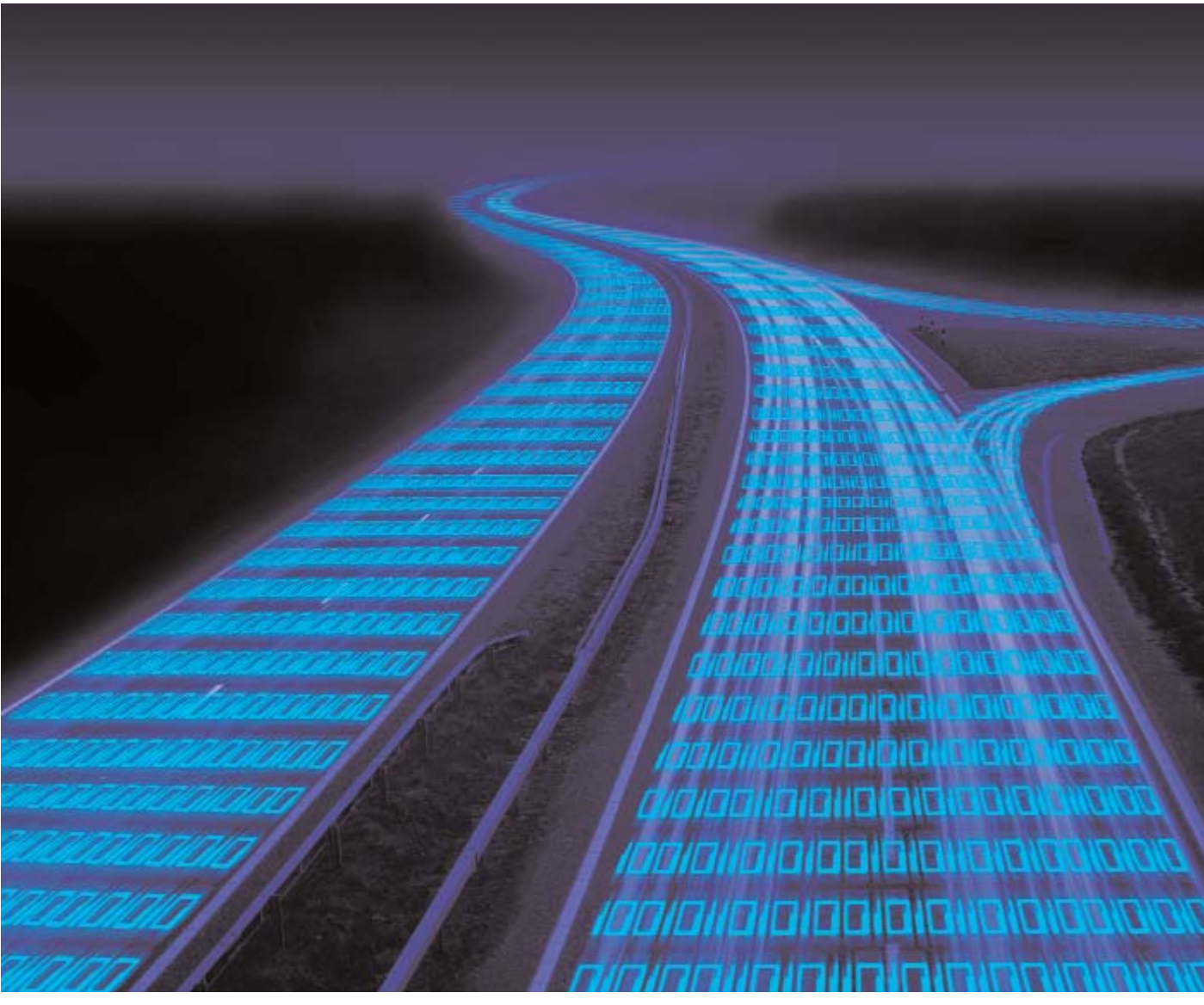
GEODE Position Paper on the Development of the DSO's Tariff Structure



GEODE Working Group Tariffs

September 2013

GEODE

The Voice of local Energy Distributors across Europe

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Executive Summary

The current distribution tariff structure is inherited from earlier regulatory regimes where tariff structure was a combination of distribution and supply requirements. Further development of the DSO's tariff structure is needed now, in order to: improve the cost reflectivity; provide fairness between customers; and, enable the effects of incentivisation driven by the changes to the energy system resulting from the integration of more renewables and distributed generation.

