Council of European Energy Regulator

Tariff Task Force

Tariff Harmonisation and Long Term Locational Signals

Final Report

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Executive summary and conclusions

In principle, efficient long term locational signals could create the conditions for an optimal equilibrium between generation costs (including investment and fuel costs) and transmission capacity costs. Therefore, when deciding where to site a new power plant (or a new consumption unit), an investor should be faced with the additional costs that its decision will impose on the network, in addition to a bundle of other important locational factors such as the cost of land, environmental and planning considerations (most notably cooling water availability, fuel supply options, hydro or wind resources, existence of heat load). If investment decisions do not fully consider network costs there is a risk that new power plants may concentrate in zones with lower costs of primary energy (like harbours, gas terminal or windy zones), requiring inefficient investment on the grid to transmit this newly created energy flows.

Appropriate locational signals are a key ingredient for the efficient siting of new power plants in the Internal Energy Market as well as for the efficient development of transmission infrastructure. This issue is raised in the context of European energy liberalisation which increased energy flows between countries and also the occurrence of congested situations, in particular at borders between member states.

Under regulatory supervision, TSOs have already put in place different methods that provide locational signals in the transmission network. To alleviate the problems of congestion in the short run, TSOs have implemented congestion management methods, which are in a process of further development and coordination at European level. Transmission operators are compensated for the costs incurred in the network because of losses and the use of infrastructure attributable to external agents, by the countries responsible for these flows (within an ad-hoc inter-TSO payment mechanism) although, in some countries, a fraction of these charges are levied on exports, thereby creating a transaction based tariff.

In the long-term the locational signals that are presently sent by the congestion mechanisms may disappear if the congestion vanishes. Moreover, the export-based tariffs should be removed as they are in conflict with the Florence Forum recommendations. Within this context of volatility of the short-term signals, the Florence forum "stresses the importance of developing, together with a cost-reflective inter-TSO compensation mechanism, the harmonisation of national tariffs systems and the introduction of long-term locational signals".

Locational signals in network tariffs serve two major purposes. One is to signal the network users where to locate, so that the cost of network development is optimised. The other is to allocate the costs of new network investment in an equitable way. Even if in the end no long-term locational signals are used in the network tariffs at European level in a harmonised way, TSOs would be adequately compensated for their investment. Otherwise there will always be a resistance to new lines to be built by those countries who feel that they are being charged more than they should for the use of their network by other countries. This can be solved by the application of suitably harmonised transmission tariffs with locational content. But it can also be solved by a sound inter-TSO payment mechanism that is able to correctly allocate the cost of the foreign use of their network to the TSOs who make use of it. Therefore, if pan-European long-term locational signals in network tariffs are postponed or never implemented, one has to make sure that the inter-TSO payment mechanism should contribute to provide an adequate solution to this issue of adequate compensation of TSOs for the foreign use of their network.

The experiences of different countries show that long term signals can be created thanks to various kinds of instruments, and not only by the tariffs for grid use. The task force has identified several tools used in practice in Europe or other countries, and discussed their efficiency as well as their practicability in the context of the IEM:

- Connection charges: a new power plant is charged the additional costs imposed on the entire network, which provide long term signals (stronger with deep cost than shallow cost) giving incentive to minimize generation and transmission costs, and not only generation costs.
- Inter-TSO payments: compensations between TSOs can ensure that TSOs would be adequately compensated for their investments.
- Congestion management methods
    - Market splitting: congestion leads to differences in energy market prices; the long run expectations concerning these differences, provide incentive for new generation to locate in the zone with high price.
    - Market based allocation of capacity: market parties bid for capacity: the long run expectations concerning the access prices provide incentive for new generators to locate in the zone with highest access price.
    - Tradable firm rights for the use of the transmission system: trading of these rights lead to emerging forward market signals that assist the TSO in planning and determining where additional investment may be required to alleviate congestion.
- Loss factors, which can be stable such as in Norway or Sweden.
- G and L tariffs with locational content within a country or TSO.

The conclusions of the Florence Forum make use of the distinction between short term signals and long term signals, in expressing than “short term signals may prove insufficient in the longer term”. So the first issue that must be raised is to assess when and where additional long term signals are necessary. If the answer to the first issue is positive (the need for locational signals still remains to be discussed according to actual conditions), then a second issue is to determine if network access charges are the best-suited mechanism to send such long-term locational signals alone or in conjunction with other mechanisms.

With this regard, the group has mainly focused on the way access tariffs by themselves could send locational signals. The conclusion on this point is that only regions with generation mainly located in a zone far from consumption zone may need to implement locational signals soon. One possibility for differentiating the G term of the tariffs is to cover network costs according to the benefits, measured in terms of the additional surplus generated by the existence of the grid. In broad terms, this leads to recommend a higher G term in exporting zones and a higher L in importing zones.

When considering the practical possibility of recommending a harmonised model to all member states, the task force investigated the possibility of using algorithms based on harmonised costs. Three main families of models have been discussed:

- marginal participation factors (MP): the tariff is based on the incremental cost of investment; computed for each node, providing incentives to invest in generation in deficit zones.
- Investment Cost Related Pricing currently used by NGC in England and Wales computes an estimate of long-run marginal costs of transmission. This method makes use of an algorithm similar to MP when determining responsibility in network investment, so ICRP shares with MP most of its strong points and also its problems.
- average participation method (AP): the tariff is based on average cost, attributed to each node according to their contribution on the flow of all links. This method can provide consistent locational signals but, as they are based on average and not marginal costs, the signals may be too weak in some cases to deter investment in new generation or demand.

However, none of these models can be considered as a perfect computation of long run incremental costs, which is very difficult or even impossible to achieve in a meshed network, and these computations can only solve the problem of the split between G and L by exogenous assumptions.

Given all the assumptions necessary to the computations and the probable absence of predominant flow patterns in many areas of the European network, the effects of signals given by tariffs computed with a common algorithm for all the European countries may not be very meaningful, except for some well defined cases. The conclusion is that, for the time being, we can not be sure that the gain from implementing such a system would be higher than its costs. The practical difficulty to reach an agreement on a common algorithm is accentuated because the approaches used or proposed in each country are very contrasted, reflecting different needs for locational pricing. All the above considerations advocate a regional approach for harmonisation, as an intermediate step towards achieving the long run goal of the single European market.

A first group of countries faces polarity of load flow (generally from north to south) and has to cope with congestion. These countries have already chosen to promote different instruments for sending locational signals: market splitting in Nordel, firm tradable access rights are proposed within GB, where ICRP is being presently used.

On the contrary, a second group of countries, mainly continental countries, have no or few structural internal congestion problems. They have no locational signals, except congestion management mechanisms reflecting the existing short run constraints. In this group of countries, the tariff for generators equals zero or is very low (with the notable exception of the Netherlands however). There is no stable load flow pattern in the long run. Then the locational content of any locational transmission tariffs would be very weak and it could be easily ignored. The methods would provide locational signals that are too weak to be taken into consideration when comparing with other signals such as cost of land, construction, taxes, surcharges, ….

In this second group of countries, the need for implementing long term locational signals is not obvious at least in the next few years, considering the difficulty to fine-tune an efficient locational signal, the huge methodological simplifications necessary to implement any locational signals, and the weakness of the locational signals foreseen. Therefore, any attempt to do so can lead to higher distortions of competition and higher inefficiencies that the existing situation. Nevertheless, the task force suggests to undertake some simulation studies to assess the instability of energy flows over time and the resulting weakness of the potential locational signals.

The following conclusions were adopted:

(1) There can be a need for locational signals in the long run, to ensure that the location of new generation is efficient and doesn’t concentrate inefficiently in certain zones, requiring too high levels of infrastructure investment. Only regions with generation mainly located in a zone(s) far from the consumption zone(s) may need to implement locational signals soon. For the other ones, implementing harmonized tariffs computed according to the available models would remain controversial and would probably yield weak locational signals when comparing with other signals such as cost of land, construction, taxes, surcharges, ….

(2) Existing congestion management mechanisms, the associated differences in energy market prices between European zones and the inter-TSO compensation mechanism already contribute to send locational signals and can already be taken into account in the investment decisions made by generators.

(3) The harmonization process should be realised step-by-step, within each region. The harmonisation of infrastructure tariffs should be realised within different regions, reflecting the magnitude of actual or foreseen congestion problems and predominant flow patterns within each region.

(4) When considering the introduction of locational signals in one region, several tools can contribute to this objective, including connection charges, market splitting, market based allocation of capacity, capacity rights, loss factors and G-tariff differentiation (marginal participation factor, ICRP or average participation factor). The choice of the most appropriate tools and computation models should be left to each member-state, within the harmonisation criteria adopted in the corresponding region.

(5) To ensure the appropriate conditions for tariff convergence in the long-term within the different regions, each Member State tariff system must be conceived under the umbrella of the following basic principles:
- Non-transaction based
- Avoid non-cost reflective extra charge for import, export or transit
- Complement the development of competition and avoid distortions of efficiency in system operation and investment.
- Cost reflective and non-discriminatory
- Transparent and easily understood
- Recovery of the regulated transmission costs, including an appropriate return

(1) If a G differentiation is needed and appropriate, it must necessarily be applied in a non-discriminatory way, without consideration of the type of primary energy used. They should be based only on the actual contribution to congestion and predominant patterns of network use, otherwise it will be inefficient in sending economic investment signals and even unwise. The reason is that flows at the origin of congestions and predominant patterns of network use cannot be discriminated according to the type of primary energy used.

(2) If long term locational signals sent by G term are desirable, this would require the introduction of a G term in all countries. In this perspective, further studies are necessary to choose the model to compute the G terms, to define the regions, and to determine the bands to be applied to the value of the G terms in each region.

(3) If it is decided not to use pan-European long-term locational signals in network tariffs, never or just for the time being, then one has to make sure that the inter-TSO payment mechanism provides an adequate solution to the problem of allocation of the costs of new network investments in an equitable way.

Introduction

(1) The implementation of the IEM in accordance with the requirements of the European directive must be done without loss of efficiency of the European electrical system. Therefore the new rules should notably give on the one hand long term incentives (the 'siting signals') to influence the location of new production plants and load necessary to balance demand and offer in a competitive way taking into account the existing and future possibilities of the European transmission network and, on the other hand, short term incentives to contribute to the optimisation of the load flows on the European grid. Prior to liberalisation, this grid was mainly developed and used to support security of supply at individual Member State level. Up to recently, this situation remained unchanged except for some developments in structural import and export flows involving a small number of stable actors. Recent market liberalisation and a consequent increase of trading activities resulted in an increase in the occurrence of congested situations, the definition of these congested situations remains imprecise.

(2) In most European countries, the choice has been made to have postage stamps for national access tariffs, which do not depend on location or distance. This choice promotes competition and is partly explained by technical considerations, i.e. the difficulty to identify which network user is responsible for the flow of energy on the meshed transmission network. Also because in some well meshed networks it is felt that there is no need to send further locational signals by means of the transmission network tariffs. But, the picture is different for international access to the networks as crossing frontiers remains a problem for energy and this precludes the development of international trade.

(3) First, to cope with emerging border congestion, some TSOs have put in place pragmatic congestion management methods, leading to transaction dependent charging of the use of congested interconnections. These mechanisms create locational signals for generators and consumers. Improvements of congestion management mechanism by co-ordination are currently being discussed to take into account loop flows and the optimal crossing of several congested borders.

(4) Another way to solve congestions is new investment in interconnections, which may be efficient in certain cases. Such investments in general benefit network users in several TSOs, and not only in the two infrastructure managers at the border. But the financing of

these investments would also require that third TSOs accept to partly cover the cost of these projects. This is one major reason to implement locational signals that adequately reflect the utilisation of the new investments. However, in the EU Internal Electricity Market there is already a mechanism that, if correctly designed, should fully account for this effect: this is the inter-TSO payment mechanism. Therefore, a proper design of the inter-TSO payment mechanism would remove much pressure from implementing a detailed scheme of European transmission tariffs with locational signals.

