

# Dynamic Electricity Pricing and the Swedish Experience

## Factsheet

Therese Hindman Persson, PhD, Chief Economicst, Swedish Energy Markets Inspectorate  
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This paper presents some insights into price signals and consumer flexibility, and gives a brief overview of the characteristics of dynamic electricity pricing, and some food for thought going forward.

## Price signals and electricity consumers

A price signal is information conveyed to consumers and producers via the price charged for a product or service. The price provides a signal to increase or decrease quantity supplied or quantity demanded. If a price is efficient, it should achieve two outcomes:

1. To allow a business to recover at least the costs of providing a good or service, thus facilitating long term service provision, and
2. To provide a signal to consumers for efficient consumption.

When prices accurately reflect the costs of provision, they provide incentives for consumers to make efficient decisions about when, and how much, of a product or service to consume. A rational consumer would be expected to only purchase a product or service when he or she believes the value of consumption is greater than the price charged. In turn, if prices reflect the efficient costs of provision, then this outcome would also be efficient from a societal perspective.

In the context of electricity markets and demand-side flexibility, the costs that have most relevance are the marginal costs of supply. These are the costs that vary as consumption varies. If the electricity price accurately reflects the efficient cost of supply, and consumers are aware of the price and able to respond to it, any consumption that occurs can be said to be efficient. Hence, key factors include knowing the price and being able and willing to respond.

## The situation in Sweden

In Sweden, the retail market for electricity has been subject to competition since the market was deregulated in 1996. For consumers, this means they can buy their electricity from any electricity supplier (retailer) of their choice. The electricity is then delivered or distributed by a distribution system operator (DSO). The retailers compete in the market and the pricing is free while the DSO is a regulated monopoly. Today Sweden has roughly 129 active retailers who serve their customers with electricity, which they buy on a power exchange or via bilateral agreements with producers

Electricity consumers pay a total price for electricity that is typically divided into three components: electricity, network, and taxes & levies. The electricity component comprises wholesale electricity costs and the supplier's margin (together often referred to as electricity trading price). Roughly 85-90 per cent of the electricity trading price represents the cost incurred by the electricity supplier to purchase the electricity needed. While the network component is made up of various transmission and distribution related costs, taxes & levies are policy charges. In Sweden, a typical household consumer faces a total cost of electricity that is divided between these three components in approximately the following percentages: taxes & levies 41 per cent, network 22 per cent, and electricity trading price 37 per cent<sup>1</sup>.

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<sup>1</sup>[https://www.ei.se/PageFiles/317552/Ei\\_R2019\\_03\\_Swedish\\_electricity\\_and\\_natural\\_gas\\_market\\_2018.pdf](https://www.ei.se/PageFiles/317552/Ei_R2019_03_Swedish_electricity_and_natural_gas_market_2018.pdf)

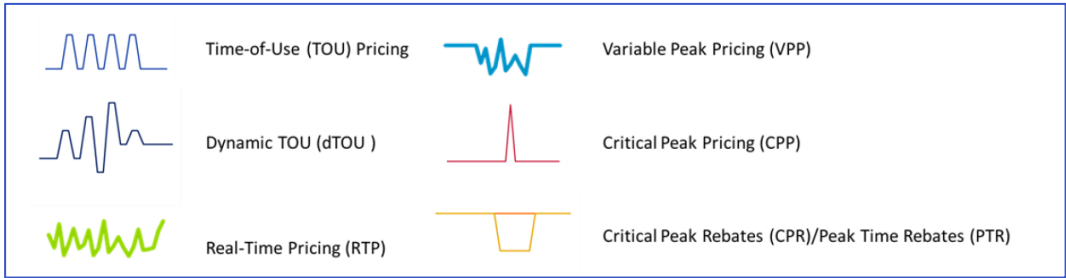
For a consumer to be able and willing to respond to price signals, prices must be transparent, and it must be possible to achieve an outcome/effect by taking action. A completely flat price cannot provide such incentives. Dynamic pricing of electricity means that at least part of the price that consumers pay for electricity varies over time. It could be the electricity trading price, the distribution tariffs, or both. If both the electricity and network components are priced dynamically then some consumers may face more than one price signal at a time. These signals could reinforce one another, but they could also move in opposite directions and be coming from different actors<sup>2</sup>. In Sweden, most of the dynamic comes from the electricity component even though there are cases of dynamic network tariffs too.

