Publication Year 2011

The Electricity Certificate System 2011

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Print run: 1000 copies
ET2011:52
Layout and production: Granath Euro RSCG
Translation: Angloscan Manuscript Ltd.
Print: CM Gruppen AB
Photographs: Per Westergård, Anette Andersson and SXC.hu
Illustrations: Bo Reinerdahl

Preface

Sweden's electricity certificate market is facing several constructive challenges. A new Electricity Certificate Act is due to come into force on 1st January 2012, with the expectation that it will provide a better structure and improved overview of the electricity certificate market. It is also expected that Norway will join the market at the beginning of January 2012, which will offer new potentials with the trading of certificates between parties in the two countries. Although, as far as Sweden is concerned, the changes are modest, there will certainly be a greater need for information. A considerable volume of older electricity production capacity will lose its rights to receive certificates from 2013, which will mark the first larger terminations of the time-limited allocation periods. This will also be the first year of the adjusted quotas, one of the effects of which is expected to be a reduction of the surplus of certificates on the market.

On the other hand, there is also much that will remain unchanged. The system continues to deliver cost-efficient electricity production from renewable sources, and is one of Sweden's key policy measures for achieving its targets for renewable energy, at both national and EU level.

This report, 'The Electricity Certificate System 2011', is intended to provide its readers with easily accessible information on the electricity certificate system and its performance and development. It has been produced by Johanna Nilsson, with the assistance of Roger Östberg, Ellen Åhlander and Anna M. Johansson.

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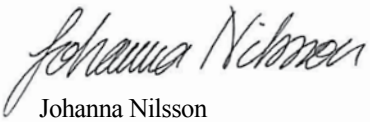

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The Swedish electricity market[1]

The Swedish electricity market consists of a physical path and a commercial path for the supply of electricity. The physical path is that of transportation from the power stations to the end users, via the various network levels of the high-voltage backbone grid, regional grids and local grids. The networks constitute natural monopolies that are overseen by the Electricity Markets Inspectorate. The commercial side of supply is formed by the trade in electricity, with the producers selling their electricity to the end distributors either directly or via the Nord Pool electricity exchange. The commercial transactions are subject to full competition between the various parties. The end user pays for two different constituents: the operational production of the electricity, and its transmission from power station to point of delivery.

Many parties and functions must work together efficiently if the electricity is to reach end users safely, and if the end users are to be able to purchase their electricity on a market characterised by open competition. The following is a brief description of the roles of the various parties.

Svenska Kraftnät is a State-owned public enterprise body, of which its main duty is to operate and administer the high-voltage grid and its cross-border connections to other countries. The very largest production plants and the regional grids are connected to the high-voltage grid. Svenska Kraftnät is also the authority with responsibility for power generation in Sweden. Its duties include responsibility for controlling the country's electricity production in real time, and ensuring that production and import of power balance the demand for, and export of, power.

The electricity producers produce the electricity in their power stations and feed it into the transmission and distribution networks. They can choose whether to sell their electricity directly to larger users, to end-user distributors or via the electricity exchange. Most of production is sold on the exchange's spot market.

Electricity trading companies purchase electricity from the producers or via the electricity exchange and sell it to end users. Their role as resellers of electricity (electricity suppliers) means that they have the commercial contacts with the end users.

Electricity network companies own the regional and local distribution networks, and are responsible for delivering electricity to the end users. The regional networks operate at 40–130 kV, and the local networks at 40 kV and below. The regional networks carry electricity from the high-voltage grid to the local networks, and in some cases also to users with very high demands for electricity, such as larger industries. The local networks distribute electricity to other end users, such as domestic consumers, offices, industry etc.

Electricity users, such as domestic consumers and industries, are the end users of the electricity. An electricity user generally has an agreement with a supplier to purchase electricity, and another agreement with a network company for connection to the network. Users pay a network charge (fixed charge) to the network company for the connection and delivery of the electricity.

The Nordic market for electricity trading – Nord Pool – offers standard contracts that facilitate trading between companies on the market. Nord Pool Spot provides a spot market for physical trading of electricity by the hour, available up to the day before delivery. OMX/Nasdaq provides a financial trading market in electric power for long-term trading, by which the parties can assure their electricity price. Most of the hourly trading is conducted on the spot market, with a smaller part effected by bilateral agreements between producers and electricity trading companies. Long-term trading may also be arranged under bilateral agreements.

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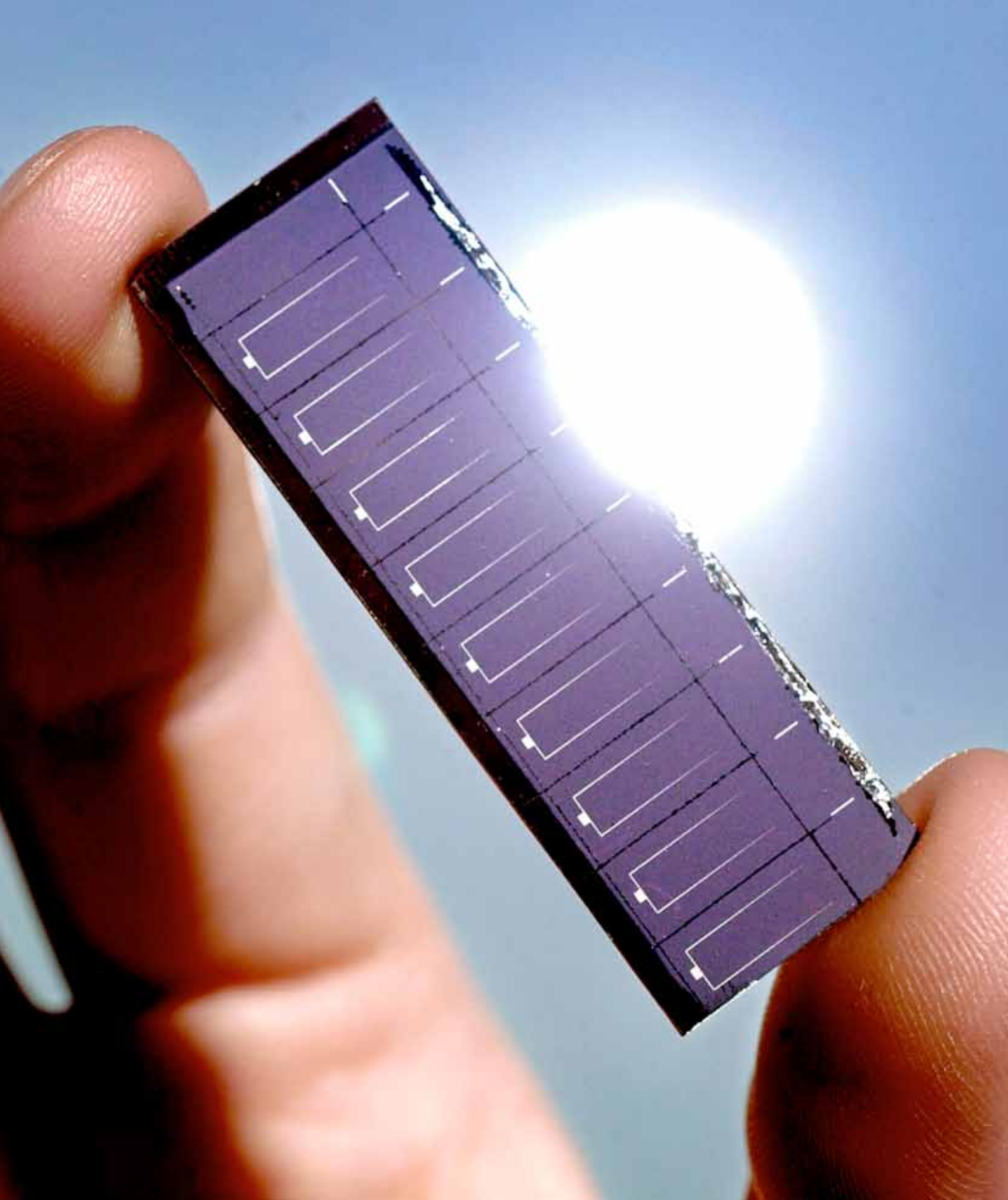
1. Source: Svenska kraftnät, Elmarknaden i Sverige och Svenska kraftnäts roll, ISBN 978-91-976721-0-8, maj 2011



The Swedish electricity certificate system

The electricity certificate system is a market-based support system for expansion of electricity production in Sweden from renewable energy sources and from peat. The objective is to increase, by 2020, the production of electricity from such sources by 25 TWh relative to production in 2002. The certificate system, which will run until the end of 2035, is intended to help Sweden achieve a more ecologically sustainable energy system.

In 2002, Sweden produced 70,3 TWh of electricity from renewable energy sources, of which about 90 % were in the form of large-scale hydro power. The EU and Sweden's Parliament have ambitious targets for the production of electricity from renewable energy sources and, in order to meet them, Sweden introduced its electricity certificate scheme in May 2003. Its objective is to increase, by 2020, the production of electricity from such sources by 25 TWh relative to the production level in 2002.

Electricity producers whose electricity production meets the requirements of the Electricity Certificates Act receive one electricity certificate unit for each megawatt-hour (MWh) of electricity that they produce. Demand for certificates is created by the fact that all electricity suppliers, and also certain electricity users, are required to purchase certificates corresponding to a certain proportion (quota) of their electricity sales or electricity use. The quantity of certificates to be purchased is adjusted from year to year in step with progressive changes of the quota proportion, thus generating an increasing demand for the certificates. In turn, this increases the incentive to produce more electricity from energy sources approved for production of certificate-entitled electricity. The producers of electricity from renewable sources can receive additional revenue to complement their sale of electricity by selling their certificates. The certificate system thus encourages the expansion of production from renewable energy sources.