With this paper **GEODE** intends to demonstrate why the current energy based DSOs' tariff structures[1] do not reflect the true costs of the grid and provide weak incentivisation to improve customers' savings, customer behaviour and DSO investments, and therefore has to be reconsidered.

GEODE proposes that future energy needs require regulatory systems enabling a DSO tariff that promotes incentivisation for the overall energy efficiency of distribution that encourage customers to optimize their load profiles so that the utilization rate of the distribution network capacity is as high as possible

The target of future tariff structure development should aim to establish a pricing scheme for DSOs that encourages the end-users to behave in a way that improves the overall efficiency of the energy system, (generation, transmission and distribution), and minimises the total costs to the national economy. Smart Meters and Smart Grids shall provide the technical framework enabling tariff structures for the future.

In this paper **GEODE** presents a DSO power based tariff approach as one tariff scheme that better suits the requirements of a DSO tariff structure.

GEODE underlines that **there is no "one solution fits all" in Europe when discussing tariff structures**. It is therefore essential that the DSOs are allowed to develop their tariff structures to incentivize overall energy efficiency of distribution.

[1] This paper focuses on a DSO tariff for electricity household customers, including prosumers.

The current tariff structure

The current electricity price model normally consists of distribution cost components (the payment to the DSO covering the costs of the grid), electricity consumption (covering the costs of the energy supplied) and taxes. The proportion of the total electricity bill paid by the household customer in European Member States for **distribution costs ranges between 10% and 30%.**

Generally, both DSO and supply prices consist of fixed and variable energy-based components. The current distribution tariff structure is inherited from previous regulatory regimes when tariff structure was a simple combination of distribution and supply costs, including fixed and variable energy costs. In theory the fixed costs matched distribution while the variable energy costs matched supply.

Today, in most of the European countries, the distribution tariff structure of electricity household customers typically comprises a fixed charge and an energy rate, which may vary between the times of the day and the seasons. The distribution tariff is mainly based on the distributed amount of energy.

As an example, see below the electricity price formation for a household customer in Finland (Figure 1). Network costs consist of TSO and DSO costs. Energy prices consist of electricity purchase costs and retail/supply costs. Tax is added to all invoices. In total energy consumption charges represent 75% to 82% of customer electricity bill.

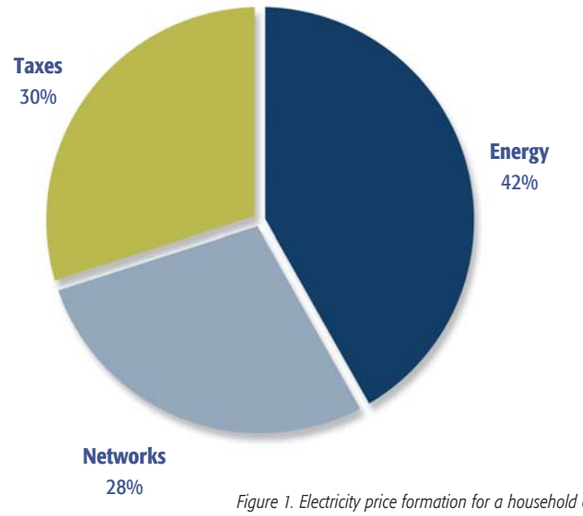

Figure 1. Electricity price formation for a household customer in Finland

Challenges of current tariff structure

The following barriers have been identified in the current DSO tariff structure around Europe:

- Current tariff structure does not reflect costs appropriately. If a customer varies consumption, the cost will change; however the DSO's cost may not change in the same proportion. A reduction of energy consumption without a reduction of the maximum demand will reduce the DSO's revenues but not DSO's grid cost.
- Current tariff structure does not encourage customers' behaviour to optimise the use of distribution systems infrastructure. This can result in expensive grid reinforcements. The current DSO tariff structure focuses upon energy consumed and does not provide viable financial incentives for the customer to adapt their electricity consumption in harmony with the network capacity perspective.
- Current tariff structure is not fair to the customers. The number of "prosumers" will rise steadily over the next years. More customers will lower their energy consumption with the help of their own production or new technologies. Based on the current tariff structure, these customers will lower their grid fees (DSOs' tariffs) at the expense of others. Germany, for example, with a significant growth rate for "prosumers" is starting to face this problem.

