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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying document to the

Commission Regulation establishing a mechanism for the compensation of transmission system operators for the costs of hosting cross border flows of electricity and a common regulatory approach to transmission charging

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This report commits only the Commission's services involved in its preparation and does not prejudge the final form of any decision to be taken by the Commission

1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1. Inter Transmission System Operator compensation

The need for an Inter Transmission System Operator compensation (hereinafter ITC) scheme was first agreed in 1999 by stakeholders at the Electricity Regulatory Forum (generally called the Florence Forum)[1]. It results from the abolition of import and export fees at national boundaries (see Section 2 below for a more detailed explanation of the need for ITC) and is an explicit requirement of Regulation 13228/2003 (hereinafter the Regulation).

[1] The Florence Forum was established in 1998 and meets bi-annually to discuss the creation of a true internal electricity market. Participants include national regulatory authorities, Member State governments, the European Commission, TSOs, electricity traders, consumers, network users, and power exchanges.

Stakeholders, in particular Regulators and Transmission System Operators, have tried over many years without success to agree a scheme amongst themselves. In January 2007 the Commission and the European Regulators Group for Electricity and Gas[2] (hereinafter ERGEG) discussed the need for binding guidelines on ITC. The Commission agreed that it would take responsibility for developing proposals with the Directorate General for Energy and Transport (hereinafter DG TREN) leading. Commissioner Piebalgs informed the organisation for European Transmission System Operators (hereinafter ETSO) in March 2007 of the intention to move forward and requested ETSO assistance finalising guidelines.

In 2008 the Commission engaged consultants to review the options available for the development of an enduring ITC mechanism. The role of the consultants was to assist analysing and assessing potential methodologies for ITC.

The Commission published a full public consultation paper on ITC in December 2008[3]. Full public consultation was considered appropriate as transmission charging, and hence ITC, affects all sections of society. Industry and consumer organisations have an important perspective these issue. The consultation set out the background to ITC, and examined potential approaches to establishing a scheme. It set out objectives which would serve as the framework for designing an ITC mechanism that could meet the requirements of the Regulation and support the effective functioning of the internal market. In particular it invited views on the appropriateness of the Commission setting out binding guidelines.

A wide range of organisations, including government ministries, regulators, industry associations, and individual Transmission System Operators (hereinafter TSOs) and companies responded to the consultation. A summary of response is provided at Annex B. Respondents agreed the need for Commission action and that such action should involve detailed guidelines. This reflects the difficulty in achieving agreement on a voluntary scheme. Responses on the detail of the scheme were extremely useful in assessing the impact of different ITC schemes, and while there was no single approach commanded universal support, the views provided have enabled the Commission to develop proposals which represent a fair balance and will facilitate the ongoing development of the internal market in electricity.

The Commission presented feedback from the December public consultation to the Florence Forum on 5 June 2009. The Commission indicated that it was working on a proposal and an impact assessment which could possibly be presented to the Electricity committee in the second half of 2009. The Forum welcomed steps to adopt binding guidelines and asked the Commission to progress this work as a matter of priority[4] .

1.2. Tariff Harmonisation

Article 8(1) of the Regulation provides that "Where appropriate, the Commission shall, acting in accordance with the procedure referred to in Article 13(2), adopt and amend guidelines on

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2 ERGEG is a body of independent national energy regulatory authorities, which was set up by the European Commission as an Advisory Group to the Commission on energy issues. ERGEG was established by Commission decision 2003/796/EC which can be found at http://www.ceer-eu.org/portal/page/portal/CEER_HOME/CEER_ADMIN/ADMIN/DOCS/CEER_DOCS/ERGEG%20decision_11-11-03.pdf

3 The consultation document and public responses to it can be found at: http://ec.europa.eu/energy/gas_electricity/consultations/2009_02_28_tso_en.htm

4 The Conclusions of the Florence Forum of 4-5 June 2009 can be found at http://ec.europa.eu/energy/gas_electricity/doc/forum_florence_electricity/meeting_16_conclusions.pdf

the issues listed under paragraph 2 and 3 and relating to the inter-transmission system operator compensation mechanism, in accordance with the principles set out in Articles 3 and 4. When adopting these guidelines for the first time the Commission shall ensure that they cover in a single draft measure at least the issues referred to in paragraph 2(a) [relating to ITC] and (d) [also relating to ITC] , and paragraph 3 [tariff harmonisation]".

