

## PRINCIPLES FOR PRICING THE ELECTRIC UTILITY SERVICES - TARIFFS

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### SUMMARY

Deregulation of the Norwegian energy market by 1990 indicated the beginning of a total re-adjustment of the energy sector in Norway.

In the early periods before 1990, this sector was supported by local ownership and also dedicated an important role to ensure control with hydropower development and electricity generation. By this early regime, the pricing of energy was set by the investments in power plants and the costs of the distribution systems as a whole. After the deregulation was a fact in 1990, this practice changed into a new regime where the market now got the role to point out the prices of the electricity as a fundamental energy resource, while the grid and distribution network tariffs was designated by monopoly regulation of the utilities. At first tariffs were regulated by setting the dividend yield (from 1990 up to 1997), and then from 1997 by regulating the income of the utilities. The number of customers in each concession area along with decisions made by the utilities concerning allocation of burden to different user groups, affect the level of grid tariffs.

Political measures for the energy sector did not change because of deregulation, despite the extensive re-adjustments following the wake of the new energy law. The debate has however later years put an increasing focus on the fact that market mechanisms not alone will be enough for energy sector to reach the measure of levelling the total energy prices, as energy users see them. To obtain levelled prices to end-users, there have to be developed new mechanisms for levelling the monopoly regulated grid-tariffs, in addition to the market mechanisms pointing out and levelling the prices of the energy resources themselves.

The level of the grid-tariffs are to a certain point depending on the efficiency of the utilities, but will additionally also depend on local conditions which are not in control of the utilities themselves. Such conditions may be related to climate, geography or rural area within the licensed area, by concessions given from the authorities. Grid tariffs will decrease as transported amounts increase, and distribution in scattered populated areas will be relatively more expensive per kWh than equivalent in more urban central areas. A levelling of grid-tariffs across concession borders can -because of these concession based effects, not be obtained just through regulating the efficiency of the utilities alone.

A levelling of grid tariffs will remove the strong discrimination of equally characterized users, located in

different concession areas. Inside one area tariffs will be levelled for all equal characterized users, but not compared to same characterized users in neighbouring areas where climate, geographical and population criterion may be quite different.

The study behind this report has particularly looked closer at cost elements which may possibly be levelled across concession areas, and the study also have discussed the possibility to adapt certain new market mechanisms to maintain local tariff incentives. The recommendations of this study will also aim to put forward tariffs which are easy to understand by the users, preserve political fairness and is sturdy against influence from professional and industrial bodies.

The ambition of the study accomplished and reported in this paper, was to discuss why price discrimination should follow concession borders. Is there a reason or a model for levelling tariffs throughout the entire energy system, or is there a good reason or possible model for discriminating each user also inside the concession area? Principles pointed out in this study claim viewpoints that will consider the entire energy system as a homogeneous market, and that this will increase consumers benefits. A new tariff model giving all equal characterized user groups the same average level of tariffs, are presented. Additionally it may also increase consumers benefits at local level, if a minor variance local tariff, well administrated by the utilities, is allowed to adapt local payment for users who may be able to choose alternative sources of energy.

Such levelled tariffs, focusing on not-discrimination of *end-users*, will contrast today's tariff practice where the incentive focus is laid against the utilities and their possible prospective development of the *grid*. New principles will also bring to light that efficient management and development of the grid system must be *uncoupled* from the tariffs.

### MONOPOLY - STRUCTURE AND OWNERSHIP

Grid companies and electric utilities represent natural monopoly structures. Scale advantages are considerable as investments in infrastructure are extensive. In practice there are no alternative to monopoly services. Competition to moderate prices are also absent.

Monopoly structures will in theory take its seat as a social inefficient market actor by restricting output to a not efficient level, at higher prices than a free market position will arrange.

The most urgent conclusion of monopoly systems is that the volume of services will be set too low. Efficiency thus requires that market forces have to be replaced; the monopoly producer must be forced to produce more than monopoly quantity, either by regulation or by government ownership and operation. Conf. figure 1

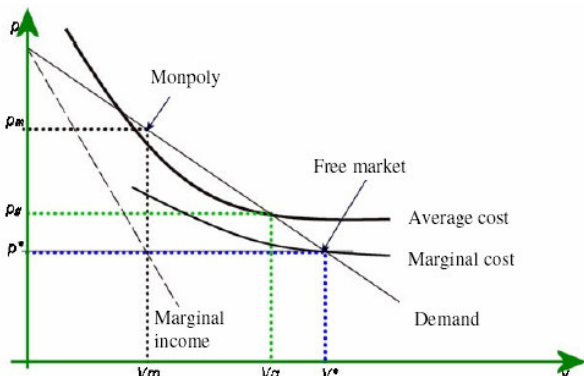


Figure 1 : Monopoly structures will adapt both higher prices( $p_m$ ) and lower services( $V_m$ ) compared to a free market competition( $p^*-V^*$ )

Monopoly structures involve distinctive characteristic for pricing, investments and regulations that are not that urgent to solve if monopolies are owned as public bodies.