The deregulation of the Swedish electricity market paved the way for more innovative and more dynamic pricing options than before, thus providing at least some incentives for a consumer to be active in the market.

### Importance of dynamic pricing

Dynamic pricing stimulates competition between electricity suppliers, and it makes it possible for consumers to adjust consumption patterns in response to price signals, thereby allowing the possibility to lower overall electricity costs. This lower cost would then stem from both consumption shifting to avoid peak price hours but also lower margins on contracts based on spot-related prices if the market is sufficiently competitive. More active consumers would also contribute to a more well-functioning market, i.e. a virtuous circle where more efficient prices would reduce peak demand, lower the need to build capacity to meet it, and therefore lead to an overall increase in economic welfare.

There are many different pricing models for dynamic pricing where real time pricing (RTP) involves the most frequent price fluctuations. Other options include Time-Of-Use (TOU) tariffs, dynamic TOU tariffs, variable peak pricing, critical peak pricing, and critical peak or peak time rebates, see below for a simplified graphical illustration. The main difference between various pricing models is how frequently the price varies and how the price variations are communicated.



**Figure 1: Graphical illustration of dynamic pricing options.**  
 Source: Ecofys, February 2018<sup>3</sup>.

### Challenges

In regions with deregulated wholesale electricity markets like the Nordics, electricity prices reflect differences in marginal generation costs as well as time-varying differences in firms'

<sup>2</sup> See also Öhrlund, I; Linné, Å och Bartusch, C; "Convenience before coins: Household responses to dual dynamic price signals and energy feedback in Sweden", Energy Research & Social Science, Volume 52, June 2019, Pages 236-246.  
<sup>3</sup> Authors: Sil Boeve, Jenny Cherkasky, Marian Bons and Henrik Schult

abilities to push prices above marginal costs by exercising market power. In this context, more dynamic electricity prices can reduce firms' incentives and ability to exercise market power by increasing the elasticity of their residual demand<sup>4</sup>.

Historical arguments against introducing dynamic pricing have included the following: (a) metering would be too costly for residential and small commercial customers, (b) meter reading and billing costs would increase with more complex rates, (c) retail consumers would not understand or effectively utilise complex rate designs, and (d) changing rate designs would lead to large redistributions of income reflecting the variations in consumption patterns across individuals.

Given technological developments and the wide introduction of smart metering and billing systems, the largest current impediment is likely to be the political fear of large redistributions across customers. For example, there are studies indicating that a large share of benefits, when going from a flat rate to time-of-use rates, would accrue to a small number of consumers who are responsive and, for example, own electric vehicles<sup>5,6</sup>.

## Insights for other countries

In Sweden, both the wholesale and retail markets are competitive, and Sweden also benefits from the early roll-out of smart meters and reliable communication networks. These are all important prerequisites for dynamic pricing, especially RTP, to work well. However, there are important lessons to be learned and improvements to be made based on the Swedish experience, some of which are mentioned below.

- In Sweden, there has been a strong focus on digitalisation and the roll-out of smart metering systems since the beginning of 2000. As early as May 2010, 91 per cent of the meters could register hourly values remotely and in 2017, a new amendment was made to the legislation so that all electricity consumers could request hourly metering at no extra cost. Installing the meter is a DSO responsibility.
- In Sweden, we have a supplier of last resort system. When a consumer does not make an active choice of electricity supplier, the DSO assigns a supplier to the consumer. However, this means that the contract the consumer gets may not be the most favourable for the consumer. In fact, on average, the price of such designated contracts is 20–30 per cent higher than for other types of contracts. Information from the Swedish Energy Markets Inspectorate suggests that consumers living in apartments are relatively more likely to be inactive than other types of consumers.
- The most dynamic part of the electricity cost (i.e. the electricity trading price) is only a fraction of the total cost of electricity and hence the price signal is not as clear or strong as it could be. If the aim is to stimulate consumer activity it is critical that the price signal is sufficiently strong and that it reaches the consumers. There is also recent research indicating that there are benefits from coupling the price signal with information and communication activities as well as technological options like automation to influence behaviour<sup>7</sup>.

