



# ICT and energy efficiency in Sweden

Sweden's response to the European Commission's recommendation (C2009 (7604)) on mobilising Information and Communication Technologies (ICT) to facilitate the transition to an energy-efficient, low-carbon economy

*This report aims to give a general picture of developments in Sweden as a response to the European Commission's communications and recommendation from 2009 in the field of ICT and energy efficiency. The report also has an annex which gives more detailed answers to the questions posed to EU Member States in the recommendation.*

*This is part of a longer-term project, and national and international cooperation is expected to continue in the form of annual reports and working groups of different kinds in order to drive forward development towards a sustainable society with the help of ICT.*

*The report has been compiled by the Swedish Ministry of Enterprise, Energy and Communications and the professional association Swedish IT and Telecom Industries in Almega. We would like to express our gratitude to all the organisations and people in both the public and private sector who have contributed in some way or other to the report and to Swedish efforts in this field.*

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## TABLE OF CONTENTS

|  |    |
|--|----|
| 1. INTRODUCTION .....  | 4  |
| National initiatives .....   | 5  |
| 2. GOVERNMENT INITIATIVES .....  | 7  |
| ICT for a greener administration .....   | 7  |
| Broadband – a prerequisite of “green ICT” .....  | 7  |
| More efficient administration.....   | 8  |
| 3. ICT AND TELECOM.....  | 9  |
| Best practice examples .....   | 10 |
| 4. BUILDINGS AND PROPERTY .....  | 11 |
| Challenges.....  | 13 |
| The future and potential .....   | 13 |
| Best practice examples .....   | 14 |
| 5. ENERGY .....  | 15 |
| Smart electricity grids .....  | 16 |
| Smart electricity meters .....   | 17 |
| Challenges.....  | 17 |
| The future and potential .....   | 18 |
| Best practice examples .....   | 18 |
| 6. TRANSPORT AND LOGISTICS .....   | 19 |
| Challenges.....  | 21 |
| Best practice examples .....   | 21 |
| <br>   |    |
| ANNEX 1. Sweden’s response to European Commission<br>recommendation C2009 (7604) ..... | 22 |

## 1. INTRODUCTION

The EU has established a demanding climate target - to cut greenhouse gas emissions by 20 percent by 2020. Sweden's climate target is even more ambitious. We will reduce our emissions from the non-trading sector by 40 percent by 2020.

In spring of 2009, the European Commission presented a second communication on ICT and energy efficiency<sup>1</sup>. The communication presents a set of ambitious measures that focus on what can be achieved in the short term both by the ICT sector and by fully exploiting the enabling capacity of ICTs in all sectors of society and the economy.

The communication states that ICTs have the potential to both improve energy efficiency in all sectors of society and enable us to more effectively measure and evaluate energy efficiency initiatives in society both on the system and on the individual level.

The following initiatives are worth mentioning as regards the first area mentioned:

- Monitoring and direct management of energy consumption.
- Services, such as eCommerce, teleworking and eGovernment, which *replace* other processes in society and thereby reduce impact, known as dematerialisation.
- Emerging solutions in computing that are *in themselves* energy-efficient, such as thin clients, grid computing and virtualisation technologies.

The following initiatives are worth mentioning as regards the second area mentioned:

- Smart meters show individual consumers how much electricity they use, creating incentives for behavioural change.
- Systems that can manage and aggregate complex measures and figures on different levels and in a comparable way to enable efficient monitoring and the adoption of a long-term approach.

1.75 percent of carbon emissions in Europe originate from the use of ICT equipment in the delivery of services. According to the Commission, however, the potential lies in how ICT can contribute to *reducing emissions in all sectors of society* - according to some reports by up to 15 percent by 2020 - and thereby also lead to cost savings. The

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<sup>1</sup> <http://www.anvandgronit.se/website2/1.0.2.0/78/1/> (only in Swedish)

challenge lies in creating harmonised methods and comparable measures on the system level in order to be able to quantify energy consumption and evaluate targets and strategies on different levels in society.

The abovementioned communication was followed in October 2009 by a recommendation<sup>2</sup> containing concrete proposals for measures and targets mainly aimed at the ICT industry and the Member States in general. The aim is to mobilise information and communication technologies to facilitate the transition to an energy-efficient, low-carbon economy.

One of the intentions of the recommendation is to “*address energy saving potential in the energy end-use sectors that are not covered by the Emissions Trading System (ETS)*”. This is because of “*the need for a paradigm shift to change the behavioural patterns of our societies so that we use less energy while maintaining our quality of life*”.

Since the ICT sector plays an important role regarding both its own impact, and the potential of ICT solutions to create quantitative data, a special forum has been established on the European level, *ICT for Energy Efficiency*<sup>3</sup> (ICT4EE). The task of the forum is to adopt and implement measures to measure the sector’s energy and carbon footprints, set targets and benchmark progress.

In the buildings and construction, and transport and logistics domains, a need for comparable methodologies for measuring energy performance and carbon emissions has already been identified, and work to this end has already been initiated. Common methodologies should serve to provide reliable data and a basis upon which ICT tools could be developed.

The recommendation also states that partnerships between sectors could accelerate the development and wide-scale roll-out of ICT-based solutions for monitoring, managing and measuring energy-use and carbon emissions in energy-using activities.

#### National initiatives

A number of initiatives have been implemented on different levels and in different configurations in Sweden since the beginning of the 2000s in order to increase knowledge about the significance and potential for reducing society’s environmental impact.

As early as 2001, the Government appointed a *forum for ICT and the environment*, under the then Minister for the Environment, with a mandate until December 2003. The idea of the forum was to create a

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<sup>2</sup> [http://www.anvandgronit.se/website2/1.0.2.0/78/Recomm\\_7604-sv.pdf](http://www.anvandgronit.se/website2/1.0.2.0/78/Recomm_7604-sv.pdf) (only in Swedish)  
<sup>3</sup> [www.digitaleurope.org/index.php?id=1145](http://www.digitaleurope.org/index.php?id=1145)

natural platform for ICTs and ecologically sustainable development. Work was implemented in a working group consisting of representatives from industry, research, the Swedish Environmental Protection Agency (Swedish EPA), ministries and environmental organisations. One of the group's tasks was to study the potential of ICT use in the development of emerging infrastructures, products and services that are resource-efficient and less environmentally harmful.

The work continued in the form of the Government's *Strategy Group on IT Policy* under the then Minister for Industry. Members of the group and its secretariat staff were recruited from both the private and the public sector.