(5) Second, international exchanges exhibit differences in access tariffs between countries (for instance differences in G terms). Some TSO's charge imports or exports, leading to tariffs dependent on transactions. The Inter-TSO mechanism has begun to address the issue of such charges but only for "pure transits" on the system, which is limited to trade crossing more than one border.

(6) All the above elements (regulations, network costs, congestions) of the charging regimes create differences in access prices between countries and some times within the country itself. These differences create locational signals but not all of them form a consistent system at the European level. In countries such as Scandinavian countries and GB, the tariffs aim at sending locational signals and have a significant G term. In all the other countries (except NL), mostly continental, the G charge is very Low and not differentiated. In these countries, the G/L tariffs does not aim at sending long term locational signals. In addition the costs covered thanks to these tariffs can be different in different countries.

(7) At the ninth meeting of the Florence Forum, on 17-18 October, regulators, the European commission and ETSO, adopted that conclusion : "The Forum stresses the importance of developing, together with a fully cost-reflective inter-TSO compensation mechanism, the harmonisation of national tariff systems and the introduction of long-term locational signals".

(8) In the first part of this paper the issue of locational signals related to transmission network access and use of system tariffs is examined under a more theoretical point of view. The second part identifies the potential options for the design of transmission access and use of system. The third part examines the need for locational pricing in Europe.

Part I – Economic rationale for short and long term locational signals

(9) The issue of locational signals in Europe has been raised by the Florence Forum and it is currently presented in the Draft Regulation as a prerequisite for the removal of export taxes and the implementation of CBT inter-TSO mechanism. This issue raises different problems. Under a pure theoretical perspective the doctrine does not offer a consolidated position; this makes it difficult to formulate practical proposals in terms of tariff harmonization at European level.

(10) The main concern in implementing a tariff system is to provide right signals in relation to the use of scarce resources such as transmission networks. It is usually possible to distinguish between short term signals and long term signals. Short term signals refer to price components which cover costs controllable in the short run. In the case of transmission networks, short term signals inform users about the cost of network losses and grid congestions.

(11) In the short term, first best locational pricing is nodal marginal pricing. In a nodal pricing system, the revenues of the network are calculated for each link, using the differences between competitive electricity market prices at each node, in order to reflect the economic value of transmission of energy from one node to another. Where differences in energy prices between two nodes are important, this creates incentives to invest in the network, as well as incentives to invest in new generation at the appropriate nodes.

(12) Such a pricing scheme tends to cover short run variable costs and, due mainly to congestion rents and also to the losses over-collection, it also allows to cover partially transmission network infrastructure costs. Therefore the rest of the infrastructure costs have to be recovered somehow.

(13) Long term signals are related to infrastructure costs. The idea of giving locational signals related to transmission has an economic rationale only if it can somehow influence the decisions of network users, and generators in particular.

(14) Therefore when we consider network infrastructure costs related to past investments, so called sunk cost, the economic rationale for giving locational signals appears to be

extremely weak when the signals are considered in a dynamic way, i.e. the signals respond to the current network situation, trying to look for cost causality directly Although this approach appears to be conceptually sound, it has to face strong implementation difficulties, as indicated below, and it is not followed in practice.

(15) In line with the approach suggested in the preceding point , alternatively it is possible and, sometimes appropriate, to give long term locational signals in relation to new investments and to operation and maintenance costs directly attributable to specific portions of the grid or specific lines. However, since only a small portion of operation and maintenance costs can be directly allocated to specific assets, it seems better to confine the long term locational issue only to new investments.

(16) New investments can be divided into two categories: investments related to the needs of new network users; investments related to the requirements of already connected users or to future users. According to this distinction it seems relatively easy to justify price differentiation in relation to the former category. If a new network user demands to be connected, it seems reasonable to ask him to pay all the network reinforcements necessary to satisfy its needs. Here locational signals can be provided via connection charges and they also appear to respond to efficiency criteria. When we consider investments not related to the needs of new network users the transmission operator should be able to find existing users ready to pay for that investment, sign with them a specific contract and charge them accordingly. This would give almost perfect signals to the network users, who therefore will incorporate in their cost function the costs of expanding transmission capacity. However, deep connection charges may be difficult to implement in a meshed network.

(17) Transmission costs present relevant economies of scale, both in the form of lumpiness, and in the form of advanced construction of plants. There is therefore the problem to allocate common costs. According to the economic theory common costs should be allocated in the way that less distort the market. Relevant free-riding problems also arise. Under a more practical point of view, other issues should be beard in mind, in particular with regard to the viability and the cost of developing and maintaining charging mechanisms able to record the responsibility of the different users related with network costs. It seems therefore reasonable looking for practical and feasible solutions capable to respond to the issues deemed more relevant in the different local situations.

(18) In the long run the transmission network operator can be considered as a competitor of generators. When the transmission system operator builds a new line which removes a network constraint, *de facto* it renders available more generation capacity. Costs related to the building of the new line should therefore be compared to the costs related to the building of a new generation plant in the congested area. In this sense we can conclude that efficient LTLS should create conditions in which any extra transportation infrastructure costs associated are justified by the benefits in terms of lower generation costs at this place. Efficient long term locational signals should create the conditions for an optimal equilibrium between generation costs (including investment and fuel costs) and transmission capacity costs.

Part 2 - Tools to send locational signals

(19) Concerning LTLS as a mean to influence the location of new power plants and the need for infrastructure, different solutions have been discussed within the Task Force :

- connection charges: a new power plant is charged the additional costs imposed on the entire network, which provide an incentive (stronger with deep cost than shallow cost) to minimize generation and transmission costs, and not only generation costs.

- Inter-TSO payments: compensations between TSOs can ensure that TSOs would be adequately compensated for their investments.

- Congestion management methods

  - Market splitting: congestion leads to differences in energy market prices; the long run expectations concerning these differences, provide incentive for new generation to locate in the zone with high price.

  - Market based allocation of capacity: market parties bid for capacity and the long run expectations concerning the access prices provide incentive for new generators to locate in the zone with highest access price.

  - Tradable firm rights for the use of the transmission system: trading of these rights lead to emerging forward market signals that assist the TSO in planning and determining where additional investment may be required to alleviate congestion.

- Loss factors, which can be stable such as Norway or Sweden.
- G and L tariffs with locational content within a country or TSO. Inter-TSO payments: compensations between TSO can insure that TSOs would be adequately compensated for their investments.

2.1. Creation of a European Agency

(20) The first possibility is to create a European Agency, which would deliver rights to connect where there is available capacity, or where it is least costly from a social point of view, given the generation costs or market participants' valuation. This corresponds for instance to administrative authorisations and should be regarded as a theoretical benchmark. This solution may be not implemented because it restricts the scope of liberalization of the European power generation market. However, these computations must be made anyway to have efficient LTLS in Europe

2.2. Connection charges

(21) Connection charges (CC) is another interesting solution because it is a fixed term taken into account by the investor, and it is by construction a long term signal entering in the investment decision function. Actually, reductions of the connection charges for producers have been decided in order to attract new investment in deficit zones (Italy). The connection charges have the same effect as a differentiated and stable G charge.

(22) However this may conflict with other considerations which justify shallow-cost : non – discrimination and transparency, if new entrants are charged a higher deep cost connection charge. The majority of members use shallow costs for connection charge, which does not reflect the costs of the meshed network and does not deliver proper locational signals. Members of the group expressed their view that connection must remain a local thing (decision to build new plant 25 km from the grid or near) and be based on a shallow cost approach. An extreme approach of this kind can also exist, if new connection is not charged.

(23) Another problem with the connection charges is that it may be considered as barriers for new investments, while in some cases it can be more efficient to close an old power plant and replace it by a new one.

2.3. Inter-TSO payments

(24) Even if in the end no long-term locational signals are used in the network tariffs at European level in a harmonised way, TSOs would be adequately compensated for their existing and future investments. Otherwise there will always be a resistance to new lines to be built by those countries who feel that they are being charged more than they should. This can be solved by the application of suitably harmonised transmission tariffs with locational content. But it can be also solved by a sound inter-TSO payment mechanism that is able to correctly allocate the cost of a new line to the TSOs who make use of it. Therefore, if pan-European long-term locational signals in network tariffs may be postponed or never implemented, one has to make sure that the inter-TSO payment mechanism provides an adequate solution to this issue.

2.4. Congestion management methods

2.4.1. Capacity rights

(25) Ofgem proposes to introduce tradable transmission rights. Properly priced and defined transmission access rights will facilitate competition in generation by allowing market participants to purchase access rights that reflect the degree of risk or opportunity that they are willing to take i.e. the value that they place on being able to generate at different times, places and levels. For example, they give existing generation flexibility to respond to price signals by increasing or decreasing production and they facilitate new entry by enabling new plant to secure long-term transmission access to the system at a fixed price.

(26) However, the economic question of decentralisation of investment decisions through a price signal or the creation of new tradable property rights should be analysed in the context of other European countries for several reasons:

- i. insufficient unbundling of the network owner and/ or operator
- ii. not enough competition in the generation market
- iii. absence of congestion on most of the domestic meshed networks
- iv. problem of capacity mainly at the interconnections

(27) Merchant lines must be efficient (as opposed to regulated public lines in meshed networks owned by TSO).

(28) It has to be recognised that merchant lines, though a welcome party in promoting needed transmission investment, cannot be relied to provide all the network investment that will be needed. A simple proof of this is that congestion rents in the existing European network would collect only a small fraction of the present total network costs.

2.4.2. Market splitting

(29) Firm congestions are handled by splitting the market into several price areas. For instance, in a deficit area the market price of electricity rises, which relieves congestions and makes it more feasible to construct new generators in that area. Price areas give long term locational signals, because the price differences remain as long as there are congestions between areas.

2.4.2. Market based allocation of capacity

(30) Market parties bid for capacity at the congested part of the networks and the long run expectations concerning the access prices provide incentive for new generators to locate in the zone with highest access price.

2.5. Loss factors

(31) Marginal loss fee can give locational signals, if calculated for each node or zone. In general it will give short term signals, but if the sign of the marginal loss fee is the same over time for either node or zone, long term locational signals can be given.

2.6. G/L tariffs

(32) G and L play the same role. G and L require a harmonization with other countries in order to maintain a level playing field and avoid distorting G/L decisions.

(33) Generators being likely to be more elastic to price than consumers, G terms are more likely to send locational signals. This fact also makes it important to prioritize harmonization of the G term.

(34) Several algorithms are available to allocate network infrastructure costs. Some of them give good proxy results to what appear to be the conceptually sound criteria for network cost allocation: responsibility in network investment or, conversely, economic benefits for the network users that are derived from network investments. Here are described several alternative approaches. The marginal participation factor method, the investment cost related pricing method, and the average participation method.

2.6.1. Marginal participation factor

(35) This method computes the marginal costs of investments in the transmission system resulting from an increase in demand or generation at each connection point or node on the transmission system.

2.6.2. Incremental Cost Related Pricing

(36) ICRP Methodology: This is the method currently used in the UK and known as ICRP methodology. It does not deliver strong enough long term signals on the network for market participants (insufficient forward market signals): The ICRP methodology has been used within England and Wales for the last ten years. Ofgem believes the introduction of zonal transmission losses will further enhance efficiency through more cost reflective charging which could be expected to influence both short and long-term business decisions.

(37) ICRP can work in some conditions, but is not adapted to a European context (see Annex: Paper for Electricity Working group / applicability of ICRP to Europe) because of several reasons. First, the transport model must be the same at a European level. Second, the choice of the reference point is difficult to determine (these problems can be overcome by defining several reference points, one for each consumption zone). Third, highly meshed networks may lead to difficulties when applying the model.

2.6.3. Average Participation Method

(38) APM (average participation method) is based on electric network utilisation, as a proxy to cost causality (as any other network utilisation method does), and identifies the actors responsible for the existing flows on each individual network facility.