As a consequence proposals for a Guideline on ITC must also address the issue of tariff harmonisation. ERGEG agreed draft guidelines in relation to tariff harmonisation in 2005, which have been implemented on a voluntary basis. The consultation requested the views of stakeholders as to whether the current voluntary approach should be continued; whether the 2005 draft guidelines should be adopted as binding guidelines; or whether amended guidelines should be adopted.

1.3. Third Energy Liberalisation Package

The Regulation is due to be repealed and replaced by a new Regulation (hereinafter the new Regulation) as part of the third energy package agreed between Parliament and Council. The main objective of the legislative package, first proposed by the Commission in September 2007, is to put in place the regulatory framework needed to make market opening fully effective and to create a single EU gas and electricity market in the interest of achieving the lowest possible energy prices and better security of supply for the citizens and the industry of the European Union.[5]

The package facilitates cross-border energy trade by establishing an EU Agency for the Cooperation of Energy Regulators (hereinafter the Agency), with certain powers to adopt binding decisions. While National Regulators will be responsible for dealing with national energy matters, the EU Agency will focus on cross-border issues and the internal market. The new Regulation promotes cross border collaboration and investment with a new European Network for Transmission System Operators (ENTSO – E). Grid operators will cooperate and develop common commercial and technical codes and security standards, as well as plan and coordinate the investments needed at EU level. This will also ease cross border trade and create a level playing field for operators.

Provisions relating to ITC and Tariff harmonisation are in substance unchanged. The new bodies which were established as part of the third package did not affect the reasons for providing for an ITC mechanism. Neither was the appropriateness of the principles on which such a mechanism should be based affected. In particular, the Agency is not a European Regulator with the authority to set tariffs or pricing rules which apply across Europe.

1.4. Procedural Aspects of Impact Assessment

This impact assessment was carried out internally in DG TREN, with assistance from a steering group, with participants from DG Competition, DG Environment, DG Economics and Finance, DG Enterprise, as well as the Secretariat General and the Commission's Legal Service.

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[5] The impact assessment undertaken for the Third Energy Liberalisation Package gives a comprehensive overview of the benefits flowing from the internal market in energy. It can be found at http://ec.europa.eu/energy/gas_electricity/interpretative_notes/doc/2007_09_19_impact_assessment.pdf

This impact assessment has benefited from helpful and insightful comments from the Impact Assessment Board, which have helped sharpen the analysis and at the same time make it more accessible to a general audience. Following review of a first draft of this impact assessment on 17 July 2009, the board requested that the report give a more comprehensive background, suitable for the non-expert reader, to the issues involved. Specifically the board requested that the report be revised to:

– Clarify the nature and magnitude of the problems addressed

– Better justify the proportionality and need for EU action

– Widen the range and deepen the analysis of policy options

– Strengthen the analysis of impacts

Based on these recommendations additional background was added on the operation of the interconnected transmission systems in Europe. Explanations have been included about how the distinctive technical and economic features of electricity transmission in the context of the internal market create a need for a supra-national regulatory framework. In this context, the report was revised to give additional treatment how costs associated with transmission relate to the overall size of the European electricity industry.

The report was also revised to make clear that the provisions of the Regulation continue to represent the appropriate high level principles for the development of a compensation mechanism for the costs of hosting cross border flows of electricity. The board reviewed the revised version on 7 September 2009 and made a number of detailed comments on the above points, which have been incorporated into the final report.