In April 2010, the *Swedish EPA* finalised its proposal for an action plan "ICT for the environment - a draft action plan" at the behest of the Government.

In July 2010 the *Swedish Government* presented "ICT for a greener administration - ICT agenda for the environment 2010 - 2015"<sup>4</sup> which is mostly based on the Swedish EPA's proposal. The overarching objective of the agenda is: *to use green ICT to reduce the state's environmental footprint.* (For more information, please see under 2. Government initiatives.)

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*The following text will describe on a more general level developments, potential and obstacles to development both in the public sector and in sectors where the potential of ICT for environmental improvements is deemed greatest, i.e. buildings and construction, transport and the ICT sector itself. The description is in no way comprehensive, but can constitute a basis for further work within the field.*

*The examples mentioned in the text are just a small selection of all the interesting and innovative work that is ongoing both in the private and the public sector. No priority or value is attached to the choice of text and example.*

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<sup>4</sup> <http://www.sweden.gov.se/sb/d/574/a/152926>

## 2. GOVERNMENT INITIATIVES

ICT for a greener administration

In July 2010, the Government adopted “ICT for a greener administration – an ICT agenda for the environment 2010-2015”, which is mostly based on the Swedish EPA’s proposal for an action plan from April 2010. The Government’s agenda constitutes an annex to a government decision primarily aimed at the approximately 180 central agencies that are governed by the Regulatory Impact Assessment Ordinance (2009:907), but which also encourages other public and private sector organisations to follow the Government’s recommendations.

The agenda contains objectives and recommendations in three action areas - 1) acquisition, 2) operation and use and 3) travel and meetings - all areas in which government administration is deemed to have considerable potential influence. The objectives for the three action areas are:

- To increase the number of acquisitions with environmental requirements in the ICT area.
- To reduce energy consumption in ICT activities.
- To increase the number of travel-free meetings.

The agenda will be monitored as part of the agencies’ annual reporting requirements under the Regulatory Impact Assessment Ordinance, compiled each year by the Swedish EPA.

In connection with the decision on the agenda, the Government tasked the Swedish EPA to develop indicators in the area of ICT for the environment, to make it easier to monitor the extent to which agencies are implementing the agenda. This task shall be reported by latest 31 May 2011.

Broadband – a prerequisite of “green ICT”

The Swedish Government adopted a broadband strategy in December 2009 with the overarching objective of providing Sweden with world-class broadband. This involves:

- 40 percent of all households and businesses having access to at least 100 Mbit/s broadband by 2015
- 90 percent of all households and businesses having access to at least 100 Mbit/s broadband by 2020

ICT use is extensive in Sweden and in the spring of 2009, 89 percent of the population had access to Internet at home, 83 percent of whom had broadband. A large proportion of businesses, 90 percent, used Internet and had a broadband connection. Small enterprises (1-9 employees) used

Internet to a lesser degree, about 85 percent, of whom 74 percent had broadband.

In the public sector, the use of Internet has increased as part of the initiative to offer better and more efficient services to Swedish citizens. Almost all central agencies now operate online services aimed at citizens and businesses, e.g. the Swedish Tax Agency's and the National Social Insurance Office's eServices for submitting tax returns, applying for sickness benefit, etc. In many Swedish municipalities, citizens can choose their preferred pre-school, compulsory school or upper secondary school, contact the health service and apply for financial assistance or planning permission online.

#### More efficient administration

The development of eGovernment is essential in order to increase public sector dematerialisation, leading to environmental savings. According to the Government's action plan for eGovernment from 2008, work is underway to render information management more efficient, including digitalisation, to make things easier for citizens, businesses and the relevant agencies. Better coordination and information exchange can improve security, quality and accessibility.

Work is also ongoing to develop standardised forms and agreements for ICT-based, organisation-wide development projects. This is to facilitate cooperation on user-oriented and integrated eServices, e.g. on common points of contact for businesses and citizens.

In order to fulfil the objective of developing eGovernment that is as easy as possible for so many as possible, the Government has set up the eGovernment Delegation. Four studies are currently (autumn 2010) ongoing that are prioritised and cofinanced by the delegation.

- *My pages* for private citizens (pre-study) - to make contact with agencies and municipalities easier for citizens and to bring together eServices that require log-in.
- *eArchive and eRecord* (pre-study) - examine what is needed to create a common eArchive and eRecord system for the central agencies. The aim is so that the agencies no longer need to develop their own archive and record solutions but can instead concentrate on their core activities, such as improving customer service. In the longer term, the project will make it easier for private citizens to find what they are looking for in the archive.
- *Business operator eService* (pre-study) - to bring together all basic data on all Swedish business operators in one eService. This will make it easy for private citizens, businesses, agencies and municipalities to find information about business operators. It will also be easier for system developers to build services for private citizens and entrepreneurs based on the business operator



eService. Results of the pre-study shall be delivered in December 2010.

- *eServices catalogue* (pilot) - eServices from agencies and other public-sector actors shall be published in an eServices catalogue. The aim is to make it easier for system developers to build new services for private citizens, businesses and the public sector.

### **3. ICT AND TELECOM**

The ICT and telecom sector in Sweden has been committed to reducing the environmental impact of its products and services for a long time. This has been based on both legislative and market requirements and on the lifecycle impact of the products. The legislation covers everything from requirements on content, design and energy-efficiency to requirements on end-of-use collection and recycling. Market requirements are mainly created by purchasers and procurers in both the private and the public sector.

An early success story from 2006 is how the Nordic ICT and telecom sector developed a tool (the IT Eco Declaration) that became an international standard for how to communicate the environmental contents of products mostly within the framework of public procurement. This was aimed at creating a common way of communicating e.g. data on energy consumption, contents, design, electromagnetic radiation, etc. and how this information can be verified.

Apart from various ways of reducing the direct impact of products on the environment, work is also ongoing to increase knowledge about how different ICT applications can reduce environmental impact in other sectors of society.

The ICT and telecom sector has, for example, helped to generate several reports to the Swedish Government that both highlight the potential of ICT solutions for the environment and put forward concrete proposals for targets and action as regards how the public sector can realistically both save the environment and costs with the help of ICT in its activities. This is a question of both efficiency improvements as regards its own ICT use and a more comprehensive introduction of eServices, replacing travel and meetings and, within the framework of public procurement, setting requirements that drive development towards greener products and services.

As has already been mentioned in the introduction, the Swedish ICT sector is involved in work being done at the European level within the

framework of the ICT4EE Forum, an initiative by Digital Europe <sup>5</sup>, GeSI<sup>6</sup>, TechAmerica<sup>7</sup> and JBCE<sup>8</sup>.

