

## On a common path towards the future electricity system

**Switching to a green electricity system must take place cost-effectively and without endangering the security of supply.**

The electricity system is currently undergoing a major transformation. The driving force behind it is climate change and the efforts to combat it. Emissions trade and the targets of renewable energy and energy efficiency have accelerated the rapid transformation of the entire energy and electricity system.

This transformation has had a major impact on the electricity market. The strong growth in weather-dependent electricity generation, built with the support of society, has increased the supply of electricity at the same time as the economic recession has reduced electricity consumption. The consequence has been a decline in the price of electricity, which has also been affected by the decrease in the prices of fuels and emission rights.

Electricity must be generated and consumed in precisely equal amounts at every moment. The traditional thinking has been that electricity production matches electricity consumption at any given time. The increase in weather-dependent electricity generation has led to a greater need for flexibility in the system. At the same time, flexible and adjustable electricity generation, which for us in Finland was essentially thermal power plants, is exiting the market, due to falling electricity prices. This equation has, in terms of the electricity markets, become challenging. The market has to change.

In Fingrid's view, the switch to a future green electricity system is crystallised into three themes: strengthening the position of the electricity consumer, developing the marketplaces in line with the changing structure of electricity generation, and the active participation of market operators in balancing the electricity system.

Combatting climate change concerns all of us, and consumers must have the opportunity to be involved in it through their own choices. In addition to being able to select their electricity supplier, in future electricity consumers will also be able to participate in demand-side management. An increase in demand-side management will enable the switch to a green electricity system cost-effectively and on market terms.

Electricity marketplaces must also be brought up to date with the new electricity generation structure. This means, for example, increasing trade opportunities immediately prior to the electricity consumption hour. Our objective is to create new opportunities for electricity market participants – consumers and producers alike – to participate in balancing a green electricity system. We believe that it will be possible in future to balance the system more on market terms, more diversely and in a way that allows consumers to benefit from their own flexibility.

Fingrid's vision of the future electricity system is green, bright and reasonably priced. We are already on our way to achieving that vision.

## Consumer's role growing

### **The future electricity system highlights the importance of consumers' choices.**

The traditional thinking has been that electricity production matches electricity consumption at any given time. With a green electricity system, a considerable proportion of the electricity generated is weather-dependent: sometimes the skies are clear and the sun shines, and sometimes even the strongest winds become still. Before the large-scale storage of electricity becomes common, this means that it must be possible to match electricity consumption with electricity production on an entirely new scale.

The changing electricity system will mean consumers will play a more prominent role. In future, consumers will be able to help combat climate change and at the same time gain financial benefits by being flexible in their use of electricity in response to the situation in the electricity system. In Finland, especially homes that are heated with electricity will have excellent opportunities to participate in realising the energy change. The growing use of electric cars offer consumers additional flexibility opportunities.

Some consumers are already purchasing their electricity at hourly prices and switching their consumption times from high-priced to lower-priced hours. In future, consumers will also be able to give electricity suppliers and other service providers the opportunity to smartly guide their electricity consumption according to price. For example, electrical heating can be controlled automatically without compromising in living comfort.

On the path to the future electricity system, it will also be possible to offer consumers demand-side management in real time in order to maintain a balance in the power system. Service providers will combine consumers' electricity consumption and production into a larger entity, for example by combining the capacity of electrically heated homes' hot-water tanks or thermal pumps. Service providers will offer demand-side management to real-time markets that support the system's balance on behalf of consumers.

The consumer must obtain monetary benefits from participating in demand-side management, and the participation must be as easy as possible.

## Flexibility in marketplaces

**The procurement and sale of electricity will, in future, take place closer to the consumption hour.**

The price of electricity is determined in the market, where the market price reflects its value, which varies at each moment. In the short term, the market price will guide electricity production and consumption. In the long term, it will enable and guide investments both to production and consumption, as well as to transmission lines and storage.

It has traditionally been relatively easy to predict electricity production and consumption in the short term. Weekdays are generally very similar, on weekends saunas are heated up at around the same time, and as the mercury drops, more electricity is used for heating. At any given time, an exact amount of electricity is produced to meet demand.

The electricity marketplaces have largely evolved to meet the needs of the traditional time frame for planning electricity consumption and production. On a winter weekday, for instance, electricity consumption and the required production can be predicted relatively accurately a day in advance on the basis of the temperature forecast.

