uninformed.
- **Current quality control systems based on self-regulation do not work.**

²² Energy costs accounted for 2.5 per cent of industry's total variable costs in 2000. For basic industries (iron, steel, smelting, pulp and paper, the graphics industry, basic chemicals, manufacturing and engineering), whose energy consumption is relatively high, energy accounts for an average of around 6 – 7 per cent of total costs. *Energiindikatorer 2003* ("Energy Indicators 2003"), Swedish Energy Agency, p 44. Energy costs also comprise a fairly small proportion of household expenses (around 3.5 per cent for heating and 1.5 per cent for household electricity). *Energianvändning i bebyggelsen* ("Energy consumption in buildings"), John Holmberg and Jonas Nässén, *Energi i Bebyggelsen* ("Energy in Buildings"), Formas – the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, 2004.

- **There is a "contractual" problem**, where one actor pays for the investment (eg, the landlord), and another reaps the rewards (eg, the tenant), which means that investments are not made.
- **There are no easy-to-sell standard solutions**. It is hard to render products, costs and financial gain tangible for the customer.
- **There has been little financial incentive**. Electricity consumption is higher in Sweden than elsewhere, mainly because electricity prices have been low for decades, eg, around 50 per cent lower than those in Germany.
- **There is little feedback between power companies and users** with regard to consumption and costs.
- **There is no incentive for apartment dwellers** to save, since the cost of heating and hot water is not charged separately.
- **There are behavioural obstacles**, eg, it is sometimes time-consuming and laborious to carry out the measures.

Thanks to information, know-how and technology largely developed in the 1980s and 1990s, we are now in a new and favourable position as regards the potential for more efficient use of energy. We can continue to provide a good standard of welfare using an every-decreasing amount of energy.

A comparative account

During the economic boom of the 1950s and 1960s enormous investments were made in housing, roads, medical care, care of the elderly, education etc. Together with a successful export industry, these investments were a powerful engine of growth, which in turn allowed further improvements in welfare. The role of the State was clear, involving political decisions and investment subsidies designed to promote social sustainability.

The welfare system must now be made more resource-efficient and ecologically sustainable. Investments in energy efficiency can fuel environmentally driven growth and ecological sustainability at the same time. The policy on resource efficiency should be expressed as clearly as during the first phase of welfare policy.

A policy for energy efficiency – proposals for Government action

A strategy and a palette of specific instruments are needed to show that the Government is committed to achieving energy efficiency and that it is a priority area of policy. The Environmental Advisory Council proposes that the Government adopt the following strategy: formulate visions, targets and an action plan, stimulate “the forefront” (develop and disseminate technology), use the public sector as a bridge for market development and support broad implementation. We also propose that the Government consider the ten measures set out below. In some areas of energy policy there are already initiatives, eg, under the near-term energy policy programme and in EC directives. In those respects the Council's proposals represent a complement or suggestions for a shift in focus. Details of ongoing initiatives and further proposals for consideration are given in background material for the Council's discussion (memorandum 2004:2B).

Vision, aims and strategy

1) A strategic platform

Establish an Energy Efficiency and Transition Commission in line with proposals put forward in the evaluation of the long-term energy policy²³ programme. A strategic platform of this kind should include representatives from relevant sectors of society. The key tasks to be performed by the commission include formulation of a vision: "Energy-efficient Sweden 2050", setting of national energy efficiency targets, adoption of a strategy and translation of that strategy into targets and measures broken down by sector. A national target of this kind for the building sector might be 1 per cent per year, or approximately 50 per cent greater energy efficiency by 2050.

The Commission should adopt a systemic approach so as to achieve economies where the measures do most good. It may be that greater emphasis should be given to electric heating and electricity consumption than to general improvements in energy efficiency. It may also be important to examine and combat the trend towards increased energy consumption for cooling. We need measures aimed at existing buildings and construction of new buildings. The measures should also be analysed from a target group viewpoint (see the Environmental Advisory Council discussion document – only available in Swedish) and the Commission should endeavour to ensure continuous accumulation of knowledge about instruments and target groups. It is proposed that this knowledge be further developed by the "council" and the "engine" (see measures 2 and 6) in a dialogue with national energy advisers.