Producers' entitlements to electricity certificates

Producers of electricity in approved plants are allocated one certificate unit for each megawatt-hour (MWh) of electricity that they produce and meter from renewable energy sources or from peat. Electricity from the following energy sources entitles its producers to certificates:

- Wind power
- Solar energy
- Wave energy
- Geothermal energy
- Biofuels, as defined in the Ordinance (2003:120) Concerning Electricity Certificates
- Peat, when burnt in CHP plants
- Hydro power:
  - small-scale hydro power which, at the end of April 2003, had a maximum installed capacity of 1500 kW per production unit,
  - new plants,
  - resumed operation from plants that had been closed,
  - increased production capacity from existing plants,
  - plants that can no longer operate in an economically viable manner due to decisions by the authorities, or to extensive rebuilding.

The Bill submitted by the Government to Parliament in the spring of 2011 proposes tightening up the qualification requirements for hydro power.

Restrictions on entitlements to certificates

The electricity certificate system is intended to support the construction of new plants for the production of electricity from renewable energy sources or from peat. However, in order to limit the cost to consumers of electricity from sources such as older, commercially viable plants, there is a time limit to the right of producers to receive certificates. Plants commissioned after the start of the electricity certificate system are entitled to receive electricity certificates for fifteen years, or until the end of 2035, whichever is the earlier. Plants that were commissioned before the certificate system was introduced are entitled to certificates until the end of 2012. Plants that, at the time of their construction or conversion, received a public investment grant after 15th February 1998, are entitled to certificates until the end of 2014.

Quota obligation

Electricity suppliers (i.e. network companies distributing electricity to end users) are required to purchase electricity certificates corresponding to a certain proportion of the electricity that they sell, known as their quota obligation. In order to fulfil their obligations, the suppliers must submit an annual return to the Swedish Energy Agency with details of the amount of electricity that they have invoiced to their customers during the previous year, together with certificates corresponding to a certain specified proportion (quota) of their sales. These returns must be submitted by not later than 1st March each year. In addition to electricity supply companies, the quota obligation applies also to electricity-intensive companies and to electricity users who have used electricity that they have themselves produced, imported or purchased on the Nordic power exchange.

Who does what?

The Swedish Energy Agency and Svenska Kraftnät share responsibility for the electricity certificate system, with the Agency being the compliance authority and Svenska Kraftnät being the accounting authority. Their duties are as follows.

The Swedish Energy Agency:

- Approves plants for allocation of certificates,
- Provides advance decisions of whether approval will be granted for allocation of certificates,
- Registers/deregisters parties having quota obligations, and checks their annual returns declaring their amount of quota liable electricity,
- Decides on late delivery penalties for those required to submit annual returns but who have not done so by 1st March,
- Decides on a quota obligation charge if the quota obligation is not fulfilled,
- Is the compliance authority in respect of compliance with the Act, Ordinance and regulations concerning electricity certificates,
- Publishes information on the electricity certificate system,
- Monitors and analyses developments on the electricity certificate market.

Svenska Kraftnät:

- Issues electricity certificates based on metered values from certificate-entitled electricity production,
- Prepares and maintains the certificate register, with details of certificate holdings,
- Cancels certificates on 1st April each year, in accordance with information in the returns received and checked by the Swedish Energy Agency,
- Regularly publishes information on the number of certificates issued, traded and cancelled, together with their average price.

Important dates in the electricity certificate system

1st March: Latest date for those having quota obligations to submit their returns of electricity sales and electricity use, on which the previous year's quota obligation was based.

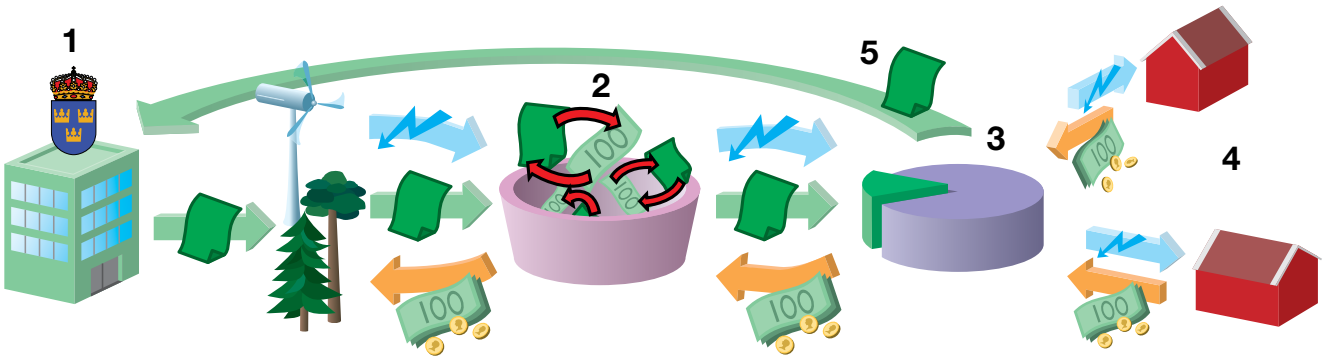
31st March: Latest date for those having quota obligations to ensure that a sufficient number of certificates is held in their certificate accounts in order to meet their obligation.

1st April: Cancellation of the number of certificates as needed to fulfil the quota obligation. If the account holds an insufficient number of certificates, the Swedish Energy Agency will decide on an appropriate quota obligation charge.

A joint Swedish-Norwegian electricity certificate market

A binding agreement on a joint Swedish-Norwegian electricity certificate market was signed in 2011. The market is planned to start on 1st January 2012, with the agreement running until 2036. The objective of the joint market is to increase the production of renewable electricity by over 26 TWh between 2012 and 2020, with both countries having equal ambition levels.

A joint electricity certificate market, in which Norway joins the Swedish model, produces a larger market with a greater number of members, which is expected to result in improved competition through increased liquidity and more stable prices. The target for increased renewables production can be achieved more cost-efficiently, as investments will be made where conditions are most favourable.



HOW THE ELECTRICITY CERTIFICATE SYSTEM WORKS

The State issues electricity certificates to producers of renewable electricity (1). The producers then sell the certificates on an open market (2). Demand arises from purchasers who have quota obligations, mainly electricity suppliers, who are required by law to purchase a certain quota of certificates in proportion to the amount of electricity that they sell (3). The cost of the certificates forms part of the price paid for electricity by the suppliers' customers (4). In this way, the customers contribute to expansion of renewable electricity production. Each year, on 1st April, the electricity suppliers hand over the number of certificates needed in order to fulfil their quota obligations to the State, which then cancels the certificates (5). The suppliers must then return to the market to buy new certificates in order to acquire the necessary number for next year's quota obligation.

Number of certificates available

Power plants producing electricity from renewable energy sources or from peat, and which have been approved by the Swedish Energy Agency, receive a number of electricity certificates, depending on the amount of renewable electricity produced by the plant. In 2010, there was still a surplus of certificates, amounting to about 5,5 million units.

The number of certificates issued is determined by the number of approved plants, by the amount of electricity that they produce and by the proportion of renewable fuel that they use. Electricity production is also affected by external factors such as temperature, precipitation, wind and the country's overall electricity balance.

For 2010, the difference between the demand for electricity certificates and the associated electricity production was about 500 000 certificate units, resulting in a marginal change of the surplus which, for the last four years, has amounted to about five million certificates.

Importance of the surplus for the electricity certificate market

The accumulated surplus of electricity certificates on the market has increasingly been discussed in the last few years. Some general aspects of the surplus must be borne in mind. Some surplus is needed in order to ensure market liquidity, and thus a quantity interval for trading. The surplus also acts as a buffer to absorb variations in the electricity market between one year and the next. Cold, wet and windy years generate a surplus, while mild, dry and calm years generate a deficit in comparison with conditions in a statistically normal year, around which the quota curve is designed. It is also so that bringing forward the start-up of a production capacity creates a surplus during part of the production period, with a deficit arising fifteen years later when that production is phased out of the certificate system. A surplus can also arise if quota-obligated electricity use differs from the forecasting data used when the quotas were set. This particular deviation can be compensated for at the next review of the certificate system (known as a checkpoint), which is performed about every fourth year. The next checkpoint review is due by not later than 2015. The magnitude of the surplus affects the price of certificates, but the long-term price trend is also affected by the market's view of changes in the surplus in the future.

During the certificate system's first three years, a surplus arose as a result of rapid expansion of existing biofuel-fired production capacity. This was followed by a period of diminishing surplus as construction of new production capacity did not keep pace with the rises in quota obligations. The market responded by worrying that a deficit of certificates would arise in a few years. Between 2007 and 2010, the surplus has remained essentially unchanged at about 5 TWh. From 2010 and onwards the surplus is expected to increase as a result of substantial expansion of production capacity and because the quota obligations covering the period up to 2012 do not provide sufficient demand to take up all the certificates available. Quota-obligated electricity use has been considerably less than the forecasts on which the new quota obligations were based in 2006 in order to meet the target (at that time) of 17 TWh additional production by 2016.

New quota obligations with effect from 2013 have been approved by Parliament, intended to reduce the surplus and to achieve the production target by 2020. Entitlement of a significant number of older plants to receive certificates will cease with effect from 2013 as their allocation entitlement periods come to an end. The surplus of certificates is expected to decline over the period 2013/2014. However, it will continue to vary in the future, depending on the amount of quota-obligated electricity actually used and on actual increases in production capacity.