(39) As any other cost allocation method that is based on network utilization, APM lacks a strong methodological background. However, APM has good applicability properties. APM is not transaction based, it makes physical sense and produces results conform to economic intuition (use of the network is a local phenomenon), it is robust, easy to understand, justify and apply.

2.6.4. Procedure to introduce harmonised locational signals

(40) A sound transmission tarification procedure at IEM level should be based on the responsibility of each network user, regardless of political borders, in the utilization or the development of each one of the elements of the transmission network of the IEM.

(41) The implementation of a sound transmission tarification procedure at IEM level will consist of the following steps:

i. Assign the responsibility of every network user in the development or the utilization of each one of the facilities of the transmission network, regardless of political borders.

ii. Use standard transmission costs across the IEM in order to make the conversion from the responsibility factors in step (i) to assignment of costs.

iii. Translate the assigned costs into transmission tariffs G and L (i.e. charges per kWh, per kW or per customer) using some harmonized procedure.

(42) The procedures to calculate the remaining transmission charges in the Member States, beyond the G and L charges above, should be harmonized. For instance, the remaining charges (or credits) that are needed for complete transmission cost recovery of a given country or TSO could be totally assigned to consumers, either uniformly or in such a way that total charges to demand may become uniform, if this is required by the national regulation. The advantages of this harmonization approach are:

- All generators within the IEM receive totally correct long-term locational transmission signals that are meant to convey correct siting incentives.
- The total amount of regulated remuneration of the transmission activity within each country or TSO is left entirely to subsidiarity. This appears to be reasonable, because of the large disparity of values and procedures that have been adopted at each country

or TSO, which correspond to well established commitments of the regulatory authorities with the owners of transmission assets within the IEM.

- It is left to the regulatory authorities of each Member State how to allocate to their consumers the difference between the revenue collected within a country or TSO by the IEM-wide G and L tariffs that apply to the network users within that country or TSO and the regulated value of the remuneration of the transmission activity. In general this will distort the long-term locational signals to consumers. However, it is deemed to be an acceptable compromise, since: a) the potential for market distortion of incorrect locational transmission signals for consumers is considered to be lower than it is for generators, in particular if the extra charge is applied so that the loss of economic efficiency is minimized, as it is the case when Ramsey-like tarification methods are employed; b) some Member States have long standing commitments to maintain uniform tariffs for consumers within their territories; c) the economic value of the difference in the preceding bullet point has to be assigned somehow and this appears to be the least damaging option.

(43) The procedure to compute IEM-wide transmission tariffs that has just been presented implicitly contains an inter-TSO compensation scheme. In fact, political borders have been ignored when the allocation of transmission responsibility and cost has been performed. Therefore the G and L tariffs so computed already contain the compensations and charges (evaluated using standard costs) that are required because of the external use of the networks of other countries or TSOs. Inter-TSO payments could easily be derived and applied jointly and consistently with this procedure.

(44) Note that the inter-TSO compensation mechanism does not deliver per se optimal cost reflective charging and locational signals, since it works at an aggregated TSO level and not on an individual nodal or zonal basis. However, the economic signals that are derived from the outcome of the inter-TSO payment mechanism should be applied at least in a harmonised form. The net balance of compensation and charges can be a payment or a credit. If a TSO has to pay, it should be added to the L tariff in importing countries and to the G tariffs in exporting countries. If the TSO receives money, it should be used to reduce L in exporting countries and to reduce G in importing countries.

(45) Pre-requisite for long term locational signals: The adoption of a tariff structure reflecting long term locational signals implies the acceptance that network tariffs will be

differentiated by individual nodes or by zones encompassing several nodes where the same value of the transmission tariff will be assumed.

2.7. Complementary points

2.7.1. Long term locational signals within the Nordic model

(46) A liberalized electricity market does already exist in the Nordic area (Denmark, Finland, Norway and Sweden). The G tariffs have been harmonized since 1.1.2002. The harmonized G tariff consists of two components, 1) a marginal loss fee and 2) a residual component, which will ensure cost recovery for the network owners. There are several ways of giving locational signals in the Nordic system.

a) *Market splitting.* Firm congestions are handled by splitting the market into several price areas. For instance, in a deficit area the market price of electricity rises, which relieves congestions and makes it more feasible to construct new generators in that area. Price areas give long term locational signals, because the price differences remain as long as there are congestions between areas.

b) *Marginal loss fee* can give locational signals, if calculated for each node or zone. In general it will give short term signals, but if the marginal loss fee is the same over time for either node or zone, long term locational signals can be given.

c) *The residual component.* It is possible to give long term locational signals through the residual component. It is left for each country to decide whether to give long term locational signals through the residual component, as long as it is done within the harmonized range.

d) *Connection fees,* which are based on the actual costs of connecting a new customer to the network, can give long term locational signals. Producers are expected to take into account the differences in costs of connecting to various points in the network.

2.7.2. How zones should be defined ?

(47) Defining relevant zones is a preliminary task to the introduction of appropriate locational signals.

(48) The task force considers that zones for sending long term locational signals, should be defined according to existing network constraints observed. Indeed, this method can lead to the definition of zones stable in the time in countries where there is a dominant flows such as North to South flows in the UK and in Scandinavian countries. However, in other regions, new investments can remove congestions (which is the objective of locational

signals), creating an instability concerning the existence of different zones and associated locational signals. High level of instability may creates uncertainty for investors, destroying the incentives of the locational signals. This suggests that there is a need for a trade-off between the need to define long term zones, and the probability of congestions.

2.7.3. Long term locational signals and tariff structure

(49) The incorporation of long term locational signals into network transmission tariffs has to be done without introducing distortion to the short run equilibrium. In the short run tariffs are expected to reflect the use of resources in real time. Generally the optimal dispatch tends to minimize fuel costs. The addition of per kWh terms to the network access and use tariffs would create a distortion of the optimal short term dispatch, depending on the way it is charged (ex ante or ex post).

(50) In order to avoid such a distortion, according to a general accepted idea, long term locational signals should be given through the non energy part of a multi-part tariff (two parts tariff).

(51) This can be done, generally speaking, in two different ways:

i. Charging the fixed amount in a one shot solution (that is including this long term locational signals in connection charges);

ii. Calculating an annuity of the fixed amount calculated as in case a) and charging it to the different network users each year.

(52) Method (i) seems to be particularly suitable in case of new connection. It is more difficult to be applied in case of network expansions, whose net benefit are to be attributed to already connected network users.

(53) It is adequate to remind here that short term locational signals, i.e. those derived from losses and congestions, also may have a long term impact on the decisions of the network users.

(54) Indeed, short term locational signals should also influence the marginal generation and consumption decisions of market participants, both in the short and the long term. For

instance, without zonal transmission losses, there will have cross subsidisation in the charging arrangements that will have two effects:

- if the short run costs are higher, some generation plant would be generating when it would be less costly for it not to generate, and the reverse is true. Pattern of electricity consumption failing to reflect fully the costs of providing the electricity.
- in the long run, there will be a tendency towards an inefficient pattern of investment in generation and closure with consequential adverse impact on transmission. There could also be inefficiency in the location of demand.

Part 3 - Identifying the need for LTLS in Europe

3.1. Are long term locational signals really effective?

(55) When we consider the siting choice of a generator, it is recognised that the decision to locate a generation plant in a certain point is influenced by a bundle of important locational signals, which includes the 'G' charge, the cost of land and environmental and planning considerations, as well as taxes and surcharges. Indeed, location decisions of power plants are based on:

- cooling water availability (river, see, lake) for large thermic power plants
- fuel supply options (harbour, pipe line, etc..) for gas, oil; coal power plants
- local resources (hydro, wind) for renewables
- existence of heat load (for CHP plants), and suitable land
- distance to a suitable connection point in the electrical network

Price and availability of primary energy is the most important variable for locational decision of a new plant, behind (¿?) network charges.

3.2. Present situation of transmission tariffs in EU Member States

(56) The task Force has begun to compare the tariffs actually applied in the different European countries. First, the cost categories covered by the tariffs are different (See

Annex A). In particular losses are not covered by the tariffs in Portugal, Spain and Italy. Second, the connection charging rules are not harmonised (see Annex B), even if the majority of generators pay a connection charge computed according to a shallow cost method approach.

3.3. Optimisation problems in non-liberalized markets

(57) The need for LTLS comes from the separation between network (the grid) and generation, and the necessity to decentralize the decisions concerning the location of new generation power plants at a European level, within the framework of the IEM. Prior to liberalization, optimisation decisions were taken within the framework of vertically integrated monopolies, under which the location decisions were made on the basis of an internal trade-off between the costs of new power plants and the cost of increasing transport capacity to consumption areas.

(58) With regard to location of power plants and transmission capacity, the current situation inherited from the former integrated monopoly is fairly efficient within each state.

(59) The picture is different for international interconnections, because these links were historically not used for the transport of power between countries but for security reasons, i.e. to put in common primary reserves of generation capacity required in case of loss of one generator (primary reserves). This characterises a first role of the network which is the **security** of the electric system.

3.4. Problems arising with the liberalization and the creation of the IEM

(60) With the development of the IEM, the least cost dispatch tends to be determined on a European-wide decentralised basis. In this liberalized context, the international interconnection network tends to be used to achieve an efficient liberalized market at European level, in the short run. This role of facilitating trade and giving access to its network is the second role of the transmission network.

(61) However the use of locational signals may have no effect in practice for the following reasons:

i. The problem of "deficit zones" is associated with the lack of interconnection capacity to reach an efficient liberalized market at a European level. This creates electrical peninsulas for which investment projects are already considered (it can be additional transmission capacity with Spain, or additional generation capacity in Italy), independently of identified locational signals such as G differentiation.

ii. Potential market impediments (e.g. political influences and market structure issues) can prevent effective locational signals. Indeed a lower G in one region (in the presence of market impediments) would simply provide a rent to generators, rather than increasing their production in the short term.

iii. Locational signals may have little effect if countries consider security of supply at a national level, and not at a European level.

(62) Finally, a degree of harmonization may be possible, as illustrated by NORDEL. But it is clear that European transmission tariff harmonization will not be a straight forward process, given the wide range of current approaches and view points.

3.5. Implementing locational signals in Europe

(63) There is already a liberalized electricity market in the Nordic area (Denmark, Finland, Norway and Sweden). In the Nordic market the congestions are managed mainly with two instruments; counter trading and market splitting.

(64) Within each country, occasional congestions are relieved using counter trading. The TSO buys electricity from the temporary deficit area and sells it to the temporary surplus area, which reduces the need of net transmission from surplus area to deficit area.

(65) Firm congestions are handled in the Nordic market by splitting the market into several price areas. In a deficit area the market price of electricity rises, which relieves congestions and makes it more feasible to construct new generators in that area. If the price differences between areas are permanent, market splitting gives long term locational signals, because the price differences remain as long as there are congestions between areas.

(66) Concerning LTLS as a mean to influence the location of new power plants and the need for infrastructure, different solutions have been discussed within the Task Force, for instance:

(67) Adoption of a two parts use of system tariff, with the non energy part determined in order to incorporate and reflect long term locational signals, calculated according to the methods defined in the previous section.

(68) Alternatively long term locational signals can be given through connection charges (CC). This is another interesting solution because it is a fixed term taken into account by the investor, and it is by construction a long term signal entering in the investment decision function. The connection charges have a similar but more direct effect as a differentiated and stable G charge.

3.6. Zonal approach

(69) Given all the assumptions necessary to the computations and the probable absence of predominant flow patterns in many areas of the European network, the effects of signals given by tariff computed with a common algorithm for all the European countries may not be very meaningful, except for some well defined cases. The conclusion is that, for the time being, we can not be sure that the gain from implementing such a system would be higher than its costs. The practical difficulty to reach an agreement on a common algorithm is accentuated because the approaches used or proposed in each country are very contrasted, reflecting different needs for locational pricing. All the above considerations advocate a regional approach for harmonisation, as an intermediate step towards achieving the long run goal of the single European market.

(70) A first group of countries faces polarity of load flow (generally from north to south) and has to cope with congestion. These countries have already chosen to promote different instruments for sending locational signals: market splitting in Nordel, firm tradable access rights are proposed within GB, where ICRP is being presently used.