Monopoly profit will as public bodies remain public, not private. The need for regulating electric utilities was by this cause not that urgent in the period before 1990 (Norway). Deregulation and privatization have however made the need more obvious, and the most urgent duty is to make the utilities produce "more grid-services". To force monopolies to adapt fully "free market competition" ( $V^* - P^*$ ) are however not desired. Such an adaption represents theoretically an optimal use of resources, but will not give sufficient income for the utilities to cover expenses. A more pragmatic, and also theoretical, proper ambition for the regulation is to make the utilities to produce services according to optimal use of resources, but given an income equal to average costs. Conf. the points  $V_g - P_g$  in figure 1.

In theory the users of services should be presented the social economic costs for the services. This will make users demand proper amounts. Alternative services and investments may be sought in decentralized energy production, district heating, use of gas & oil or just energy savings. This is the obligation of the regulation, and authorities may chose to regulate direct or indirect. Alternatives may also be combined. In practice other motives may also be considered and the optimum regulation may be an impossible case to implement.

Supply of additional funding for monopolies, to make them produce optimal amount of services, will in theory represent a good regulation if this may be done without affecting the use of resources between utilities, or without influencing the income of the customers. Conf. points  $V^* - P_g$  in figure 2.

Figure 2 shows the adaption of the monopoly to obtain

optimal amount of services delivered at the same time as all costs are covered. The red-shaded area represents the optimal amount of all subsidies needed for the energy sector. This is the theoretical base to instruct duty of supply by utilities and to level tariffs also above residual costs of the utilites.

Further on, this shows how to bring forth a pricing ( $P$ ) of services that are lower than monopoly prices, at same time as the amount of services are rised to higher levels ( $V^*$ ).

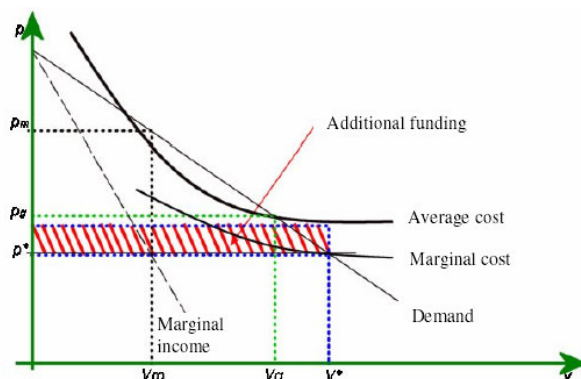


Figure 2 : Supply of additional funding (subsidies) may be used as a regulatory instrument to make the monopoly produce optimal amount of services ( $V^*$ ).

### MONOPOLY - PRICING

As deregulation of energy sector has proceeded, different countries have chosen different arrangements for the regulation and tariffing of the grid system. So far there are no acknowledged models neither for principles, nor for the tariffs itself. Among economists there are nevertheless a predominant agreement that short-term marginal costs, reflected by electric grid losses, should be mirrored direct into the tariffs. How to arrange this by de facto tariffs, are however a matter of huge dissent. An example of this is the discussion of how to tariff consumers versus producers. For bottleneck costs there are even more various opinions.

The real disagreement is however associated to how fixed costs should be covered. One opinion is that these costs should give signals to users to achieve increasing efficiency of the grid, while other opinions say that tariffs should remain neutral. In Norway there have become an experience that each utility carry out principles as each of them consider to be the most suitable. Additionally there are no available instruments to apportion costs across concession borders.

The way fixed costs are tariffed are however not indifferent. In the sense that disparity entail discriminating conditions to otherwise equal user groups, from one concession area to another, this may evolve to an unwanted, not cost effective, use and development of the grid. Allowing the utilities to develop such tariffs may also entail over-complex interpretations of the energy market, and will

bring increasing social cost. This approach are relevant between different concession areas, but may also be of relevance between different countries as time goes on.