A further factor is that of the effect of Norway joining the electricity certificate market on 1st January 2012, which will increase the demand for certificates and mean that the percentage proportion of the total demand for certificates represented by the surplus will be reduced. Norway's quota obligations are based on a linear growth of demand, amounting to almost 1,5 TWh per year. The rate of production expansion

in Norway during the start-up years will affect the size of the surplus, so that Sweden's present surplus will be needed if Norwegian demand exceeds Norwegian issue.

2011 and 2012 are expected to see the greatest amount of surplus, after which the size of the surplus will fall as the Swedish quota obligations are increased. At the same time, Norwegian parties will be entering the market, with their rate of expansion affecting the size of the surplus. One of the purposes of the checkpoint reviews, to be held by not later than 2015 and 2019, is to decide whether the quota sizes need to be adjusted in response to changes in the amount of quota-obligated electricity used, the rate of production capacity expansion, or the size of the surplus and its expected development.

Most renewable electricity production in biofuel-fired plants

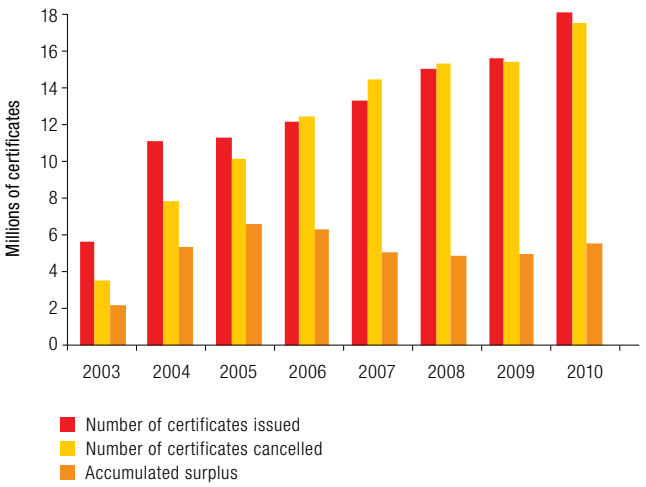
Of the electricity production that received certificates in 2010, 61,8 % was from biofuel-fired plants, and 4,4 % from CHP plants burning peat. Wind power plants produced 19,3 %, and hydro power plants produced 14,5 %, thus making significant contributions to electricity production within the system. A small number of solar energy plants were approved for reception of certificates, but they produced only a few MWh during the year. No wave energy or geothermal energy plants have so far been submitted for approval and inclusion in the electricity certificate system.

In 2010, a total of 2711 plants were approved for the allocation of certificates, made up as follows: biofuels, 163; wind power, 1371; hydro power, 1164; and solar, 13. 49 plants had been approved for receipt of certificates based on an increase in output from large scale hydro power. All told, a total of 292 plants were approved for receipt of certificates during 2010.

Two groups of producers in the electricity certificate system

The producers of certificate-entitled electricity can be classified essentially into two groups: one consisting of a few large companies, which in fact produce most of the electricity, and the other consisting of a large number of producers who individually produce relatively small quantities of electricity. In 2010, 96 % of the producers received certificates for a production of 50 GWh (50 000 MWh) or less, making up 22 % of the total number of certificates issued during the year. The three largest producers accounted for 18 % of certificate entitled production, which was more or less unchanged from earlier years. This can be put into perspective by the fact that these producers in fact produced about 80 % of all electricity in Sweden.

Figure 1. Number of certificates issued, number cancelled and accumulated surplus, 2003–2010



Source: Svenska Kraftnät's Cesar accounting system

Market demand for certificates

The Swedish Parliament set adjusted and new quotas for certificates on 1st July 2010. The purpose of this update is to ensure that the certificate system will help to achieve the new target of increasing the production of electricity from renewable energy sources by 25 TWh in 2020, relative to production in 2002.

The demand for electricity certificates is created by the obligation for electricity suppliers and certain electricity users to purchase certificates corresponding to a certain proportion of their electricity sales and/or electricity use. This proportion, or quota, has been decided for each calendar year, and is set at such a value that the system will play its part in achieving the objective of increasing the production of electricity from renewable energy sources. Competition and technical development have both been important long-term starting points for reducing the costs of electricity production from renewable energy sources, and thus for achieving the established target. If the target is to be achieved, the quota obligation must be increased as time passes. In the spring of 2010, Parliament agreed increased quotas for 2013-2030 and new quotas for 2031-2035.

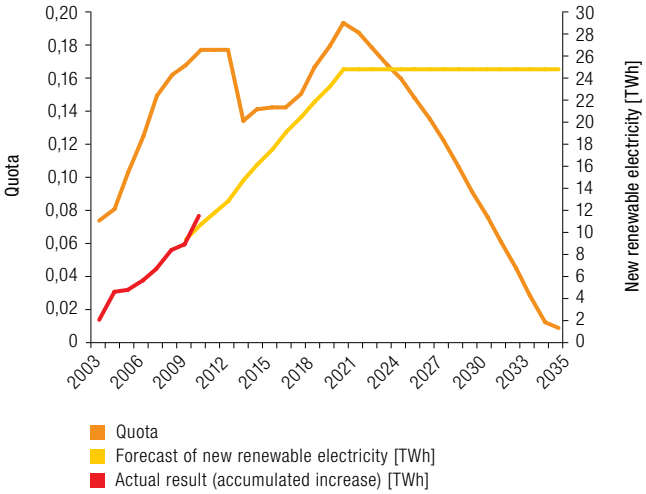
Table 1 and Figure 2 show quota sizes and developments over the period 2003¬ 2035. The structure of the quota means that demand is relatively price-inelastic, due to the fact that parties having quota obligations have an incentive to purchase certificates up to a price that is 50 % higher than the average price for the year. This is because, for each certificate that they do not cancel, they are required to pay a quota obligation charge of 150 % of the average price of certificates, calculated over the period of one year leading up to the date of cancellation.

Table 1. Quotas for the period 2003–2035, with forecast new renewable electricity production and actual renewable electricity production.

Year	Quota	Forecast, new renewable el. production (accumulated) [TWh]	Actual new renewable el. production (accumulated increase) [TWh]
2003	0,074	-	1,96
2004	0,081	-	4,55
2005	0,104	-	4,80
2006	0,126	-	5,66
2007	0,151	-	6,76
2008	0,163	-	8,54
2009	0,170	9,31	9,07
2010	0,179	10,81	11,55
2011	0,179	11,84	
2012	0,179	12,94	
2013	0,135	14,80	
2014	0,142	16,26	
2015	0,143	17,71	
2016	0,144	19,17	
2017	0,152	20,63	
2018	0,168	22,09	
2019	0,181	23,54	
2020	0,195	25,00	
2021	0,190	25,00	
2022	0,180	25,00	
2023	0,170	25,00	
2024	0,161	25,00	
2025	0,149	25,00	
2026	0,137	25,00	
2027	0,124	25,00	
2028	0,107	25,00	
2029	0,092	25,00	
2030	0,076	25,00	
2031	0,061	25,00	
2032	0,045	25,00	
2033	0,028	25,00	
2034	0,012	25,00	
2035	0,008	25,00	

Source: Bill no. 2009/10:133; Svenska Kraftnät's Cesar accounting system

Figure 2. Quotas for 2003–2035, forecast new renewable electricity production and actual renewable electricity production



Source: Bill 2009/10:133 and Svenska Kraftnät's Cesar accounting system

Different sizes of quota obligations

The companies having quota obligations are electricity suppliers, electricity-intensive manufacturing companies and electricity users to the extent that they have used electricity that they have themselves produced, imported or purchased on the Nordic power exchange. The amount of electricity sold or used varies widely among the companies having quota obligations, which creates substantial differences in the sizes of the obligations. 79 % of those having a quota obligation had an obligation of 10 000 certificate units or less in 2010, equivalent to annual sales or use of electricity of somewhat over 7 GWh on average. The quota obligations for these companies and individuals amount to only about 3 % of the total quota obligation. The three largest companies in the system have an obligation amounting to about 34 % of the total obligation, which is essentially unchanged from earlier years.

Electricity-intensive industry exempted from quota obligations

Free power, and electricity used as ancillary power for electricity production, are exempted from the quota obligation, as are losses arising in connection with operation of the transmission or distribution networks. Electricity used in manufacturing processes by electricity-intensive companies registered by the Swedish Energy Agency is exempted from a quota obligation, although other electricity used in the company is quota-liable. For such companies to be registered, they must notify themselves to, and be registered with, the Agency, and must also submit annual returns of their electricity use in the same way as other companies having quota obligations. The reason for exempting these companies from having quota obligations is to ensure that the competitiveness of Swedish electricity-intensive industries is not affected by the higher costs of electricity that would result from having a quota obligation. It is also possible to register only part of a company, if that part is operating as an independent business or activity. In 2010, 419 companies were registered as electricity-intensive, exempting a total of 39,7–40,6 MWh from a quota obligation.

Proportion of cancelled electricity certificates close to 100 %

The electricity certificate system requires those having a quota obligation to purchase the number of certificates as needed to fulfil their quota obligation. By not later than 1st March each year, the companies submit a return with details of their sales and/or purchases of electricity during the previous year, and these details are then used for calculation of the companies' quota obligations. The requisite number of certificates as needed to fulfil the quota obligations is then cancelled on 1st April. If a company holds insufficient certificate units in its account, it is required to pay a quota obligation charge to the state, based on the number of units shortfall. This charge amounts to 150 % of the volume-weighted average price of certificates during the period from the previous 1st April until 31st March of the following year. Apart from the first year of the system, the proportion of cancelled certificates in relation to the overall quota obligation has been over 99 %, as shown in Table 2.