In partnership with the Ministry of Enterprise, Energy and Communications, the Swedish ICT and telecom industry has formed a national informal ICT4EE forum to both follow up the work done by the Commission and to improve Swedish cooperation and knowledge exchange for development on the national level. This forum is made up of representatives of the ICT industry, the energy sector, transport, building and property sector, from both professional associations and from private enterprises and the academic world.

*Swedish IT and Telecom Industries* is a professional association that represents the Swedish ICT and telecom industry. The association works constantly to improve the knowledge of customers in both the private and the public sector about the potential of ICT to reduce environmental impact. Its efforts have included the development of a green ICT index that shows the level of awareness of ICT's potential and the level of desire there is among private and public actors throughout Sweden to act for change. A tool for implementing "green ICT" in the association's own activities has also been developed<sup>9</sup>. A common Nordic database with best practice examples of green ICT in different sectors of society has also been developed with support from the Nordic Council of Ministers<sup>10</sup>.

Best practice examples

#### *TeliaSonera - a more efficient way of working*

Between 2001 and 2009, TeliaSonera has:

- Reduced its business travel by more than 60 percent.
- Reduced the number of plane journeys per employee by 59 percent.
- Increased the number of telemeetings per employee by 157 percent.
- Reduced its office floor space per employee by 50 percent.
- Improved its energy efficiency by 59 percent.
- Used only green electricity since 2007.

An important explanation is that TeliaSonera has changed its working methods and behaviour. There has been a conviction within the company that ICT services can contribute in different ways to better resource efficiency, fewer emissions and sustainable social development.

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<sup>5</sup> <http://www.digitaleurope.org/>

<sup>6</sup> <http://gesi.org/>

<sup>7</sup> <http://www.techamerica.org/>

<sup>8</sup> <http://jbce.org/>

<sup>9</sup> <http://www.anvandgronit.se> (only in Swedish)

<sup>10</sup> <http://www.nordicenergysolutions.org/solutions/green-ict>

### *Stokab - reusing energy*

The City of Stockholm's ICT infrastructure company, Stokab, is building its seventh cross-connect node for broadband connections in an old air-raid shelter located under a school in central Stockholm. Heat will be generated in the node, where about 60 operators will cross-connect their broadband connections. The room will be geothermally cooled while all the heat will be transferred into the school's heating system via a heat exchanger. When the node is fully operational, it will contribute 100 kW to the school's heating system. The system will be operational and provide heat to the school in early winter 2010.

The node under the school will be the "green" broadband route into the new sustainable city district of Stockholm, Norra Djurgårdsstaden, an area that will be built with minimum energy and maximum sustainability. (For further information, please see Section 5 Energy.)

### *Telenor - energy-efficient base stations*

In partnership with the technology company Air-Site, Telenor has implemented a development project to reduce energy consumption in base stations using a method called free cooling. The base station is cooled using the ambient air. Basically, air is taken in and then released again very slowly. This avoids turbulence, minimises dust and therefore requires smaller filters. The project has already shown that it can halve energy consumption and reduce noise levels. The company is now looking at using additional direct control and monitoring to deliver surplus heat to surrounding property owners when the base station is located indoors. The potential is considerable due to the large number of base stations and their high energy costs. This technology could also be put to good use in server rooms.

## **4. BUILDINGS AND PROPERTY**

The construction sector is currently responsible for about 40 percent of society's energy consumption. A lifecycle perspective needs to be taken when constructing buildings. Earlier, the discussion in society has mostly centred on how to heat buildings in the most efficient way. Now it focuses just as much on how to cool them. Here, ICTs can create what are known as "smart buildings". When it comes to such buildings, we must also create smart systems that provide residents with direct and concrete feedback as regards their own energy consumption and how they can influence it. It is equally important to incentivise and bring about a shift in behaviour on the individual level.

There is considerable potential in the building and property sector to reduce environmental impact. According to the European Commission's

communication from 2009,<sup>11</sup> recent studies suggest that ICTs can be exploited to reduce energy consumption of buildings in the EU by up to 17 percent and to reduce carbon emissions.

Apart from implementing purely technical measures, such as good insulation and the right type of windows, ICTs and other control systems can make a considerable difference. These measures can be implemented *both* in new buildings *and* when rebuilding and refurbishing old ones. In general, the housing sector has made good progress as regards energy use in its operations, but there is still a lack of individual solutions and incentives to *use* them.

ICTs are already widely used in property management. A survey by the Swedish Association of Municipal Housing Companies (SABO)<sup>12</sup> has found that there is potential for about 20 percent energy savings in existing systems.

*Regulations* already exist in the construction and property sector governing environmental and energy issues, e.g. construction product ordinances, energy labelling, eco-labelling, rules on an environmentally classified building, requirements from municipalities, requirements from procurement units on different levels (the European Commission's Green Public Procurement (GPP), the Lead Market Initiative, etc.)

Initiatives have been implemented in the construction and property sector to improve *knowledge* about energy issues in a wider sense in the industry. A cooperation project between the Government, central agencies and the construction industry, known as the Building-Living Dialogue (*Bygga-Bo dialogen*),<sup>13</sup> included a well-appreciated in-service training programme aimed at, among others, business operators in the construction industry. The rest of this project was concluded in 2009 but the training programmes have continued in 2010. One of the focus areas of the training is energy issues in connection with new constructions. The Swedish Energy Agency and the National Board of Housing, Building and Planning have been given the task of developing and establishing an information and advice portal to promote energy efficiency in homes and business premises.

*Energy simulations* are also an important part of the work done by the Swedish Energy Agency to stimulate energy efficiency in buildings.

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<sup>11</sup> <http://www.anvandgronit.se/website2/1.0.2.0/78/1/> (only in Swedish)

<sup>12</sup> [http://www.sabo.se/om\\_sabo/english/Sidor/default.aspx](http://www.sabo.se/om_sabo/english/Sidor/default.aspx)

<sup>13</sup> [http://www.byggabodialogen.se/templates/Page\\_\\_\\_\\_3477.aspx](http://www.byggabodialogen.se/templates/Page____3477.aspx)

Housing built 35-40 years ago as part of the *Million Homes Programme*<sup>14</sup> must now be renovated and made energy-efficient. These homes currently make up about 25 percent of Sweden's total housing stock. This will require huge investment and much effort but there is also considerable potential to create improvements and make energy savings. We can call this project the "New Million Homes Programme".