Tariffing each concession area as a homogenous system as practice is to day, brings with it a very close correlation between economy of the utilities and the level of tariffs. Changes like merging of utilities, big investments to reinforcing the grid, and also changes in transport of energy through the grid, will give direct changes in the grid tariffs. In cases of merging two utilities into one new concession area, rise of tariffs in one area will give negative effect to users, which may propagate to politicians in the area opposing structural changes.

Theoretically, fixed costs of public infrastructure may be paid by taxes through governmental budgets. Confer for instance public roads, healthcare and education. For energy services, the fixed cost are however of such dimensions that fully payment through taxes exclusively is recognized to be impossible. To find other regimes for tariffing principally must involve direct payment by users.

On the other hand, price-discrimination of *different* characterized user groups may very well be developed, because this may lead to increasing consumers benefit. Such discrimination will tend to alter volumes to adapt to different users willingness to pay. The total volume of services may be constant, but public income and consumers benefit may increase.

Splitting the income for each utility from the tariffing task may lead to some benefits compared to today's practice :

- Today's discrimination of equally characterized user groups across concession areas will vanish
- Authorities may develop more precise regulation instruments by managing income of electric utilities and tariffing as divided questions. This may increase consumers benefit by trimming tariffs for different user groups, for example how to increase new renewable energy input versus lowering electric energy used for heating in households.
- Structural considerations of the sector (merging) may get a more free position relative to tariffing and user-payment in the concession areas under consideration
- Incentives for efficient utilities will be more distinct as running costs will be more liable

More efficient price-discrimination rise both the consumers and producer benefits without more consume of energy grid services.

## MONOPOLY - REGULATION

The superior ambition of monopoly regulation is to increase consumers benefit from an efficient energy sector. Basic rules for natural monopoly regulation is

- Prices should be as close to long-term marginal cost as possible

- Profits should provide only normal rate of return
- Production should be efficient.

Efficiency may be measured by low production costs and high volume of services. Development of the grid system, and also to some extent location of production and consumption of energy, are alternative instruments to regulate. A running evaluation from the regulating authority concerning the use or savings of electricity versus use of other energy carriers, should be a part of the tariffing regime. Consumers benefit depend on a running efficient balancing of alternatives.

Utilities themselves, owners of the utilities, and politicians have so far set their focus exclusively on regulation mechanisms, and trimming of the regulation of income incentives towards the utilities. The effort dedicated to these matters have been very extensive in Norway, especially in the last ten years. According to the viewpoints of this study, focus should be very much strengthened towards utilities focus on innovation and creativity on new services for the customers. Levelling of tariffs by considering the grid system as a homogenous tariff-area instead of the concession-based tariffing of today, will contribute very much to shift this focus.

Levelling tariffs across concession areas may also give origin to new questions of how to approve huge investments in new grid elements.

## LEVELLING OF TARIFFS

Users of grid services are looking for well arranged tariffs, clearly set out, and simple to understand. There should be no need for users to have particular skills to understand changes in basis or level of the pricing. Missing simpleness of today's tariffs may possibly make users passive and this will hinder the further development of energy market mechanisms. Additionally there is a risk for democratic shortage at the consumer and politician level, because layman judgement is too weak to understand existing rules.

Today's tariffing regime, concentrated on discrete concession areas, also dispute sense of justice for the country observed as a community. By users relying on social security, the regime may be accused to support social injustice. "Sense of justice" tells everybody to have the same level of playing field. Tariffs from this point of view, should be modelled according to consumers requirements, not the requirements of the grid system.

The grid system of today is designed to support huge centralized energy plants. A re-adjustment towards decentralized production will call upon new mechanisms for energy market and tariff regimes. Tariffs for storage market and privileges are examples of the demand set by for instance renewable energy.

The tariffs should also hinder building of parallel grid structures as decentralized systems evolve.

Considerations on how multi-utilities may develop their economy and tariffs, should also be a matter of interest. Convergence of for instance water supply and electric grids, digital networks and waste, may be a challenge for grid-tariffing. Models for grid-tariffs following concession borders may by these new external conditions even be more diverse an impossible to understand. Simple, transparent and reasonable models for tariffing and regulation, will be preferred in meeting this challenge.

In Norway the most of big power-plants are located in districts where grid-tariffs are at a high level. On the other side the tariffs in central districts are very low according to high population density, even so low that alternatives like district heating are displaced. According to national strategies, building of bio-based district heating to substitute electric energy is preferred. District heating will be quite more low-cost in towns. Levelled tariffs will decrease electricity consumption in central districts. The effect of levelling tariffs across concession borders will by this give a contribution to national strategies.

