Summary

This final report from the 'Inquiry on small entities[1] in a changing energy landscape' concerns several important areas in the ongoing energy transition: energy efficiency, microgeneration, energy storage and electrification of transport.

These are areas where the market activities of small entities, such as households, and small- and medium-sized enterprises (SMEs), are particularly important and where, in parts, rapid developments are currently under way. But they are also areas where these entities encounter barriers. This report presents proposals and assessments in the Inquiry's four main areas. The proposals aim to remove several major barriers, benefiting households and SMEs, and the development of the energy system as a whole.

Remit

On 29 June 2017, the Government decided to appoint an Inquiry Chair to identify the potential barriers that customers – in the form of households, SMEs and other small entities – encounter in implementing energy efficiency improvements and renewable electricity microgeneration, including energy storage. The Inquiry Chair was also tasked with highlighting the potential barriers to greater transport electrification.

The Inquiry Chair was instructed to present proposals in the final report for any necessary changes and simplifications to the current regulatory framework and, if economically justified, new policy instruments. The due date of the final report in its entirety was 15 October 2018.

[1] In this report, 'small entities' refer to small consumers/end users of electricity that occasionally take on the additional role of producer. The term is also used by the Inquiry to generally refer to entities that normally lack the knowledge and professional capacity to act in the energy area.

This is the Inquiry's final report. The first phase of the Inquiry was presented on 28 February 2018 in the interim report 'Small entities in the energy landscape – a state of play review'.

Reasons and objectives

The Inquiry's remit includes small entities in the form of households, tenant-owner associations, and SMEs. These entities have the potential to implement cost-effective measures that can contribute to the transition required by Sweden's energy and climate policy goals.

The Inquiry aims to present policy instrument proposals that support measures that allow small entities to contribute, in an economically efficient manner, to the transition to 100 per cent renewable electricity generation by 2040, while also contributing to the 2030 energy intensity target, the 2030, 2040 and 2045 climate goals, and the three pillars of energy policy.

Through solar photovoltaic (PV) microgeneration, energy efficiency improvements and flexibility offered by energy storage and demand side response, small entities can contribute to achieving the target of 100 per cent renewable electricity generation.

These measures will also improve conditions for greater electrification of both transport and industry, which is key to ensuring the national climate goals are achieved. Increased efficiency of electricity use, coupled with greater electrification of transport, will also improve the ability to achieve the 2030 energy intensity target.

However, there is a risk that small entities will not implement cost-effective measures because of the barriers they encounter. In many cases, these barriers arise from what are often referred to as 'market failures', including those caused by how people actually make their decisions. These circumstances justify introducing additional policy instruments.

The Inquiry's proposals and assessments

Peak load reduction through energy efficiency

Measures to reduce peak load and improve energy efficiency must increase in society. Measures need to be implemented by both small and large entities. Additional policy instruments need to be introduced to improve energy efficiency and, as far as possible, take a long-term approach.

The Inquiry submits the following main proposals in the area:

- Introduce an energy efficiency obligation scheme (white certificates) for peak load reduction through investments in energy efficiency measures. It is proposed that electricity suppliers be required to meet an energy efficiency obligation through measures implemented by end users (except for electricity-intensive industries). This is the Inquiry's preferred proposal.
- Introduce, as an alternative to an obligation scheme, an energy auction scheme for projects that improve energy efficiency and peak load reduction. It is proposed that the auctions have the same scope as the obligation scheme.
- Introduce a special tax credit for residential energy improvements – linked to the current tax credit system for building repairs, maintenance and improvement – to reduce the labour costs for implementing selected energy efficiency measures by 50 per cent. Keep the buyer's maximum total tax deduction at today's level. The tax credit for residential energy improvements will be introduced as a complement to an obligation scheme or alongside an auction scheme.
- Amend the Building Energy Performance Certification Ordinance to ensure the instrument provides greater information on cost-effective measures.
- Task the Swedish Energy Agency with drawing up a plan to better harness behavioural insights, enabling their integration in energy efficiency communications initiatives, including municipal energy and climate advisory services, networks for small businesses and groups of buyers of detached or semi-detached houses.