### Challenges

- One problem is that the construction sector has not really embraced the transport issue and its associated problems, i.e. transport linked to buildings and new constructions. The sector is using technology to control and optimise transportation, but there is currently a need for greater knowledge about logistic solutions.
- Major investments, such as implementation of the "New Million Homes Programme", demand considerable financial strength and liquidity among housing companies if they are to be able to afford to invest for the long term. These companies also need to have a high level of competence in energy and ICT issues.
- The construction and property industry doesn't always keep pace with the ICT sector. Substantial and expensive systems have to be devised and developed in order to be stable, but this also requires major investment. A catch-22 situation can sometimes arise before a high level of quality is reached in these systems. Good standards are needed to develop this area.
- Many housing companies currently offer their tenants fibre-optic broadband. In other words, the infrastructure is in place but the services are lagging behind. There is considerable monitoring and control potential for the individual citizen, but suppliers and users are not quite mature enough. Today's most appreciated eService is probably the online laundry booking system.

### The future and potential

"The New Million Homes Programme" means that about two million people will have to be moved, leading to a shortage of both space and manpower. This is expected to cost about SEK 350 billion (EUR 37.3 billion). Smart ICT will most certainly be needed here to manage the programme. Large parts of Europe are facing the same challenge.

With broadband services available to all and incentives to use services, there is considerable potential to develop efficient home health services for the future, particularly as more and more elderly people have to

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<sup>14</sup> The colloquial name for the housing construction programme that took place in Sweden between 1965 and 1975, following a parliamentary decision in 1965. The aim was to solve the acute housing shortage of that time by building a million new homes within a short period and by improving the housing standard.

continue living in their own homes for longer. However, this will require political decisions to be taken.

#### Best practice examples

##### *Svenska Bostäder – reduced energy use*

Svenska Bostäder, one of Stockholm's municipal housing companies and Sweden's largest housing companies<sup>15</sup> has managed to reduce its energy consumption by about 35 percent over the last thirty years. The company's long-term goal is to reduce its energy use by a further 30 percent by 2020. The "*Blå Jungfrun Block*" project is part of this initiative. *Blå Jungfrun* involves the construction of a passive block of 100 apartments, each with smart metering and billing direct to the individual consumer. Another project "*Sustainable Järva*", which is part of the New Million Home Programme aims to reduce energy use by at least 40 percent in every refurbishment project.

##### *Logica - green tenancy agreements*

In the spring of 2010, Logica and Vasakronan signed Sweden's first green tenancy agreement. The green tenancy agreement involves an undertaking by both the landlord and the tenant to implement a number of different concrete measures. These include reducing energy use, ensuring proper waste management, selecting the right materials and having a higher recovery rate when refurbishing property. Tenants also undertake to use exclusively green electricity in their premises.

According to the Swedish Energy Agency, business premises and homes are responsible for 40 percent of energy consumption in Sweden. A large amount of energy goes to heating business premises. These green tenancy agreements provide a financial incentive to both the tenant and the landlord to save energy. This has not been possible previously with traditional heating contracts.

##### *Energy In Mind – more efficient use of hot water*

The *Energy In Mind* project aims to find new innovative ways of reducing energy consumption in homes. Interaction with residents takes place online, by mobile telephone, displays and the TV. Logica and Riksbyggen are working together to develop a concept aimed at reducing hot water consumption in the existing housing stock, a major challenge in the New Million Homes Programme. The solution is based on interaction and the visualisation of hot water, encouraging the residents to adopt more energy-efficient behaviour.

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<sup>15</sup> <http://sv.wikipedia.org/wiki/Allm%C3%A4nnyta> (only in Swedish)

### *Energy simulation in buildings*

The Swedish Energy Agency has taken a number of initiatives aimed at disseminating knowledge and developing energy efficiency methods, using for example energy simulation.

*The Total Project* aims to develop a methodology to maximise the effect of energy efficiency measures in existing business premises while maintaining healthy profitability for the property owner. This methodology includes utilising building simulation programmes to calculate the effect of both individual energy efficiency measures and of entire packages of measures.

*The SVEBY Project* aims to provide guidance to the construction and property sector in calculating, erecting and verifying buildings in order to fulfil the energy performance requirements laid down either by the National Board of Housing, Building and Planning or the building purchaser. The guides that have already been published contain, among other things, concrete and detailed routines for when and how energy simulations should be implemented.

The Swedish Energy Agency also supports *pilot projects* in which *municipalities* place even tougher requirements on new constructions than the minimum requirements laid down in Swedish building regulations. This is done for constructions built on municipality-owned land. Simulation programmes are also used in this context.

## **5. ENERGY**

*The Energy Services Directive* (2006/32/EC) requires the public sector to set a good example regarding energy efficiency and highlights in particular the existing potential in the public procurement of both equipment and services. The provisions of the directive in this area have been incorporated into Swedish law via two ordinances: the *Ordinance (2009:893) on energy efficiency measures for government agencies* and the *Ordinance (2009:1533) on state aid to energy efficiency measures in municipalities and county councils*. To support the work done by the public sector in this area, the Swedish Energy Agency has a special responsibility to provide lists of product specifications for energy-efficient equipment. This work is being done in cooperation with the Swedish Environmental Management Council<sup>16</sup>, which, among other things, has the task of providing guidance on green procurement in general.

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<sup>16</sup> The Swedish Environmental Management Council endeavours to contribute to sustainable development by supporting businesses and public administrations in their environmental work in a strategic and cost-effective way. <http://www.msir.se/en/>

## Smart electricity grids

A task given to the Energy Markets Inspectorate includes analysing how an expansion of smart electricity grids (smart grids)<sup>17</sup> can promote a transition to a sustainable energy system, identifying possible obstacles and putting forward proposals for measures to create the conditions for efficient expansion and better use of smart grids.

Smart grids use digital technology to reduce energy consumption and minimise carbon emissions by integrating an entire power grid - generation, distribution and use - into a single, interactive real-time network. Smart grids create two-way communication and provide end-consumers with better insight and control over their own energy consumption and related costs.

The driving-force of smart grids is the transformation of the energy system into a more sustainable one. More renewable electricity production does however introduce “balance problems” since power generation is both irregular and unpredictable. A larger number of electric cars, for example, may lead to capacity problems in the grid. The electricity system needs to be made more efficient and customers can play an important role in this. With smart grids that register and put a price on electricity per hour, we can achieve more efficient electricity use and with the help of more active electricity customers and automation, we can reduce output peaks by steering electricity consumption to hours when renewable energy is readily available and there is sufficient capacity in the grid. Smart grids reward the active customer with lower energy prices and lower environmental impact.