²³ *EFUD en del i omställningen i energy systemet* ("EFUD – part of transforming the energy system"), Swedish Government Report - SOU 2003:80.

Stimulating the forefront

2) A function for developing and disseminating energy-efficient technology

A function, eg, a council, should be established for developing and disseminating new energy-efficient technology. The council should be able to give market launch grants to accelerate the development process. It can also arrange for up-to-date information about technological developments to be communicated to key stakeholders, such as technology purchasers, exporters of environmental technology, banks, and insurance companies, the Swedish Export Credits Guarantee Board (EKN), Svensk Exportkredit AB (SEK), the Swedish Trade Council and the Swedish International Development Cooperation Agency (SIDA). One objective of these efforts is to achieve an upgrade of any technology-driven requirements or guidelines.

A further task may be to inspire researchers and enterprises to become involved internationally (see also measure 4d), and to bring together Swedish stakeholders in various networks such as the World Business Council for Sustainable Development (WBCSD), the International Council for Local Environmental Initiatives (ICLEI), Energie-Cités, the climate campaign, the "climate municipalities" etc.

The council should propose measures and instruments to further the development and dissemination of new technology for consideration by the Energy Efficiency and Transition Commission. The council may be organised within existing public agencies or be coordinated with other initiatives; for instance, the Organisation for the Promotion of Energy Technologies (OPET) at the Swedish Energy Agency is of interest (but will be wound up within a year).

3) Developing technology procurement

The main function of technology procurement is to advance the front for performance in the market, but it also serves to ensure that the market as a whole does not rest on its laurels. Although most stakeholders are in favour of complementing the market in this way, activities appear to have become dormant. Government funding will continue to be needed to organise procurement. Among other things, the Government should urge public sector property owners to join the scheme and take an active part via existing groups for technology procurement. It may be desirable to develop and provide further support for existing groups, such as the Swedish Energy Agency's three purchasing groups for business and commercial premises, apartment

buildings and houses. The council for development and dissemination of energy-efficient technology should be responsible for this work.

4) Research, demonstration, testing grounds and international participation

a) Research

The evaluation of the long-term energy policy programme has revealed that improved efficiency has the potential to become an important niche in the field of energy technology, since this trend goes hand in hand with the interests of the market.

The Government should ensure that there is clear and substantially greater scope for research into improved energy efficiency in buildings.

A research network in the field of energy efficiency in buildings needs to be established in Sweden. This can serve as an arena for research, further development and evaluation of measures taken, as well as a source of know-how and knowledge for the sector. It would be advantageous for this network to link up with networks in other countries, ideally in Northern Europe, which have a similar climate (see also measure 4d).

b) Demonstration

It is important to demonstrate the new technology. We need concrete examples to independently evaluate technology and show that it works. This is essential for market impact. One example that has attracted much attention is that of the "passive houses" at Lindås. The apartment buildings in the Jöns Ols apartment buildings of Lund are another instance of highly energy-efficient performance. Technical and behavioural aspects should both be taken into account in evaluation and development. The Government should stress the need for demonstration objects and evaluation of technical and behavioural aspects in relation to new and existing buildings of all types.

c) Testing grounds

We need to put technology into practice and conduct research in parallel to learn about the potential of technology and the need for support to ensure market impact (eg, complementary infrastructure and instruments). A number of large-scale testing grounds, eg, regions or municipalities, will be needed if we are to fully understand the potential offered by improved energy efficiency. Some projects in the practical and research fields that have a similar, albeit narrower, approach, are the Stockholm Eco-car project, the climate project in Växjö and research on hydrogen, linked to Uppsala Municipality.

