Analysis of success in meeting the Swedish national indicative targets for renewable electricity 2011

Final report in accordance with Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market.

Table of contents

Table of contents **4**

1 Introduction **5**

1.1 The national target 5

2 Achievement of targets in 2010 ..... **7**

2.1 Percentage of renewable electricity in 2010 was 55.7 % 7

2.2 Renewable electricity production in 2010 was 84.0 TWh 7

2.3 Electricity consumption 8

3 National climate change commitments **10**

Annex 1 Percentage of renewable energy over time **11**

1 Introduction

Article 3(3) of *Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market* stipulates that Member States:

> '…shall publish, for the first time not later than 27 October 2003 and thereafter every two years, a report which includes an analysis of success in meeting the national indicative targets taking account, in particular, of climatic factors likely to affect the achievement of those targets and which indicates to what extent the measures taken are consistent with the national climate change commitment.'

This report is the fifth and final Article 3(3) report and must therefore be published by 27 October 2011. Directive 2001/77/EC ceases to apply on 1 January 2012.

1.1 The national target

The Directive states that Member States must take account of the reference values indicated in the Annex to the Directive when adopting their national target. That Annex gives Sweden's reference value as 60 % by 2010. The base year used for the Directive's reference values was 1997, which was a high-rainfall year with high hydropower production; Sweden's percentage of renewable electricity production that year was 49 % compared to 46 % in an average year. In a footnote to the Annex Sweden indicated that a reasonable target for Sweden in 2010 would be 52 %.

The target adopted by the Swedish Parliament is not the same as the reference value of 60 % indicated for Sweden in the Annex to Directive 2001/77/EC. The main reason for this was quite simply that it was believed that the additional supply of renewable electricity needed to increase by 26 TWh if Sweden was to achieve 60 % by 2010. The Government felt that this was unreasonable given the short time left until 2010.

Nevertheless, Sweden set an absolute target (or production target) in TWh. It did so because the target expressed as a percentage of electricity consumption is dependent on weather conditions. Electricity production from hydropower is heavily affected by precipitation whereas electricity consumption is affected, among other things, by temperature because Sweden uses a high proportion of electric heating. The target is also easier to communicate, measure and assess. At the same time, the Swedish Government is trying to stimulate more efficient use of electricity and this will have a positive effect on the percentage target.

The main tool for achieving the target is the introduction of the electricity certificate system, which started on 1 May 2003. A quota determines the proportion of their total electricity consumption that electricity users who are subject to the quota must purchase as certified electricity. These quotas may be adjusted at scheduled 'check points' so that the target is achieved.

Sweden's original national indicative target was to increase the amount of electricity produced from renewable sources by 10 TWh by 2010, compared to 2002 levels. The Government felt that the target was properly thought through in view of the different interests and the introduction and lead times for investments in power. When the 10 TWh target was announced in 2002 the Government concluded that such an increase would mean that the percentage of electricity produced from renewable sources would be some 51% by 2010, based on electricity consumption forecasts at the time and the assumption that the hydropower inflow would be equivalent to that of a normal year.

In 2007 Sweden adopted a more ambitious target of an additional 17 TWh of new renewable electricity between 2002 and 2016. Since then, the system has been refined and the ambitious targets were increased further in 2010 as the system was extended to the end of 2035.

The current target under the electricity certificate system is to increase electricity production from renewable energy sources by 25 TWh by 2020, compared to 2002 levels.

Certain changes are in the pipeline for the electricity certificate market. From 1 January 2012 a new Electricity Certificates Act [Lag om elcertifikat] is expected to enter into force, which will be better structured and easier to understand. At the same time, Norway is expected to join the electricity certificate market, providing better opportunities for trade between players in both Sweden and Norway.

2 Achievement of targets in 2010

2.1 Percentage of renewable electricity in 2010 was 55.7 %

Preliminary statistics show that in relation to total electricity consumption, the percentage of electricity from renewable energy sources in Sweden is 55.7 %

Sweden has therefore not achieved the indicative target of 60 % specified in the Directive. Sweden has already indicated, however, that a target of 60 % is too high. The calculations were based on the year 1997, which was a high-rainfall year with high hydropower production. In a footnote to the Annex Sweden indicated that a reasonable target for Sweden in 2010 would be 52 %, which Sweden has exceeded.

2.2 Renewable electricity production in 2010 was 84.0 TWh

Electricity is produced from renewable sources under the electricity certificate system and using existing hydropower which is not supported by the scheme. In addition, some electricity is produced from waste (only renewable waste is included) and from the sun.

Table 1 Electricity from renewable energy sources in 2010, TWh

	Production
Hydropower (average)	67.8
Biofuel	11.2
Wind power	3.5
Renewable waste	1.5
Solar	0.009
Total	**84.0**

Statistics and percentages for previous years can be found in the Annex.

2.2.1 Hydropower production

Hydropower production in Sweden varies within a wide range depending on precipitation. The lowest production since the beginning of the 1980s was in 1996, at 52 TWh; the highest production to date was in 2001, at 79 TWh. The production used in the analysis has an effect on the target expressed as a percentage; the production chosen does not affect the absolute national target.

Because of the great variation in hydropower it is necessary to define an *average production*. Otherwise, assessment of Sweden's national target would depend entirely on how much rainfall there was in 2010.