The Commission's minimum standards and the minimum standard in relation to public consultations have all been met in carrying out this impact assessment and in developing the proposals set out below.

2. PROBLEM DEFINITION

2.1. Background

Europe's citizens and companies need a secure supply of energy at affordable prices in order to maintain a high standard of living. That is why EU policy focuses on creating a competitive internal energy market offering quality service at low prices.

Electricity is a powerful and particularly versatile energy source. It is generated using the energy created from a primary energy source - burning fossil fuels, splitting uranium atoms, harnessing the power of water or the wind - and then transported using the transmission and distribution systems to consumers. Generators can compete on their ability to generate more flexibly, or more efficiently – either for technical or commercial reasons. Suppliers of electricity to end users can also compete with each other – offering better prices based on their ability to source competitively priced energy or finding innovative solutions to the needs of consumers.

However, the electricity networks – the transmission and distribution systems- needed to bring electricity from generators to consumers are natural monopolies. Therefore normal

market forces do not result in competitive pricing. For this reason strict rules, overseen by a regulatory authority, governing access and pricing of network use are necessary.

The national transmission systems of most of Europe are connected with each other, creating an interconnected European transmission system. This allows electric power to be produced where it is most efficient and then transported across Europe. It also enhances security of supply across Europe by making each country less reliant on power generated within its own borders.

The total value of the wholesale Electricity market in Europe is over €150 billion per annum. Around 10%, or €15 billion, is accounted for by trade in electricity across national boundaries. The total annual cost of operating the transmission networks for all EU/EEA countries is €10-11bn. This cost is met by the consumers of electricity; either directly through network charges or indirectly through costs passed on by energy suppliers. However differences in how network charges are set, and in particular the charges faced by generators for using the system, can affect the effective functioning of the internal market.

Charges for access to the network are set in accordance with the rules set out in the Regulation 1228/2003 and Directive 2003/54/EC concerning common rules for the internal market in electricity. A key element in ensuring effective competition in the electricity industry is the requirement that non discriminatory and transparent charges be approved in advance by national regulators. Only users directly connected to national systems – that is national consumers and the generators can be charged for access to the system. In particular charges cannot be transaction based.

Non-domestic users who import and export over the transmission system of a country should pay a fair proportion of the costs of grid operation. However in the absence of a European Regulator there is no body equivalent to the national regulator to set the rules governing cross border access and pricing of network use. Moreover, the nature of electricity networks means that distance or transaction based charges, such as specific import or export charges, result in the inefficient use of the overall network (see section 2.2 below).

For these reasons the Regulation requires the establishment of an ITC scheme to compensate TSOs for costs engendered by users connected to other transmission systems. Payments to or receipts from the ITC scheme are then reflected in the regulatory approved network charges in Member States.

2.2. Inter-TSO Compensation

At the European level the electricity transmission system is made up of individual transmission systems at a national or sub-national level which are interconnected with each other. For each individual transmission system a TSO must be designated who is responsible for managing energy flows on the system.

TSOs must take account of the impact of flows of electricity originating on other systems when managing their own system. There are two reasons for this. Firstly, the overall European system of which they form part is used to transport electricity across Europe. Secondly, electricity flows on each individual transmission system affect all other parts of the

interconnected European system instantaneously[6]. This is because electricity transmission flows utilize all available paths on the interconnected system in accordance with the laws of physics. The actual transmission path that a commercial trade between two points takes is dependant on *all* injections and *all* load points on the system across the grid. The precise flows which take place depend on production and consumption on all other points on the grid at that point in time. For example a commercial transaction involving electricity generated in Germany being sold to consumers in France can result in additional flows on the Slovenian-Italian border (see Annex [E] for an description of how this can occur).

This is why distance based or "direct path" charging is not appropriate to electricity transmission. Instead efficient charging needs to takes account of the fact that the entire interconnected transmission can be used in a trade. This is in contrast to other types of transport networks where distance based charges are often the most appropriate – e.g. in rail or road.

