

# Summary

Reliable and consistent access to electricity and other forms of energy has been a primary driver of prosperity in Sweden for centuries and continues to play a key role in the development of our country's economic, social, and political well-being.

Historically, the electricity system in Sweden has been known for its technical reliability and efficiency. However, over time – particularly the past decade – major changes, including internationalization, re-regulation, technological change, digitalization, and new forms of business, have dramatically altered the playing field for stakeholders across the electricity system, affecting both electricity production and national, regional, and local electricity supply networks.

The electricity networks have long been characterized by a high security of supply, as well as safe and satisfactory access for all customers. However, in 2019, media began reporting that several major users were denied access to the power grid, which prompted immediate political action to remove acute barriers to network access. At the same time, Sweden has rolled out a rapid expansion of wind power while closing nuclear power plants. This expansion has fuelled an ongoing debate whether it is possible to increase reliance on wind power, while sustaining a consistent and reliable supply of electricity.

This report aims to discuss whether recent shortages in network capacity were caused by unexpected surges in demand in major cities, or by more fundamental problems, related to the institutional structure of the electricity market and the regulations that govern its activities. In other words: does the electricity market need a new regulatory framework?

*A comprehensive regulatory framework*

The electricity supply system has a complex structure with many stakeholders, and is subject to extensive regulations, including special permits to establish and operate power grids. In the mid-1990s, the electricity market was re-regulated to separate retailing and production of electricity from transmission and distribution. Retailing and production were exposed to competition to achieve an efficient use of resources and a reduction in costs, while electricity networks – which are deemed natural monopolies – remained regulated to ensure reasonable prices for electricity grid services. Over time, both the European Union and individual member countries have continued introducing additional regulations, including the establishment of special regulatory and permit authorities.

*Increased electricity use in the future*

During the post-war period, electricity use in Sweden increased rapidly, reaching a peak of 130 TWh in the early 1990s and then remaining stable in the 130-140 TWh range for over two decades. For long, the consensus across the expert community was that electricity use would remain at this level in the decades ahead. However, several experts have begun to adjust their projections to reflect emerging trends that affect electricity use, such as the anticipated electrification of the transport sector and other energy-intensive sectors, as well as emerging large-scale users of power, including “server halls” and battery factories.

We project that the demand for electricity and electricity-grid services will increase substantially in the next few decades, due to an overall increase in electricity use as well as a shift in the geographical spread of electricity generation and use. Meeting this increased demand will require significant investments to maintain and expand the capacity of the electricity grid. We believe it is critical to assess network operators’ incentives to make these investments and to make them in a timely manner, as part of a broader analysis of the structure and regulations that govern electricity-grid operations. As noted, this is especially important since lacking capacity has begun to cause increasingly frequent shortages in supply.

*The electricity grid*

The electricity grid is an interconnected technical system that connects producers and users of electricity, and is managed by a large number of national, regional, and local network operators. Network operators' ability to coordinate their operations, including investments and tariffs, is essential for achieving an economically well-dimensioned and cost-effective grid that evolves in tandem with demand. Currently, there are no institutions in place for coordinating the operations of either the transmission network or regional and local networks. In light of the anticipated growth in demand for electricity-grid services, it is critical that such institutions be established.

Network operators hold monopoly positions in their geographical service areas and must therefore comply with government regulations set forth by the Energy Market Inspectorate (EMI). To this end, the incentives to invest in the electricity grid are to a great extent aligned with the design and application of the regulations of the grid. Notably, however, investments are affected not only by incentives, but also by other legal requirements and a rigorous process for securing permits that may prevent or delay investing.

*A new regulation on returns*

In light of the urgent need to invest in increased capacity across our electricity networks, the regulation on returns on invested capital represents the most critical part of the regulatory framework governing electricity-grid operations in Sweden. With a rapidly increasing share of private ownership – via pension funds and insurance companies – across the Swedish electricity-grid industry, the principle that the return on network operators' so-called capital base should equal the return required to attract capital for investments is both reasonable and the most sustainable in the long term.