Table 2. Cancellation of electricity certificates, 2003–2010

	Cancellation per quota obligation year							
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Quota-obligated electricity [TWh]	63,3	97,4	97,6	97,1	96,0	94	91	98
Exempted electricity in electricity-intensive companies[1)] [TWh]	37,8	40,6	40,9	40,5	42,8	41,6	36,5 - 37,4	39,7 - 40,6
Quota	0,074	0,081	0,104	0,126	0,151	0,163	0,170	0,179
Number of cancelled electricity certificates [million]	3,5	7,8	10,1	12,4	14,5	15,3	15,4	17,5
Quota obligation fulfilment [%]	77	99,2	99,9	99,9	99,8	100	100	100
Quota non-fulfilment charge [SEK per certificate]	175	240	306	278	318	431	470	402
Total quota non-fulfilment charge [SEK million]	182,8	14,4	3,1	2,3	8,3	2,3	0,7	0,8

1) New regulations for electricity-intensive industries introduced on 1st January 2009

Source: The Act 2003:113 Concerning Electricity Certificates, Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Certificate trading

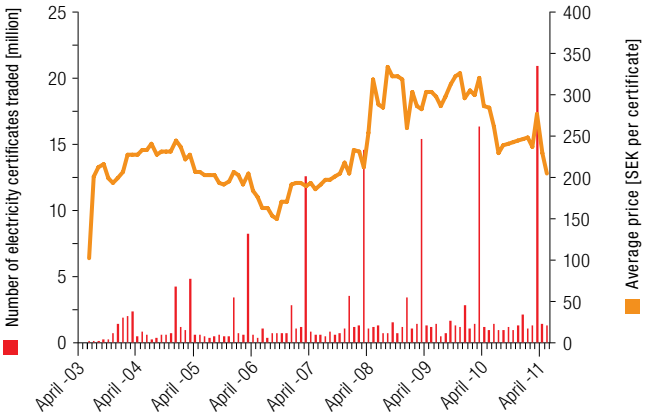
Each electricity certificate is proof that one megawatt-hour of electricity has been produced from renewable energy sources. Both producers and those having quota obligations have accounts in Svenska Kraftnät's electronic register, Cesar. Trading involves transfer of certificates from a seller's account to a purchaser's account in Cesar.

Trading on the electricity certificate market occurs through bilateral agreements, directly between producers and those having quota obligations, and through contract purchases involving the services of a broker. The use of brokers has shown itself to be a suitable method, as the parties on the market have different requirements and circumstances. Certificates are traded not only by electricity companies having their own trading departments, but also by industrial companies and district heating utilities, and by smaller electricity network companies and producers who trade only a few times per year. The diversity of, and variation between, sellers and purchasers has meant that there is a demand for different levels of information on aspects such as price trends, traded volumes, forms of contract, price levels etc. Current prices of electricity certificates are published regularly by Svensk Kraftmäkling, SKM, on its web site, www.skm.se. SKM also lists historical weekly and monthly average prices for electricity certificates.

Half of all trading through brokers

Electricity certificates are traded in the form of spot contracts, which involve immediate delivery of, and payment for, certificates, or as forward contracts, which means that a price is settled at the time of trading, but that the certificates will be delivered and paid for at some point in the future. The most liquid trading is in forward contracts for the following March, and in spot contracts, each of which account for about a third of traded volumes. Contracts for March 2012 are expected to make up about one fifth of traded quantities. SKM estimates that the proportion of certificates traded via brokers is about 50 %, with the other 50 % estimated as traded either internally or directly between parties. Figure 3 shows the turnover of certificates since the system started. The price of a certificate is registered when the certificate is transferred

Figure 3. Average price of electricity certificate transactions between accounts in Cesar and numbers of certificates traded per month, June 2003 to May 2011



Source: Svenska Kraftnät's Cesar accounting system

between accounts in Svenska Kraftnät's Cesar register, even though the price may be the volume-weighted average price of all transactions during each month, and cannot therefore be seen as a market price of certificates for the particular months. However, it does happen that the Cesar price is used as a reference price for certain trades on the electricity certificate market.

Producers of certificate-entitled electricity operate under, or experience, different conditions when selling their allocated certificates. The main differences are to be found between large and small producers, with the small producers being more dependent on a steady sale of their certificates in order to assure revenue flows and thus maintain production. Among the larger producers, it is common for there to be less need directly to link revenue from the sales of certificates to continued production, which means that these producers can afford to wait for a better price for their certificates before they sell them. However, it is mainly the particular conditions of each company that determine when and how certificates are sold, with fluctuations in the general economy or liquidity requirements being decisive factors in determining when certificates are traded.

The market determines the price of certificates

On a competitive market, the price of certificates is determined by the interaction between supply and demand. Liquidity is important if the price structure is to be regarded as reliable, and it is here that the parties on the market have a joint responsibility for participating in public trading, as a market-based policy measure requires a market price to be reached by negotiation, and for information on contract times and prices to be published. Market liquidity has progressively improved, partly as the market has grown in parallel with increasing quota obligations, and partly because of a greater need for a price reference for electricity contracts and investments, together with a general increase in trading in electricity certificates.

Several factors affect the setting of prices, such as the expected demand for electricity and expected introduction of new production capacity, as well as changes in the certificate system as a result of political decisions. All these factors are considered by the parties on the market when trading, with the result that the traded price becomes an indicator of expected availability of, and demand for, electricity certificates. If the market expects a shortage of certificates, their price will rise, while a surplus causes the price to fall. Figure 4 shows the spot-traded price of certificates since the system started on 1st May 2003.

The diagram shows a substantial rise in the price during the spring of 2008, which was due to an expected future shortage of certificates and a strong economic boom. This was rudely interrupted in September 2008 by the world-wide financial crisis, causing a comprehensive downturn in business levels and a substantial fall in the demand for electricity. 2008 was also a warm year, which also reduced the demand for electricity. Finally, the production of renewable electricity and availability of certificates were unexpectedly high during the autumn, with the result that the price of certificates fell.

The future price development of certificates is largely dependent on the extent to which production expansion plans for larger plants are realised.

Figure 4. Average spot price of electricity certificates, 2003-2010

Source: SKM, Svensk Kraftmäkling AB

End-user electricity customers fund the support for renewable production

The producers of electricity from renewable energy sources receive economic support for doing so through the sale of electricity certificates. The money for the certificates comes from consumers' electricity bills, and helps the electricity producers increasingly to invest in the production of electricity from renewable energy sources. In 2010, the average cost of this element of the total cost of electricity was 6,3 öre per kWh.

Since 2002, Sweden's electricity production from renewable energy sources has increased by 11,6 TWh. The fact that the producers choose renewable energy sources is largely due to the extra revenue received via the certificates.

End-users pay for the electricity certificate system…

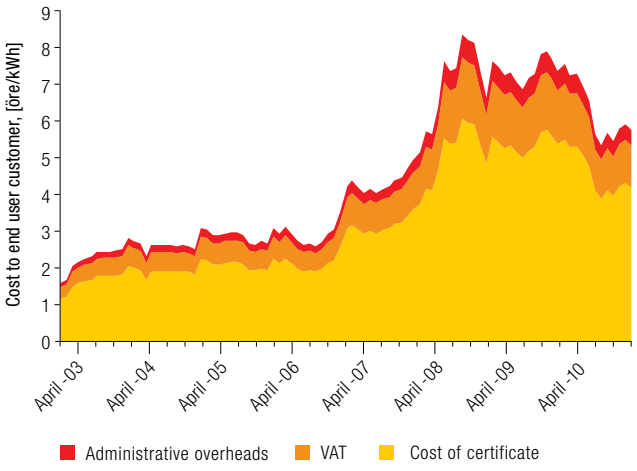
Although it is the electricity supplier who buys the certificates, it is the end-user customer who ultimately pays for the certificate system via the supplier's bills. However, not all the money paid by the consumers reaches the producers: some of it is used to pay value added tax, quota obligation charges and transaction costs for the suppliers, such as administration, wages, brokers' fees and risk costs. Since 1st January 2007, electricity suppliers' costs for certificates are included as part of the price of electricity in fixed-rate tariffs, which makes it more difficult to work out the cost to the user today. This change was introduced in order to improve cost efficiency and to make it easier for consumers to compare electricity prices between suppliers.

… with domestic users paying the greatest proportion

It is still possible for customers to estimate the cost of the certificates to them by multiplying the price of an electricity certificate by the quota for the year in question. To this must be added an administrative cost element and 25 % VAT. Figure 5 shows the estimated cost, on the basis of the spot price of a certificate, from 1st May 2003, when the certificate system started, to the end of 2010. The administrative cost element fell from 10 % to 5 % over the period until 2007, but the higher proportion has been used, as there is no data for the cost after 2007. Note that the final cost for an individual customer can vary, as certificates are bought not only on the spot market, and also because many customers do not have variable-rate tariffs.

In 2010, the certificates provided a revenue of about SEK 4,6 billion to the producers of renewable electricity. There are several types of electricity customers who ultimately pay for the certificates. The largest group is that of domestic consumers, who account for about 45% of quota-obligated electricity use. The owner of a detached house having electric heating and using 20 000 kWh per year paid about SEK 1250 (including VAT) for electricity certificates in 2010. The service sector uses about 29 % of the electricity, with quota-obligated industry using 17%. The remaining 9% of renewable electricity is used by transport, agriculture, district heating suppliers etc.

Figure 5. Cost of certificates to end user customers, 2003-2010, [öre/kWh]



Source: SKM, Svensk Kraftmäkling AB

Electricity production in the electricity certificate system

Electricity certificates are issued to those who produce electricity from various renewable energy sources, and from peat, and who have had their production plants approved by the Swedish Energy Agency. To date, certificates have been issued to producers of electricity from biofuels and peat, wind power, hydro power and solar electricity. Electricity production from renewable sources and peat amounted to 18,1 TWh in 2010, which is an increase of 11,6 TWh compared with corresponding production in 2002.