The Inquiry also makes the following assessments:

- The market conditions for demand-side flexibility need to improve. Roles and responsibilities for network companies at different levels, and for aggregators, need to be defined, while network charges need to more accurately reflect costs.
- Introducing an obligation scheme in line with the Inquiry's preferred option would provide a sustainability and security in management towards set goals. Introducing an auction scheme instead, or for an initial period, would reduce administrative costs for society as a whole, but the scheme would lack the sustainability and incentive of the energy services market provided by an obligation scheme.
- In the choice between the two policy instruments, the Inquiry recommends an obligation scheme but also recognises that there is reason, at least initially, for the mechanism to take the form of an auction scheme.
- The Inquiry's priority is that one of the policy instruments be put in place, since what is most important is to implement additional energy efficiency measures in society.

Global and regional scenarios that show how energy systems around the world need to be transformed to achieve climate and sustainability goals all point to the need for extensive energy and resource efficiency improvements in all sectors, worldwide.

Wind power is expected to play a major role in northern Europe's future electricity system, and to impact the fluctuation on the supply side, especially during the winter months. Wind power output variability can extend over several days. As more intermittent electricity generation is added to Sweden's electricity system and the demand for electricity, particularly in industry and transport, is expected to increase, the challenges of electricity capacity and peak load will increase. These challenges are numerous and diverse.

To manage the integration of a large volume of intermittent electricity generation, many different solutions are needed to design an electricity system that is both robust and flexible. The demand side can contribute through flexibility and energy efficiency improvements.

Household demand response, combined with battery storage, can match demand over short periods, creating relative grid benefits in

local networks. In the short term, the need for increased flexibility is greatest at local or regional level, in networks with particularly high peak loads.

In the long term, permanent energy efficiency measures may potentially offer greater system benefits than demand-side flexibility, since the energy capacity demands of both small and large entities cannot be easily managed for longer periods.

Previous analysis indicates that potential exists for additional energy efficiency measures, even those that could be privately or commercially profitable, in all sectors of society. However, a number of barriers sometimes prevent entities from receiving price signals in a way that leads them to act.

Energy efficiency obligation scheme

The Inquiry proposes, in the first instance, the introduction of an energy efficiency obligation scheme on electricity.

This scheme is expected to lead an expansion of the energy services market. The instrument may reduce transaction costs[2] and increase the implementation of measures not taken at present due to the barriers referred to in economic research as 'myopia',[3] status quo bias and non-decision.

The obligated parties can make implementing measures easier by offering advisory services and co-financing investments, thus reaching end users, despite the barriers that exist.

Key components of the design of the proposed obligation scheme are described in the box below.

[2] Primarily in the form of search costs. For example, a buyer looking for a certain service or product puts in a certain amount of time and effort, and possibly other costs, to bring about a deal.

[3] Myopia means that investment costs needed in the short term are valued at a disproportionately higher level than the present value of the future return on energy efficiency measures.

Proposal for the design of an obligation scheme to reduce peak loads through energy efficiency improvements:
It is proposed that electricity suppliers be assigned responsibility for meeting the obligation. Investments in energy-efficiency measures by both small and large entities/end users may be made and credited in all sectors except electricity-intensive industries.

As an indicative long-term target for the obligation scheme, a peak load reduction is proposed of 3 GW during a peak hour by 2040. It is proposed that this target level be reviewed in connection with implementing the scheme's initial three-year period.

In the initial three-year period, it is proposed that the obligated party meet an obligation, calculated as cumulative electricity savings in kilowatt hours, equivalent to the following percentage of the obligated party's sale of electricity:

2021	2022	2023
2.5%	3.5%	5.5%

After the initial period, it is proposed that the obligations be increased and expressed instead as peak load reduction per peak hour, accumulated over the average life of the measures.

