

# RES-e Regions

## WP 1: Regional Targets & Strategy

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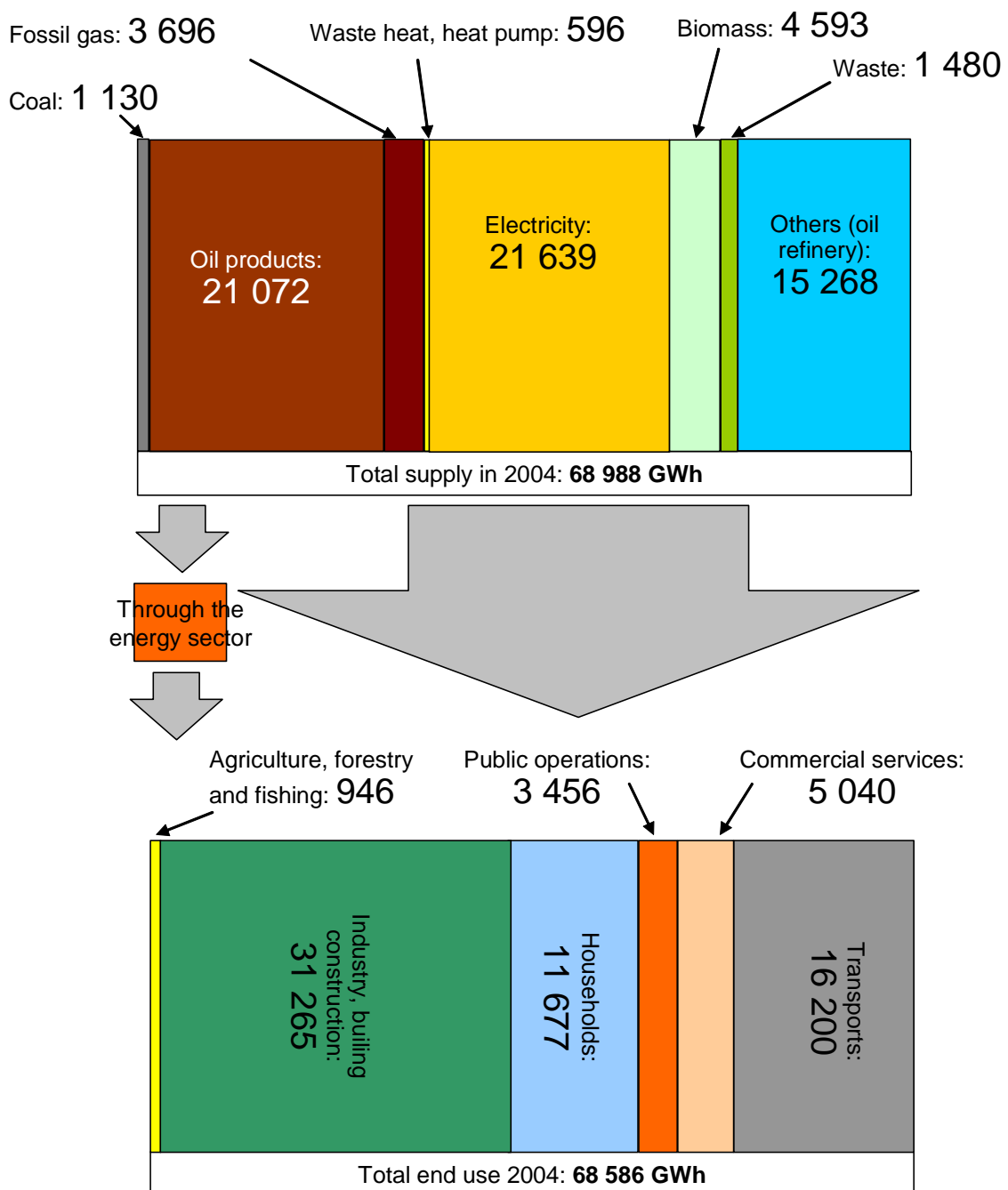
## Present status & potentials

### Present market development (status-quo)

#### *The energy supply and use in Västra Götaland*

The figure below illustrates the energy situation in the region in terms of supply and use of different energy carriers and within different sectors.