(71) On the contrary, a second group of countries, mainly continental countries have no or few structural congestion problems. They have no locational signals, except congestion management mechanisms reflecting the existing short run constraints. In this group of countries, the tariff for generators equals zero or is very low (with the notable exception of

the Netherlands however). There is no stable load flow pattern in the long run. Then the locational content of any locational transmission tariffs would be very weak and it could be easily ignored. The methods would provide locational signals that are too weak to be taken into consideration.

(72) In this second group of countries, the need for implementing long term locational signals is not obvious at least in the next few years, considering the difficulty to fine tune an efficient locational signal, the huge methodological simplifications necessary to implement any locational signals, and the weakness of the locational signals foreseen. Therefore, any attempt to do so can lead to higher distortions of competition and higher inefficiencies that the existing situation. Nevertheless, the task force suggests to undertake some simulation studies to assess the instability of energy flows over time and the resulting weakness of the potential locational signals.

Conclusions

(6) There can be a need for locational signals in the long run, to ensure that the location of new generation is efficient and doesn't concentrate inefficiently in certain zones, requiring too high levels of infrastructure investment. Only regions with generation mainly located in a zone(s) far from the consumption zone(s) may need to implement locational signals soon. For the other ones, implementing harmonized tariffs computed according to the available models would remain controversial and would probably yield weak locational signals when comparing with other signals such as cost of land, construction, taxes, surcharges, ….

(7) Existing congestion management mechanisms, the associated differences in energy market prices between European zones and the inter-TSO compensation mechanism already contribute to send locational signals and can already be taken into account in the investment decisions made by generators.

(8) The harmonization process should be realised step-by-step, within each region. The harmonisation of infrastructure tariffs should be realised within different regions, reflecting the magnitude of actual or foreseen congestion problems and predominant flow patterns within each region.

(9) When considering the introduction of locational signals in one region, several tools can contribute to this objective, including connection charges, market splitting, market based allocation of capacity, capacity rights, loss factors and G-tariff differentiation (marginal participation factor, ICRP or average participation factor). The choice of the most appropriate tools and computation models should be left to each member-state, within the harmonisation criteria adopted in the corresponding region.

(10) To ensure the appropriate conditions for tariff convergence in the long-term within the different regions, each Member State tariff system must be conceived under the umbrella of the following basic principles:

- Non-transaction based
- Avoid non-cost reflective extra charge for import, export or transit
- Complement the development of competition and avoid distortions of efficiency in system operation and investment.
- Cost reflective and non-discriminatory
- Transparent and easily understood
- Recovery of the regulated transmission costs, including an appropriate return

(4) If a G differentiation is needed and appropriate, it must necessarily be applied in a non-discriminatory way, without consideration of the type of primary

energy used. They should be based only on the actual contribution to congestion and predominant patterns of network use, otherwise it will be inefficient in sending economic investment signals and even unwise. The reason is that flows at the origin of congestions and predominant patterns of network use cannot be discriminated according to the type of primary energy used.

(5) If long term locational signals sent by G term are desirable, this would require the introduction of a G term in all countries. In this perspective, further studies are necessary to choose the model to compute the G terms, to define the regions, and to determine the bands to be applied to the value of the G terms in each region.

(6) If it is decided not to use pan-European long-term locational signals in network tariffs, never or just for the time being, then one has to make sure that the inter-TSO payment mechanism provides an adequate solution to the problem of allocation of the costs of new network investments in an equitable way.

ANNEXES

ANNEX A : Comparison of costs covered by network access tariffs

Synthesis

This document proposes a synthesis of the information collected by the CEER task force on tariff harmonisation, concerning the cost categories included in the tariffs in the 11 countries represented in the task force. Several aspects concerning access to the network have been treated, such as voltage levels, the connection charging methodology and the existence of taxes collected by the transport operators on behalf of the government.

1) Voltage levels definitions

The voltage level and associated tariff categories used in each country are different. In general, transmission includes at least voltage levels above 130 kV, but it is not possible to define transmission with the same voltage levels in all the countries.

In some countries, the Transmission System Operators also operates voltages down to 50 kV (in France, Belgium, -).

Given the fact that in most countries power plants are connected to higher voltage levels, harmonization of the tariff for generators is important for these voltages. However, there are countries where most or a lot of production is connected to lower voltage levels. Some examples might be Finland, Norway, Austria where hydro generation is dominant, wind-power in UK and so on. There is reason to believe that in the future several countries will have increased generation also at lower voltage levels.

The task force concluded that the definition of transmission in terms of voltage level cannot be achieved.

2) Connection Costs

Consumers connection charges at high voltage level are computed according to a deep cost methodology for 5 out of 12 countries, the others using a shallow cost methodology. In some cases, these deep costs can be totally covered by consumers. It can also be partly covered by consumers, the rest being included in the access tariff.

As a conclusion, it may be useful to harmonize connection charging methodologies for generators, in addition of the access tariffs. In the longer run, harmonizing connection charging methodology would also be desirable, but this is likely to take more time to achieve given the probable difficulties of implementation with customers. However, it should noted that CEER does not have the appropriate

remit to deal with the harmonisation of connection charges (refer to Article 8(3) of the new European Regulation).
Metering tariffs can be regulated or not regulated. However the associated costs can be neglected for generators and customers connected to the transmission network.

3) Infrastructure costs

Infrastructure costs are covered, including a reasonable return, varying from 6,5 to 9 % nominal pre tax.
These infrastructure costs are covered though a specific charges (i.e. separated from the system operation costs) only in E&W, Belgium and Portugal.

4) Losses

The following table summarizes the different ways network losses on line are covered in different countries.

Table 1 :Losses

Covered General tariff	**Covered, Specific term**	**Not covered through transmission use of the system tariff or general tariff**
France, Finland, NL, Denmark	*Belgium, E&W, Austria, Norway*	*Ireland, Spain, Portugal, , Italy*

Considering the introduction of locational loss factors at European level, different views coexist within the task force. Some countries expressed concern about the distortion of competition caused by the absence of harmonisation concerning the methods for charging the costs of losses : generators which must produce more to compensate losses suffer from a competitive disadvantage. For Spain and Portugal, the harmonization in the cost of losses may be focused in that generators as well as consumers should pay for the cost of losses, but that the cost of losses is calculated as a component of generation cost or included in the transmission tariffs is not a necessary issue for harmonization.

5) Congestion costs

Table 2 :Congestion costs

Covered	**Not covered through transmission use of the system tariff or general tariff**

Annex A: Cost comparison

France, Finland, Ireland, Belgium, Norway, NL, EW, Austria, Denmark	*Italy, Spain, Portugal*

Congestion costs are in general covered by the general access tariff, without any locational signals for internal congestions. In certain countries, congestion costs are not covered by the access tariffs and generators have to produce without any compensation. This solution seems to be possible only where there is very little congestion (which is actually the case in Spain[1] and Portugal). In addition, the relationship between congestion and firm or interruptible access should be considered. Indeed, if market participants have firm access to the network it is the responsibility of the TSO to deal with congestion and associated costs. However, if the access right is not firm the cost of interruption may not be fully reflected within the tariff, therefore distorting the market which does not recognise the difference in property rights.

6) System services

The definition of system services is not the same according to the countries. The task force has worked with the following correspondences.

Reactive Power / Regulating Tension / Tension monitoring
Primary reserve / Fast Reverve (UCTE Obligation)
Secondary reserve / Slow Reserve (UCTE Obligation)
Tertiary Reserve / Imbalance compensation (between injection and offtake) / Maintaining Power Balance /Regulating power capacity
Blackstart facilities

In most countries, reactive power, primary reserves and secondary reserves costs are included in the access tariffs. However, there is a lot of diversity for tertiary reserves costs.

Table 3 : Tertiary reserves

Covered General tariff	**Covered, Specific term**	**Not covered through transmission use of the system tariff or general tariff**

[1] In Spain, there is a market mechanism to solve the technical constraints management (i.e. voltage problems in some areas)

Norway, NL, Denmark	*Belgium, E&W*	*France, Ireland, Finland, Spain, Portugal, Austria, Italy*

Black-start facilities costs are always covered by the access tariff, with the exception of France and Spain.

7) Other charges

They encompass different cost categories which are not transmission costs. Their level are determined by government, and the access tariff is only a tool used to collect money. However, it is important to keep in mind that tariffs can cover such costs, in particular when they are included in a tariff covering the different cost categories (general tariff, second column), and can not be easily isolated.

Table 4. Other costs

Cost category	Covered, general tariff	Covered, Specific term	Not covered
Supply policy and public service	*Norway, Spain, Denmark, E&W*	*France, Ireland, Italy, Belgium, Austria, Portugal**	*FinlandE&W*
Regulatory budget	*Ireland, Finland, NL, Spain, E&W, Portugal, Austria, Italy*	*Belgium, Denmark*	*France, Norway*
ETSO, Nordel, CBT	*Finland, Belgium (revenue), Norway, Astria, NL, Spain, Denmark, Italy*	*France, , Portugal**	
Stranded costs	*Spain, E&W*	*Italy, Belgium, Austria*	*Portugal*

* one tariff for all the "other costs" in Portugal

8) Tariff structure

The tariff structure defines the split between G and L as well as the pricing variables used (fixed term, kW or kWh).

Significant G component are observed for E&W, NL and Ireland, Norway, Western Denmark, but the majority of countries cover more than 98 % of transmission costs with the L charge.

The pricing variables used are very different. Only 5 countries out of 12 have a pure capacity (kW) L charge, and only one has a pure energy (per kWh) charge. Other countries cover costs using multi-part tariffs.

Annex A: Cost comparison

The task force notes that, considering harmonisation of tariff and long term locational signal, it may be necessary to introduce significant G in a majority of countries and to differentiate G terms according to the countries.

9) Conclusion

Comparing the costs categories included in the national tariffs, the task force concluded that:

- Harmonisation of tariffs should focus on the transmission, the definition of transmission remaining under the responsibility of each country.
- There is a need to consider connection charging methodology for generators, in addition of access tariffs. Harmonization of connection charging methodology for consumers may also be advisable, but seems more difficult to achieve.
- Where possible, the transparency of harmonization would be facilitated by the use of specific charges to cover specific cost categories; for instance for “tertiary reserves” and « other charges ».
- Considering long term locational signals, substantial changes to the scope of costs covered by the tariffs may be required.
- Consideration should be given to property rights and whether the full costs of congestion are attributed appropriately.
- Contributing to pay losses by generators as users of the network is accepted by the members of the TF. However, the task force noted some different viewpoints concerning the need to include the cost of losses in the transmission tariffs.

ANNEX B: Connection charging methodologies

1) Austria

Connection charges in Austria consists of two components

- A grid access charge
- A grid provision charge

whereas consumers have to pay both charges and generators only pay an access charge.

Grid access charge

This charge covers all costs directly associated with the connection to the existing grid - from the clients asset to the "point of connection" at the existing network. Part of the construction work can be carried out by others than the grid operator. Operation and maintenance of the grid access equipment is due to the grid operator. The grid operator chooses the point of connection, taking into account technical, economical reasons as well as consumers interests.

For specified groups of users (at low voltage level) a fixed fee (not regulated) can be charged instead of true costs. The construction as well as operation and maintenance of equipment that remains in the ownership of the customer is in the responsibility of the customer.

Grid provision charge

This charge has to be paid by consumers only. It is a regulated fee depending on the voltage level of the connection point. The fee has to cover the costs for carried out and pre-financed network expansion. For large consumers with power measurement it is charged per kW, for small consumer it is charged depending on energy use or fuse size. A minimum charge per voltage level is allowed.

2) Belgium

The tariffs (royal decree dated April 4, 2001 – art. 3)

The tariffs are build in a way where all the individualised costs are paid by the user and the over capacity of the connection or the network, not requested by the user, are "socialised".