The Government should set aside funds under the forthcoming Climate Investment Programme (Klimp) for a limited number of

strategic testing grounds. This funding should include support for investments in technology and behavioural change, evaluation, as well as support for cooperation between the stakeholders involved.

d) Involvement of international research and sectors

There is a growing interest in energy-efficient buildings internationally and in Europe. The energy question is addressed in a number of new EC directives, and energy-efficient buildings may become a priority area under ETAP.²⁴ The report evaluating the long-term energy policy programme²⁵ is in favour of Sweden adopting a role in international energy research. If Sweden wishes to do so, now is the time to act.

Swedish energy researchers are working together under the auspices of the International Energy Agency (IEA), one area of particular focus being "passive houses". Construction industry professionals are also involved in that particular project. There are other initiatives being conducted by international agencies, in which Sweden should take part and air its know-how and expertise for the benefit of Swedish industry, eg, the Climate Technology Initiative and the Renewable Energy Efficiency Partnership (REEP).

The council for development and dissemination of energy-efficient technology (see measure 2) should monitor initiatives of this kind so as to maximise its ability to identify relevant Swedish expertise in the research and business communities. A particular area of focus is to support international dissemination of information about Swedish demonstration subjects and testing grounds (see measure 4c).

²⁴ Environmental Technology Action Plan.

²⁵ *EFUD en del i omställningen i energy systemet* ("EFUD – part of transforming the energy system"), Swedish Government Report - SOU 2003:80.

A bridge between the forefront and broad implementation

5) The State as role model and bridge for broad implementation

a) **Make Government buildings more efficient and make the Parliament buildings and Government offices into "show houses"**

Adopt a more rigorous target for buildings belonging to the State, eg, 1.5 per cent improved energy efficiency per year. Make the Parliament building and Government offices models of energy efficiency and a "sightseeing destination" for energy delegations. Challenge public stakeholders in a competition for municipal, county administrative board and county council buildings.

b) **Public procurement from the uppermost quartile**

The power of the consumer in public procurement is enormous – some SEK 400 billion is spent every year. However, the Government, county councils and municipalities do not seem to be taking full advantage of this potential for changing over to sustainable development. The Government should set an example and act as a bridge between developments at the forefront and broad implementation of new technology.

Set objectives for Government procurement, eg, that when equipment using energy is purchased, only buy products whose environmental performance seen over their entire life-cycle falls within the best quartile of products on the market, and only purchase white goods classed as "A" for energy consumption. Lay down these requirements in directives or budget appropriation documents for the agencies and state-owned companies in question. Have the purchasing board under the Government purchasing coordination system arrange a meeting on this issue for director-generals of the agencies responsible for framework agreements.

The Green Procurement Commission created a tool capable of managing the "uppermost quartile requirement". The tool, which is administered by the Environmental Management Council, has a potential of 1.5 TWh/year. The Environmental Management Council handbook for "green procurement" should serve as a guide for all procurement; some forms of Government funding should not be payable unless these requirements are met. Countries with experience of demanding energy efficiency in their procurement include the US and Japan.

If doubt remains as to the potential for demanding energy performance in procurement procedures, the Government should

assume responsibility for setting precedents and establishing practice, and also for informing public sector purchasers.

c) Develop Vattenfall into a spearhead for energy services

Parliament has decided that Vattenfall, the Swedish state-owned power company, should play a part in the transition to alternative energy sources. One major challenge in this process is to reduce energy use at times of peak consumption. Vattenfall should therefore be at the forefront of the process of adjustment by offering hourly metering. Vattenfall should inform its customers as to how they can use this information to reduce their energy costs, eg, by providing them with more easily understandable bills, key figures showing normal consumption and offering them a display of their energy consumption. Vattenfall should here offer an energy survey and attractive energy services. The Government should set out the above new orientation of Vattenfall's services in a directive, which should also include an energy efficiency target for the company.

Broad implementation

6) An engine for broad implementation

A function is needed to achieve broad implementation of the vision "Energy-efficient Sweden 2050", eg, an "Energy Efficiency Fund". Primary tasks of the fund should include identifying and supporting purchasers of energy-efficient technology and focusing on improving energy efficiency in existing buildings. A fund of this kind will be able to support investments on a broad front with grants and low-interest loans (see also measure 8). Another task of the fund could be to motivate others to contribute third-party financing²⁶ and to make other contributions supporting energy service providers in line with the draft EC directive.²⁷

One important task is to assist the Energy Efficiency and Transition Commission by supplying it with discussion documents and proposals for new instruments and measures.