Certificate-entitled electricity production has increased since the start of the certificate system, mainly in the form of increased production of electricity from biofuels as a result of using a greater proportion of renewable fuels, or of an increase in capacity of existing biofuel plants. Table 4 (see the tables section) provides further information on electricity production from certificate-entitled sources, from 2003 to 2010. Note that a plant can consist of one or more production units, e.g. a wind power farm with several turbines is regarded as one plant.

18,1 TWh of certificate-entitled electricity production in 2010

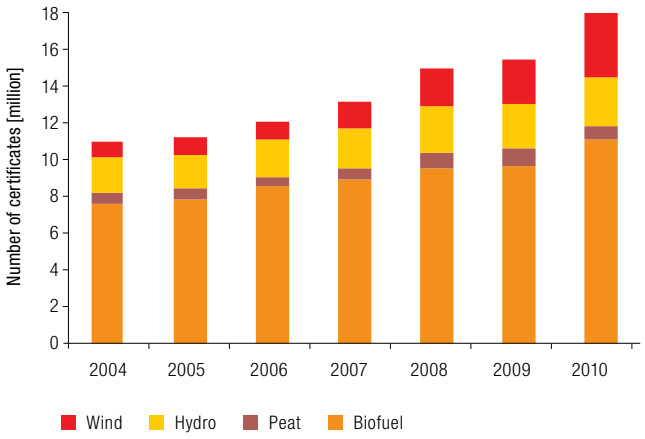
Certificate entitled electricity production in 2010 amounted to 18,1 TWh, having increased from 6,5 TWh in 2002. This represents an increase of 11,6 TWh since 2002.

Figure 6 shows the breakdown of allocation of certificates among different energy sources from 2003 until 2010. (As the system started on 1st May 2003, information for that year covers a period of only eight months.)

1 210 new plants started up

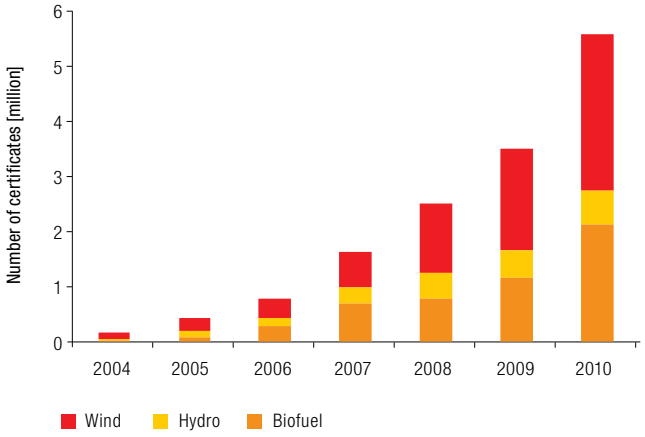
Electricity production from renewable energy sources can be increased through the construction of new plants or through increases in production from existing plants. Since the certificate system started on 1st May 2003, a total of 1210 new plants had been started up by the end of December 2010. Figure 7 shows that these new plants produced a total of 5,6 TWh in 2010. Table 5 (see the tables section) contains more information on new plants.

Figure 6. Number of certificates issued, by type of energy source, 2004–2010



Source: Svenska Kraftnät's Cesar accounting system

Figure 7. Number of certificates issued for new plants, by type of energy source, 2004–2010



Source: Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Wind power

Wind power today supplies somewhat over two percent of Sweden's total electricity production. Potentially it could supply considerably more than this, which means that it is a politically high-profile area. Parliament has set a planning target of 30 TWh of wind power production in 2020, with 20 TWh of this from onshore plant and 10 TWh from offshore plant.

Technical development in the wind power sector has been explosive. Twenty years ago, wind turbines had outputs of a few hundred kilowatts: today, some turbines with outputs of over 7 MW are being built, although units installed in Sweden are generally in the 2–3 MW range. Most expansion to date has been inland or near coasts, but offshore plants are now increasingly being planned: 2007, for example, saw start-up of the Lillgrund offshore wind power farm in Öresund. However, at present, offshore wind power production is more expensive than onshore production, and requires higher levels of revenue. Nevertheless, applied research and experience from a growing number of projects should enable cost reductions to be made in the future. Offshore wind power production facilities are already in operation in the UK, Ireland, Denmark, The Netherlands and Germany. In these and other countries, such as Spain, the USA and China, offshore expansion is expected to take off over the next few years. The Swedish Lillgrund wind power farm was built with financial assistance from the state fund (known as the Pilot Fund) for market introduction of wind power.

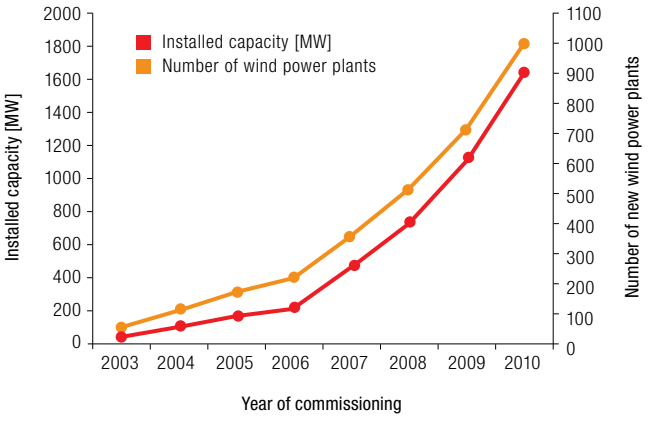
1 371 wind power plants have received certificates

1 371 wind power plants were granted certificates in 2010. Several production units, close to each other and having a common connection point to the grid, are counted as one plant: in total, the plants consisted of 1606 individual turbines, of which 67 were offshore. Total installed capacity in 2010 amounted to 1998 MW, as can be seen in Table 6 (see the tables section). Figure 8 shows the total number of new wind power plants in the certificate system, and their expected annual energy production.

40 % increase in wind power production

Wind power production varies with wind conditions, and therefore changes with time, depending on weather conditions. 2010 was a relatively calm year in terms of wind, while wind conditions in 2004 were of the longer-term average value. 2007 and 2008 were windy years, with a relative wind energy content amounting (as indicated by the actual production figures from the wind plants) to 110 % of the energy content to be expected of a statistically average year, based on data from the last twelve years. Total electricity production from wind power plants in 2010 amounted to about 3,5 TWh, which was an increase of 40 % over the previous year.

Figure 8. Total number of new wind power plants registered in the electricity certificate system and their installed capacity, 2003-2010



Source: Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Biofuels and peat

With its substantial areas of forest and arable land, conditions in Sweden are favourable for the production of biofuels. From a systems perspective, the Swedish Energy Agency regards combined heat and power production (CHP) as a very efficient way of using biofuels, as much of the energy in the fuel is converted to both electricity and heat. The heat can be supplied to a public district heating system, or be used in industrial processes. If used in industry, this process is referred to as industrial back-pressure production. As it is the heat demand in such plants that generally determines the amount of electricity that can be produced, the amount of electricity produced is more constant, more reliable and more forecastable than from many other forms of renewable production, such as wind power, which assists the overall power balance on the grid. Electricity demand in Sweden is also highest during the winter, which coincides with the greatest electricity production in CHP plants. Since the beginning of the 1980s, the proportion of biofuels used in CHP plants has steadily increased, and the electricity certificate system has provided a further incentive for changeover to the use of renewable fuels.

Peat included in the electricity certificate system

Peat is an indigenous energy asset which, in a strict meaning, is not classified as a renewable fuel. Nevertheless, on 1st April 2004, the scope of the electricity certificate system was expanded to include the use of peat as a fuel in CHP plants. The reason for this was based on environmental considerations: by making electricity production from the combustion of peat eligible for the receipt of certificates, it would prevent the use of peat as a fuel in CHP plants from being replaced by the use of coal.

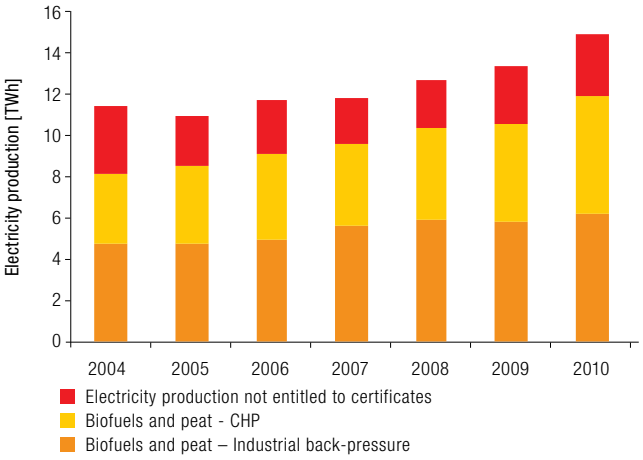
With this change, electricity production from the combustion of peat in CHP plants became entitled to certificates. In 2010, there were 22 such plants burning peat, producing about 792 GWh of electricity, which is about 79 GWh less than were produced in 2009.

Bioenergy is the major energy source in the certificate system

For the purposes of the electricity certificate system, biofuelled plants are divided up into CHP, industrial back-pressure and biogas. All approved biofuel plants in the certificate system make monthly returns of their total electricity production, and of the energy proportions provided by biofuels, peat and other fuels. Certificates are then allocated to the plant owner for that part of the electricity production based on biofuels and peat. Figure 9 shows electricity production from approved biofuelled plants from 2003 to 2010. The proportion of renewable fuels and peat used for electricity production differs between biogas and CHP plants, and also between them and industrial back pressure plants, as shown in Table 7 (see the tables section).