### Energy supply and use in Västra Götaland, 2004



The energy situation in the region can be summarised as follows:

1. In general the energy use is decreasing in industry, households and service sector but increasing in the transport sector. This is most evident in the use of fossil fuels. The use of electricity is generally increasing in all sectors.
2. The rate of self-sufficiency in the region, as well as Sweden, is quite low and shows no tendencies to improve. The power balance, i.e. the supply and demand of electric power, is improved by new electricity production from fossil gas CHP, bioenergy CHP and wind power. However, the use of electricity is increasing more rapidly than new electricity production.
3. The base industry is depending on energy as a main resource and with increasing electricity prices their competitiveness can be decreased. However, the increases are quite equal towards other European countries. The purchasing power of the households has only marginal been effected by rising electricity prices due to general income increases and low interest rates as well.
4. The environmental impact from the energy supply and use comes mainly from fossil fuels in terms of CO<sub>2</sub>. The transport sector is increasing and still large parts of the fuel are petrol or diesel. The development of biogas and ethanol is growing rapidly but from a very low share.

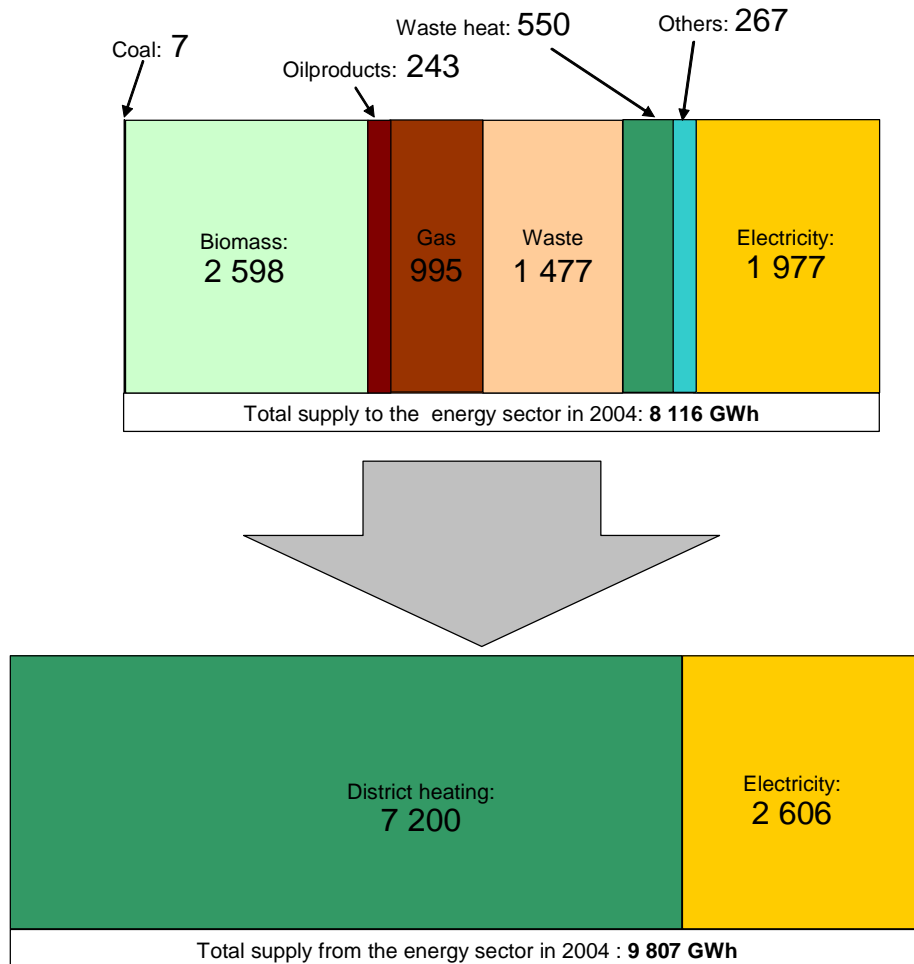
### ***The energy sector***

The regional situation on the development on RES-e production is different for each technology. There are three technologies that have better prospects for increase within the region in a short to medium term perspective. These are wind power, biomass and biogas CHP.