The fund should be based on existing initiatives and can be organised at existing agencies. Alternatively, it can be organised jointly between the public sector and private enterprise, so that both public and private funding can be channelled for investment (compare with the UK Carbon Saving Trust). The fund should act in close cooperation with the local and regional energy advisers.

7) Truer and clearer prices

Signalling a "truer" price, in which environmental costs have been incorporated, is a necessary fundament of an effective energy policy. Sweden has begun to internalise environmental costs, eg, via the carbon dioxide tax, sulphur tax and nitrogen oxide charge.

a) **Abolish the exemption from electricity tax for non-energy intensive industry**

From an environmental viewpoint, there are unjustified exceptions to the internalisation of environmental costs that has begun. Domestic users have paid gradually rising electricity taxes and carbon dioxide tax on heating oil in exchange for lower taxes on earned income. These rises have probably contributed to the fall in Swedish electricity consumption for two years in succession and a reduction of almost 40 per cent in greenhouse gas emissions from private heating since 1990. It is

²⁶ Known as "performance contracting".

²⁷ Draft Directive of the European Parliament and Council on end-use efficiency and energy services, COM (2003) 739.

unreasonable that industry, which reacts more quickly to electricity price rises than domestic users, is still exempt from electricity tax (aside from the compulsory EU tax of SEK 0.05). The electricity tax paid by non-energy intensive industry should therefore be raised in exchange for lower social security contributions.

b) Incorporate fixed grid charges in the variable electricity price

Better information on electricity consumption helps customers to save. Changes in the pricing methods used by power companies will also increase effect of the price incentive on domestic energy consumption. The grid charge currently represents some 10 – 30 per cent of total electricity bills, which weakens the incentive to reduce electricity consumption. There is no reason why electricity customers should pay the fixed charge direct to the grid operators. The grid charge should be managed by the grid operators and power suppliers in the same way as other fixed costs for power companies. Electricity consumers should pay an entirely variable price, like petrol buyers, and so the electricity companies should be urged to "bake" the fixed cost into the electricity price. Failing this, legislation should be considered. This change would create a clearer price signal and increase the incentives for energy-efficient investments and behaviour. The same is true of the fixed basic electricity consumption charge levied by many electricity companies.

c) Demand-related pricing and consumer information

Compared with many other countries, Sweden uses large quantities of electricity for heating. This causes problems with peak demand on the coldest winter days, which is costly to society. Despite wide variations in electricity consumption, the price is only marginally affected by demand. In the winter time off-peak night rates exist, but the price is not linked to actual demand. Combining demand-related pricing with comprehensible information for consumers about current consumption and price would probably reduce electricity consumption on cold winter days. A demand-related pricing system should therefore be developed.

8) Economic incentives for energy-efficient choices

a) Classification of buildings and differential property tax

A uniform system is needed for environmental declaration of buildings, with the standard being gradually raised. This need has also been identified by the EU Commission EDM Committee.²⁸ Among other things, the committee has discussed energy labelling of buildings. The

²⁸ EDM – Energy Demand Management. The committee assists the Commission in implementing the Directive on the energy performance of buildings (Dir. 2002/91/EC).

Swedish "Building and Living Dialogue" (*Bygga Bo-dialogen*)²⁹ has proposed a system of environmental classification of buildings in combination with economic incentives such as differential taxes, interest rates and insurance premiums.

The "Building Declaration Commission"³⁰ and the "Energy Performance of Buildings Commission"³¹ may provide material on which to base a system of this kind. However, the process should not drag on too long. An initial step could be to swiftly develop a uniform method of comparing the energy performance of new and existing buildings. This will create a spirit of competition between property managers, with public sector property managers taking the lead (see measure 5a). The International Performance Measurement and Verification Protocol is one initiative that may give guidance in this process.