Obligated electricity suppliers are only allowed to use 'authorised measures' to meet their obligation. Authorised measures primarily include standard measures that can be found on a list provided by the responsible authority. In addition to these standard measures, it is proposed that other measures also be allowed, but that stricter requirements be imposed on verifying the results.

When calculating how the obligation is met, it is proposed that the results of the energy efficiency measures be accrued over the life of the measures to obtain the cumulative electricity savings (kWh_{cum}). In this way, measures with a longer life are given a higher value in the scheme.

Auction scheme

The Inquiry proposes that an auction scheme be introduced as an alternative to a mandatory obligation scheme. It is proposed that this scheme be introduced with the same scope and level of ambition as the obligation scheme.

The scheme involves a responsible authority conducting auctions of electricity efficiency measures, where businesses and public sector services can place bids. The measures can be implemented by the business or by its customers. Rather than a mandatory obligation, an indicative capacity target is proposed for this scheme. If the intended capacity is not achieved, an obligation scheme should be considered instead.

To increase fiscal revenue when introducing an auction scheme, the Inquiry proposes that the energy tax on electricity be increased by 0.5 öre per kWh.

Special tax credit for residential energy improvements

It should be possible to change the existing tax credit system for building repairs, maintenance and improvement to provide a higher tax credit for certain energy efficiency measures.

It is considered that, given certain conditions, this change in policy instrument could be introduced in combination with or alongside an obligation or auction scheme. The proposal to also introduce a tax credit for residential energy improvements is justified by the barriers to implementing energy efficiency measures that are deemed greater for households than for large end users of energy.

To increase fiscal revenue when introducing a tax credit for residential energy improvements, the Inquiry proposes that the energy tax on electricity be increased by 0.5 öre per kWh.

Building Energy Performance Certification Ordinance

The Building Energy Performance Certification Ordinance should be amended to clarify what is meant by cost-effective measures. This amendment is expected to lead to a greater number of recommendations for improvements in energy performance certificates, i.e. to

more information that property owners can use to implement energy efficiency measures.

Behavioural insights assignment

It is proposed that the Swedish Energy Agency be tasked with drawing up a plan to better harness behavioural insights, enabling their integration into energy efficiency communications initiatives, including municipal energy and climate advisory services, networks for small businesses and groups of buyers of detached or semi-detached houses. The proposal aims to increase the effectiveness and cost-effectiveness of existing informative instruments, given the market failures and other barriers highlighted by the Inquiry and, in this way, promote the implementation of energy efficiency measures.

System-efficient microgeneration for small entities

Solar photovoltaics (PV) is the microgeneration technology most relevant for small entities. Solar PV may also play an important role in achieving the target of 100 per cent renewable electricity generation by 2040. However, this means that market growth must be stable over the long term. Small entities need a clear regulatory framework and reasonable conditions, while the sector also needs to evolve from immature to mature and grow at a stable rate. The technical/economic prospects for solar PV systems and the politically driven energy transition together shape the market for solar PV.

Many barriers to the positive development of solar PV have been removed in recent years or are currently being examined in other processes in the central government administration. The proposals and assessments in this Inquiry aim to serve as a complement and, in light of this, the Inquiry presents the following proposals:

- Set up a broad-based council that annually proposes to the Government a level of investment subsidy for solar PV for a gradual phase-out. At a maximum, the level of investment subsidy should be such that the average payback period of a solar PV investment is not less than ten years. The council should be under the Swedish Energy Agency. Harmonise the definition of micro-

producer in the Electricity Act and the Income Tax Act so that the upper limit in both acts is a fuse of 100 amperes.

Furthermore, the Inquiry makes the following assessment:

- Strengthen trust and security for installation work through better collaboration between government agencies, small entities and the sector.

Solar PV investment subsidy

The large number of applications for today's investment subsidy indicates that it is attractive for small entities to invest in solar PV systems under current economic conditions. To create long-term and predictable capital investment appraisals for small entities, the Inquiry proposes that the Swedish Energy Agency be tasked with setting up a solar PV council that reports annually to the Government. The solar PV council should be comprised of experts from government agencies, academia and the solar PV sector.