Individual TSOs must manage the effects of cross-border flows on the grid which they are responsible, even though the flows might not have originated or ended on their system. These can cause costs to the TSO, and thereby to the users of its system. These effects include:

(1) Cross border flows causing **internal congestion** which the TSO must manage. Transmission lines have a maximum capacity of energy which they can transport. When planned generation and consumption patterns mean that the expected flows on a line would be greater than it is physically capable of transporting, congestion is said to exist.[7] It is usually the responsibility of TSOs to manage this within the system for which they are responsible, for example by instructing some generators to reduce production and increasing other generators' production so that lines are not overloaded. Generators who are instructed to reduce output must be compensated for lost profits while the additional generation must also be paid for. The costs of managing additional congestion as a result of transit flows should, in principle, be compensated (though it is also dependent on how the TSO manages its own system). However, cross border flow can, in some circumstances, also have the opposite effect and actually alleviate congestion in the host network.

(2) The cross border flows of electricity, by increasing the amount of power transported on the TSOs system, increases the amount of **energy losses** incurred on the TSOs system. Losses occur because, as the amount of electricity being transported on a line increases, resistance also increases. This resistance results in electrical energy being lost as heat. Overall about 2-3% of electricity transported over the transmission system in Europe is lost in this manner. (However, in some instances the amount of losses can actually decrease as a result of transit flows reducing power flows on some internal lines). This results in real resource costs or savings within the control area hosting the flows. These costs are generally met by the TSO, and therefore ultimately by the end consumer of electricity.

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6 Great Britain, Ireland the Nordic countries and the Baltic Countries are connected to the continental system by Direct Current interconnectors the flows across which can be directly controlled by the responsible TSOs.

7 Individual transmission systems are usually operated on an "unconstrained" basis – generators are given connection rights which allow them to inject a particular amount of power to the network. The TSO must then manage situations where all generators planned production would result in lines being overloaded.

(3) The need to accommodate cross border flows of electricity influences the **design and development of the transmission system**. That is when planning the transmission system, TSOs need to take into account how it will be used for cross border flows of electricity. This is a shared benefit of all users of the interconnected European transmission system. However, only national users directly pay for the use of the Transmission system.

At a European level the need for an ITC mechanism to address these costs was recognised even before the adoption of the Regulation, and was agreed by stakeholders at the Florence Forum as early as 1999. This was tied to the ending of long-term contracts for energy exchanges between the individual transmission systems in Europe. Following much work with stakeholders Article 3 of the Regulation specifically *requires* that an ITC scheme be put in place. The Regulation requires that charges for access to networks be applied regardless of the countries of destination or origin of the electricity. No specific charge can be levied for declared transits of electricity.

Not only was the need for a form of compensation for TSOs hosting cross border flows generally accepted, the fact that compensation should be arranged between TSOs and subsequently charged (or paid back) to national users of the host network was also recognised. This is because individual producers and consumers, although they use the entire interconnected European transmission system, are only connected directly to their local transmission system.

The full rationale for the ITC model provided for is set out in the explanatory memorandum accompanying the commission's proposal[8] - but the core elements are that it be based on ensuring that TSOs are compensated for the "clearly specific costs incurred by transits". The explanatory memorandum emphasised the need to ensure that TSOs of those Member States which are located in the centre of the European electricity system did not benefit at the expense of those in peripheral countries and that the core horizontal network of every national network is constructed for the service of domestic customers.

An effective ITC mechanism must:

(1) Assess the extent to which a particular transmission system is utilized for power flows which neither originate nor are consumed within that system.

(2) Assess the effects those flows actually have on the transmission system – that is affect the costs incurred by hosting cross border flows.

These detailed elements of ITC were not specified in the Regulation, and since its adoption have been left for the voluntary agreement of stakeholders. The number of participating countries in voluntary mechanisms increased from 8 in 2002, to 35 in the current voluntary mechanism.