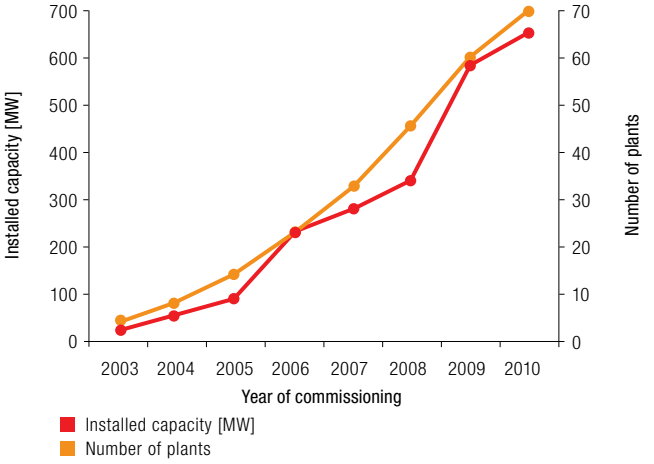
In 2010, biofuel-fired plants produced 12,0 TWh of renewable electricity (including that from peat). Compared with a total 18,1 TWh of renewable electricity produced by all plants covered by the certificate system, it can be seen that bioenergy is by far the largest energy source in the system. Of this, about 8-9 TWh are produced in plants that were commissioned before the electricity certificate system was started. With the introduction of the certificate system, annual production of renewable electricity in these plants increased by about 3.5 TWh as a result of factors such as increases in the proportion of biofuels and increases in power outputs. This trend continues, although now at a slower rate, so that production from 2004 to 2010 in these plants increased by about 20 %. However, it is not just the older plants that contribute to overall production, but also new plants that are being registered each year for the system. Figure 10 shows the growth in the total number of new plants from 2003 until 2008, together with their installed capacity, while Figure 9 shows electricity production from them.

Figure 9. Electricity production in approved biofuel-fired plants, 2004–2010



Source: Svenska Kraftnät's Cesar accounting system

Figure 10. Total number of new biofuel-fired power plants registered in the electricity certificate system and their installed capacity, 2003–2010



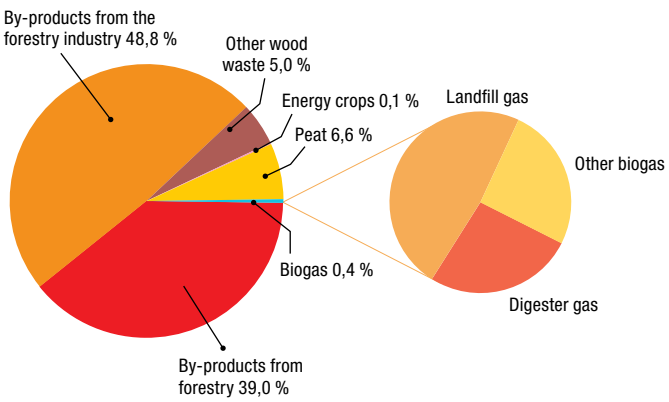
Source Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Forest industry by-products are the commonest fuel

Electricity from plants that partly or wholly produce electricity from biofuels or peat is entitled to certificates. The biofuels that are included in the certificate system are defined in the Ordinance (2003:120) Concerning Electricity Certificates. Bill No. 2005/06:154, Renewable Electricity with Green Certificates, expressly excludes biomass in mixed domestic waste from the electricity certificate system.

By-products from the forest products industry, such as black liquors, form the single most common type of biofuel that is eligible for the receipt of certificates, closely followed by by-products from forestry, such as felling residues. Other wood industry waste and peat are also used to a considerable extent, as is shown in Figure 11 and Table 8 (see the tables section). Table 8 also shows that the relative proportions of the various renewable fuels have not significantly changed over the duration of the certificate system. The information in the table is based on the biofuel returns submitted by the plant owners. The returns in 2003 were less detailed, which means that production in that year cannot be exactly assigned to all categories. In 2009, by-products from the joint forestry/forest industry category were divided up into the two constituent categories of forestry by-products and forest industry by-products.

Figure 11. Types of biofuels used in approved biofuel-fired power plants in 2010



Source: Svenska Kraftnät's Cesar accounting system

Hydro power

Historically, hydro power is a very important energy source in Sweden, and nowadays supplies - on average - almost half of Sweden's total electricity production. Generally, construction of new hydro power plants, or modifications to increase the output from existing plants, involve very substantial investments. With the aim of increasing hydro power-based output, hydro-power plants can therefore receive certificates for the following measures:

- continued operation of small-scale hydro power that was in operation at the end of April 2003 and which had an installed capacity not exceeding 1500 kW per production unit,
- new plants,
- resumption of operation in plants that had been taken out of operation before 1st July 2001, and which were then started up again after the end of 2002,
- increased production capacity from existing plants,
- plants that can no longer be viably operated in the long term due to decisions by public authorities, or to extensive rebuilding.

The bill submitted by the Government to Parliament in the spring of 2011 proposes tightening up the qualification requirements for receipt of certificates for hydro power production. The proposal means that a hydro power plant that is taken into use and has a rated output exceeding 1500 kW does not qualify for receipt of certificates for anything other than any increase in production relative to earlier production. According to the proposal, the decisive factor in determining whether a plant qualifies for receipt of certificates should be that the new production capacity does not replace previous production capacity from existing waterfall rights. For hydro power plants that are being brought back into operation, this means that the plant will be required to have been the subject of such extensive rebuilding or conversion that it can effectively be regarded as a new plant.

1 164 hydro power plants qualified for certificates

Hydro power plants of which production qualifies for electricity certificates vary in size. Small-scale plants, with a maximum installed capacity of 1500 kW per production unit, dominate, as shown in Table 9 (see the tables section). In 2010, 597 companies were issued with certificates for 1164 hydro power plants. (Several production units, grouped closely together and having a common connection point to the transmission/distribution network, are counted as one plant.)

2,6 TWh of electricity production

Electricity production from hydro power varies from one year to another, depending on factors such as precipitation. Precipitation in 2010 was of normal value, with production in approved hydro power plants amounting to 2,6 TWh. Since 2003, measures to increase production have been carried out at about 40 large-scale hydro power plants, with replacement or renovation of turbines and generators being the most common upgrades. In this way, plant outputs have been increased by about 0,25 TWh.

Solar electricity

Solar electricity is produced by solar cells, which are the only technology available at present that can convert solar energy directly to electricity. Present-day solar cells have an efficiency of about 15 %. Although there are thousands of small solar cell installations, e.g. for private homes, they are on sites where it would be expensive to connect the production units to the public electricity network.

Solar cell installations are generally relatively small in comparison with, for example, wind power plants or CHP plants. If a plant is to be approved for inclusion in the electricity certificate system, it must meet the requirements for hourly metering and reporting of electricity production. For small plants, this becomes very expensive per MWh of production: in such cases, the cost of metering can exceed the revenue from the electricity certificates, which is one reason why very few solar electricity installations are registered in the certificate system.

275 MWh of electricity production

In 2010, there were thirteen approved solar electricity installations covered by the system, having an installed capacity of 557 kW and producing 275 MWh/year. It can therefore be seen that solar electricity contributed only a marginal quantity of energy within the certificate system.

Limited allocation

The purpose of the electricity certificate system is to encourage the production of electricity from renewable energy sources and from peat. However, in order to prevent commercially viable older plants from exploiting the certificate system and creating unjustifiably higher costs for electricity consumers, there is a time limit for the right to receive certificates. Limitation of this qualifying period reduces consumers' costs for the electricity certificate system, which is important when the overall target objective of increased production is raised.

Plants started up after 1st May 2003 are entitled to receive certificates for up to fifteen years, but in no case after the end of 2035. These plants will be steadily phased out of the electricity system during the year concerned, depending on their date of starting up.

Production plants that were started up before the start of the certificate system on 1st May 2003 are entitled to certificates until the end of 2012. Plants started before 1st May 2003, and which received some form of public grant for investment or conversion of the plant, are entitled to certificates until the end of 2014. However, any such grant must have been paid after 15th February 1998, as part of a programme of investments in the energy sector.

The installed capacities of plants due for phase-out at the end of 2012 and 2014, as well as those due for phase-out over the period 2018–2025, are shown in Table 10 (see tables section).

Table 11 shows the corresponding phase-out of production over the years concerned, based on annual average values of the plants' certificate entitling production during 2009 and 2010, which means that the values may change, depending on operating conditions. The relatively short history of the electricity certificate system means that annual average values are at present based on only a few years' production, which can introduce some uncertainty into forecasts. However, the longer the periods for which annual average values can be calculated, the less the significance of structural and system changes. An example of this is the increasing proportion of certificate-entitled fuels in bio-energy plants. Other factors that can affect the expected production values are external conditions such as precipitation, temperature and wind. As the forecast is based only on operating statistics, it will change with time.

The past year and coming events

2010 in brief

- Number of cancelled electricity certificates: 17 535 632
- Number of issued electricity certificates: 18 052 536
- Average price per certificate: SEK 295
- New renewable electricity: 11,6 TWh, including 0,79 TWh from peat
- Number of approved plants: 2711
- Number of parties having quota obligations: 789 (of which 196 are electricity suppliers)

Important events in 2011

- The Government presented a bill to Parliament in 2011 proposing a new electricity certificate law. If approved, the new act would come into force on 1st January 2012.
- Sweden and Norway have agreed to establish a common electricity certificate market. A binding agreement on a joint electricity certificate market was signed in 2011, with the aim of opening the market on 1st January 2012.
- The Swedish Energy Agency will present a report on the working of the cooperation mechanisms, in accordance with the Renewables Directive, by not later than 30th September 2011.
- A new IT support system for those involved in the electricity certificate system and guarantees of origin is being developed. It is planned to be introduced before the end of 2011.
- The Swedish Energy Agency will publish new regulations and general guidance for electricity certificates, to come into force on 1st January 2012.