- The wind power development is driven by project developers and financiers and there are quite a lot of planned establishments both off-shore, on the coastline or the plains. However, the development is strongly dependent on the regional and local authorities and the environmental and building permits. Another barrier is the costs for access to the electricity grid. The project developers and involved parties such as consultants etc. are currently tackling all these barriers. The potential is still high although some areas will be protected from wind mills.
- The wood biomass CHP development is strongly depending on the future electricity prices and the extension of the certificate scheme. This development is mainly driven by the local municipality owned utilities and the big utilities. The technology is quite well-known although there is an on-going technology development. The potential in the region is big due the existing district heating systems in many towns. Today several small- or medium sized technologies are under development or demonstration. These new technologies could increase the potential by attracting new actors and applications.
- Recently new market actors, such as farmers, have shown an increased interest of biogas production due to increased electricity prices, cost for fertilizer and demand on ecological growing and food production. The benefits for the farmers are many – increase value of the manure as nutrition, extra income, possibility to be self-supportive of heat and electricity etc. The potential for biogas CHP based on crops and manure is relatively big.

- The sewage plants mostly have biogas production but lots of biogas is flared since there has been no use of it. Increased prices and other benefits have made CHP production more interesting.

### The energy sector in Västra Götaland 2004



### Market actors and stakeholders

The main market actors are companies active in the field of technology manufacturers and suppliers, electricity production, planners and consultants. One of the most important actors are the municipal owned utilities which operates and owns the district heating grids and also in many case the electricity grid as well. They play a key role when implementing RES-e projects both as an energy producer and supplier but also in the grid connection issues for e.g. wind power, small-scale hydro or biogas installations.

Besides businesses, NGO's, active citizens such as farmers and entrepreneurs, networks and other institutions play an important role.

Many of the projects are developed through the municipal utilities, consultants, project developers or research organisations. The projects are in many cases a result of a local cooperation and process in the framework of the municipal energy planning or through cooperation between key actors in different fields.

Most of the important companies in the energy, and especially the RES-e, field are operating on national, European or international level. For example the biomass and waste CHP equipment and turn-key suppliers are big corporations due to the fact of the relatively low amount of projects with high investments. This is also the situation on the wind power field. The equipment suppliers are almost all international companies with regional branch offices and sales through project developers and financiers.

The biogas CHP companies are utilising the equipment and knowledge of both large trans-national suppliers of key technology as well as local equipment suppliers and construction companies in each respectively case.

The small hydro companies are quite few and they operate and sell on national more trans-national basis. Many of them are situated outside the region but have several installations within the region.

The PV companies are in Sweden in general very few. Most of the sales are on the off-grid application as and these are usually sold through mail or internet order businesses. Most of the grid connected installations has been developed by a research organisation in cooperation with a larger utility. This is mostly seen as a demonstration unit and a way of learning more about the technology and the establishment criteria's.

### **Present policies on national & regional levels, factors that may influence market development in the coming years**

The electricity certificate system established in 2003 has replaced most of the public grant and subsidy systems which have led to that the most cost-efficient RES-e technologies benefit the most. Wind power still has a support through the so-called environmental bonus system but this will decrease year by year. There is a two-year programme of a 70% support for PV installations on public buildings. This is mainly to support new demonstration units and the know-how of the man key actors.

The electricity certificate scheme involves suppliers, producers, traders, grid owners and users. Electricity producers receive a certificate for each MWh of renewable electricity that they produce. These certificates are then sold to electricity users, who are obliged to purchase certificates equivalent to a certain proportion of their electricity use. Each year, the proportion of renewable electricity that users are required to purchase will be increased. In this way, producers of renewable electricity will receive additional revenue, over and above the price for the actual electricity.