2.2.1. Who is affected, in what ways, and to what extent?

Net ITC payments under the voluntary systems developed are currently just under €200 million (of the up to €11bn total cost of operating the European transmission system), though the impact relative to local network costs can be substantially higher for some net payers and

[8] This can be found at: http://intradev:8088/energy/electricity/legislation/doc/regulation_proposal_2001/reglement_en_acte.pdf

net recipients. Only TSOs are directly affected by ITC. There are no implementation or compliance costs for either households or small and medium enterprises. In the short run, total network costs are unaffected, and ITC is merely a way for apportioning those costs. The direct impact of ITC is distributional.

In line with the Regulation national regulatory authorities and TSOs take payments and receipts into account when setting tariffs for domestic users. Users of systems where cross border flows originate and/or end pay increased tariffs. Conversely, the users of systems which are used for transporting cross border flows of electricity face lower tariffs.

Under the voluntary system for 2008/2009 Germany received just over €51 million in compensation - equivalent to one hundredth of a cent per kilowatt hour of consumption in Germany. Switzerland received €69.7 million – the highest net recipient in absolute and relative terms. This equates to a benefit of one tenth of a cent per kilowatt hour of consumption. By way of comparison average household prices were 15.3 cents per kilowatt hour across Europe in 2007.

Under the Regulation, guidelines for ITC would apply to the EU/EEA and, eventually, the Energy Community. To be effective ITC would have to make provision for other countries such as Switzerland to join on a bilateral basis. Practically, it would only be applicable where transmission networks were interconnected, for example, Iceland or Cyprus would not be affected by the ITC mechanism.

Future cross border flows, and hence ITC payments depend on two factors – differences in prices between countries and the configuration of the (interconnected) transmission network. Most of the current flows of electricity result from exports of electricity from areas with low (marginal) production costs – in particular French nuclear and Norweigan hydro. Increasing amounts of wind will have an impact both on cross border flow and on the necessary infrastructure[9]. The third package contains provisions for the development of a ten year Community wide network development plan. This will be overseen by the newly established Agency. An effective ITC mechanism can help support these developments[10], though system users on each side of the border can also be charged directly reducing ITC payments. The overall magnitude of (net) ITC payments should not increase substantially over the next number of years.

2.2.2. How would the problem evolve, all things being equal?

Although many potential methodologies have been studied for the ITC mechanism, there has been no agreement among TSOs and regulators on a single method. ETSO has developed approaches which have been applied on a voluntary basis. TSOs are finding it increasingly difficult to agree on a compensation system acceptable to all participants. Already in 2005 ETSO concluded that it was probable "that an unequivocal and doubtless solution [to ITC] does not exist. This is due to the physical properties of transmission systems and their

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9 Several factors, not least the offshore nature of much of the expected wind production, mean that it may prove necessary to develop specific mechanisms to pay for the transmission infrastructure associated with this wind energy.

10 There are particular issues related to the development of incentives to build additional interconnection capacity. In Novermber 2008 Concentec and Frontier Economics prepared a report for the European Commission addressing this problem. This can be found at: http://ec.europa.eu/energy/gas_electricity/studies/doc/electricity/2008_rpt_eu_transmission_incentives.pdf

independent development under different political and economic frameworks".[11] This is why developing a voluntary mechanism has proven particularly problematic.

Stakeholders accept the need for appropriate compensation for the costs of hosting cross border flows. Nonetheless the views of individual TSOs (and regulators in the Member States who must approve the transmission tariffs which will be affected by ITC payments) as to what constitutes appropriate compensation will inevitably be coloured by local concerns. Simply put – TSOs and regulators from highly transited countries tend to consider that the costs of hosting cross border flows are high, while those countries which cause transits – either through exports or imports consider that the additional costs caused by transits are in fact quite low.