Hence, the **current tariff structure has to be developed further, to address the absence of adequate cost reflectivity and to improve customer incentives for network optimisation, customer savings and reasonable investments by DSOs.**

The target for future tariff structure development

The target of the tariff structure development should be to establish a pricing scheme for DSOs to enable the end-users to behave in a way that the overall efficiency of the total energy system, including generation, transmission and distribution, is maximised, and the total costs to the national economy are minimised.

Operational framework in electricity distribution is changing rapidly, due to increasing energy efficiency and energy savings. Smart Grids, together with distributed generation, demand response and energy storage will have significant influences on the demand for electricity. This will have a dramatic impact on electricity distribution networks.

Smart Meters and Smart Grids provide new technical possibilities for load voltage control and the measurements of electricity consumption. At the same time they provide possibilities for new tariff structures.

It should be emphasised that both energy consumption and capacity load have an impact on the overall efficiency of the electric power system, and therefore, a pricing scheme that only encourages reductions in consumption does not necessarily produce an optimal result.

Incentives are required to reduce the peak load and optimise the temporal variation of capacity load in the grid. At present, the financial incentives for optimizing the electricity consumption from the network capacity perspective are very limited.

In addition, the peak load determines the network dimensioning requirements, and most network components (lines, cables, transformers) have a long life span (normally several decades).

The DSO's revenues need to reflect peak load and energy distributed for consumption. Network infrastructure building costs for peak load demand can be reduced by enabling customer efficiency to utilise capacity outside of the peak demand and incentivise customer behaviour that utilises the network capacity. This would require a tariff structure that looks beyond current energy distributed and encompasses reduction in peak demand usage.

After analysing the barriers of current DSOs tariffs, **GEODE** recommends the following **general principles for the future development of DSO tariffs.**

- Tariffs should be cost reflective, easily understandable and transparent.
- Customer has a genuine opportunity to affect the distribution charge.
- Tariffs should promote peak demand management and aim to reduce infrastructure costs purely for peak demand.
- Tariff structure should encourage distributed generation, demand response, and efficient energy consumption [from the distribution system perspective].
- Tariff structure should enable sufficient and predictable revenues for DSOs investments now and also in the future.
- Tariffs should be technically feasible to implement (metering and control).
- Tariffs should promote well-functioning electricity markets.
- Tariffs should support the European Union and national energy and climate policy.
- Tariff structure should not conflict with overall regulation and legislation.

European legislative framework

Concerning the DSO tariffs, in Article 15 of the Directive 2012/27/EU[2] is stated that:

> *"Member states shall ensure the removal of those incentives in transmission and distribution tariffs that are detrimental to* ***overall efficiency*** *(including energy efficiency) of the generation, transmission, distribution, and supply of electricity or those that might hamper participation of demand response, in balancing markets and ancillary services".* Furthermore, in Annex XI of the Directive, it is stated that *"network tariffs shall be cost-reflective of cost-savings in networks achieved from demand-side and demand-response measures and distributed generation, including savings from lowering the costs of delivery or of network investment and a more* ***optimal operation of the network****".* Moreover, it is presented that *"network regulation and tariffs shall not prevent network operators or energy retailers making available system services for demand response measures, demand management and distributed generation on organized electricity markets".*

To ensure that DSO tariffs provide incentives for the overall energy efficiency of distribution, it has to be guaranteed that the tariff structure encourages customers to optimize their load profiles so that the utilization rate of the distribution network capacity is as high as possible. This objective is not met by the current energy based pricing tariff structures, but **the power based component has to be included in the tariff structure**.

As a conclusion, **GEODE** finds that the demands of the Directive can probably be best fulfilled by a power approach in tariffs.

[2] Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC

Power based tariff structure

The DSO's tariff structure should contribute to the overall efficiency of the system by giving adequate incentives with regard to DSOs' costs. It should also encourage customers to optimize energy behavior in the long term while providing incentives to encourage energy savings in the short term.

In **GEODE**'s view both targets are achievable: DSO tariffs should encourage efficiency in the long term while the energy price encourages efficiency in the short term.

Therefore **GEODE** gives as one example a DSO power based tariff structure as one tariff scheme, among others, that better suits the requirements of DSO tariff structure as outlined previously.

If the DSO tariff is based on power it provides incentives to decrease the capacity demand and it should result in cost savings in the long run. Moreover, power based pricing encourages customers' demand response actions. The power based tariff is cost reflective for the DSO, because the pricing principle is the same as the key cost basis of the electricity distribution. Also the predictability of distribution revenues for DSOs and bills for customers is higher than in the energy-based pricing, as for instance the variations in the annual mean temperature have a significantly lower impact on the annual peak powers than on the volume of distributed energy. Similarly, the structural changes in the electricity end-use, such as installation of a heat pump for space heating, have a lower effect on power than on energy.