The Nordic region has a fully deregulated wholesale market that gives price signals all the way down to the hourly level. If these signals could reach the end-consumers, they could participate fully in the dynamic electricity market. As a result of deregulation having progressed so far in Sweden, and investments in meters having already been made, smart-grids are only a small step away.

The Swedish Energy Agency is the responsible agency for *energy research* in Sweden and already cofinances several smart grid programmes. The Swedish electrical power industry is active in the field of smart grids and the Swedish Energy Agency has approved support to two large-scale pilot projects, one in Norra Djurgårdsstaden, which is mainly a cooperation project between two companies, ABB and Fortum, and one on Gotland, which is a cooperation project between ABB and Vattenfall (for more information, please see under Best practice examples).

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<sup>17</sup> <http://www.abb.com/cawp/seabb361/b823cb445895db5fc12575a5003b1edb.aspx> (only in Swedish) or <http://www.abb.com/cawp/db0003db002698/145abc3534b16460c12575b300520d8b.aspx>



In the international arena, Sweden takes part in ISGAN (International Smart Grid Action Network)<sup>18</sup>, which is an initiative to promote the development of smart-grids worldwide and which is linked to the “*Clean Energy Ministerial*”, a high-level process initiated by the United States within the framework of the G20.

#### Smart electricity meters

Between 2004 and 2009, Sweden has introduced automatic meter-reading for all electricity customers. The consumption of major customers (>63A) is registered by the hour and for smaller customers every month. The industry has invested SEK 10-15 billion (EUR 1-1.5 billion) in replacing 5.2 million electricity meters (the majority during a two-year period) and building communication links to virtually every household in the country. The electricity industry has also adapted its systems to the new regulations and the administration of 62 million meter readings is now done in a quality-assured way. This means that the price can be set by the hour for major customers and per month for smaller ones. Furthermore, all customers can now pay for their actual consumption retroactively and follow their consumption statistics on a monthly basis. About 90 percent of the installed meters have been programmed so that they can register consumption by the hour, but this function is not yet used to any noteworthy extent.

Further investment may be necessary to fully enable this development. Internationally speaking, Sweden is very much in the forefront of development as regards the installation of smart meters. Work is ongoing in the EU to establish a definition of what a smart meter actually is. This is in light of the target in the “Third Internal Energy Market Package” stipulating that smart meters shall be rolled out to 80 percent of the population in all Member States by 2020.

#### Challenges

- One problem to solve is a complex system development that affects several stakeholders who normally do not cooperate on such issues in both the private and the public sector.
- Another problem can be that grid companies may need to invest in metering systems as a result of the current regulations governing the electricity market, but the major profits will go to the actors who are exposed to competition. Active regulation is needed here so that the grid companies can keep pace and make the necessary investments.
- Inter-stakeholder cooperation is therefore the key to finding the right system solution. Furthermore, it is a question of creating a customer interface for hourly metering and dynamic pricing and billing. This is all about information management.

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<sup>18</sup> [http://www.smartgrid.gov/news/isgan\\_announce](http://www.smartgrid.gov/news/isgan_announce)

- Investment in communication, ICT, settlement systems, meters, etc., is also needed. Furthermore, the regulatory framework and market are in need of review.

#### The future and potential

There is considerable scope for taking global leadership in order to fully implement smart-grids. R&D arenas like Norra Djurgårdsstaden are needed for this, arenas that can gather together all the relevant actors in electricity, ICT, communication, equipment, rulemaking, etc. Sustainability in the energy system will only be achieved once the *local* system is synchronised with the *larger* system.

#### Best practice examples

##### *Norra Djurgårdsstaden – modern, innovative and environmentally friendly*

In October 2010, the Swedish Energy Agency, in partnership with VINNOVA, has approved financial support for a pre-study aimed at developing a concept for a future pilot area for development and field installation of new technology providing both general and specific knowledge about the optimisation, control, maintenance and regulation of future smart-grids. This pilot area consists of what is known as Norra Djurgårdsstaden which is in the City of Stockholm and is one of Europe's most extensive urban development areas<sup>19</sup>. A total of 10 000 new homes and 30 000 new workplaces are planned and will be combined with modern port operations and other strategic infrastructure. One aim of the project is to find a way of driving forward the transition to a more sustainable energy system. A fully developed smart-grid provides benefits to consumers, society and the business sector alike. Norra Djurgårdsstaden can be the first city district in the world to be constructed with a complete smart-grid.

##### *Energy Check (Energikollen)- climate-smart behaviour*

Smart meters have enabled feedback to be given to the end-user and instructive online solutions that encourage energy efficiency have been launched in several places. "Energy Check" (*Energikollen*) developed by Logica in partnership with Växjö Energi, is a good example of an innovative solution for "eco-visualisation" which, because of its competitive element, has mobilised the inhabitants of Växjö and promotes climate-smart behaviour.<sup>20</sup>

##### *Green IT Homes – environmental footprint in the mobile phone*

The Green IT Homes project gives consumers more control over their electricity bills, enables them to remote-control their heating, lighting and alarms by mobile phone and makes them aware of their ecological

<sup>19</sup> <http://www.stockholm.se/norradjurgardsstaden> (push "Translate")  
<sup>20</sup> <http://www.veab.se/Miljoe/Energikollen.aspx> (only in Swedish)

footprint. Green IT Homes is aimed at house-builders, house-owners and rental property owners.

Consumers who receive instantaneous information about their electricity consumption reduce it by up to 15 percent. For a detached house-owner, this amounts to a saving of about SEK 3 000 (EUR 320) a year. In Sweden there are 2 million detached houses and in Finland there are 1.5 million. The number of apartments in Sweden is 2.5 million and in Finland 1 million. Green IT Homes is a cooperation project between the Swedish consultancy firm Elicit, the Finnish company Posintra, the Interactive Institute and IMCG (International Management Consulting Group). The project is being partly financed by VINNOVA to the tune of SEK 1.3 million (EUR 138 500).<sup>21</sup>

## 6. TRANSPORT AND LOGISTICS

Intelligent transportation system, or ITS, is a generic term for the use of new technologies in the transport system and inter-organisational collaboration. The area covers things like payment systems, logistics systems, traffic control and other signal systems. ITS is currently developing more rapidly than ever before when emerging and advanced technology is essential if different modes of transport are to become more efficient and put less of a strain on the environment. An increasing number of systems are being integrated into ITS, thereby facilitating travel and goods transportation and linking up all means of transport.

