



Summary and recommendations

The Swedish National Audit Office has audited the total support to solar power on the basis of Sweden's energy and climate policy objectives. The audit analyses whether the reference material presented ahead of the Riksdag decision was adequate and transparent, in particular as regards socio-economic analyses.

Background

The Government and the Riksdag have set several targets aimed at increasing the share of renewable energy in the Swedish energy system; the EU renewable energy objectives to 2030, Sweden's renewable energy objectives to 2020 and the extension of the electricity certificate system to 2045. A majority of the Riksdag parties also support the Commission on Energy proposal that Sweden should have 100 per cent renewable electricity generation by 2040. The objectives do not, however, specify the type of renewable energy sources to be used. Solar power is one of several possible technologies for renewable electricity generation and may constitute a part of that generation.

Solar energy currently makes up 0.1 per cent of Swedish electricity generation. The Swedish Energy Agency's proposed strategy for increased use of solar power estimates that to help achieve the target of 100 per cent renewable energy, solar power can increase to a level corresponding to between 5 and 10 per cent of total electricity consumption in Sweden in 2040.

Solar power generation has increased considerably in recent years, both globally and in Sweden. This is largely in connection with falling generation costs combined with targeted subsidies in many parts of the world. In addition, solar power is popular with the public, in part because it does not release greenhouse gases, other environmental pollution and is not noisy. A high proportion of solar power may, however, create major challenges in the power system, since it is variable, in other words it is not possible to control generation. In Sweden it is relatively costly, despite rapid technological development globally.

Swedish solar power generation is subject to a number of different subsidies, including investment support, electricity certificates and various tax subsidies. In total, the support to solar power generation was about SEK 800 million in the period 2009–2016. In the event of extensive development, the costs to central government for the support will be considerably higher.

Since solar power is relatively costly, the support per kWh generated is high, compared with the support to other renewable electricity generation, which is primarily subsidised via the electricity certificate system. The reason for the Swedish NAO's audit was that the cost per kWh is high, while the system is complicated and obscure. Since an important point of departure for energy and climate objectives is that central government initiatives must be cost-effective, the purpose has been to investigate whether the support is cost-effective and the extent to which cost-effectiveness has been taken into account in the design.

Questions and grounds for assessment

The audit is divided into two overall questions:

- Have the Government and responsible agencies developed and reported adequate and transparent reference material to facilitate well-founded decisions on support to solar power?
- Has the support to solar power contributed to Sweden's objectives in energy and climate policy in an economically efficient way?

The Swedish NAO bases its assessments on the assumption that support to solar power was introduced as a policy instrument that together with other policy instruments is to lead to cost-effective achievement of the energy and climate policy objectives. The audit is based on the Commission for Energy target that Sweden is to have 100 per cent renewable electricity generation by 2040 and the climate policy objective of zero net emissions of greenhouse gases by 2045 adopted in June 2017.

Moreover, the assessments are based on the Budget Act's effectiveness and economy requirements, as well as the requirement that central government energy and climate initiatives must be cost-effective in the long term.

Audit findings

The Swedish NAO's overall conclusion is that the reference material largely lacks socio-economic analyses and that the cost-effectiveness of the support in relation to the objective of increased renewable electricity has not been sufficiently highlighted.

Have the Government and responsible agencies developed and reported adequate and transparent reference material to facilitate well-founded decisions on support to solar power?

The regulatory framework behind the support that targets renewable electricity generation in general, or solar energy in particular, has been changed several times. This may obstruct an overview of the support and its effect

The audit shows that the decision-support data on support to solar power has not included adequate socio-economic or long-term budgetary policy analyses. In particular there are no evaluations that take a holistic view of renewable electricity generation in which different generation technologies are set against each other in order to find a cost-effective combination of technologies and policy instruments to achieve the long-term target for renewable electricity. Nor is there any aggregated analysis of the effects of support as regards income and regional distribution.