In earlier analyses Sweden calculated the normal-year production as a statistical mean over a longish period, from 1950 onward. Calculating this mean was complicated by the fact that hydropower was

expanding throughout the period. Older statistics were therefore corrected for the lower degree of expansion that was the case at that time. Also, older statistics are not as reliable as or directly comparable with current statistics, and the Energy Agency does not have access to all the data that formed the basis for that method so during recent years it has avoided using it.

In this analysis and its most recent forecasts the Energy Agency decided that average production of Swedish hydropower should be calculated as a mean of the production from 1985 to the most recent year for which statistics are available, in this case 2010; the figures are therefore 67.0 TWh net and 67.8 TWh gross. Actual production for 2010 was 67.7 TWh.

2.2.2 Production under the electricity certificate system

Electricity production that was eligible for electricity certificates amounted to 18.1 TWh in 2010. Peat is not a renewable fuel but is included in the electricity certificate system and is eligible for aid as a CHP fuel. Since renewable electricity production is to be indicated, the electricity derived from peat (0.792 TWh) should therefore be excluded. Electricity production from renewable sources under the certificate system amounted to 17.3 TWh in 2010; 6.5 TWh of this already existed in 2002. In comparison with 2002[1] this is an increase of 10.8 TWh.

It is only newer plants and production increases that receive aid under the electricity certificate system. Average hydropower production mentioned in the section above includes both large-scale and small-scale production and hydropower eligible for aid is therefore not reported separately in the table above.

2.2.3 Electricity from waste and solar power

Electricity produced from renewable waste is not supported under the electricity certificate system but can be counted as renewable under the Directive. This item has not been included in analysis from previous years. The calculations assume that 60 % of waste is renewable.

Solar power is eligible for aid under the electricity certificate system but it is only larger plants that join. As a result, not all production is captured by the statistics.

Production from waste and solar power is therefore taken instead from the statistics that Sweden submits to Eurostat.

2.3 Electricity consumption

The denominator of the equation contains Sweden's total electricity consumption. Under the Directive, this is calculated as gross national electricity production (including auto-consumption) plus imports minus exports.

Preliminary statistics show that consumption stood at 150.8 TWh in 2010.

[1] In the 2003 report production was quoted as 6.1 TWh in 2002. This figure was revised to 6.5 TWh in Bill 2002/03:40 *Elcertifikat för att främja förnybara energikällor* [Electricity certificates to promote renewable energy sources]

Table 2 Sweden's total electricity consumption in 2010, TWh

	Consumption
Electricity production	144.8
Imports / Exports	2.0
Auto-consumption	4.0
Gross electricity consumption	**150.8**

3 National climate change commitments

In the report, Member States are also required to indicate to what extent the measures are compatible with national climate change commitments.

In Sweden only a relatively small percentage of national carbon dioxide emissions originates from electricity production. However, changes in the prevailing electricity production mix may occur and have occurred and, at the same time, electricity consumption is expected to increase, albeit marginally. The current assessment is that natural-gas based electricity production is commercially the most interesting alternative for investment in new power production and two such plants have been brought into service since 2007.

The electricity certificate system forces a large volume of electricity onto the market which is not fossil-based and which would probably not have been produced without aid schemes. This renewable electricity, along with other regulatory instruments, reduces the market share which would probably have been met with natural gas or imports for commercial reasons. In this way the scheme holds back any increases in carbon dioxide emissions. The target set is in line with Sweden's climate change commitments.

As an EU Member State Sweden, too, participates in the EU's carbon trading scheme. Electricity production is included in the traded sector.

Annex 1 Percentage of renewable energy over time

Given that the method for calculating average hydropower production has been changed since the first report and that production of electricity from renewable waste is now included in the analysis, a time series has been put together in the table below.

Table 3 Percentage of renewable energy for selected years

	1997	2004	2005	2006	2007	2008	2009	2010
Production (TWh):								
Hydropower average		68.2	68.4	68.1	68.0	68.0	67.9	67.8
Biofuel		7.7	7.9	8.6	9.0	9.6	9.8	11.2
Wind power		0.9	0.9	1.0	1.4	2.0	2.5	3.5
Renewable waste		0.5	0.5	0.6	1.1	1.3	1.0	1.5
Solar		0.002	0.002	0.002	0.003	0.004	0.007	0.009
Total	**72.03***	**77.2**	**77.8**	**78.2**	**79.6**	**80.8**	**81.2**	**84.0**
Gross electricity consumption (TWh):								
Electricity production	145.3	148.9	154.5	139.4	144.9	143.8	133.7	144.8
Imports/Exports	-2.7	-2.1	-7.4	6.1	1.3	-2.0	4.7	2.0
Auto-consumption	4.1	3.6	4.0	3.0	3.7	3.7	3.3	4.0
Total	**146.7**	**150.3**	**151.1**	**148.5**	**150.0**	**145.5**	**141.6**	**150.8**
Percentage	**49.1 %**	**51.3 %**	**51.5 %**	**52.7 %**	**53.1 %**	**55.6 %**	**57.3 %**	**55.7 %**

*Renewable electricity production in Sweden in 1997 as per Directive.

The table above includes average production from hydropower.
Average production is calculated between 1985 and the year in question (i.e. for 2010 it is the average production between 1985 and 2010 that is reported).

Statistics for wind power and biofuel-based electricity production are taken from the electricity certificate system. Production based on renewable waste and solar is taken from Sweden's submissions to Eurostat as not all production is eligible for aid under the electricity certificate system.

The higher percentage of renewable electricity for 2009 is explained by the fact that electricity consumption was unusually low, particularly in industry, during the financial crisis that was taking place at that time.