The average certificate price from 20060221-20070221 has been 190.79 SEK/MWh (about 0.02 €/kWh). So far 1927 producers have been registered for RES-e certificates.

Support for PV installations on public buildings is available until 31 December 2008. The support includes the instalment of PV modules and connection to the grid or other electricity use within the building. The support is 70% of the eligible investment and maximum 5 million SEK per building.

## **Potentials for RES-e in 2010**

### ***Hydropower***

For Västra Götaland the hydro power situation of today is:

- production ~2 000 GWh/year (mainly in Göta Älv)
- There is more than 300 plants in operation
- There are a lot of existing but decommissioned small scale hydro power plants.

The theoretical potential is about 6 TWh/year without any considerations taken to protection of other natural resources and wildlife etc. However, the technical and economical potential for increased production in existing large scale plants and increased utilisation of small scale hydro power is considerably lower, about 0.3 TWh.

There are unexploited resources for hydro power production but based on the protection of nature and the public opinion the actual increased production is estimated to be very limited. The RES-e certificate system will probably have some effect on the investments in existing plants.

A reasonable estimation for Västra Götaland is about 50 GWh additional production until 2010.

### ***Wind power***

For Västra Götaland the wind power situation of today is:

- 128 plants in operation in 2005 with a production of 116 GWh.
- The regional authority's planning objective for land based wind power is 354 GWh/year until 2015.
- Today many plants are planned or under construction in the region. In Tanum 23 larger plants, and in Strömstad 25 is planned. On the plain in the region centre new plants is erected all the time.

The theoretical potential for wind power on land in Västra Götaland is 2-4 TWh/year and about 9 TWh at sea. This corresponds to more than 100 times of the current production.

The reasonable long-term potential is about 2-3 TWh/year depending on the administrative procedures for building and environmental permits as well as the public opinion. Wind power is the renewable energy source that has the most promising potential in terms of realistic development and economics. Until 2010 it is estimated that the annual production will reach 0.7 GWh/year. However, this strongly depends on the development of off-shore wind parks.

### ***Solar energy - photovoltaics***

There is about 340 000 single family houses and 390 000 multi-family houses in the region which could be utilised for solar electricity production. In addition there are a lot of public and commercial buildings. In addition solar energy fields could be placed on ground as well.

However, the main barrier for solar electricity production is the economics. Currently, and in the near future, there is very limited support for PV in Sweden. Only a short-term support programme for PV on public buildings exists. The development is at this stage mostly driven by non-grid solutions for summer houses, boats etc.

Until 2010 a very limited development is estimated if not any additional support schemes will be introduced.

### ***Wave energy***

There is a wave energy pilot project outside Lysekil on the west coast in the region. However, a future development is estimated beyond 2020. The project shall continue for 10 years. When the project is fully developed about 300-400 MWh/year of production is estimated.

### ***Bioenergy CHP***

Biomass is widely used for district heating in Sweden. However, biomass has only been utilised for electricity generation in a small extent and than in larger CHP plants due to the low electricity prices. Many of the biomass district heating plants could be complemented with electricity production when existing boilers or adding new boilers in the system.

An increased production of electricity in industrial plants, CHP and district heating will demand large quantities of bioenergy. According to a regional study about additionally 11.3 TWh of biomass can be used for energy production purposes without interfering with the food production.

The limiting factor for electricity production with bioenergy is the heat load. With today's technology and extension of the district heating grids about 1.8 TWh/year of electricity production could be further utilised. However, this implies large investments in new boilers and turbines etc. The plans of the utilities in terms of CHP until 2010 are shown below. The large increase in 2007 is the new fossil fuelled CHP plant in Gothenburg. The light green is the development of bioenergy based CHP and the dark green on waste fuel CHP

### **Different scenarios taking into account electricity demand development as well as different levels of support mechanisms**

The RES-e certificate scheme has been prolonged until 2030 which gives the market actors the incentives to implement production plants for a long time. The electricity demand will slightly increase and thus set pressure on the supply side.