The tariffs of connection to the network include two sub-categories:

a) the tariffs with single application and,

b) the periodic tariffs.

a.The tariff with single application depends on:

- the orientation study with a view to new connection or for the adaptation of existing connection. The tariff is divided into four categories small, medium, large and complex orientation study;
- the study of detail for new equipment of connection or the adaptation of existing equipment of connection. This tariff is related to technological parameters defined in the technical rule.

b. The periodic tariff is related to the right of use of a network user of:

- a span of connection. It depends on the operating voltage, the nominal output, the power of short-circuit, the type of substation and technological parameters defined in the technical rule. The tariff is a percentage of the investment.

- an air or underground connection and with the possible equipments, necessary to this effect. This tariff is a function of the operating voltage, length, nominal output and technical parameters defined in the technical rule. The tariff is a percentage of the investment.
- equipments necessary for the transformation or for the compensation of reactive energy or to the filtering of the tension wave. This tariff depends on the operating voltages, of the power, of the circumstances of use and of technological parameters defined in the technical rule. The tariff is a percentage of the investment value.
- the complementary equipment of protection, alarms indication, measurements and metering for the tele actions and/or ripple controls. This tariff is related to technical parameters defined in the technical rule. The tariff is a percentage of the investment value.

The tariffs do not create any signal or incentive for the localisation of new power plant. Belgium has a postage stamp tariff.

3) Denmark

a) Household consumers

Consumers connections fees are a left over from the old regulatory regime. Consumers connection fees are approved by the regulator as average procentuel share of actual cost in the past 3 years. The approved fee, which varies according to type of building connected, can be used by any grid company across country.

The general rule is that lines of connection to the grid of consumers are owned by the grid company, which is responsible for maintenance.

As a consequence of this it must be considered that consumers connections fees do not represent any locational signal. Secondly, the fee coves only shallow costs.

b) Industrial consumers

Industrial consumers fee of connection is part of a commercial deal, where the connected to be will be held responsible for the costs he causes to the coherent system. The industrial consumer might own the connection line and be responsible for maintenance as well, but the opposite situation occurs as well.

Thus you can’t say anything in general as to signals or the nature of costs being shallow or deep.

c) Producers

Central producers pay actual costs at the designated point of connection. In Denmark locating central plants is a result of governmental planning so location is a result of other political issues or the existence of natural resources. The fee is not regulated probably a shallow cost fee but you can’t tell for sure.

Plants producing on renewables or CHP plants are connected at a fee laid down in regulations. This regulation states that the fee must cover actual costs of connection. Reinforcements and enlargements

are recovered by the grid-company in the general tariff. The fee is only covering only shallow costs.

In a small country like Denmark it must be concluded that the connection fee of this type of producers does not hold any locational signal. Location is primarily a result of central/municipality planning and/or the presence of natural resources (wind) and closeness of urban areas.

Connection of large-scale wind mill farms is laid down in regulations recovered in general tariffs and covers shallow costs.

4) Finland

a) Connection of Consumers

Distribution network companies decide their own tariffs independently. All the 96 distribution companies have different connection fees. In general, LV customers pay fixed fees for connection in cities, and varying fees in rural areas. Customers pay usually 100% of the costs of the new line that is build for the connection. Maintenance and renewal costs are covered through the general tariff. The client pays all the costs (investment, renewal and maintenance) of a back-up line.

b) Connection of generators

The following is based on the clarification given by a representative of Fingrid Oyj (the Finnish TSO):

Fingrid maintains, operates and develops the network, which comes under its responsibility, as well as connections to the other networks, in order to meet the users' requirements within reasonable limits. Fingrid must carry out the connection of new customers to its power system, under conditions complying with Fingrid's general connection regulations.

a) If the customer is connected directly to the transmission line, the customer takes care of the construction of the connection line and connection point, and thus pays all the costs. There is no separate connection fee. The separate connection lines are usually owned *(and maintained)* by the customer.

b) If the customer is connected to the transmission grid via line feeder, Fingrid takes care of the construction and charges the customer the costs directly.

The customers and Fingrid agree together in a separate agreement on financial compensation and the other conditions relative to the connection (the costs are operation and maintenance costs). The operation cost are 3360 EUR/feeder/a and the maintenance costs 5880 EUR/feeder/a.

Fingrid has an obligation of overall development of the grid. Thus it pays for all the reinforcements of the main transmission grid.

As a conclusion, the connection charging in Finland is to be categorised as "shallow".

5) France

All of the users requesting the connection of an installation to the public transmission network.

a) Connection of Consumers

Specifications of the main power supply network –(amendment of April 10, 1995)

The consumers pay 70% of the costs of connection between their installation and the bus bar of the nearest substation with the appropriate connection voltage. Another possibility exists but is rarely used: if the client wishes to benefit of a "droit de suite" / following rights, he pays 90% of the costs but is partly reimbursed if another client come and connect to this line during the 6 following years.

For clients at lower voltage levels (MV and LV), customers pay a fixed price. A law under discussion, planes to move to a more cost reflective charging system involving local communities and real estate developers.

Maintenance and renewal costs are covered through the general tariff.

For Back-up lines, the client pays all the costs (investment, renewal and maintenance).

Connection for consumers is a pure shallow cost that delivers incentives to locate near existing substations. However this shallow cost approach doesn't create sitting signals, if the new power plant creates congestions on the grid or requires network investments.

b) Connection of generators

Since Nov. 1st, 2002, (decree #2001-365 relative to transmission and distribution network utilisation tariffs) producers are charged on a shallow cost basis. A generator pays:

- The costs of new lines between the point of connection and the nearest substation with higher voltage level;Cells at the substation;
- If any, the costs of upgrading existing lines between the connection point and the nearest substation with higher voltage level;
- If any, extra costs of transformers in substations;
- If it is necessary, all the costs of a new substation.

If RTE wishes to build a more costly network (for instance to anticipate future connections), extra-costs are not charged to the client.

Maintenance and renewal costs are covered through the general tariff.

Connection for generators is a shallow cost that covers more costs than for customers. This delivers incentives to locate near existing posts/transformers, but doesn't create sitting signals, if the new power plant.

6) GB

The following is sourced from the National Grid 'statement of the connection charging methodology, 1 April 2002'. For further information please refer to National grids connection statement available at: http://www.nationalgrid.com/uk/indinfo/charging/mn_charging.html#c

a) Principles:

Costs and their allocation:

1.1 Connection charges enable National Grid to recover, with a reasonable rate of return, the costs involved in providing the assets, which afford connection to the transmission system.

1.2 Connection charges relate to the costs of assets installed solely for use by one User or a specified group of Users.

1.3 National Grid's connection charges encourage Users to share connection sites, as this promotes efficiencies in the provision of assets and other costs which can be realized and shared between Users.

1.4 National Grid's connection charges are designed not to discriminate between Users or classes of User. The methodology is applied to both connections that were in existence at Vesting (30 March 1990) and those that have been provided since.

b) Connection/ Use of system Boundary

1.5 The first step in setting charges is to define the boundary between connection assets and transmission system infrastructure assets.

Annex B: Connection charging

1.6 In general, National Grid substation assets fall within the connection asset category. In addition, any overhead lines or cables or other assets defined in paragraph 1.10 to 1.13 below as Generation Only Spurs will also be treated as part of the connection category. For the purposes of this Statement, all connection assets at a given location shall form a connection site.

1.7 There are however occasions where assets within a connection site are providing a benefit to more than a subset of users at that site and hence are not charged fully to the connectees but instead are charged at least in part to Transmission Network Use of System (TNUoS).

1.8 Where there is no generation only spur, connection assets are defined as all those assets which lie between the National Grid/User ownership boundary, and:

a) the point at which the overhead line conductors from the terminal tower or junction tower(s) are fixed to the substation gantries of the outgoing feeder circuit at the first transmission voltage substation beyond the ownership boundary. The substation gantry is a connection asset; or

b) in the case of cabled circuit entries, the busbar side of the cable sealing end of the outgoing feeder circuit at the first transmission voltage substation beyond the ownership boundary; or

c) the transformer side clamp of the disconnector or earth switch on the first transmission voltage substation side of an National Grid owned transformer, where the outgoing feeder circuit of the first transmission voltage substation incorporates a transformer whose lower voltage is also a transmission voltage; or April 2002 The Statement of the Connection Charging Methodology

d) where the Ownership Boundary exists at a substation which operates at a Distribution Voltage and the substation is connected to the transmission system via a transformer feeder circuit where the lower voltage side of the transformer is a Distribution Voltage and the feeder operates at a transmission voltage and is over 2km in length, the boundary shall be on the HV side of the transformer at the point described in a) and b) above.

1.9 The design of some connection sites may not be compatible with the four basic boundary definitions above. In these instances, a connection boundary consistent with the principles above will be applied. For example, one condition to acquire Trading Site status is for a party to have contiguous connection assets. This may lead to a different connection boundary than the above definition but that boundary will follow similar principles to the above.

c) Generation only spurs

1.10 The DGES in his proposals of 3 October 1996 for National Grid's price control indicated that a "Generation Only Spurs" approach to boundary definition should be adopted by National Grid. The 1997/98 LC10 Statement of Connection Charges reflected the principles, which the DGES set out in paragraph 9.12 of the October 1996 Proposals document.

1.11 National Grid also circulated a system map on the 15 October 1996 identifying Generation Only Spurs and referenced that map in its October and November 1996 Charging Letters on the basis of charging for 1997/98.

1.12 In addition, for new generation connections, Generation Only Spurs are identified with reference to the following principles:

- Normally Public Distribution System Operator or directly connected customer connection charges are confined to sub-station assets, that is, they do not include overhead lines or cables (other than those which constitute substation assets or where Users forming a trading site have opted for any overhead lines and cables to continue to be treated as connection);
- Overhead lines and cables are excluded in the calculation of generation connection charges if such overhead lines and cables are essential to connect demand at Public Distribution System Operator exit points;

- Generation Only Spurs (i.e. where there is no Public Distribution System Operator exit point) are included in the connection charges of the generator(s) concerned and are allocated between generators as appropriate in accordance with the allocation procedure at shared sites;
- In the case of "multiple spurs" which serve to connect both generation and demand at Public Distribution System Operator exit points, where not all these circuits are required by security standard to serve the Public Distribution System Operator exit point, the more costly circuits are classed as connection. For the avoidance of doubt multiple spurs serving generation only will be treated as connection assets;
- Generation Only Spurs also incorporate, for the purpose of calculating connection charges, an appropriate allocation of the sub-station assets at the "system" end of the Generation Only Spurs. This allocation is carried out in accordance with the "The Allocation of Connection Assets at Shared Sites";
- The Statement of the Connection Charging Methodology April 2002 • For the avoidance of doubt overhead conductors between terminal and junction towers and substation gantries (Down Droppers or cable equivalent) which do not have intermediate overhead line towers are not considered to be overhead lines and therefore such assets cannot be defined as Generation Only Spurs for the purpose of calculating connection charges;
- Generation adjustments (at 400kV and/or 275kVgeneration sites) apportion to TNUoS Charges a share of the connection charge payable on the lowest cost Generation Only Spur circuit, including lines, cables terminating switchgear and substation assets. The lowest cost circuit is identified with reference to the associated Net Asset Values excluding the switchgear.

7) Ireland

a) Connection Assets

Connection charges cover the cost of network assets that are specifically installed to connect a demand or generation user to the transmission system. As connection costs are specific to each individual user the connection charge levied to an individual user will depend on the specific configuration required to connect that user. The connecting user will be charged directly for the full cost of the connection, which includes an appropriate share of the capital costs and an on-going operations and maintenance cost. Connection costs are recovered through the initial connection charge, the Transmission Use of System (TUoS) charge, or some combination of the two.

b) Connection Charging Policy

The Commission for Energy Regulation issued a '**Deep to Shallow Connection Charges'** Directive on the 23rd December 1999.

Connection assets are those assets used 'solely or mainly' for a single connection, whilst use-of-system assets serve more than one connection. The principle of cost reflectivity requires that those seeking connection pay for all dedicated connection assets.