By using different ITS solutions, carbon emissions can be reduced by 10-20 percent, accidents and near-accidents by 5-15 percent and congestion by 5-15 percent according to estimations made for road transport in Europe. According to the European Commission's 2009 communication recent studies suggest that ICT can reduce energy consumption in transport logistics by up to 27 percent.

In 2010, the Swedish Transport Administration (formally the Swedish Road Administration) has delivered an overarching *strategy and action plan for ITS in Sweden*. The ambition is to increase the use of ITS solutions in order to utilise its potential to help achieve transport policy goals. The strategy and action plan shall cover both goods and passenger transport.<sup>22</sup>

A cooperation project is ongoing called *ITS Sweden* between 40 or so organisations in the public sector, business sector and academic world to

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<http://www.businessregion.se/mappfornyheter/greenithomessmarthemtillagrepris.5.5e1b8712558b5c88380005937.html> (only in Swedish)

[http://publikationswebbutik.vv.se/upload/5419/89401\\_kortversion\\_trafikslagsovergripande\\_strategi\\_och\\_handlingsplan\\_for\\_anvandning\\_av\\_its%20\(2\).pdf](http://publikationswebbutik.vv.se/upload/5419/89401_kortversion_trafikslagsovergripande_strategi_och_handlingsplan_for_anvandning_av_its%20(2).pdf) (only in Swedish)

develop ICT solutions in the transport sector and create a vision for the transport system in 2030. The cooperation covers safety, efficiency and the least possible environmental impact. This includes efficient innovation systems and a coordination of pilot and demonstration projects. An example is a national forum for the harmonisation of electronic road traffic payment systems. In addition, ITS Sweden shall pursue Swedish interests in international developments.

Sweden is also involved in a number of national and international activities aimed at improving the environmental and energy performance of transport and logistics services and at developing common roadmaps. Some examples are:

- *Movits* for common European digital transport documents and a strategy for establishing them.
- *Easy Way*, for cross-border, seamless services based on ITS for Europe's road-users.
- *Marco Polo*, for maritime initiatives.
- A number of regional cooperation projects with international links (Interreg III ongoing) aimed at building cross-border ICT solutions to enable intermodal transport<sup>23</sup> in cross-border transport corridors (*EastWest TCII*, *Scandria*, etc).

Sweden also participates in cooperation projects aimed at developing complete, comparable and reliable data on energy consumption and carbon emissions such as:

- *International Benefits, Evaluation and Costs* (IBEC) to develop models in the ITS field.
- *European Green Cars Initiative*, a Public Private Partnership (PPP) to support research into ITS (not just for cars).
- *Green Transport Corridors*, which originate from the European Commission's initiative to develop a greener transport policy that simultaneously meets the climate challenge and increases the EU's competitiveness.
- *Gröna Tåget (Green Train)*, an industry-wide vehicle research programme aimed at developing knowledge on future high-speed trains adapted to Swedish/Nordic conditions.
- *TRISS* is the Swedish Transport Administration's system for data collection and monitoring of the road network which also provides accurate traffic information and good support for road-users' route planning. The solution contributes both to quicker and safer transport and to reducing emissions as a result of smoother traffic flow.

All the abovementioned projects generally have a *significant* IT component.

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<sup>23</sup> Intermodality is a concept in transportation technology. It means that transporting goods or passengers can be done using several modes of transport.

## Challenges

- ITS is a new technology in the transport sector, very much in its infancy. The technology exists, but introduction of it is being delayed by a lack of standardised methods and coordination. A mass market needs to be accessed for such standardisation to take place.
- There are no overarching ICT strategies for the transport sector.
- The issue needs a specific focus and the real benefit for the end-consumer must be demonstrated.
- The business sector wants a long-term approach and pledges before daring to invest in global solutions. The problem with standardisation is getting all parties to really commit to the cause.
- It is important that there are business models that work and that involve the entire chain, from start to finish.
- Sweden is doing good work in this area, but is somewhat divided. The ITS action plan (see above) constitutes a solid basis for the work and there are many links to the Commission's recommendation.

## Best practice examples

### *IBM - a congestion charging system*

The Stockholm congestion charging system, which has been in permanent operation since August 2007, covers a 24-square kilometre area of the inner city and is the largest system of its kind in Europe. 18 control stations have been installed at the city's entrance and exit points. Every station is fitted with cameras that take photographs of passing vehicles. The system then identifies the registration number, matches it with the vehicle register and the vehicle owner is charged a fee. Traffic flow remains unaffected as the driver doesn't need to stop or slow down. The solution was developed by the City of Stockholm in cooperation with IBM. It has reduced inner-city traffic by 18 percent, the number of green cars has risen by 9 percent, and travel times have in many cases been cut.

## **ANNEX 1. SWEDEN'S RESPONSE TO EUROPEAN COMMISSION RECOMMENDATION C2009 (7604)**

### *IT IS HEREBY RECOMMENDED*

*In order to ensure full coherence of ICT policies with national, local and regional approaches to making the transition to an energy-efficient, low-carbon economy.*

*(8) Through their competent national authorities, Member States should do the following:*

*(a) by the end of 2010 at the latest, agree on a common minimum functional specification for smart metering that focuses on providing consumers with improved information on, and improved capabilities to manage, their energy consumption.*

*(b) by the end of 2012 at the latest, set up a coherent timeframe for the roll-out of smart metering.*

*The Swedish Energy Agency has been tasked by the Government to investigate, identify possible obstacles and put forward proposals for measures that will create the conditions for expansion and greater use of smart meters and smart-grids. This task shall be done based on the scope for creating the conditions for more active electricity customers, improved incentives for more efficient electricity use and output reduction during output peaks and facilitating the more widespread introduction of renewable electricity production. The task shall be implemented in consultation with the Swedish Energy Agency and the state utility Svenska Kraftnät (electricity grid management) and reported to the Government on 1 December 2010.*

*(9) Member States shall adopt and implement procurement practices that leverage the strength of public sector demand to promote the dematerialisation of ICT goods and services.*

In Sweden there are a number of strategies and initiatives aimed at promoting greater digitalisation and dematerialisation in the public sector, see Point 16.

### *Public procurement*

In accordance with *The Green Public Procurement Action Plan* from 2007 (skr. 2006/07:54), the overarching objective is to increase environmental requirements in public procurement. The national objectives are:

- to increase the number of public procurements containing well-formulated environmental requirements
- to increase the number of state framework agreements containing well-formulated environmental requirements

- to increase the number of central government, municipal and county council authorities that regularly stipulate well-formulated environmental requirements.