Considering the fact of increasing electricity prices, long-term RES-e certificates and a need for more capacity in production gives very good incentives for large-scale and cost efficient RES-e technologies. These are mainly wind power hydro and biomass CHP. For these technologies this support mechanism is well balanced and will give a major impact on the market.

The wind power development has, after some years of relatively slow growth, been rapidly increasing. There is a lot of plans of larger (2-3 MW) single wind power plants as well as wind parks on land. However, the development on off-shore applications

will most probably be moderate due to other environmental values along the west coastline of the region (tourism and nature conservation).

The biomass CHP will increase both in the industry applications as well as in district heating systems. As these investments are quite large there is a need for long-term support. Many of the existing boilers will during the next 20 years be renovated or exchanged which gives possibilities to upgrade to high pressure boilers and thus electricity production, New large boilers (>20 MW) has during the last years in most cases already been prepared for future CHP production.

However, the RES-e certificate scheme is not that effective as a steering measure for small-scale and new technologies. Examples are PV and biogas CHP that needs additional support or a technology breakthrough in terms of investment costs. This depends on the relatively moderate production per installation which implies high threshold costs for entering the RES-e certificate scheme.

For example a 20 m<sup>2</sup> grid connected PV plant which produce 2 MWh/year will only receive about 400 SEK/year (44 €) from the certificates. To be feasible other support mechanisms has to be implemented.

## Process towards regional RES-e strategy

### Approach to developing a RES-e strategy in the region

The regional authority has a brief action plan for energy and environment for 2005-2007 which involves renewable energy sources and energy efficiency. However, there are no dedicated actions towards RES-e. However, a lot of initiatives are taken in both their own organisation (hospitals etc) and at municipalities and commercial actors. The development is not lacking behind due to the missing of a dedicated regional strategy but the actions are not fully coordinated in between themselves.

The regional authority has the responsibility of planning and giving environmental permits for larger RES-e plants.

During 2006 the regional administration has initiated a strategy work in the field of energy. This work has so far involved a stakeholder dialogue and a wide study of the potential, barriers and possibilities for the region to become a "low carbon society". The study has been carried out by ECON Analyse AS and KanEnergi Sweden AB on behalf of the Environmental Board of the regional administration. The study includes:

- Fossil energy – problems and use
- the relation between energy and commercial development
- regional policies and measures
- possible future scenarios
- how can a region influence the development
  - objectives
  - regional steering measures, costs etc
- the situation today in terms of energy production and use
- potential for renewable energy and energy efficiency
- What has the region done so far?
- Good examples on more efficient use of energy resources
- Shall Västra Götaland be a forerunner and how to do it?

During the work a range of meetings with different kinds of stakeholders and politicians has been held. The report, finalised in February 2007, from the study will be a base for the development of a regional energy strategy with an action plan.

During 2007 a stakeholder dialogue will be carried out. The action called "climate dialogue" has been prepared by a group of politicians from the regional administration as well as municipalities. They have given a suggestion of an action plan in the report "Smart energy – a dialogue and strategy for a stronger economy and lower climate impact" which was presented in autumn 2006. The Board of the regional administration has adopted the report and action plan.

During the dialogue a suggestion on regional strategy will be formed. The strategy shall incorporate how all together can speed up the phase out of fossil fuels from the regional economy. The suggestion on strategy will than be sent out to relevant actors for comments and during 2008 be adopted by the Regional Council and others.

## **Stakeholder dialogue, meetings and contributions made by different groups**

Several meetings has been held with both politicians on regional as well as local level and relevant other stakeholders and actors.

For example a meeting was held 20 October 2006 where 19 regional experts gathered for a half-day meeting discussing the future potential, barriers, measures needed and the present situation in terms of renewable energy and energy efficiency in the region. The aim of the meeting was to get valuable input from the experts on the development of the regional strategy. Another aim was to identify the main barriers in different fields as well as identifying key areas where measures should be taken.