Distribution network connection charges employ a different classification of assets, with connection charges based on 'attributable' rather than shallow assets. Attributable assets include shallow connection assets and any required reinforcement assets contiguous to the shallow connection.

(A) Upfront Element of Connection Charges

Transmission connected customer's pay 50% of shallow connection costs upfront with 50% included in TUoS charges. Transmission connected generators pay 100% shallow connection costs upfront.

Annex B: Connection charging

Distribution connected customers 50% of attributable connection costs upfront with 50% included in DUoS charges. Distribution connected generators pay 100% of attributable connection costs upfront. Distribution system connections to the transmission system are treated on the same basis as demand customers for charging purposes. These connection charging arrangements are outlined in the Table below.

Distribution System Connections	Shallow: 50% upfront/50% TUoS
Transmission Connected Demand	Shallow: 50% upfront/50% TUoS
Transmission Connected Generation	Shallow: 100% upfront
Distribution Connected Demand	Attributable: 50% upfront/50% DUoS
Distribution Connected Generation	Attributable: 100% upfront

(B) TUOS Element of Connection Charges

Elements of connection charges recovered through TUoS charges are initially paid upfront by the System Operator. These costs become part of the operators Regulatory Asset Base (RAB) for 40 year's, upon which it earns an annual regulated return (currently 6.5%). All System Operator costs, including this return, are recovered 25% from generators and 75% from demand users.

c) Contestable Connections

Parties connecting to the transmission system will wish to connect at the lowest cost and in the shortest time possible, and to retain a degree of control over ensuring that these objectives are met. Regulation 33 of Statutory Instrument 445 of 2000 allows generators and customers to construct their own connection (termed 'contestable connection') to the transmission system. Contestability of connections shall allow parties seeking connections to take responsibility for on-time and to-cost delivery of connection assets.

d) Review of Tariff Structures

The Commission is currently carrying out a detailed review of its tariff structures, including connection charging policy.

8) Italy

The Italian connection charging system in force originated at a time prior to the establishment of the Italian regulatory authority. The system can in general be classified as *shallow,* and it is due to be reformed soon.

Three different regimes can be distinguished:

a) Connection of final clients at low and medium voltage level

Under the general regime in force for final clients connected at low and medium voltage levels, clients are required to pay a fee which partially covers the costs of the connection from the existing network to the client's own equipment. Network reinforcement costs, if applicable, are covered by network tariffs.

The choice of a shallow approach was based on two main considerations: the first one had a social implication and was related to the necessity of promoting the access of new customers to the network; the second one had a technical implication and was related to the idea that every network reinforcement brings benefits for all system users.

Connection fees are regulated. The amount charged to each client depends on the distance between the existing network and the client's equipment and on the connected load.

b) Connection of final clients at high and extra high voltage level

Final clients connecting at high and extra high voltage level have to pay a 50% contribution of the related investments. Investments charged in the form of connection contribution comprehend both the costs incurred to build the connection between the existing network and the client's equipment and a part of the so called "anticipated investment", determined as a function of the connected load. Since the contribution is supposed to cover also eventual grid reinforcements, the charging principle applied for connection of final clients at high and extra high voltage levels tends to be "deep".

c) Connection of producers.

Connection fees charged to the producers cover the entire cost sustained by the grid operator for the building the connection between the existing network and the producer's equipment. connection fees for producers are not regulated but negotiated between the parties. Investment contribution paid by producers doesn't include the so called anticipated investments. Therefore contribution charges paid by producers have, once again, to be considered as "shallow".

9) Netherlands

When addressing this subject there should be made a clear distinction between connections below 10 MVA and above 10 MVA. Below 10 MVA the fee consists of an average tariff based on a standard configuration Above 10 MVA the fee consists of actual costs for a connection. The former has a very small locational signal (i.e. close tot the network), the latter has a stronger signal (i.e. close to where sufficient capacity in the grid is available).

a) < 10 MVA

Below 1o MVA there a network company has around 8 categories (based on the requested capacity) for which he offers a standardised tariff based on a standardised configuration. Differences in cost can occur but are not past trough to customers. Basically customers pay an average of the costs of a connection. The fee consists of three parts: 1. the disconnection of the grid;2. the connection between the disconnection and the customer; 3. the protection equipment. So the customer who asks for a connection of a certain capacity is only confronted with the standardised tariff. This is even so in the event the network company has to or chooses to, due to circumstances, build a different configuration. The only exemption to this is if the distance between the grid and the customer is above 25 meters, in which the customer pays an extra fee for the additional meters.

b) > 10 MVA

Above 10 MVA the connection fee is based on the actual costs of the realised configuration. The network company has to make a transparent and detailed offer for the connection on which basis parties can negotiate the actual configuration and tariff. Part of these negotiations form the investment costs in the network the network company is confronted with because of the involved connection. This is due to the fact that the large consumer/producer is connected to a point on the grid where sufficient capacity is available. In this situation it might be more efficient to increase capacity in the existing network, rather than physically connect the consumer/producer to the point where capacity is available. For this the network company and the consumer/producer have to reach an agreement for dividing the cost of the increase in capacity in the existing network.

In these connections fees are some locational signals. Below 10 MVA these are probably not significant. Customers only pay an extra fee for being further away from the grid than 25 meters. So it could be stated that there is a small incentive to locate near the grid.

Above 10 MVA there is a stronger incentive. So to locate a large facility in a place with limited grid capacity customers can be faced with high costs to connect to the net.

10) Norway

In Norway the Network Companies can decide themselves to charge new customers (consumers or generators) connecting to the network an investment contribution and/or a connection fee.

The use of Connection Fee can not be said to gives location signals in the Norwegian system. The Investment Contribution however gives long run location signals.

a) Investment contribution

The network companies in Norway may calculate and charge an investment contribution to cover the cost of connecting new customers to the network and/or reinforcing the network for already existing customers.

Investment contribution is the most common connection charge used in Norway. The reason for this is that the investment contribution is an allowed income for the network companies that are partly in addition to the income cap[2], while the connection fee is an income for the network companies within the income cap.

An Investment Contribution must be charged based on objective and non-discriminatory conditions. In general this means that if a network company charges a new connection 100 % Investment Contribution, this shall apply for all similar connections.

Local politicians often influence a decision from a network company to cover less than 100 %. This could be motivated for instance from wanting people to settle down in a specific area. The network companies then use this as a long run location signal.

To calculate an investment contribution in a meshed system would not be easy, so Regulations[3] state that Investment Contributions can only be charges in a meshed network in very special occasions.

If a new connection requires reinforcement in a radial joint network, a pro-rata share of these costs can be included in the Investment Contribution.

The Investment Contribution shall be charged independent of the customers expected out-take of energy and can as a maximum be set as high as the installation/investment costs minus the Connection Fee (see under). The installation/investment costs of the installation should equal necessary costs of the installation or reinforcement, including hourly charges for personnel, machines and equipment.

The network company can distribute the Investment Contribution between customers that are connected at the time the installation is brought to completion, and customers that is connected after, but no later than 10 years after the completion of the installation. The network companies can do this by for instance prepay the installation/investment costs and calculate an Investment Contribution pro-rata for each customer as they get connected to the network. Or, the network companies can do a re-calculation of the Investment Contribution after the new customers are connected.

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[2] In Norway we regulate the network (transmission/distribution) by setting an income cap for each company every year that says how much income the company is allowed to cover through their network activities that year. A connection charge within the income cap means no extra income for t he network company.
[3] can be found on our web-side: www.nve.no.

Location signals from the Investment Contribution

The Norwegian Investment Contribution gives long run location signals. The size of the cost covered through the Investment Contribution will give a signal to the new customer on where to locate. Different locations will cause different investment/installation costs, and given this information prior to the connection a rational customer will choose the best/cheapest location.

99 % of production in Norway is hydro power. This means that production will locate where there is water. The location signals through the Investment Contribution will therefore not influence the location of a generator to the same extent as a consumer. For other production technologies this may be different.

As mentioned above a network company can have other agendas for wanting to locate new customers in his area (as for instance politics). Charging less than a 100 % Investment Contribution can be used to influence the decision for a new customer on where to locate.

b) Connection fee

Connection fees is mostly used only in the Distribution Network (22 kV →). In 2001, only 30% of the Distribution Companies (157 companies) was using a connection fee in their network. Network companies have relatively smaller incentives to use a connection fee than an Investment Contribution, because charging a Connection Fee will not influence their income.

Connection fee is some general charges mostly used for covering the additional administrative costs that arise when connecting a new customer to an already existing network. The Connection Fee will not give any location signals.

Regulations say that a Connection Fee can be charged new connections, and that if used the Connection Fee shall be general and charged all new connections in the network.

11) Portugal

a) Generators

- Generators with installed power over 50 MVA are connected to the National Grid.
- Generators with installed power less than 50 MVA are connected to the distribution networks (connection between 10 and 50 MVA can be made with National Grid in case of agreement with the distributor).
- Conditions and charges for the construction of the connection (exclusive parts) and for the eventual deep reinforcement are established by agreement between generator and network operator. In the absence of this agreement, ERSE is competent to decide.

b) Customers

MV, HV and VHV customers

The charges resulting from the construction of the parts of the connections **for exclusive use** are integrally supported by the customer.

The charges relative to the parts of the connections for **shared use** must be shared among customers (in cases of having simultaneous connection applications) or, in cases in which the network operator decides the over-dimensioning of the connection between customer(s) and the network operator.

For **HV and VHV customers**, charges relative to the **deep reinforcement** will be object of an agreement between customer and the network operator. In the absence of this agreement, ERSE is competent to decide.

For MV customers, charges relative to the **deep reinforcement** are paid whenever the requested power exceeds the reference power established for MV networks (2000 kVA).

LV customers

The charges resulting from the construction of the parts of the connections for **exclusive use** are integrally supported by the customer.

The charges relative to the parts of the connections for **shared use** must be shared among customers (in cases of having simultaneous connection applications) or, in cases in which the network operator decides the over-dimensioning of the connection between customer(s) and the network operator.

The charges relative to the **deep reinforcement** are paid whenever the requested power exceeds the reference power established for each localities.

The charges relative to the **expansion of the LV networks** are calculated according to the concession contract of LV distribution established between Municipalities and the LV network operator.

12) Spain

All necessary investments of connection installations shall be paid by the promoters of the connection.

In the case that the connection to the transmission grid gives rise to the division of an existing or planned line with input and output in a new substation, the installations required for such connection (i.e., the new input and output line, the new transmission grid or distribution network substation, as regards the needs prompted by the new connection, the possible reinforcement of existing or planned line and the adjustment of the positions at the ends of that line resulting from the new meshing set out in planning), shall be considered as a part of the network to which they are connected. Its owners shall be responsible of the operation & maintenance of these facilities At present, the ownership of these facilities is entirely transferred by promoters to the transmission company.

a) Generation connection installations

Such installations act as a link between one or more electricity generation plants and the corresponding transmission or distribution network. Any substations and lines at transmission[4] or distribution voltage that are necessary for the effective union of generation installation to the pre-existing network or resulting from approved planning constitute connection installations.

The generator who requires a direct connection of a new plant to the transmission grid, shall apply for access to the system operator/transmission grid manager. The system operator/transmission grid manager shall establish the access capacity and the definition of any eventual reinforcements, taking into account system safety and functioning criteria. Generally, the generator obtains the access and pays the connection installations to the network but not any meshed network investment. However, if the system operator/ transmission grid manager denied the access to the generator, the generator should pay any necessary reinforcements of meshed network.

In Spain, there is an obligatory planning of the transmission network in the sense that the transmission planning is regulated by the government who approves the new transmission investments that the system operator decides as necessary for the security of the system. The new investments of the

[4] The transmission grid is formed by: (i) Voltage lines equal to or higher than 220 kV (ii) International interconnection lines if any voltage whatsoever (iii) Switchyards having a voltage lines to or higher than 200 kV 400/220 kV (iv) transformers (v) Any active or reactive capacity control element connected to the 400 kV and (vi) the 220 kV grids that are connected in transformer tertiary windings.

transmission network are financed through tariffs as a part of the remuneration of transmission[5]. The long-term grid planning takes into account the forecast of the installations of new generation for the coverage of the demand in order to contain the possible associated reinforcements that are required for the development of the grid. Due to the necessary reinforcements are included in the development of the grid, at present, the generators pay only a shallow connection charge. The system operator sets up any capacity of connection limits at each connection point.