Important future events

- A major review of electricity-intensive industries that have been registered as quota-obligated parties will be carried out by the Agency during 2012, covering those companies in the sector whose three-year qualifying period has expired.
- Certain electricity production plants will be phased out of the system at the ends of 2012 and 2014. Those plants taken into operation before the introduction of the electricity certificate system are entitled to receipt of certificates until the end of 2012. If, after 15th February 1998, a plant received public investment support assistance under a programme for certain investments in the energy sector when it was built or converted, it is entitled to receive certificates until the end of 2014.
- The Agency will perform checkpoint reviews of the performance of the joint electricity certificate system together with the Norwegian Water Resources and Energy Directorate (NVE) by not later than 2015 and 2019. One of the purposes of these reviews is to decide whether the quota sizes need to be adjusted in response to changes in the amount of quota-obligated electricity used, the rate of production capacity expansion, or the size of the surplus and its expected development.

Glossary/Explanation of terms

Auxiliary power is electricity used in connection with the production of electricity (e.g. fans, pumps etc.).

Calculated normal year production is the calculated annual amount of production of renewable electricity under normal operating conditions.

Cancellation of electricity certificates means that the certificates are returned to the State from the Cesar account of the party having a quota obligation. When a certificate is cancelled, it can no longer be sold or used for fulfilment of the party's quota obligation. Cancellation of certificates occurs on 1st April, covering the previous year's quota obligation.

Certificate-entitled electricity production is electricity production from renewable energy sources or from peat, and which meets the requirements in the Act (2003:113) Concerning Electricity Certificates.

Cesar is Svenska Kraftnät's electronic accounting system for certificates. Parties eligible for receiving certificates, or wishing to purchase or sell them, must hold a certificate a ccount in Cesar.

Combined heat and power production is the use of a thermal process, e.g. a steam boiler, for the combined production of electricity and heat.

Conversion value or **added value** is defined as the difference between the total turnover of an electricity-intensive industry and its total purchasing expenditure, as these concepts are defined in Section 1 8 § of the Act Concerning Taxation of Energy. 'Total turnover' refers to income from sales of goods and services, including the company's own use of such goods and/or services, as produced or provided in accordance with the company's normal business activities (net turnover), changes in stock levels, work performed for the company's own uses, together with other income due to operating activities and interest income. 'Total purchasing expenditure' refers to all costs of operating the business, including depreciation and write-down of assets and interest charges. Personnel costs, including statutory employer social security charges etc., and the costs of hired temporary staff, shall not be included in the business operating costs.

Electrical losses are losses that occur in operating the electrical transmission or distribution networks.

Electricity certificates are issued by the State, and provide electronic proof that 1 MWh (megawatt-hour) of renewable electricity has been produced in accordance with the Act (2003:113) Concerning Electricity Certificates.

Electricity certificate entitled producer is the owner or operator of a plant that produces electricity from renewable energy sources or from peat, and who has had the plant approved by the Swedish Energy Agency for receipt of electricity certificates. Approval for inclusion in the electricity certificate system means that the producer is allocated one certificate unit per produced and metered MWh of electricity.

Electricity-intensive industries are those in which, in their entirety or as a particular part that constitutes an independent business or performs an independent activity:

- electricity is used, and has been used over the last three years, in an industrial manufacturing process using an average of at least 190 MWh per million SEK of the added value of the industry's production, or
- electricity is used in a new industrial process application using an average of at least 190 MWh per million SEK of the added value of the industry's production, or
- electricity is used for purposes that qualify for exemption from energy tax on electricity, in accordance with Section 11 9 § 2, 3 or 5 of the Act (1994: 1776) Concerning Taxation of Energy.

Electricity suppliers are suppliers of electricity that has been produced by themselves or by some other producer. In addition to companies whose main business activity is the supply of electricity, this means that other suppliers, such as property-owners who supply electricity to their tenants, are included in this category.

Forward contracts are agreements to purchase at a particular time in the future, and at a price agreed at the date of entering into the contract.

Free power is electricity supplied to a user without charge, in accordance with an agreement for compensation for loss of potential benefit or commodity.

Industrial back pressure power production is the simultaneous production of heat (normally in the form of process steam) and electricity in an industrial production plant.

Parties having quota obligations are:
- electricity suppliers who supply electricity to end users, or
- electricity users, to the extent that they have used electricity that they themselves have produced, imported or purchased on the Nordic electricity exchange, or
- electricity-intensive companies, registered as such by the Swedish Energy Agency.

Quota obligation is a requirement to hold, each year (on 1st April), electricity certificates representing the sale or use of electricity during the previous year.

Quota obligation charge must be paid by any party having a quota obligation who does not cancel the necessary number of certificates corresponding to his obligation. The charge is set at 150 % of the volume weighted average price of electricity certificates over the period from the preceding 1st April until the following 31st March.

Renewable energy sources are those that are perpetually replaced or replenished by the effect of the sun on the earth and nature, and are therefore referred to as renewables. Hydro power, wind power and wave energy are in this category, as is tidal energy.

Biomass is classified as a solar-based energy source, and is therefore renewable, as is of course solar energy. In addition to these energy sources, there are also geothermal energy sources that have their origins in the interior of the Earth.

Returns for electricity production from bio-energy and from peat must be received by Svenska Kraftnät by not later than the 15th of the month following the production month. The return must state what proportion the respective fuels constitute of the total quantity of energy input.

Returns from those having quota obligations must be submitted for each calendar year by not later than the following 1st March. Returns must give details of the quantity of electricity sold, the quantity used and any deductions for such qualifying purposes as electricity use in electricity-intensive manufacturing processes, auxiliary power, free power or electrical losses.

Small-scale hydro power plants include those having an installed capacity not greater than 1500 kW.

Spot contracts are contracts that have been entered into at the current market price, and under which electricity certificates are transferred from seller to purchaser within one week.

Svenska Kraftnät (SvK) operates the Swedish high-voltage distribution grid (the country's backbone grid), and maintains the electronic accounts of certificates in the electricity certificate system, with responsibility for its Cesar accounting system.

Links

On its web site, the **Swedish Energy Agency** publishes market statistics such as the number of approved production plants and of registered entities having quota obligations, information on which electricity producers from whom electricity certificates can be purchased, and also other general information on the electricity certificate system.
This report is also available in electronic form on the site.

www.energimyndigheten.se/elcertifikat

On its web site, **Svenska Kraftnät** provides constantly updated information on such statistics as the number of issued, traded and cancelled certificates, as well as on the certificates' average price.

https://elcertifikat.svk.se

The Energy Markets Inspectorate's web site has information on the certificate-inclusive price of electricity from suppliers, thus enabling consumers to compare prices on the market. The web site also displays the results of analyses and business intelligence on the electricity market.

www.energimarknadsinspektionen.se

The Norwegian Water Resources and Energy Directorate (NVE) is the Norwegian public authority that will be the surveillance authority for the Norwegian Electricity Certificate Act. Its duties in this respect on a joint electricity certificate market will be similar to those of the Swedish Energy Agency.

www.nve.no

Statnett SF is the Norwegian authority that will operate the accounting system for the Norwegian Electricity Certificate Act. Its duties in this respect on a joint electricity certificate market will be similar to those of Svenska Kraftnät.

www.statnett.no

References and further reading

(Note that not all of the following documents etc. are in English.)

- Energy in Sweden 2010, Swedish Energy Agency
- Vindkraftsstatistik 2010, Energimyndigheten
- Proposition 2002/03:40 Elcertifikat för att främja förnybara energikällor
- Proposition 2003/04:42 Torv och elcertifikat
- Proposition 2005/06:154 Förnybar el med gröna certifikat
- Proposition 2008/09:9 Ändring i lagen (2003:113) om elcertifikat
- Proposition 2008/09:92 Ändringar i lagen (2003:113) om elcertifikat- tilldelningsprinciper och förhandsbesked
- Proposition 2008/09:163 En sammanhållen klimat- och energipolitik – Energi
- Proposition 2009/10:133 Höjt mål och vidareutveckling av elcertifikatsystemet
- Proposition 2010/11:155 En ny lag om elcertifikat – enklare regler och en gemensam elcertifikatsmarknad
- Lag (2003:113) om elcertifikat
- Förordning (2003:120) om elcertifikat
- STEMFS (2009:3) om elcertifikat

Tables

Table 3. Estimated cost of certificates to electricity customers per kWh of electricity, 2003–2010

	2003	2004	2005	2006	2007	2008	2009	2010
Average spot price per certificate [SEK]	221	234	200	167	208	326	312	255
Quota	0,074	0,081	0,104	0,126	0,151	0,163	0,170	0,179
Electricity customers' cost for certificates [öre/kWh]	1,64	1,90	2,08	2,10	3,14	5,32	5,30	4,56
Electricity suppliers' transaction cost [öre/kWh]	0,16	0,19	0,21	0,21	0,31	0,53	0,53	0,46
VAT, 25 % [öre/kWh]	0,45	0,52	0,57	0,58	0,86	1,46	1,46	1,25
Electricity customers' estimated total cost [öre/kWh]	2,2	2,6	2,9	2,9	4,3	7,3	7,3	6,3

Source: SKM Svensk Kraftmäkling and the Swedish Energy Agency

Table 4. Number of plants, installed capacity and electricity production, by type of energy source, 2003–2010