On 31 October 2006 The working Committee of the Environmental Council of the Regional Administration gathered for a meeting where amongst others, the future potential, barriers, measures needed and the present situation in terms of renewable energy and energy efficiency in the region was discussed. The aim of the meeting was to get valuable input from experts on the development of the regional strategy and to get a political anchoring and decision on the upcoming work.

## **Results of RES-e map and of the analyses in WP2 & 3**

The work carried through the project in terms of mapping of the RES-e development, drivers and barriers, meetings with stakeholders, project advises, training for municipalities and information about RES-e in general and the technologies in specific has speed up the work in the region.

The project has enabled us to take an active role in the strategy work initiated during 2006 in the region in terms of developing RES and energy efficiency. By meetings with a range of municipalities we have been able to highlight the RES-e in terms of energy planning and project development. Earlier a lot of effort has been put on RES-Heat and energy efficiency by the municipalities. Now they also see there role in the development of RES-e more clearly. Especially as many of them also owns the local utility.

The project has also been involved in the development of the biogas CHP at farms. This has been made through a large range of meetings with planners, companies, farmers and other organisations as well as individual project advices. In addition to this work the deliverables of WP4 has focused on biogas technology.

Today there is one plant in operation and another under construction. The project has supported the establishment and the main persons responsible.

The analysis of the administrative procedures and grid issues in WP2 has given us valuable input on the bottlenecks in this process as well as the needs and barriers for an increased development of RES-e installations as well as support for the procedures for building and environmental permits. Many of the identified issues has since then been addressed and hopefully will be diminished within the nearby future. An example is the increased threshold for environmental permit for wind power plants (now 25 MW). The authorities has also put more focus on the RES-e issue by employing more staff and also enhanced spatial planning for wind power at local and regional level.

The analysis of the municipality's role and work in the RES-e development was also very valuable. Today RES-e is more highlighted in their work with planning etc.

## Targets proposed for the region

### Regional targets for each of the different RES-e technologies & an overall RES-e target for 2010

In the table below we have compiled the known or estimated potentials for the different RES-e technologies in use or interesting for the near future. The potential is shown in an interval where the lower figure should be the most reasonable potential with today's framework and the higher figure is the potential that could be realised if the framework is considerably improved.

RES-e technology	Economic/technical/practical potential
Hydro power	300 – 2,000
Wind power	1,900 – 4,500
Solar energy (PV)	40 – 500
Wave energy	1 – 2,000
Bioenergy (for all energy use)	6,000 - 11,300
<b>TOTAL</b>	<b>8,600 – 22,300 GWh</b>

Based on the situation today and the potentials described earlier we suggest regional targets for production (from 2004) of RES-e to be set as described in the table below.

RES-e technology	Today (2004-2005)	Target to 2010	Target to 2025
Hydro power	2,000	2,100	2,200
Wind power	116	700	2,000
Solar energy (PV)	>>1	<5	50
Wave energy	0	<1	10
Bioenergy/waste CHP	~500	700	2,000
<b>TOTAL</b>	<b>~2.600</b>	<b>~3,200</b>	<b>~6,200</b>
<b>Share of electricity use*</b>	<b>13%</b>	<b>16%</b>	<b>31%</b>

\* The remaining use is imported from other regions in Sweden. The origin of the electricity is about 45-50% large scale hydro power and 45-50% nuclear power and some wind power and CHP production from biomass and waste.

To reach these targets it will for example require:

- Hydro power: 180 small scale hydro power plants on each 250 kW.
- Wind power: ca 800 plants on 2 MW each placed on land or about 5 medium sized off shore wind parks.
- PV: 500,000 m<sup>2</sup> PV modules installed.
- Biomass/waste CHP: 30 biomass CHP plants with an installed capacity of 20 MWe each.

1 GWh can seem small but in reality requires quite substantial development and investments.

## Measures & time-table

### The role of the regions and municipalities in Sweden

The issue on sharing the responsibilities between the national, regional and local level has been thoroughly investigated through the years and is still relevant. A simple and final answer to this question is however not clear.