Considering the wish for utilities to cash in on local expertise, a wish to handle discrimination and competition from renewable energy, the development of levelled tariffs should be done within a national framework. The right to discriminate on the local level, to give incentives for good efficiency to the utilities, should avoid obstruction of new renewable energy to grow up.

By introducing levelled tariffs across concession borders there will not any longer exist an adaption for the utilities to tariff certain user groups. The demand side will be defined by country-wide characteristics for user groups, and by this it will be the duty for the regulator to define average tariffs for this group. Local variances will be allowed within given national frames. Volume of services will be held at a given high level, and local tariffs will not affect this level.

**SYSTEM BASED NATIONAL TARIFFS**

Methodically, the economy of the utilities may be observed as a trade against three institutions :

- Owners, wants maximum dividend and political influence/control
- Regulator, wants maximum efficiency
- Customers, wants simple, justified and robust tariffs

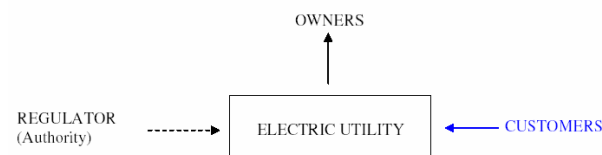


Figure 3. The economy of utilities depend on trade against institutions like regulator (authority), owners and customers.

The regulating authority decides the income for each of the utilities. The owners acquire their dividend according to normal discussions between shareholders meeting and the board.

In the case of levelled tariffs, the utilities will cash in the corresponding payment from all customers. The difference between this amount and the income set by the regulating authority should be handled through a fund (national) interacting with all utilities. Total cashflow from all customers through utilities to the fund and back to the utilities will correspond to the total income for all utilities set by the regulating authority.

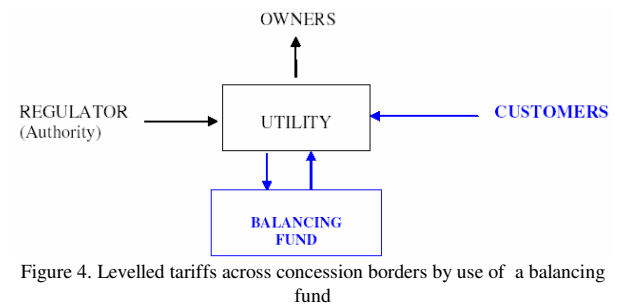


Figure 4. Levelled tariffs across concession borders by use of a balancing fund

Alternative energy like district heating, renewable energy and also energy savings, will have other characteristics then the electric supply. Knowledge about such characteristics is supposed to be best at the local level. If levelled tariffs are supposed to arrange and prepare for new energy sources, the model have to be local "market enabled" instead of central "cost enabled".

Levelled tariffs may then be modelled like this :

$$T_{ib} = k_b + a_b * N_i$$

for users belonging to group *b*, connected to point *i*

- $T_{ib}$  : income from users belonging to group *b*-connected at point *i*-
- $k_b$  : tariff set by national regulator
- $a_b$  : tariff set by local utility
- $N_i$  : use of services (kW, kWh etc)

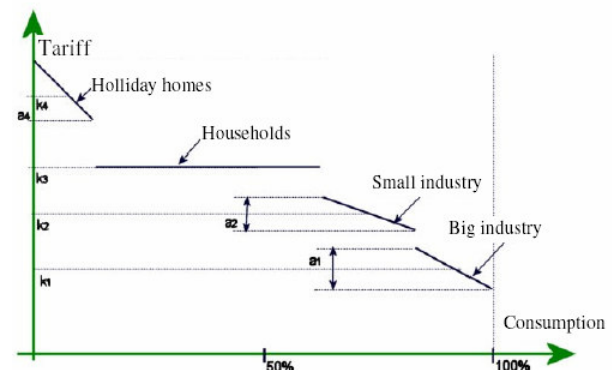


Figure 5. Levelled tariffs. This example shows four national user groups;

holiday homes, households, small industry and huge industry. Average tariffs (k1-k4) are given by regulation authorities. Local tariffs may be adjusted within limits (<ai) by the utilities.

To limit the discrimination of equal user groups, there may be defined a set of fixed user groups. Average tariffs for each user-group are set at national level according to for instance national/international competition and national energy strategies (kb). The utilities are given an upper and lower limit to adjust tariffs to adequate local level (ab). These limits are also set by national regulating authorities, taking into consideration that utilities by this should develop innovative and creative behaviour.

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