The action plan contains four strategic areas with targets and measures to achieve the objectives:

1. Government agencies, governance and competence
2. Engage politicians and other decision-makers at the local and regional level
3. Ensure procurement officer have the necessary competence
4. Offer an efficient, simple tool

The issue of a revised action plan is currently being discussed in the Swedish Government Offices.

*Ordinance (2009:893) on energy efficiency measures for government agencies and Ordinance (2009:1553) on state aid to energy efficiency measures in municipalities and county councils* contain requirements on the public sector to consider energy efficiency when procuring equipment and services.

*(10) Member States should facilitate, at all levels of administration, the use of relevant ICT tools to better understand the implications of different policies and avoid negative spill-over effects from their interaction.*

Assuming this issue relates to ICT systems that can handle large amounts of data, the health service can be taken as an example. An example of a service that is based on a very complex underlying structure is the National Patient Summary which is once again being operationalised.

*(11) Member States should encourage the use of energy simulation and modelling in the education and training of professionals in critical sectors, in particular:*

- (a) architects, builders and installers;*
- (b) energy auditors;*
- (c) logistics and the transport of goods or persons;*
- (d) public services, planning and policy functions.*

According to *the Energy Efficiency Inquiry* (SOU 2008:110), there is a need for education and training in some sectors. It can also be established however that the current education and training structure in Sweden makes it difficult to steer the content of educational programmes in the way stipulated in the recommendation. Swedish universities and university colleges are free to choose the content of their educational programmes and the Government does not micro-manage in this respect.

There are no specific higher education programme initiatives directed at the construction industry although concerted efforts have been made to increase interest in mathematics, science, technology and ICT.

There are initiatives that promote increased knowledge about energy issues in the construction and property sector in a wider sense. As part of a cooperation project between the Government, public authorities and the construction industry, the Building-Living Dialogue (*Bygga Bo-dialogen*), a well-appreciated in-service training programme was implemented aimed at, among others, business operators in the construction industry. The rest of this project was concluded in 2009 but the training programmes have continued in 2010. One of the focus areas of the training is energy issues in connection with new constructions. In order to gather information and advice on energy-efficient homes and business premises, the Swedish Energy Agency and the National Board of Housing, Building and Planning have set up an information and advice online portal.

Energy simulations are also an important part of the work done by the Swedish Energy Agency to stimulate energy efficiency in buildings. The below-mentioned initiatives taken by the Swedish Energy Agency are not strictly education programmes, but they aim to disseminate knowledge and develop energy efficiency methods, using, for example, energy simulation.

*The Total Project* is developing a methodology to maximise the effect of energy efficiency measures in existing business premises while maintaining healthy profitability for the property owner. This methodology includes utilising building simulation programmes to calculate the effect of both individual energy efficiency measures and of entire packages of measures. As part of this project, a special energy simulation methodology has also been developed to increase reliability when simulating energy efficiency measures.

*The SVEBY Project* aims to provide guidance to the construction and property sector in calculating, erecting and verifying buildings in order to fulfil the energy performance requirements laid down either by the National Board of Housing, Building and Planning or the building purchaser. The guides that have already been published contain, among other things, concrete and detailed routines for when and how energy simulations should be implemented. These simulations are implemented in several steps, from the early stages right through to an operationalised building, in order to verify and check whether the building's energy performance will fulfil the requirements set by either the National Board of Housing, Building and Planning or the purchaser. The SVEBY manuals highlight energy simulations as an important tool when it comes to verifying the energy performance of a new building.



The Swedish Energy Agency also supports *pilot projects* in which *municipalities* place tougher requirements on new constructions than the minimum requirements laid down in Swedish building regulations. This is done for constructions built on municipality-owned land. Simulation programmes are also used in this context.

As part of the European *Intelligent Energy Europe 2* project, a special initiative is currently being planned to increase knowledge about energy efficiency and energy efficiency measures among construction workers. As a first step in this initiative, Member States are expected to develop a national education and training strategy. Similar initiatives for other professional categories cannot be ruled out. The Government will decide if and how these initiatives could be applied in Sweden once it is possible to analyse concrete proposals.

*(12) Through their national, regional and local authorities, Member States should pursue, and, where necessary, upgrade strategies for the roll-out of a dependable, high-speed, broadband infrastructure to facilitate monitoring and management of consumption, distribution and production of energy including renewables, and the introduction of community-wide systems such as smart metering, smart-grids and smart-cities.*

#### *The broadband strategy*

The Swedish Government adopted a broadband strategy in December 2009 with the overarching objective of providing Sweden with world-class broadband. This involves:

- 40 percent of all households and businesses having access to at least 100 Mbit/s broadband by 2015
- 90 percent of all households and businesses having access to at least 100 Mbit/s broadband by 2020

ICT use is extensive in Sweden and in the spring of 2009, 89 percent of the population had access to Internet at home, 83 percent of whom had broadband. A large proportion of businesses, 90 percent, used Internet and had a broadband connection. Small enterprises (1-9 employees) used Internet to a lesser degree, about 85 percent, of whom 74 percent had broadband.

In the public sector, the use of Internet has increased as part of the initiative to offer better and more efficient services to Swedish citizens. The vast majority of central agencies now offer online services for citizens and businesses, e.g. the Swedish Tax Agency's and the National Social Insurance Office's eServices for submitting tax returns, applying for sickness benefit, etc. In many Swedish municipalities, citizens can choose their preferred pre-school, compulsory school or upper secondary school, contact the health service, apply for financial assistance or planning permission.

### *Smart grids*

Part of the previously mentioned task given to the Energy Markets Inspectorate is to analyse in what way an expansion of smart grids can promote a transition to a sustainable energy system, to identify possible obstacles and to put forward proposals for measures that create the right conditions for an efficient expansion and improved use of smart-grids.

*(13) In addition to their obligation foreseen in the Art. 3.11 and Annex I.2 of the Directive 2009/72/EC for the internal market in electricity Member States should engage all relevant stakeholders in large-scale pilots and demonstrations of smart metering and smart grids, to build consensus on the requirements for the emergence of future ICT-enabled innovations.*

The Swedish Energy Agency is the responsible agency for energy research in Sweden and already cofinances several smart grid programmes. The Swedish electrical power industry is active in the field of smart grids and the Swedish Energy Agency is currently discussing the issue of support to two large-scale pilot projects, one in Norra Djurgårdsstaden, which is mainly a cooperation project between two companies, ABB and Fortum, and one on Gotland, which is a cooperation project between ABB and Vattenfall.