After obtaining the favourable report from the system operator/ transmission grid manager about the transmission grid access capacity at the required connection point, the generator shall connect to the connection point ordered by the system operator/transmission grid manager.

b) *Consumer connection installations*

Consumer installations for connection to the transmission grid or distribution network shall be any installation that acts as a link between the consumer and the corresponding transmission or distribution installation. Such installations shall not form part of the transmission grids or distribution networks.

In the case that the new installations developed are to be made additional use of by another consumer and/or generators, the new user shall contribute for the proportional part of the use of the installation capacity to the investment made by the first user, but only during the five-year period starting from the commissioning of the connections.

The necessary actions to link the consumer installation to the transmission grid or distribution networks shall be covered by the connection charges, customer connections and verification of installations charges.

- **Connection charges** include both connection investment charges and access fee.
  - **Connection investment charges** or extension charges are economic payments to be made by each customer for a new supply or for the expansion of the capacity of an already existing supply to the distribution company for the new electrical infrastructure necessary between the existing distribution network and the first element that is the property of the customer. These payments are regulated for connection investment in building land that have building plot status both for customers connected in low voltage level and capacity requested lower than 50 kW and for customers connected in high voltage level and capacity requested lower than 250 kW. Otherwise these charges are not regulated.
  - **Access fee** to be paid by each customer of a new supply or of the expansion of capacity of an already existing supply by its incorporation into the network and the coverage of necessary reinforcements for the security of supply. The access fee is a regulated price that the consumer pays to the distributor by taking into account the voltage and the capacity requested.
- **Customer connection** as the economic payment to be made by each consumer by the physical connection to the network of the distributor.
- **Verification of installations** as economic payment to be made by each consumer by the revision and check that the installations meet the statutory technical and safety conditions.

Customer connection charges as well as verification of installations charges are regulated tariffs paid to the distributor in accordance with the voltage level and the capacity requested.

[5] In Spain, access tariffs and final tariffs are set up by the Government and are paid only by consumers.

13) Sweden

Svenska Kraftnät, the Swedish TSO, maintains, operates and develops the network, which comes under its responsibility (the national grid, incl. interconnectors) , as well as connections to the other networks, in order to meet the users' requirements within reasonable limits.

The investment costs resulting from the construction of the parts of the connections for exclusive use are entirely paid by the customer.

Costs that can be considered as a reinforcement of the existing networks, thus be of use for potential future customers or increase the quality of supply for existing customers, should be sustained by the grid operator.

Connection fees for producers are regulated.

Annex C: Nordic countries experience

23.5.2003

CEER Tariff Task Force

Locational signals within the nordic model for G tariff harmonization

The Nordic model for G harmonization

There is a liberalized electricity market in the Nordic area (Denmark, Finland, Norway and Sweden). The Nordic TSOs have agreed on a G tariff harmonization model the 14th April 2000. The G tariffs have been harmonized since 1.1.2002. The basic principles of the Nordic model are:

a) to give sufficient locational signals in order to increase the efficiency of the transmission grid
b) to level out the terms of competition for the generators
c) simplicity
d) cost reflectiveness
e) subsidiarity

The harmonized G tariff consists of two components, one component that reflects the cost of marginal losses in different connection points, and a residual component that will ensure cost recovery.

1. Component giving locational signals (marginal loss fee)

The transmission tariff will give locational signals, when it reflects the difference in cost of marginal losses in different connection points or zones. The aim of this component is to give locational signals in order to increase the efficient use of the transmission grid. This component is called marginal loss fee, and the way it is calculated is agreed between the Nordic TSOs.

The component is recommended to be calculated individually for each node or zone. However, if the differences in the marginal loss fee are very small from node to another, a country can have a marginal loss fee that is equal and based on a national average. This component is an energy (kWh) based fee.

2. Residual component

This component covers all the remaining costs of the transmission company. The purpose of harmonizing this fee for the Nordic countries is to give the generators an equal possibility to compete in the liberalized energy market. The idea is to make the differences in G tariffs smaller than they used to be. However, the tariffs don't have to be exactly the same, it is sufficient to have them within a certain range.

In the Nordic countries, the residual is agreed to be within the range of 0.58 €/MWh +/- 0.35 €/MWh on average. The residual can be energy (kWh) or load (kW) based fee. It is possible to give long term locational signals through the residual component. In Sweden, for instance, an additional locational signal is used. As a fixed part of the tariff, a fee based on location and capacity is added.

Long term locational signals within the Nordic model

There are several ways of giving locational signals in the Nordic system.

e) *Price areas.* Firm congestions are handled by splitting the market into several price areas. For instance in a deficit area the market price of electricity rises, which relieves congestions and makes it more feasible to construct new generators in that area. If the price differences between areas are permanent, market splitting gives long term locational signals, because the price differences remain as long as there are congestions between areas. If there is no price difference between areas, market equilibrium is the same in both areas, and LTLS are not needed.

f) *Marginal loss fee* can give locational signals, when calculated for each node or zone. In general it will give short term signals, but if the sign (+ or -) of the marginal loss fee is the same over time for either node or zone, it indicates that the load flows are quite stable in the system. In that case the marginal loss fee gives long term locational signals.

g) *The residual component.* It is possible to give long term locational signals through the residual component. It is left for each country to decide whether to give long term locational signals through the residual component, as long as it is done within the harmonized range.

h) *Connection fees,* which are based on the actual costs of connecting a new customer to the network, can give long term locational signals. Producers are expected to take into account the differences in costs of connecting to various points in the network.

When creating a liberalized European electricity market, it is important to agree on the principles of G harmonization. Long term locational signals are one of the issues in harmonization of G tariff.

Long term locational signals should primarily be based on signals given by the electricity market. Locational signals given by the residual components in the tariff are not based on market principles, but are set administrative. Locational signals given through marginal losses and the use of price areas will be the most efficient solution.

However, the harmonized G tariff can be designed in a way, that it enables the member states to give long term locational signals through the tariff.

The Nordic model: pros and cons

Pros

- The most efficient way of giving locational signals is through marginal loss fee and the use of price areas. The Nordic harmonization model makes this possible

- The model has several different ways of giving long term locational signals, which gives each country some degrees of freedom to implement locational signals that are best suited for the conditions applying in their network. The locational signals can therefore be stronger than with other models.

- Subsidiarity. Because the model gives only a framework for the tarification, the member states can quite freely decide the way they define their G tariffs. If a country wants to give locational signals through the G tariff, it is possible with the Nordic model. It is preferable to seek to harmonize the principles for the tariff structure rather than to harmonize the tariff in detail.

- The tariffs can be defined in a cost reflective way.

- The Nordic model works in practice. There is a liberalized electricity market in the Nordic area, and the G tariffs are harmonized since the beginning of 2002. By far there are no major problems observed in the Nordic G tariff harmonization model.

Cons

- Because the final design of the G tariff has been left for the member states, the systems in different countries can be slightly different. This can affect the free competition between the generators.

Annex D: Internal Discussion Paper

CEER Tariff harmonisation, locational access pricing in Europe TF

Cross Border Trade (CBT) and Locational signals

The intention of CBT proposals is to simplify the existing mechanisms to facilitate cross-border trades, while ensuring the recovery of efficient costs of transmission and ensuring appropriate signals are placed on network users. This note looks at the latter issue: do the proposed tarification mechanisms provide the right signals to users to ensure appropriate investment and efficient use of the network?

The key issue is to ensure that locational signals at a regional level can provide the correct incentives for trade within that region and between regions.

Proposed European tariff

The proposed long-term mechanism for CBT would be based on an inter-TSO payment concept (i.e. a form of entry exit rather than suppliers paying individual TSOs along the contract path of an electricity flow). The mechanism is meant to compensate those countries that incur additional costs due to cross-border flows, while charging those countries responsible for those flows.

Inter-TSO payments will be used for the compensation of these costs with no transaction based "cross-border" tariffs on energy.

To do this the inter-TSO mechanism is intended to consist of three steps:

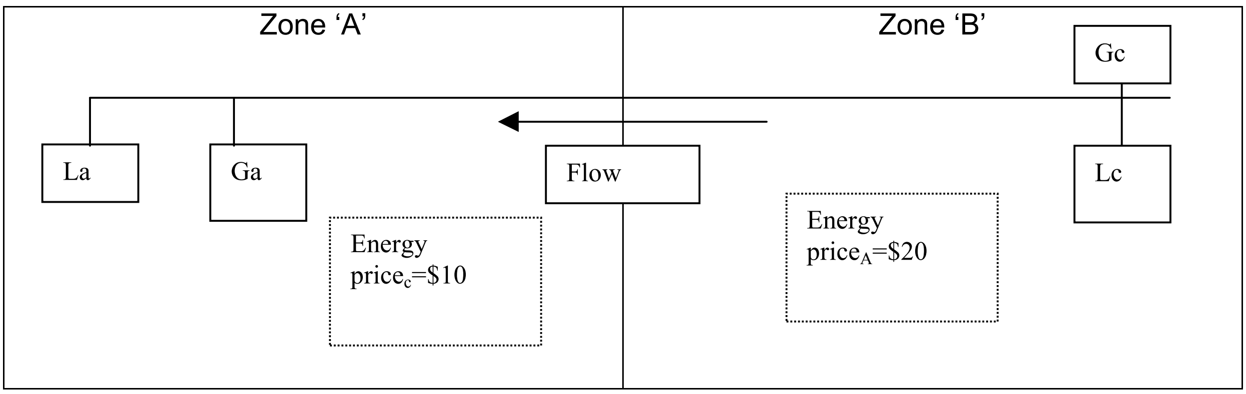
1. Determination of the compensation due to each TSO because of the costs that are incurred by cross-border flows, related to an electrical algorithm and a standard cost for each network;
2. Determination of the charges that each TSO has to pay in order to compensate others based on the algorithm;
3. Application of the net balance of compensation and charges of each TSO to its internal network users as a modificiation of their corresponding network tariff: G for generators and L for consumption loads.

After netting out compensations and charges that are due to a particular country, charges are levied either on G or L. If the net amount for any TSO area happens to be a payment, it should be debited to the L tariffs in importing areas and to the G tariffs in exporting area. If the net amount happens to be a credit, then it should be used to reduce the L tariffs in exporting areas and the G tariffs in importing areas. However, the inter-TSO compensation mechanism does not deliver the optimal cost reflective charging and locational signals that are provided for by the marginal losses approach, which is discussed below.

Locational signals within zones

The above discussion on the treatment of 'G' and 'L' refers to the pan European situation. It is clear that European transmission tariff harmonization will not be a straightforward process, given the wide range of current approaches and view points. Although a degree of harmonization may be possible, as illustrated and has occurred at a more regional level. For example, the Nordel countries already operate an integrated and consistent transmission pricing policy between them[6].

Within the regional model, there is some concern that different approaches to G/L charging may distort trade between and within the regions. In addition, there is some debate about the strength of locational signals arising from G/L charging. The following model is intended to provide a simple basis with which to think about locational signals and their impact on the market. This model can be equally applied at the individual network, country or pan-European level.