The Swedish NAO notes that as there is no socio-economic or budgetary policy analysis of the total support to solar power the Riksdag has not received sufficient information for decisions on support measures. This is a substantial deficiency, since a different form of support would probably give more renewable electricity for the money. Changes in the support system for solar energy could also give a greater amount of solar power

generation with the existing resources in the support system. Adequate and transparent reference data is also necessary, since the long-term budgetary policy effects of the support may be great. The solar energy market actors benefit from long-term rules of play and good forward planning for any changes in the support. In so far as other reasons for the support are important, such as contributing to technological progress, these effects should also be analysed and taken into account in the reference material.

Has the support to solar power contributed to Sweden's objectives in energy and climate policy in an economically efficient way?

On the basis of available reference data and the Swedish NAO's calculations, it is not clear how specific support to solar power can be justified, given a target of increasing renewable electricity generation in an economically efficient way. The budgetary policy effects of the support may be significant in the long term. This increases the uncertainty concerning the sustainability of the support. Other effects of the support, such as contribution to technological development or distribution effects, may be of significance, but are largely unresearched.

In the period 2009–2016 central government budget expenditure on solar cell subsidies was about SEK 640–710 million through investment support payments, tax credit for building repairs and maintenance and tax reduction for microgeneration of renewable energy. The Swedish NAO estimates that energy tax revenues in the same period decreased by about SEK 110 million due to tax loss on own use of microgenerated electricity. In the current situation it is a relatively small expenditure item, but experience from other countries shows that subsidy systems risk becoming a burden on public finances when there is a substantial expansion of solar energy. There is no analysis for Sweden of the long-term effects on the central government budget, which increases uncertainty concerning the long-term conditions for investments.

Generation costs for solar energy are higher than for most other technologies relevant to Swedish electricity generation. This applies even if current generation subsidies are counted.

Generation costs are higher for small solar cell plants than large ones. At present the generation cost per kWh is about 50 per cent higher for an installation on a house roof compared with a solar cell park.

Nor is the support to solar cells the same for all types of installations. The support is differentiated in particular depending on the size of the installation, which may be

difficult to justify on the basis of cost effectiveness. The differentiation can only be justified to a small extent by differences in transmission losses in the electricity grid.

The Swedish NAO's calculations show that self-generation of solar power is economically advantageous for households and companies provided the cost of capital is low (3 per cent) and that the support is the same as at present. Investment support in itself is not sufficient to achieve profitability; it is mainly the tax relief for self-generation of renewable electricity that contributes to profitability. The total subsidy to self-generated electricity, including exemption from tax and network charges, is about SEK 1 per kWh.

The difference in cost between different generation technologies for renewable electricity is still great, even after the market value of the electricity generated is taken into account, called the profile cost. This difference also risks being amplified with an increased volume of solar power.

There are mechanisms, that is causal links, that may justify giving solar power technology-specific support based on cost effectiveness, for example investment support and tax subsidies. However, these mechanisms, such as how particular support in the long term may affect technological development, are not analysed and reported clearly in the decision support data produced by the Government and agencies. Nor have other measurements, such as citizens' participation in energy transition, been presented.

The Swedish NAO's recommendations

For the purpose of achieving better decision support data that may ultimately affect the design of support to solar power so that it can contribute more cost effectively to achieving the renewable energy objective, the Swedish NAO makes the following recommendations to the Government.

Recommendations to the Government

Make an analysis of the support to solar power from an overall perspective, in which solar energy is compared with other renewable energy technologies. This will create the conditions for achieving cost-effective steering towards the renewable energy objective, in which all significant economic consequences are taken into account.

Clarify the mechanisms and other measurements that constitute the grounds for technology-specific support to solar power. These should be analysed and, as far as possible, quantified. The most important parts of this analysis should be reported to the Riksdag. This supporting material would facilitate the assessment of how support should be designed to contribute to the renewable energy objective cost effectively.

Create better conditions for long-term and stable rules of play for investments in solar power by analysing and presenting the long-term budgetary policy effects of the combined solar power support. This analysis may reduce the risk of having to revise the support.