The council should submit proposals concerning the level of investment subsidy, to gradually phase it out. The proposal linked to the size of the investment subsidy should be based on the level of the subsidy at a maximum providing an average simple payback period for investments in solar PV systems of not less than ten years with the help of this subsidy.

Harmonised definition

The larger of the small entities (typically farms or tenant-owner associations) have difficulty making well-considered investment decisions, as there is no uniform definition today of when an entity is a micro-producer and thus subject to a simpler and more advantageous regulatory framework. Under the Electricity Act, end users that have a fuse rating not exceeding 63 amperes do not pay any feed-in tariffs. The Income Tax Act defines a micro-producer as an entity that has a fuse not exceeding 100 amperes at its connection point.

To simplify, the Inquiry proposes that the limits in the two acts should be congruent. It proposes harmonising the definition of

micro-producer in the Electricity Act and the Income Tax Act so that the upper limit in both acts is a fuse of 100 amperes.

Energy storage – small entities and system benefits

In an energy system comprised of highly intermittent electricity generation and an increasingly capacity-oriented pattern of electricity use, any electricity surpluses and deficits can be balanced through energy storage. In this way, energy storage can provide a balancing resource that was previously neither necessary nor commercially available. To create benefit for both small entities and the overarching electricity system in a changing energy landscape, the Inquiry proposes that:

- The Ordinance on grants for storing self-generated electrical energy (2016:899) be amended so that entities other than private individuals can be entitled to a subsidy and so that the purpose of the energy storage does not need to be linked to self-generated electricity. The subsidy will also be extended and the maximum possible amount to apply for will be raised.

Furthermore, the Inquiry makes the assessment that:

- Energy storage for the storage of electrical energy (electricity storage) should be defined and incorporated into the Electricity Act.
- More pilot- and demonstration-scale tests of storage technologies and market solutions are needed.

Expanding existing investment subsidy

The Inquiry proposes an expansion of existing investment subsidy for battery storage to include other small entities than just today's private individuals, and not just in combination with self-generation of electricity, as is the case today. It is proposed that the total level of the subsidy remain unchanged, while the maximum amount for individual grants be raised. It is also proposed that the subsidy be extended. Since the battery storage grant was introduced, the discussion about the potential role of energy storage has expanded. Energy

storage has been increasingly highlighted as a potential key component of the emerging energy landscape. The beneficial role battery storage can play in the energy system is not covered by today's subsidy. Consequently, it is proposed that both the purpose and subsidy eligibility be expanded.

Smart charging infrastructure contributes to reducing peak load and achieving the climate goals

Increasing electrification of transport is under way, not least of passenger cars. Smart charging infrastructure for battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) is essential for progress, and under the right conditions can be developed to support the target of 100 per cent renewable electricity generation. Such a system solution may also enable electric vehicle batteries to contribute to the network capacity. However, this assumes recharging can be done close to homes and workplaces, and is flexible so that it is done during periods of minimum network loading. But the rate of expansion of charging infrastructure is not rapid enough, especially in relation to the climate goals.

The Inquiry proposes the following:

- Implement the new EU requirements for electromobility on in national legislation in a way that promotes the need for the rapid development of recharging points connected to the new and existing residential buildings and workplaces throughout developed sites.
- Design the requirements so that car parks physically adjacent to residential buildings are also covered by the requirement for a minimum number of recharging points, in the same way as non-residential buildings.
- All car parks with more than ten parking spaces physically adjacent to residential buildings should be covered by the same legal requirements for charging infrastructure regardless of the form of ownership of the residential buildings or whether they are detached or semi-detached houses or multi-dwelling blocks.