Such pricing methods encourages customers to reduce their peak loads. As the network capacity utilisation rate increases, the long-term costs decrease, which is financially beneficial to the customers.

From the energy efficiency point of view it should be underlined that even if DSO tariff was based only on a fixed price, the energy-based charges of the electrical bill, still encourages the customers to lower their total energy consumption. For instance in Finland, they still represent 65 % of total customer electricity bill. It is then guaranteed that the energy bill encourages the customers to reduce their use of energy even if the distribution network tariff scheme is based on a power charge only.

The figure below illustrates the electricity price formation of an average Finnish household customer and how it is split into energy based and fixed charges, assuming the DSO distribution tariff is based on a fixed charge only.

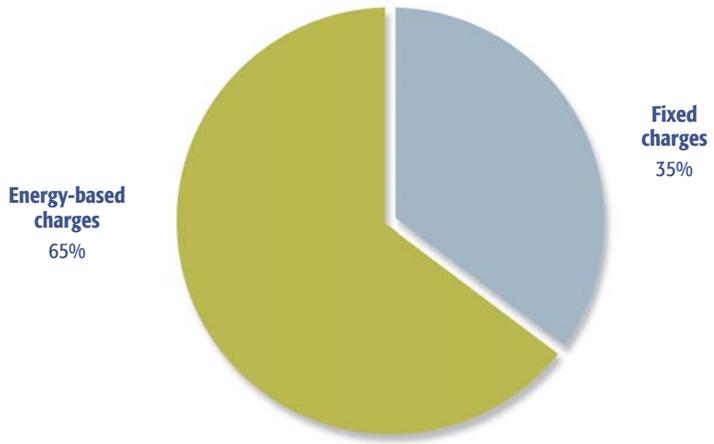

Figure 2. Division of charges in a household customer electricity bill in Finland

GEODE underlines that **there is no "one solution fits all" in Europe when discussing tariff structures**.

Future energy needs require regulatory systems enabling a DSO tariff that promote incentivisation for the overall energy efficiency of distribution and that encourage customers to optimize their load profiles so that the utilization rate of the distribution network capacity is as high as possible.

Conclusions

GEODE believes that the following principles should be taken into consideration when rethinking the current DSOs' tariff structures:

- Current energy based DSO tariffs structures need to be re-developed, in particular because of their inadequate cost reflectivity and weak incentive effects both for customers' savings and DSOs' investments.
- The target of the DSO tariff structure development should be to establish a pricing scheme for DSOs that encourages the end-users to behave so that the overall efficiency of the energy system, including generation, transmission and distribution, is maximised, and the total costs to the national economy are minimised.
- This objective is not met by the current energy based pricing tariff structures, but the power based component has to be included in the tariff structure.
- **GEODE** proposes a DSO power based tariff approach as one tariff scheme, among others, that better suits the requirements DSO's tariff structure should fulfill.
- Power based tariff approach meets the targets set for the DSO tariff:
  - Tariff is cost reflective and guarantees a predictable revenue stream for DSOs also in the changing operational framework.
  - Power based tariffs, together with the energy based supply pricing, provide customers with incentives to optimize their consumption and their own production while contributing to the efficiency of the whole energy system.
  - It encourages customers to participate in demand response activities.
  - Power based pricing is a cause-fair tariff system for customers.
  - It meets the demands of the Energy Efficiency Directive (2012/27/EU).
- **GEODE** underlines that there is "no one solution fits all" in Europe when discussing tariff structures. It is, however, utmost essential that the DSO's are allowed to develop their tariff structure without unnecessary regulatory restrictions.

ANNEX

Power band pricing

In the power based pricing, the distribution charge is based on the peak power taken from the grid (in practice, the highest hourly mean power) over a certain time period, or on a certain subscribed capacity agreed upon with the DSO. The latter of these options is called "Power band pricing", a concrete example of how the power based tariff structure described in the paper could be implemented.

Based on studies made in Nordic countries, the power band pricing scheme is one possible example of a tariff structure that meets best the targets set for the DSO tariff. In the power band pricing, a customer's distribution tariff depends on the subscribed power band, which provides customer with incentives to lower his peak power demand. Currently, a somewhat similar approach, capacity payments, is in use in wholesale electricity markets in many European countries.