In the next stage, the government should differentiate property tax on the basis of the energy performance of buildings. This will serve as an educational and positive instrument. There should be no particular fiscal problems technically speaking, since it will be a matter of adjusting the taxable value of properties using a given key.

b) Interest-free loans and grants for investments in energy efficiency

Many investments in energy-efficient technology are not made even though they may be financially advantageous. The Government should offer loans at a lower rate of interest and longer repayment period (eg, 10 years) to public institutions, and some form of grant/tax relief for home and private sector energy improvements. The effect of these two forms of support will essentially be the same, but the low-interest loans will be available to activities suffering from a permanent liquidity shortage. If no new funds are available, some of the money allocated to the Climate Investment Programme should be earmarked for this purpose. Another possibility is to give priority to investments of this kind under the existing system of tax relief for home improvements. Encourage local authorities to allow units such as schools and hospitals that save energy to spend the money saved on new services.

These instruments should be administered by the Energy Efficiency Fund (see measure 6).

c) Ecolabelling and differential purchase charge

The Government should actively develop the European labelling system of classifying products (A – G) according to performance. The system should be dynamic and be periodically revised to remain effective. This

²⁹ A voluntary agreement between authorities, companies, local municipalities and the Government from year 2003.

³⁰ Utredningen om byggnadsdeklarationer, byggnadsregister och byggfelsförsäkringar (Dir. 2002:93).

³¹ (Dir. 2003:139).

procedure is used in Italy and the UK, for example. Further use should be made of these systems at national level for other product categories, which occurs and is permitted under EC regulations. The Government should also instigate the establishment of Nordic labelling, eg, of energy-efficient windows.

If energy-efficient products are also cheap, this will engender more rapid introduction of new technology. A differential purchase charge on white goods should be introduced along the lines of the existing differential purchase tax on cars. This will make white goods that consume large quantities of energy more expensive and energy-efficient options cheaper. The charge system should be fiscally neutral and be based on the existing classification system.

d) Develop instruments for improving energy efficiency in industry

One method of improving energy efficiency in industry is to create energy-saving reserves in corporate accounts, whereby profit can be reinvested. Energy-saving reserves can also be used in negotiations, eg, with financiers and insurance companies, to give contours to the company's risk profile.

A further proposal may be to develop existing programmes for improving energy efficiency in industry.³² Standards should be raised and agreements should only cover investments for which the payback time is longer than three years.

9) Tighter planning and building controls

The Housing, Building and Planning Act is currently under review³³; proposals will be presented on 1 July 2005. The National Board of Housing, Building and Planning is revising energy standards in the current building regulations.

a) Improve municipal energy planning

The standards to be met in municipal energy plans must be raised and must include energy efficiency. The Municipal Energy Planning Act should therefore be revised. Energy conservation should also be integrated in all municipal physical planning. This should be made clear in the Housing, Building and Planning Act.

Municipal planning and development processes should include consideration of various heating options from a systemic viewpoint, based on the aim of supporting individual energy-efficient solutions. The Government should examine the scope for ensuring that this occurs. It should here be noted that one argument against compulsory connection to the district heating network in housing development areas is that it

³² Programme for improving energy efficiency etc (Bill 2003704:170).

³³ Översyn av plan- och bygglagstiftningen (Dir. 2002:97).

may restrict competition. There may also be a risk of overcapacity, that district heating is expanded at the expense of improved energy efficiency. The financial incentive for investing in highly energy-efficient buildings (eg, houses without separate heating systems) or in environmentally sound individual energy solutions (eg, geothermal heating) also diminishes if the owner has to pay to be connected up to the district heating network.

b) Tighter building regulations, planning permission, regulatory control and guarantee regulations

Energy statistics from Statistics Sweden reveal a falling trend for energy consumption in new houses and commercial premises. There is a long-term trend whereby newly-constructed apartment buildings are no longer more energy-efficient than an average existing building. Energy-efficiency has not improved since the mid-1980s.³⁴

Building regulations are lax and have not been tightened appreciably since 1977.³⁵ Moreover, there are exceptions that further undermine their capacity to drive technological development; for example, the heat recovery requirement need not be met in buildings using at least 50 per cent renewable energy when heated. Nor do the standards take any account of the geographical location of the building.