On the day-ahead market, electricity is sold and purchased for the next day. Sellers and buyers leave their offer on the electricity exchange by 1 p.m. and the results are published roughly an hour later. The basis for trade is the operators' plans concerning the required amount of electricity, either for resale in the retail market or for consumption by industrial facilities. Each hourly price settles at the level where demand meets supply. Nowadays, most trade takes place on the day-ahead market, which, in the Nordic countries, is maintained by the Nord Pool electricity exchange.

The intraday market supplements the day-ahead market. If, for example, the wind and temperature forecast changes over the course of the day, trade can take place on the intraday market, taking the revised situation into account. Electricity market operators in the Nordic countries can make use of Nord Pool's Elbas market, which is based on continuous trade. The intraday market gives electricity market operators the opportunity to balance their electricity purchases and sales closer to the consumption hour.

With a green electricity system, trade will be concentrated closer to the hour of consumption, as varying electricity generation and the difficulty in forecasting it will increase the need for trade to take place closer to the hour of supply. At the same time, this will require the development of all marketplaces and their regulations in order to meet the requirements of the transformation. The most obvious need for change exists in the short-term intraday markets and the real-time markets.

## Everyone involved in the electricity market

### **A green electricity system will reward the active electricity consumer for flexibility.**

Electricity must be generated and consumed in precisely the same amount at every moment. If generation outweighs demand, the power system's heartbeat, i.e. frequency, rises. Correspondingly, if there is not enough generation, the frequency drops. Excessive frequency disturbances can cause problems such as defects in electrical equipment and, in the worst-case scenario, a considerably lengthy blackout. Electricity production has traditionally been flexible, matching consumers' needs. With the change in the electricity market, flexible generation capacity that has the ability to regulate has been replaced by weather-dependent generation. An increased amount of weather-dependent generation calls for increased power system flexibility.

In the electricity market, the price of electricity illustrates the balance between consumption and production. In the real-time markets, i.e. the balancing power and reserve markets, price variations can even be great. It is easy to understand that, for instance, when a large production plant experiences a disturbance, quick measures are needed to balance the power system, and other operators must be able to either reduce their electricity consumption or boost their production very rapidly. The higher price in the real-time market reflects the growth in the need for balancing.

In Finland, big industry has for some time been active in the electricity market and, guided by price signals, has adapted its electricity consumption. With a green electricity system, this alone is not sufficient: an increasing number of electricity consumers will have to be able to adapt their electricity consumption to weather-dependent generation. Since the price of electricity guides and reflects the need to adapt consumption, active and flexible electricity consumers benefit financially through their participation in the electricity market.

Fingrid's goal is to enable full-scale use of the power system's potential to adapt in the electricity and real-time markets. Our goal is to eliminate barriers to market entry so that every consumer can have the opportunity to influence and benefit from the change taking place in the electricity system, either directly or through a service provider. At the same time, we are especially improving transparency in the real-time markets and increasing the availability of electricity market data.

Our aim is to develop electricity balance pricing to increase financial incentives for active electricity market operators. When the value of flexibility in a green electricity system grows, it will also mean that inflexible electricity producers and consumers will have to correspondingly pay a larger share of the overall costs to balance the power system. Active electricity consumers, however, will benefit from the change.

# FINGRID

## The bright future of electricity

**The future green electricity system will be diverse, flexible and cost-effective.**

The energy system, and the electricity system that forms a part thereof, will be green and low carbon. In this green electricity system, electricity is generated diversely through, e.g., hydro and wind power, nuclear power, biomass and solar energy. In addition, homes make use of microgeneration and stored power.

A bright and warm future is being safeguarded with a reliable electricity system that flexibly absorbs the power variations caused by weather-dependent, renewable electricity generation. Flexibility has been realised through a smart grid made up of electricity storages, flexible generation, sufficient transmission capacity and market-based demand-side management for electricity consumers. Electric cars, hot water tanks and battery storage operating in connection with solar panels are some examples of the energy-storing technologies available to consumers. Consumers have become active energy citizens.

The well-functioning electricity market has given energy citizens a reasonably priced electricity offering, and operators in the sector diverse services; it has also enabled the cost-effective achievement of energy and climate targets. Consumers can also make their electricity bills more reasonable by offering their own storage and demand-side resources for the needs of the power system. A well-functioning electricity market has guaranteed a foundation for sufficient electricity generation capacity and incentives for flexibility in the system.

A green, reliable electricity system is being achieved through the joint efforts of active energy citizens, a well-functioning electricity market and a smart grid.