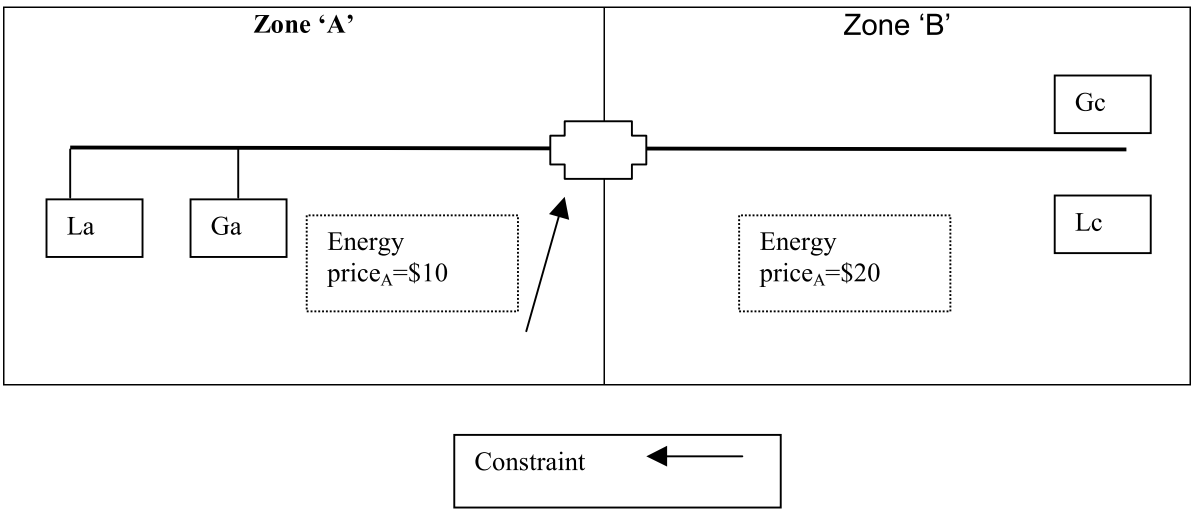
By assumption, in our model, G/L are set optimally in each zone 'A' and 'B' to reflect the geographical distribution of G and L. This might include different charges at different entry-exit points where the distribution of generation and demand is quite differentiated or 'postage stamp' charges where G and L are more evenly distributed.

In zone 'A', the G and L represent the geographical location of generation and demand, with the majority of Generation in the east and the majority of demand in the west of this zone. If this is the case then the predominant flow of electricity will be from east to west within this zone. Assuming that optimal price signals are in place in zone 'A', the TSO will want to levy (positive) charges to discourage flows from east to west (G to L) and encourage flows from west to east via (negative or discounted) charges. The effect would be to encourage the location of new generation investment in the West and new demand in the East.

Trade between zone's

Given the existing locational signals in each zone, how does trade between area 'A' and 'B' and the respective charges (within a particular area) provide locational signals? In this model, zone 'A' faces a domestic electricity price = 20 euros and zone 'B', an electricity price = 10 euros, there will be incentives for trade B→A. In making this trade, the charges and compensations levied need to provide locational signals, in particular the fact that a flow from B→A would be more costly than A→B.

This example is further complicated if a constraint exists between zone 'A' and 'B' on the network. If the trade B→A arose (predominant flow), this could potentially create additional costs. On the other hand, the trade A→B would contribute to alleviating the constraint (the domestic flow G to L) would be netted off against the flow A→B and reduce the cost of system losses and the need for new investment.



[6] The UK is moving to harmonize many wholesale market arrangements, including transmission, across the whole of Great Britain and regulators in Ireland are considering the development of an integrated island of Ireland market arrangements.

If the flows are substantial, redispatches across the constraint will be insufficient and significant upgrade of the network between ‘A’ and ‘B’ will be required. This implies that signals need to be sent to:

i) make it costlier to flow B→A than, A→B; and
ii) encourage new generators to be located in A.

Consequently, it is important in addition to locational access charges, to have some mechanism for signalling network losses, as demonstrated by the sitting of ‘G’ and ‘L’ that may have substantial consequences for network costs. Indeed, locational signals should also influence the marginal generation and consumption decisions of market participants.

Investors have indicated that large investment decisions and also marginal generation and consumption choices are significantly influenced by the presence of locational signals.

- Within the UK, generation is largely cited in the north of the country and load predominately in the south. The England & Wales market is connected to Scotland by an Alternating Current (AC) interconnector with a nominal capacity of 2200MW. However, the actual transfer capability of this link is currently limited by capacity constraints in the north of England. Consequently, the predominant flow on the interconnector is from north to south and locational access charges are levied to provide signals for investment. There are positive charges for flows from north to south and zero charges for flows from south to north on the interconnector.

- Within GB, the Investment Cost Related Pricing (ICRP) methodology calculates the marginal costs of investment in the transmission system resulting from an increase in demand or generation at each connection point or node on the transmission system. The resulting price signals are locationally varying and are grouped into:

  - 15 generation charging zones; and
  - 12 demand charging zones.

- In addition, Ofgem has recently approved a modification proposal that will introduce zonal transmission losses, which will act to remove the cross subsidies which the present uniform charging for transmission losses create. If charges do not reflect costs, there will be cross subsidisation in the charging arrangements that will tend to have two effects:

– in the short run costs are higher than would otherwise be the case. Cross subsidisation will lead to some plant generating when it would be less costly for it not to generate, whilst other plant, which it would be more efficient to use, is not generating. Similarly, cross-subsidies are likely to result in the pattern of electricity consumption failing to reflect fully the costs of providing the electricity; and

- in the long run there will be a tendency towards an inefficient (locational) pattern of investment in generation and closure of generation with a consequential adverse impact on transmission. There could also be inefficiency in the location of demand.

The introduction of zonal transmission losses will therefore enhance efficiency through more cost reflective charging which could be expected to influence both short and long-term business decisions.

Conclusion

The examples above illustrate the need to provide appropriate market based signals to ensure efficient trade and prevent unnecessary investments. It is recognised that the decision to investment in the network is influenced by a bundle of important locational signals, which includes the 'G' charge, the cost of land and environmental and planning considerations. It will be important to address the potential market impediments (e.g. political influences and market structure issues) that prevent effective locational signals. Indeed, a lower 'G' in one region (in the presence of market impediments) would simply provide a rent to generators, rather than increasing their production in the short term.

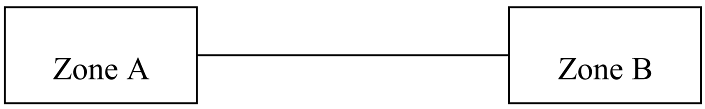
The CEER TF report (25/07/2002) noted a process of moving towards harmonization throughout the EU in stages. The first stage would consist of agreeing a set of principles to be applied to transmission access pricing, and recognizing different markets structures and practices in the non-core EU countries. These non-core regions might choose initially to introduce differing arrangements, under the umbrella of common principles, that reflect appropriate local differences.

ANNEX E: Internal Discussion Paper

Surplus approach for G/L differentiation

This note proposes a theoretical methodology for determining the split between G and L which reflects the fact that some zones are importing and other zones are exporting.

We consider two zones A and B representing two sub energy-markets, corresponding to a node.



Assume that the long term cost function of the network or HV lines between zone A and zone B is the following:

C = C(q)

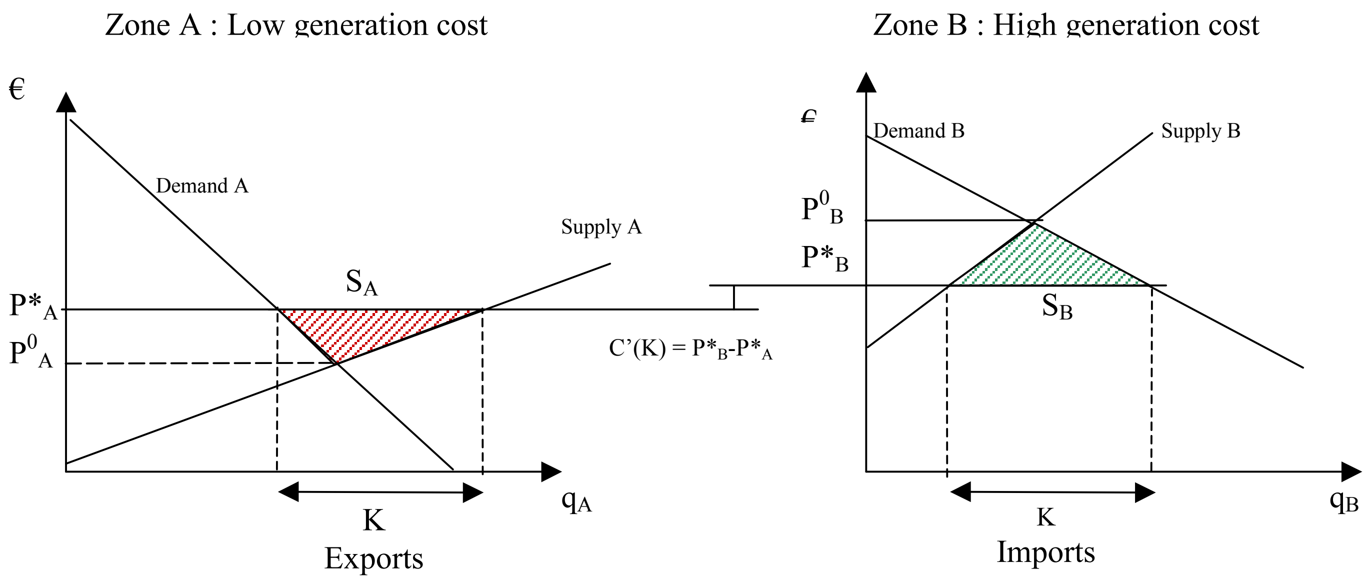
C(q) is strictly decreasing with quantities over the relevant band of consumption.
C'(q)=dC(q)/dq is the long term marginal cost of the transmission of power from Zone A to Zone B.

Economic theory tells us that efficient access prices must be equal to marginal cost.
The export access tariff should be set at a price equal to marginal cost C'(q). However, this tariff does not cover total costs C(q) of the HV lines which exhibit increasing return to scale.

Most of the investments are fixed and sunk costs. Therefore, the cost recovery objective is a problem of equity. In order to cover the remaining (fixed) costs, a surplus-based approach can help to find a solution which is fair and also efficient. The following figure represents two sub markets, in zone A and in zone B. We assume that the price per kW between zones is set by the regulator equal to the marginal cost C'(q) of the transmission network. At this price, the quantity exported is K.

The reference case is the absence of transmission network between the two zones. In this case, the prices are P^0_A in zone A and P^0_B in zone B.
Trade between zone A and B increases prices in zone A and this generates a net surplus in zone A, represented by the zone in red. This net is a profit for generators in country A. Conversely, trade between zone A and B lowers price in zones B which increases quantities consumed in zone B. This creates a net consumer surplus in zone B represented by the zone in green.

Annex E: Surplus Analysis



Economic theory tells us that the costs of efficient investment should be covered by the net surplus created by the connection of the sub-markets thanks to the HV link. The total costs of efficient HV lines between two zones, must be inferior or equal to the economic value created by this line, which is represented by the hached zones in red and green plus the 'merchandizing surplus' equal to (P_B-P_A)*K, where K is the capacity of the line, equal to the quantities exported.

Assuming that it is possible to extract surplus with a lump sum prices, for instance a fixed terms in €/year, then the fixed costs can be covered thanks to charge paid by generators in zone A, yielding some revenues S_A or a fraction of S_A. Similarly, the surplus S_B should be used to cover the fixed cost of the infrastructure.

This rule can provide a theoretical framework to allocate costs:
- to allocate costs of HV lines between zones : the fixed costs should be attributed to zones in proportion to the net surpluses generated in each zone
- to cover the share of costs of the HV line, thanks to a G charge in zone A and thanks to a L charge in zone B

The 'merchandizing surplus' can be levied on the consumers of the zone B. Assuming that access charges can be levied without distorting markets, the revenues generated by G and L in each country, for the HV lines between zones can be the following:

In zone A: $G = S_A/(S_A+S_B) * (C(K) - C'(K) * K)$
$L = 0$

In zone B: $G = 0$
$L = S_B/(S_B+S_A) * (C(K)- C'(K) * K) + C'(K) *K$

Remark : If we take into account different charging methods, i.e. per kW or kWh instead of a fixed term, then the optimal rules may be changed.