The Inquiry also makes the assessment that:

- Charging infrastructure in car parks and garages is becoming an essential feature of our society's infrastructure. Charging infrastructure should therefore be considered an 'activity of a substantial nature' for joint property units as well, thus enabling its inclusion in a joint property unit's facility order.
- Smart, digitally connected charging equipment makes it possible to divide the costs of investments and use of the equipment between the residents as desired, for example in a joint ownership association. The Inquiry therefore assesses that this will make it easier to meet the condition under the Joint Facilities Act that the economic or other benefits should outweigh the costs and inconvenience.

Raise the level of ambition in implementing the new EU rules on charging infrastructure

Organisational barriers and split incentives in rental buildings, tenant-owner associations and joint property units risk holding back development. Moreover, joint property units encounter particular barriers when wanting to deploy charging infrastructure in their joint facilities.

That common requirements on electromobility (Directive 2018/844) have now been adopted in the EU is very valuable. But these requirements will have only limited impact on existing developed sites.

The pace of preparing for expansion of charging infrastructure in connection with new construction and renovation under the amended Energy Performance of Buildings Directive is not fast enough, in the Inquiry's view.

In relation to the directive, the Inquiry therefore finds it justified to propose that car parks connected to residential buildings (and not just non-residential buildings) be covered by the requirement for a minimum number of recharging points for new construction and major renovations as a complement to the requirements for expanding infrastructure.

The Inquiry also proposes that all car parks with more than ten parking spaces physically adjacent to residential buildings should be covered by the same legal requirement regardless of the form of

ownership. This means that the requirements apply even if the residential buildings connected to the car park comprise detached or semi-detached houses and the car park is jointly owned by a joint property unit or a tenant-ownership association.

Impact assessment

The problem in the field of energy efficiency, which the Inquiry's proposals aim to contribute to resolving, is that small entities encounter barriers that prevent them from implementing energy efficiency measures to an extent that is cost-effective in relation to set energy and climate policy goals. This problem also applies to large entities with a low share of energy costs in relation to their total expenditures.

The Inquiry's proposals for an obligation or auction scheme, combined with a special tax credit for residential energy improvements, have primarily been analysed on the basis of their more direct economic impact.

The Inquiry assesses that the proposals will initially result in somewhat higher electricity prices for all end users, except for electricity-intensive industries. Over the long term, electricity prices are expected to be lower for all end users.

This assessment is founded on a calculation based on the obligetion scheme, at the level of ambition being proposed, initially having a certain upward impact on electricity prices in a similar way as in other European countries that have introduced the policy instrument.

The calculation indicates that electricity prices could initially rise by around 0.3 öre/kWh. Several years later, the obligation scheme could have an upward impact of 0.5–1.5 öre/kWh.

At the same time, the obligation and auction schemes are expected to lead to lower costs for electricity use (for the entire year) for businesses and households where measures are implemented to achieve the proposed target level.

The assessment regarding the macroeconomic effects is that they will have relatively little impact on both the GDP level and household total income since the expected initial increase in electricity price is relatively small.

In the longer term, introducing the proposed policy instruments is expected primarily to lead to lower electricity costs for the entities implementing measures, but in principle even for the entities not implementing any measures, since the energy efficiency measures have a moderating effect on electricity prices.

The Inquiry's proposed policy instruments to increase energy efficiency will also result in other benefits linked to developing the electricity system, primarily in the form of peak load reduction, particularly in winter and during peak periods.

In the longer run, the measures will also lead to benefits in other parts of the energy system, since the measures also facilitate greater electrification of industry and transport while also improving efficiency of energy use.

It is these effects, taken together, that are most significant in relation to the 100 per cent renewable electricity generation target and that will also make important contributions to achieving the energy intensity target and the climate goals – effects that enhance cost-effectiveness and the economic arguments for implementing the proposals.

In addition to removing barriers for small entities, the Inquiry's proposals in the field of microgeneration, energy storage and charging infrastructure also aim to achieve more cost-effective governance towards the 100 per cent renewable electricity generation target and, in the latter case, the climate goals as well. The Inquiry deems that the costs and distributional effects resulting from the proposals will be small and the fiscal impact neutral or positive.