	2003	2004	2005	2006	2007	2008	2009	2010
Number of plants[1)]	1 597	1 759	1 848	1 909	2 075	2 219	2 419	2 711
Hydro	966	1 040	1 060	1 075	1 094	1 120	1 144	1 164
Wind	543	613	668	706	846	948	1 108	1 371[3)]
Biofuels, peat	87	105	118	125	131	142	156	163
Solar	1	1	2	3	4	9	11	13
Installed capacity [MW][2)]	4 049	4 161	4 471	4 765	5 066	5 123	5 935	6 674
Hydro	491	504	517	540	558	598	602	620
Wind	401	472	530	583	831	1 074	1 440	1 998
Biofuels, peat	3 157	3 185	3 424	3 643	3 676	3 451	3 892	4 056
Solar	0,008	0,008	0,011	0,036	0,043	0,309	0,369	0,557
Electricity production – renewables and peat [MWh]	5 637 559	11 048 438	11 298 378	12 156 855	13 255 913	15 036 828	15 569 665	18 052 536
Hydro	963 637	1 968 325	1 799 446	2 018 577	2 195 320	2 607 348	2 441 624	2 611 044
Wind	455 642	864 546	939 125	988 340	1 431 644	1 995 846	2 490 409	3 485 933
Biofuels	4 218 276	7 670 770	7 925 790	8 593 538	9 049 308	9 599 311	9 765 983	11 162 850
Peat	-	544 791	634 012	556 380	579 622	834 194	871 437	792 434
Solar	4	6	5	20	19	129	212	275

1) Number of plants allocated at least one certificate during the year.
2) For plants allocated at least one certificate.
3) 1371 wind power plants, consisting of 1606 individual turbines.

Source: Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Table 5.1 Electricity production in 2010 in plants commissioned before 1st May 2003 and during the period 1st May 2003 to 31st December 2010

Electricity production in 2010 in plants commissioned during years below [GWh]	Bioenergy	Hydro	Wind	Solar	Peat	Totalt
Before 1st May 2003	9 118	1 983	630	0,005	708	12 439
May 2003 – December 2010	2 045	628	2 856	0,270	85	5 613
Total	**11 163**	**2 611**	**3 486**	**0,275**	**792**	**18 053**

Source: Swedish Energy Agency, Svenska Kraftnät's Cesar accounting system

Table 5.2 Number of plants commissioned before 1st May 2003 and during the period 1st May 2003 to 31st December 2010

Number of plants[1)] commissioned during years below	Bioenergy	Hydro	Wind	Solar[2)]	Total
Before 1st May 2003	101	1 027	607	1	1 736
May 2003 – December 2010	62	137	999	12	1 210
Total	**163**	**1 164**	**1 606**	**13**	**2 946**

1) For wind power, this is the number of plants. In 2010, there were 1 606 turbines in 1 371 plants.

Source: Swedish Energy Agency, Svenska Kraftnät's Cesar accounting system

2) A further five solar energy facilities were registered in the electricity certificate system in 2010, but are not included in these statistics.

Table 5.3 Installed capacity in plants commissioned before 1st May 2003 and during the period 1st May 2003 to 31st December 2010

Installed capacity in plants commissioned during years below [MW]	Bioenergy	Hydro	Wind	Solar	Total
Before 1st May 2003	3 441	485	366	0,008	4 293
May 2003 – December 2010	615	134	1 631	0,549	2 381
Total	**4 056**	**620**	**1 998**	**0,557**	**6 674**

Source: Swedish Energy Agency, Svenska Kraftnät's Cesar accounting system

Table 6. Number of wind power plants, installed capacity and production in 2010, by year of commissioning

Year of commissioning	Number of wind power plants	Installed capacity [MW]	Production in 2010 [GWh]
2001 or earlier	526	295	495
2002–2003 (Jan – April)	81	71	135
2003 (May – Dec)	57	48	70
2004	52	56	104
2005	63	61	108
2006	51	60	114
2007	145	242	575
2008	150	258	560
2009	202	375	824
2010	279	532	501
Total	**1 606**	**1 998**	**3 486**

Source: Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Table 7. Electricity production from certificate-entitled fuels, total electricity production and proportion of certificate-entitled fuels in relation to total fuel supply to biofuel-fired plants, 2003–2010

	2003	2004	2005	2006	2007	2008	2009	2010
Renewable electricity production, including peat [GWh]	4 218	8 216	8 560	9 150	9 629	10 434	10 637	11 955
Industrial back-pressure	2 804	4 735	4 744	4 999	5 622	5 924	5 885	6 249
CHP	1 415	3 456	3 783	4 125	3 984	4 484	4 725	5 682
Biogas	0	25	32	26	23	25	27	24
Total electricity production [GWh]	6 285	11 519	10 984	11 766	11 861	12 810	13 423	14 981
Industrial back-pressure	3 238	5 215	5 146	5 411	5 976	6 331	6 324	6 734
CHP	3 047	6 278	5 785	6 298	5 827	6 424	7 038	8 190
Biogas	-	25	53	56	57	54	61	57
Proportion of renewable fuels and peat [%]	67,1	71,8	77,9	77,8	81,2	81,4	79,3	79,8
Industrial back-pressure	86,6	90,8	92,2	92,4	94,1	93,6	93,1	92,8
CHP	46,4	55,0	65,4	65,5	68,4	69,8	67,1	69,4
Biogas	-	99,8	61,6	46,6	40,6	46,1	44,4	42,9

Source: Svenska Kraftnät's Cesar accounting system

Table 8. Electricity production in approved biofuel-fired plants, by type of fuel, 2003–2010

	Certificate-entitled fuels [GWh]										Non-certificate-entitled fuels [GWh][2]
Year	Energy crops	Forestry / forest industries by-products[1]	Forestry by-products	Forest industries by-products	Landfill gas	Digester gas	Other biogas	Other wood waste	Peat	Total renewables plus peat	
2003 May-Dec	-	-	-	-	-	-	-	-	-	4 218,3	2 066,5
2004	59,1	6 542,8	-	-	16,2	16,2	2,0	1 034,3	544,8	8 215,6	3 303,0
2005	50,7	6 743,3	-	-	15,2	24,1	4,9	1 087,6	634,0	8 559,8	2 424,2
2006	52,3	7 357,8	-	-	17,1	20,4	5,8	1 140,1	556,4	9 149,9	2 615,7
2007	23,9	8 051,2	-	-	16,6	16,9	7,5	933,2	579,6	9 628,9	2 232,0
2008	11,7	-	3 348,2	5 621,1	36,1	15,8	8,3	558,2	834,2	10 433,5	2 376,5
2009	18,0	-	3 369,4	5 816,8	29,4	15,6	10,4	506,5	871,4	10 637,5	2 785,5
2010	16,9	-	4 664,4	5 830,2	25,0	13,8	13,3	599,3	792,4	11 955,5	3 025,1

1) Forestry and forest industries by-products were divided up into two categories in 2008.
2) Non-certificate-entitled fuels are fossil fuels and fuels that give entitlement to guarantees of origin for renewable electricity, such as the biological fraction in waste and by-products from agriculture and domestic and industrial waste.

Source: Svenska Kraftnät's Cesar accounting system

Table 9. Certificate-allocated hydro power producers, 2010, by entitlement basis

Type of production	Number of plants	Allocated certificates	
		[Number]	[%]
Small-scale hydro	1 027	1 983 373	76,0
Restarted operation	28	14 819	0,6
New hydro power	65	284 183	10,9
Production increase	40	251 874	9,6
Concessionary dispensation[1]	4	76 795	2,9
Total	**1 164**	**2 611 044**	**100**

1) Concessionary dispensations for plants that can no longer operate profitably in the long term due to a public authority decision or extensive rebuilding.

Source: Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Table 10. Phase-out of production capacity (installed capacity), 2012–2025

	2012	2014	2018	2019	2020	2021	2022	2023	2024	2025	Total
Wind [MW]	131	246	42	62	58	60	242	236	377	295	1 749
Hydro [MW]	487	3	2	10	17	12	39	8	19	13	610
Biofuels [MW]	3 266	209	-	23	63	135	40	56	234	56	4 082
Solar [MW]	0,008	-	-	-	-	0,028	-	0,153	0,120	0,248	0,557
Total [MW]	**3 884**	**458**	**44**	**94**	**139**	**207**	**320**	**301**	**630**	**363**	**6 441**

Source: Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Table 11. Phase-out of electricity production capacity (energy), 2012–2025

	2012	2014	2018	2019	2020	2021	2022	2023	2024	2025	Total
Wind [GWh]	195	461	64	116	107	117	580	512	786	623	3 562
Hydro [GWh]	1 938	11	8	41	100	67	237	44	76	31	2 554
Biofuels [GWh]	9 089	1 049	-	51	176	523	87	91	917	197	12 180
Solar [GWh]	0,003	-	-	-	-	0,012	-	0,094	0,089	0,133	0,330
Total [GWh]	**11 223**	**1 521**	**72**	**208**	**383**	**708**	**904**	**648**	**1 779**	**852**	**18 297**

Source: Svenska Kraftnät's Cesar accounting system and the Swedish Energy Agency

Our target - better use of energy

The objective of the work of the Swedish Energy Agency is to bring about the establishment of a reliable, minimum-environmental-impact and efficient energy system. Through this, and through international cooperation, we can contribute to achieving world-wide climate objectives.

The Agency finances research and development of new energy technologies. We actively support commercial ideas and innovations that can in due course lead to the setting up of new companies. We also show Swedish households and companies how they can make better use of their energy.

This report is intended to provide a convenient source of overall statistics on the electricity certificate system, and to assist understanding of the system. It presents and comments on statistics from the Agency and from Svenska Kraftnät's IT system.

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