Within this structure, as the network capacity utilisation rate increases, the energy efficiency of the electricity distribution increases as well, and the long-term costs decrease, which is financially beneficial to all stakeholders and the society. Furthermore, power based pricing is a cause-fair tariff system for customers and provide incentives to participate in demand response and to seek permanent energy savings. Energy-based pricing of electrical energy, again, encourages the customers to cut their total energy consumption. Moreover, smart meters normally meet the technical requirements of this new tariff system, and no inconsistences have been detected in EU Directives that would prevent the implementation of the power band pricing.

Power band is the capacity limit for the customer's load, agreed between customer and DSO. Exceeding the power band limit would not lead to cut off the electricity, but to certain penalty fees, and in some cases of excess power band usage could be also allowed without extra payments. Furthermore, it is assumed that home automation would take care of the load control and inform customers, so that exceeding the power band should not occur in normal conditions. Power band could be changed once a year, so that the seasonal variations in heating or cooling demand would not affect the size of the subscribed capacity.

As an example, main hourly powers of a Finnish household customer over one year are presented in Figure 3. It can be seen that the highest power used by the customer is

approximately 16 kW. However, there are just a few peak hours during the year. Hence, the customer is given the possibility, and in the case of power band pricing also incentives, to decrease the peak power by adjusting his loads. However, demands of all stakeholders have to be taken into account in load controls. If load controls were decided to be based on the demands of the DSO, it may degrade the accuracy of the load forecast, thereby increasing the balance error and electricity purchase costs of the retailer.

Customer with a flat rate tariff and a 3x25 A main fuse

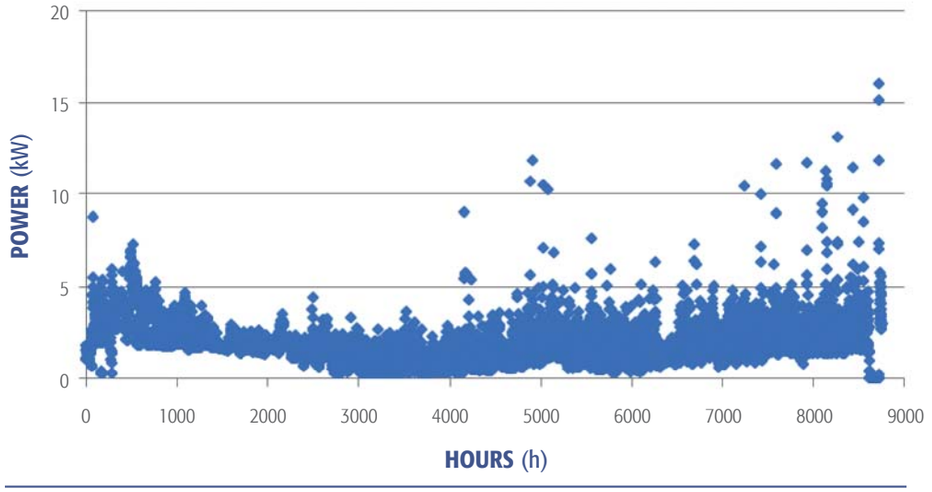

Figure 3. Main hourly powers of a Finnish electricity household costumer over a one year period

As a conclusion power band pricing is a DSO tariff scheme which meets the targets set for the DSO tariffs. The advantages of the power band pricing have been identified as follows:

- Power band pricing is cost reflective.
- Power band pricing encourages customers to optimize their electricity consumption and own generation from the viewpoint of network capacity.
- Power band pricing promotes the energy efficiency targets, where energy efficiency is considered from system perspective.
- Power band pricing enables and encourages market-based demand response and micro generation, and thereby promotes the functioning of the electricity markets.
- Power band pricing guarantees predictable revenue stream for the DSO.
- Power band pricing provides customers with incentives to cut down unnecessary electricity consumption and to replace existing devices with energy efficient ones. These will lead to permanent energy savings.

Acknowledgements

GEODE would like to thank the Working Group Tariffs who kindly gave their time and expertise in contributing to the report.

Kenneth Hänninen, Chairman GEODE WG Tariffs, Finnish Energy Industries, Finland

Anders Pettersson, Svensk Energi, Sweden

Andreas Wunderer, Stadtwerke Münster, Germany

Carmen Gimeno, GEODE Secretary General

Fiona Crawford, Energy Networks Association, United Kingdom

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