VINNOVA is financing a pre-study linked to smart grids for Norra Djurgårdsstaden. VINNOVA is also reviewing the financing of a similar pre-study on Gotland. VINNOVA is financing a pre-study on *Smart communication for smart grids*, via Swedish ICT.

The *TransOpt project* is aimed at more efficient and optimised distribution traffic in Sweden's major cities. The project is being run by the City of Stockholm, Logica, Riksbyggen and JM. It will be implemented as a large-scale pilot project in connection with the expansion of Norra Djurgårdsstaden in Stockholm. The pre-study, which analysed transport requirements and the scope for coordination, using for example ICT, has now been completed. The initial phase of the project has received support from VINNOVA.

*(14) Through their national, regional and local authorities, Member States should make use of open platforms to facilitate an integrated approach to urban planning and public service delivery, and to support knowledge-sharing, catalogues of best practices, and the maintenance of easily accessible information repositories.*

### *Open standards*

The eGovernment Delegation's terms of reference (ToR 2009:19) stipulate that public administration eServices should as far as possible be based on open standards and utilise software built on open source codes and solutions that gradually release the administrations from their dependency on individual platforms and solutions.

*The INSPIRE Directive*

Sweden has made good progress in the work required to introduce the Inspire Directive. The information covered by Inspire will be used in a planning context. The agencies responsible for the information and the municipalities shall make the information available and cooperate within Sweden and the EU. The information shall be easily accessible, e.g. at *geodata.se*, which is Sweden's "INSPIRE portal".

Within the framework of the national Geodata Project, *Lantmäteriet* (Sweden's mapping, cadastral and land registration authority) shall develop the geodata portal and models for cooperation between all the responsible agencies and municipalities in Sweden.

*The National Board of Housing, Building and Planning* has a supervisory, coordinating and advisory responsibility in planning issues. The Board is also responsible for driving forward development of Swedish eGovernment in the area of physical and community planning. It is a question of developing society's common information supply in these areas. As part of this, the National Board of Housing, Building and Planning initiated the Planning Portal Project, a project on digital urban planning in partnership with other agencies.

*The Planning Portal* has been developed in cooperation with the previously mentioned Geodata Project. The Planning Portal's search and display service is a customised interface to the national geodata portal. It shall initially focus on overall planning with geodata from central agencies, but could gradually be further developed for use in more detailed planning work, location inquiries, etc. The project also includes *Wind Service* - an eService for establishing new wind turbines. The Wind Service will be improved and further developed by the Swedish Energy Agency.

*(15) Through their national, regional and local authorities, Member States should open up opportunities for creative forms of collaboration and problem-solving at the community level through calls for ideas, competitions, and where possible by providing open access to a wide range of public digital resources and public data.*

Information at Swedish agencies may normally be freely used for both commercial and non-commercial purposes. Any terms and fees are regulated by the Act on further use of public sector documents, through which the PSI Directive has been transposed into Swedish law. *The eGovernment Delegation* has been given the task of supporting the agencies in their work to make information available for further use.

*(16) Through their national, regional and local authorities, Member States shall extend the benefits of substituting offline administrative processes with*

*online applications and services, which realise energy efficiency improvements, to all segments of their communities.*

#### *Action plan for eGovernment*

The development of eGovernment is a prerequisite for increasing the digitalisation and dematerialisation of the public sector. According to the Government's action plan for eGovernment from 2008, work is underway to render information management more efficient, including digitalisation, to make things easier for citizens, businesses and the relevant agencies. Better coordination and information exchange can improve security, quality and accessibility.

Work is also ongoing to develop standardised forms and agreements for ICT-based, organisation-wide development projects. This is to facilitate cooperation on user-oriented and integrated eServices, e.g. on common points of contact for businesses and citizens.

#### *The eGovernment Delegation*

In order to fulfil the objective of developing eGovernment that is as easy as possible for so many as possible, the Government established a delegation for eGovernment in 2009. Four studies are currently ongoing (autumn 2010) that are prioritised and cofinanced by the delegation.

- *My pages for private citizens* (pre-study) - to make contact with agencies and municipalities easier for citizens and to bring together eServices that require log-in.
- *eArchive and eRecord* (pre-study) - examine what is needed to create a common eArchive and eRecord system for the central agencies. The aim is so that the agencies no longer need to develop their own archive and record solutions but can instead concentrate on their core activities, such as improving customer service. In the longer term, the project will make it easier for private citizens to find what they are looking for in the archive.
- *Business operator eService* (pre-study) - bring together all basic data on all Swedish business operators in one eService. This will make it easy for private citizens, businesses, agencies and municipalities to find information about business operators. It will also be easier for system developers to build services for private citizens and entrepreneurs based on the business operator eService. Results of the pre-study shall be delivered in December 2010.
- *eServices catalogue* (pilot) - eServices from agencies and other public-sector actors shall be published in an eServices catalogue. The aim is to make it easier for system developers to build new services for private citizens, businesses and the public sector.

### *eProcurement*

*The Legal, Financial and Administrative Services Agency* has been responsible for a national procurement support system and for improving eProcurement since 1 January 2009. The Agency has just (October 2010) presented an analysis of the market for procurement systems and commercial databases for the procurement procedure. The aim is to analyse how different system supports for procurement relate to each other.

*The Swedish National Financial Management Authority (ESV)* has been tasked by the Government to lead and coordinate the roll-out of electronic orders from government administration framework agreements. The aim is to complete the roll-out by the end of 2013.

### *eInvoicing*

On 14 December 2006, the Government adopted Ordinance (2006:1486) amending the Public Administration Accounting Ordinance (2000:606). Under this amendment, central agencies were to manage their incoming and outgoing invoices electronically as from 1 July 2008. In order to achieve the administrative efficiency improvements desired by the Government, it is important that the roll-out of eInvoicing is as well coordinated as possible.

### *The Energy Services Directive*

The Energy Services Directive (2006/32/EC) requires the public sector to set a good example when it comes to energy efficiency and highlights in particular the existing potential in the public procurement of both equipment and services. The provisions of the directive in this area have been incorporated into Swedish law via two ordinances: Ordinance (2009:893) on energy efficiency measures for government agencies and Ordinance (2009:1533) on state aid to energy efficiency measures in municipalities and county councils. To support the work done by the public sector in this area, the Swedish Energy Agency has a special responsibility to provide lists of product specifications for energy-efficient equipment. This work is being done in cooperation with the Swedish Environmental Management Council, which has been given the task of providing advice on green procurement in general.



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