The building regulations should primarily set standards for the properties of the building so that it is constructed as energy-efficiently as possible, regardless of the energy supply system used. The building regulations should be drafted in the form of functional requirements governing actual energy consumption per square metre and taking account of the climate zone in which the building is constructed. These standards should be continuously upgraded and made so stringent that they drive the market. Additionally, more rigorous standards should be set when using undesirable forms of energy and heating (see measure 9c).

Planning permission for construction of new buildings should require that the uppermost quartile of products on the market be used for products affecting the energy performance of the building (in line with the principle for public procurement set out under measure 5b) and planning permission should also govern energy consumption per square metre.

Monitoring and control are important and will become more so under a system based on functional requirements. The current system does not work and should be altered. Reintroduce and strengthen the municipal building inspectorate so that compulsory monitoring takes

³⁴ *Energieffektiviteten i bostäder avstannar* ("A slow-down in energy-efficient housing"), J. Holmberg, J. Nässén, *Energi & Miljö* 8, 2003.

³⁵ Building standard SBN 75.

place once a building has been completed and during the guarantee period. This should also be made clear in the Housing, Building and Planning Act.

We should extend the guarantee period for new buildings to ten years as in Germany. A proposal concerning the guarantee period has been developed as part of the "Building and Living Dialogue".

c) Stricter standards for electrically heated buildings

We should not use high-quality energy for low-quality purposes. Hence, it is a disturbing trend that 88 per cent of all newly-built houses install electric heating. Seven per cent of these choose direct electric heating and 93 per cent waterborne electric heating.³⁶ It is unreasonable to constantly commit to electrically heated buildings while at the same time society is using various grants and financial incentives to persuade domestic users to convert from electric heating to other heating options.

The trend for greater use of direct electric heating is particularly alarming, since this means that this form of heating will continue to be used in the future, as conversion to alternative forms of energy involves major building alterations and hence high costs.

Building regulations should impose more stringent energy requirements for buildings installing electric heating. The restrictions on buildings using electric heating should be so great as to only allow construction of "passive houses".

Buildings constructed and fitted with direct electric heating should be subject to the strictest regulations.³⁷ Alternatively, a ban on direct electric heating should be considered. If a ban is imposed, property owners should remain entitled to install electric heating in holiday homes, which should then be subject to higher property tax. "Passive houses" should be exempt from the ban without incurring punitive taxation. It takes very little energy to heat a passive house, which obviates the need for separate heating systems. Instead, the air ducted via the ventilation system is heated when necessary.

10) More knowledge

Those planning, building and maintaining buildings lack know-how and expertise in the field of energy efficiency. We should also mobilise various user target groups in the public sector, industry and households.

The near-term energy policy programme includes a budget of approximately SEK 200 million for energy advisory services. This was

³⁶ *Konsekvenser av ett förbud mot direktverkande el i nya byggnader* ("Consequences of a ban on direct electric heating in new buildings"), National Board of Housing, Building and Planning, 2002.

³⁷ This is possible for houses, but imposing these regulations on apartment buildings and commercial premises will require amendment of the Building Works Ordinance (BVF).

decided in 2002 and started operations in 2003. The "Building and Living Dialogue" includes an initiative for competence development aimed at the industry. The Council proposes the following focus and additions to existing initiatives.

a) Extend the energy advisory service

Advisory services have potential but have hitherto been too passive and lacking in continuity. Allocate a further SEK 100 million to these services, amend the directives governing them to include home visits and specific advice for each property and set specific targets to be achieved. Actors uniting and acting jointly should be given priority. Energy advisers may also be a key resource in the process of introducing energy labelling of buildings.