However, as indicated by frequent legal disputes between regulatory authorities and network operators, we believe the regulation on returns does not function as intended. Among other adverse outcomes, these disputes have inflated the permitted real rate of return to a level well in excess of the rate determined by EMI.

We are proposing a change to the procedures for applying the regulation on returns. Our approach will facilitate greater stability and consistency in the determination of the real rate of return, and is based on an alternative way of calculating this rate than the method currently utilized by EMI. Importantly, our approach will require greater consensus between network operators and EMI regarding what is a “reasonable” return.

We believe these adjustments could be implemented promptly by making moderate adjustments to the regulations that are already in place. We also believe that any resulting generational redistributions of income must be assessed from a long-term perspective. The goal of achieving low network charges today should not be pursued in a way that jeopardizes the quality of electricity grids serving future generations.

#### *A new role for network operators*

The emerging electricity market will be characterized by remarkable change. Digital technology will enable customers to monitor the real-time electricity prices and adapt their use as needed. Local electricity generation is likely to continue expanding. Additionally, the use of battery storage power stations may increase. These developments will lay the groundwork for a new and more active role for regional and local network operators. They are also likely to at least partially dissolve the vertical structure of the electricity system, in which production, transmission, distribution, and retailing have traditionally been separated.

Moreover, given the long lead times for expanding the capacity of the electricity grid, network operators will likely continue to face shortages in the future.

As the electrical system continues to change, it is becoming increasingly complex. To this end, it is crucial to assess the evolving responsibilities, opportunities, and obligations of network operators, as they relate to the expansion and operation of local networks and, possibly, overall system operations. We believe that these issues are extremely complicated. Reassessing network operators’ role requires a comprehensive analysis of the related technical, legal, and financial aspects. We strongly recommend that no policy decisions

regarding the role of network operators be made prior to conducting such an analysis.

However, a status quo should not prevent network operators from taking action to meet surges in the demand for electricity and electricity-grid services. The current regulatory framework lends ample flexibility to manage peaks in demand that could otherwise cause shortages. For instance, network operators can facilitate more flexible use of the electricity grid and encourage customers to take advantage of this increased flexibility by using the electricity-grid tariff as an incentive. None of these initiatives requires modifications of existing regulations. Also, importantly, promoting and encouraging this type of work falls well within EMI's scope of responsibilities.

### *Wind power and security of supply*

Electricity generation systems that are largely based on wind power are vastly different from hydro- and nuclear power-based systems, which have long dominated the Swedish electricity supply. Wind power production is directly dependent on wind speed and related conditions, and can thus not be controlled to the same extent as production in conventional power plants.

Much of the energy policy debate in Sweden has focused on whether increased dependence on wind power is compatible with the need to ensure a consistent, reliable supply of electricity. A common stance is that wind power is most efficiently implemented along with capacity mechanisms – government-regulated pricing that rewards the availability of production capacity to ensure that electricity supply can meet peaks in demand.

Our analysis suggests that introducing capacity mechanisms as a standalone regulation would be short-sighted and inefficient. The fundamental changes to the power generation system will, in the longer term, create strong incentives for electricity-market stakeholders – including wind power producers – to take their own lead on developing new marketplaces and products. In other words, the stakeholders, including wind power producers, are likely to create the capacity markets that may be needed.

With the ample availability of hydropower across the Nordic electricity system, there is sufficient flexibility to offset any fluctuations in wind power production, as long as most Swedish nuclear power plants remain in operation. Thus, decision makers have time to assess the need for modifications to the institutional structure and products of the electricity market – and consequently, there is no reason to alter the regulatory framework governing the electricity market prior to making these assessments.

### *Research*

The restructuring of national electricity markets that took place in the early 1990s was to a great extent supported by research in economics. “Electricity market design” soon became a vibrant and important area of research. Currently, there is no research of comparable scope and quality on electricity network operation and regulation, at least not in the Nordic countries. We believe this is an area where the Swedish Energy Agency, which controls significant funds earmarked for research, could make an important contribution.