In general all municipalities and regional authorities are autonomous and democratically elected with right to take out taxes have relatively good possibilities to steer the development within their geographical area. The trend in Sweden is that the regions importance in this context is increasing. However, there is a range of limitations:

- Common business and competitiveness rules have to be followed i.e. subsidies that affect the competitiveness in a wrong way.
- Principles on equality are national i.e. a region can not forbid specific fuels etc if allowed on the national level.
- National limitations on the taxes a region or municipality can put on their inhabitants and what they may do in general sense
- Municipalities and regions have to follow specific action norms, i.e. they shall treat all equal and could only have commercial operations without any profit aims.
- Municipalities and regions are obliged to carry out specific duties decided by the government
- For certain specific steering measures it is defined what is within the responsibility of local/regional authorities. Examples are permits and supervision of environmental hazardous operations, certain energy and climate political steering measures, socioeconomic planning, etc
- Many of the most important steering measures in the field of energy and climate change is decided and carried through on national level. Examples are energy and environmental taxes, VAT, R&D-support, investment subsidies...

In principle the regional authorities in Sweden can not implement any own legal steering measures, but the regions can to certain extent decide how the laws and rules are applied in practices.

They also have disposal of a limited range of economical steering measures. It is mainly within the administrative steering measures that the regions and municipalities have the most important roles to support the development of sustainable energy.

It is also important to note that both municipalities and regions are dynamic units that can exercise their influence through information activities, education and training, spatial planning, procurement and by investing in their own operations.

In the table below we show a range of examples of steering measures that could be implemented on regional and/or local level.

## Supporting measures on regional and local level

Examples on measures on the regional level to support the RES-e development

Steering measure	Target groups	Impacts	Challenges	Cost/benefit-ratio
<b>Financial steering measures</b>				
Investment support	Households Companies Associations/NGOs	Depends on the project	To find the "best" projects	Positive - uncertain
Project support	Companies Associations/NGOs	Depends on the project	To find/support the "best" projects	Positive - uncertain
Investments in own operations	Own operations (hospitals, schools etc)	Demonstration units, capacity building		Uncertain
<b>Legal &amp; administrative steering measures</b>				
Public procurement	The business sector / utilities (not only local/regional)	To stimulate the development of technology, to be a good example	More expensive than the cheapest alternative? Follow-up and competence development	Uncertain
Coordination	Key stakeholders – utilities, municipalities NGOs etc	More cost-efficient measures, identification of possibilities, cooperation's etc	To gain the trust and openness between the key stakeholders	Positive
<b>Information steering measures</b>				
Information - general	Households Utilities Companies	Increased awareness	To attract attention from target groups	Positive-
Information – good examples	Households Utilities Companies Organisations			
Information Campaigns	Households Companies	Increased awareness	To attract attention from target groups	Positive-uncertain
Advisory services	Households Business	Increased awareness and knowledge	Requires regional competence and resources	Positive-uncertain
Education	School/university students	Increased knowledge	To identify the future need of labour	Positive-uncertain
<b>Spatial planning and regional development strategies etc</b>				
Regional energy plan	Municipalities Utilities NGO's Inhabitants	Overarching plan for the development of the energy sector within the region	The region cannot control local and individual interests	Positive
Municipal wind energy plans/policies	Project developers, real estate owners, inhabitants	Plan for wind energy establishments guiding building permits	To find reasonable guidelines in terms of distance, sound, view etc	Positive

## **Costs & benefits**

### **Costs of steering measures**

All steering measures cost, either directly for the actor that the measures are targeting or for the authorities/society. Due to that the authorities are financing their own operation through taxes it is indirectly the tax payers (inhabitants and companies) that also pays for these steering measures. The most important difference between the actor-financed and the authority-financed steering measures are that the first only affects the directly involved and the latter affects us all in one way or another.

Thus, from a socio-economic point of view the actor-financed measures are preferable but it is usually easier to get political acceptance for authority-financed measures. Irrespectively financing method it is of great importance to first choose the most cost-efficient measures available.