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<sup>4</sup> Borenstein, Severin and Stephen Holland, 2005. "On the Efficiency of Competitive Markets with Time-Invariant Retail Prices." *Rand Journal of Economics*, 36(3): 469-493.

<sup>5</sup> Faruqi, Ahmed; D. Mitarotonda, L. Wood, A. Cooper and J. Schwartz, 2011. "The Costs and Benefits of Smart Meters for Residential Consumers." Institute for Electric Efficiency (IEE) Whitepaper, July.

<sup>6</sup> Borenstein Severin, 2012. "Effective and Equitable Adoption of Opt-In Residential Dynamic Electricity Pricing," NBER Working Papers 18037, National Bureau of Economic Research, Inc

<sup>7</sup> Öhrlund, I; Linné, Å och Bartusch, C; "Convenience before coins: Household responses to dual dynamic price signals and energy feedback in Sweden", *Energy Research & Social Science*, Volume 52, June 2019, Pages 236-246.

- The dynamic pricing that we have is good but only one step in the right direction as long as the total cost of electricity for the consumer is roughly 60 per cent fixed. This percentage includes both taxes & levies and the network component that in most cases is fixed.
- Sometimes it is argued that dynamic pricing can cause problems for vulnerable consumers. However, in Sweden vulnerability in terms of, for example, low paying ability is handled through the social security system and not through electricity prices as this is more efficient and will contribute to lower the overall cost for the consumers.

## Conclusions and looking forward

From time-to-time, arguments on limiting consumer choice are put forward on the grounds that dynamic pricing is difficult for consumers to manage and that there are risks that consumers will be exploited. This is a bit odd as consumers are indeed very good at managing other types of goods and services with dynamic pricing and we believe they can handle electricity in this way too. Dynamic pricing models underlie many consumer goods that are handled daily, such as groceries and clothes (both domestic and imported). In addition, many consumers including households save money in mutual funds, stocks and bonds that are known to have quite complex dynamic pricing.

We see active and involved consumers as being key to well-functioning markets and a sustainable electricity system, and therefore limiting choice per se is not considered the best way forward. It is important to not underestimate consumer ability but rather contribute to strengthening consumer abilities when needed. At the Swedish Energy Markets Inspectorate, we recognise that there are challenges to be overcome and that there is a clear need for regulators to take steps to assist consumers. For example, regulators should monitor the behaviour of electricity suppliers to make sure customers are not exploited. The Swedish Energy Markets Inspectorate has undertaken and continues to undertake information related activities in relation to consumers. In addition, we undertake several activities aimed at assisting consumers to be more aware of their rights, opportunities and responsibilities by, for example, providing information to consumers on matters such as:

- How to change electricity supplier
- The costs of connecting to the electricity network. The maximum time it should take to have your meter replaced if needed in order to take advantage of hourly contracts.
- How to report your electricity supplier or DSO
- What to do if you experience a power failure
- Telephone support for consumers
- The Swedish Energy Markets Inspectorate publishes regularly reports on market developments and a special report on customer complaints
- Independent price comparison tools are important. In Sweden, electricity suppliers that offer electricity contracts to electricity consumers are obliged to report the most common contract types to the price comparison website: [elpriskollen.se](http://elpriskollen.se) Elpriskollen is run by the Swedish Energy Markets Inspectorate and allows comparisons to be made between different electricity suppliers and their offers.

In Sweden, we consider demand-side flexibility to be a cornerstone of an efficient future electricity system. For demand-side flexibility to work well, price signals are key and hence

dynamic pricing of electricity, both energy and network, is important going forward. As markets are characterised by e.g. asymmetric information, the availability of independent and unbiased information to actors, especially consumers, in the market is vital. Regulators have a special and important role to play in balancing various interests and to level the playing field in order to enable consumers and new actors to participate actively in the market, should they wish to do so. The Swedish Energy Markets Inspectorate is currently working to improve price signals coming from network tariffs. We have a mandate to issue regulations on network tariff design and the aim is to move towards even more cost reflective tariffs that stimulate an increasingly efficient use of the electricity network.