Create a network for feedback of the know-how and experience gained by energy advisers. It may be an idea to link energy advisers with the engine for broad implementation (see measure 6).

b) Training for key professions

It is important even in the early stages of planning building to be aware of the impact of various solutions. It is not possible to "bolt on" energy efficiency at a later stage. It is therefore essential that key professions in the construction industry possess the relevant knowledge. This knowledge includes aspects of the social and natural sciences as they apply to energy-efficient building. Efforts should be made to establish courses on energy-efficient technologies and methods as part of the training programmes for architects, road and water engineers, developers etc.

Courses should also be held for practising professionals in the sector, including various types of installation technicians and operating staff. Energy advisers and the "Building and Living Dialogue") are devoting some of their time to courses that can be improved, developed and disseminated.

The cost of funding the ten proposals

A lack of statistics on energy consumption and limited knowledge of instruments and target groups make it difficult to assess the potential or cost-effectiveness of these measures. The Environmental Advisory Council therefore recommends that resources be allocated so that these analyses can be carried out.

The measures should be seen in the light of the potential savings and gains, which ought to mean that many investments will be recouped in a few years.

As regards funding, there are many instances of initiatives that can be developed or coordinated with the measures proposed by the Council, eg, the existing Energy Efficiency Programme and the Climate Investment Programme (Klimp). The forthcoming energy policy programme should be organised so that the strategy for improving energy efficiency is realised.

The proposed Energy Efficiency and Transition Council should discuss innovative funding forms, such as an extension of the "green certificate" system, development of "white certificates" or possibly higher taxes on the profits of power companies.

Launch

Spring 2005 – launching the energy efficiency strategy

The strategy should be targeted at the following six building and owner categories:

- State-owned properties
- Private sector office premises
- County Council hospitals
- Municipal pre-schools and schools
- Industrial properties
- Public housing company apartment buildings, and privately owned houses.

The new policy for improved energy efficiency should be presented clearly and coherently. We recommend that three or four meetings be arranged at strategic locations throughout Sweden. Representatives from local and regional authority management, public housing companies, managers of state-owned properties and trade and industry should be invited. The regional energy offices can be used to help with arrangements, since they have the necessary contacts and networks.

The purpose of the launch meetings is so that the Government (in the form of the minister responsible) can present and explain the strategy, its aims, arguments and gains in terms of sustainability, as well as the instruments and funding that will be available to stakeholders. At these launch meetings the Government should present:

- **Existing instruments** and funding, eg, green taxation, the Climate Investment Programme, tax relief on environmental investments in public buildings, tax relief on energy-efficient windows etc.
- **The Government's future aims**, its strategic approach, in which the State stimulates the forefront, bridges the gap between market segments and supports broad implementation.

At the meetings the Government should also consider exemplifying some of the approaches in more concrete terms, for example:

- **Present a national energy efficiency target** of a 50 per cent reduction in energy consumption by 2050.
- **Present a more demanding target for Government activities**, eg, 1.5 per cent improved energy efficiency per year, and that the Parliament buildings and Government offices should become models of energy efficiency.
- **Announce a competition** for local authority buildings.

- **Identify the energy advisory services as regional motors**, statistical and knowledge support in efforts to improve efficiency.
- **Offer "that little bit extra" to stakeholders** – SEK 100 million to improve municipal energy advisory services.

The launch meetings should also provide scope for discussion and inspirational presentations of **best practice** in which local authorities, private enterprise etc show how they are using energy more efficiently, thereby creating a financial dividend, environmental benefits and perhaps also positive effects on growth and employment. Attractive energy services can also be presented.

The period 2005 – 2010

During the remainder of its present term of office and the next one, the Government should give priority to the strategy for improved energy efficiency in its efforts to achieve sustainable development.

In parallel with implementation of the strategy across the country, the Government should systematically improve and supplement the public instruments and funding available for improved energy efficiency in line with the proposed strategy and suggested priority measures set out above. The discussion document for the Environmental Advisory Council discussion (memorandum 2004:2B – available only in Swedish) contains information about energy use and efficiency potential, discussions on obstacles, as well as ideas for further measures and instruments to be considered.

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