Financial steering measures are usually the most cost-efficient but in Sweden the freedom of action in this field is limited for regions. The regional authorities can only implement "positive" measures i.e. financial support for the activities they want to support. This is in socio-economic sense the next best solution and not necessary cost-efficient. To put taxes, fees and levies and other restrictions on the activities that are not wanted is usually the best and most cost-efficient.

Administrative steering measures compass a range of measures with varying qualities and costs. The most cost-efficient measures are most probably different types of simple and well defined information activities. The costs strongly depend on which type of media chosen and the extent. In spite of low steering ability and cost-efficiency information measures are in many cases a completely necessary complement to other measures. Through good information and communication the acceptance for other measures can increase.

Networking and advisory services aimed at the business sector requires resources for building good competence at the authorities and to operate the services. It is quite easy to enlarge or reduce the extent of this work and the resources required.

Public procurement that focuses on resource effectiveness can imply that the operation is not choosing the cheapest alternative. This type of cost increases has to be considered in the budgets of the different operations. It should also not imply that the operations get less resources for the primary tasks. Otherwise this could undermine the trust of the purpose of the procurement.

### **Benefits of steering measures and the development supported**

Supporting the sustainable energy development can trigger regional socio-economic effects that lead to job creation in different phases as described below:

- At the planning and project developments; examples are consultants and project developers of wind energy plants, environmental impact assessments etc and the officers responsible at the municipalities and regional authorities
- At the implementation of the actions; examples of this is construction work for the installation of wind energy plants, biomass CHP plants and installation of PV modules on buildings etc.

- At the manufacturing industry; examples are job creation at the industry for producing the towers to the wind energy plants, the heat exchangers, piping systems etc to biomass CHP systems etc.
- At the operation and maintenance of the plants; examples are operation engineers at the CHP plant, services personnel for wind energy plants etc
- At the fuel supply chain; examples are harvesting, transport and handling of the biomass and waste used in the CHP plants

Another benefit of sustainable energy is the local resources used. In this context it strengthens the local economy and creates local jobs.

Lower energy costs on the long-term also create benefits in other sectors of the market. When the households and companies get more money left they will spend this on other purposes which will increase the industry and trade in other sectors.

Another obvious benefit is the decreased emissions of CO<sub>2</sub>. When calculation the CO<sub>2</sub>-impact of RES-e development you have to consider what this new electricity is replacing or competing with on larger geographical area. Today the electricity grid is more or less built over the national borders and electricity is traded on an open market on hourly basis. Therefore additional power input to this system is replacing the electricity with the highest marginal costs for production. In the northern areas of Europe this is coal condensing plants based in Poland, Germany and Denmark. Not the nuclear and large scale hydro power we have in Sweden.

Calculations made for the potential of RES-e in Västra Götaland in terms of CO<sub>2</sub>-emissions shows that the potential impact is higher than the emissions from the region today. This is depending on the fact that almost all electricity used in Sweden is carbon-neutral. However, by increasing electricity production from RES-e other fossil resources is replaced elsewhere

## Conclusions

The most important role of the regional authority is to take the leading role in terms of planning and coordinating actions amongst key stakeholders. In this way they get a better control of the development and can allocate resources and identify possibilities and barriers.

A lot of valuable work and findings has come out from the activities within the RES-e Regions project. All the findings, deliverables etc has been communicated to the regional authorities and administration. The project has had an active role in the first stages of a regional energy plan for Västra Götaland.

This development will carry on until the plan is presented in 2008. The involved parties in this project will have an active role in the development of the plan as stakeholders and through the valuable knowledge acquired through the interviews, analysis and other activities within this project.

The region has very good possibilities for a strong development in the RES-e field both in terms of natural resources as well as capabilities in terms of competence, industrial heritage and structure and financial resources. The regional politicians and other stakeholders have acknowledges this situation and are aware of the needs. They have taken very vital steps on forming a joint municipal and regional plan for sustainable energy.