The difficulty of coming to a consensus view on the most appropriate form of arrangement, and the shortcomings of the voluntary mechanism currently in place indicate a serious risk that there will be no agreement on an ITC methodology to replace the present voluntary arrangements. The compromise between TSOs from 35 countries reached for 2008-2009[12] bases compensation in part on historical ITC payments because TSOs could not agree a mechanism to identify the costs associated with hosting cross border flows. Additionally, the current agreement contains a provision that if one TSO not get sufficient regulatory approval the (multilateral) contract does not enter into force. This means each of the 35+ national regulators (viewing the issue from its own "political and economic framework") can prevent the implementation of the entire mechanism. Compromises based on historical payments, and with multiple veto points are not sustainable in the longer term. Without binding guidelines ITC payments are likely to cease at some point.

This would have a number of potential impacts including:

- Network users in countries which host transits would have costs imposed upon them which result from cross border use of the transmission system. This is an inevitable impact of the cessation ITC payments.

- National regulators would not approve development of the (national) network which would benefit the internal market as they would consider that they should not be funded exclusively by local users. This would undermine both the internal market by leading to (inefficient) congestion at the borders between member states, and also reduce the Europe wide security of supply benefits of increased interconnection.

- TSOs and regulators might attempt to introduce charges to cover the costs associated with hosting cross-border flows. Such charges would be likely to effectively act as import, export or transit charges. Even if imposed indirectly, such charges could undermine the internal market in electricity. This would represent a move backwards in the internal market.

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[11] ETSO 2005, *The Current ETSO ITC Model and possible development. This can be found at* http://www.entsoe.eu/_library/publications/etso/Current%20ITC%20model%2005.pdf

[12] The ETSO note is available at : http://ec.europa.eu/energy/gas_electricity/consultations/doc/2009_02_28_tso_explanatory_note.pdf

2.3. Tariff harmonisation

As noted in Section 1 above, proposals for a Guideline on ITC must also address the issue of tariff harmonisation.

Tariffs are the charge for local system users for use of the transmission system. The main elements of the tariffs represent the costs of investment and operation and maintenance of infrastructure, considered to be fixed in the short-term. In addition the costs of managing congestion on the system are also met by TSO. Tariffs are paid to the TSO to whose system the user is connected. The Electricity Directive requires that either the tariff or the methodology for calculating the tariff be approved by the national regulatory authority. The Regulation stipulates that access charges shall be: cost-reflective; transparent; approximated to those of an efficient network operator; and applied in a non-discriminatory manner. It also requires that tariffs not be related to the distance between the generator and the consumer (for the reasons set out in Section 2.2).

Exporters and/or importers pay the national network charges applicable to generation in the exporting country and/or to consumption in the importing country (as noted already in the context of ITC import and export fees are specifically prohibited). Since generators will have to incorporate in their power pricing the costs arising from the network charges they have to pay, generators with low network charges will have a competitive advantage compared to those with high charges. Where a charge is placed on actual power generated and injected on the system, production will take place where charges are lower potentially leading to an inefficient use of the interconnected transmission system. All charges on generators will affect investment decisions, as such decisions are made on the basis on expected lifetime costs. These concerns do not apply to the same extent to charges on load as demand is generally inelastic, and at any rate less mobile.[13]

An important element of the structure of national tariff systems in the context of cross-border trade is therefore the ratio between the costs allocated to generation and the costs allocated to consumption. It is clear, for instance, that generators in a country where all network costs are paid by consumers are in a better position than a producer from a country where generators are charged a proportion of these costs when competing in the internal market. Similarly, excessive transmission charges on generators in a (short-term) effort to minimise the costs of consumers also distorts investment incentives in the long run. In order to ensure competitive neutrality between generators in different countries, there is a need for a certain degree of harmonisation proportion of total network costs borne by generators.

In view of this desire to ensure competitive neutrality between countries, the Regulation envisages that the network costs be recovered predominantly through charges imposed on consumption (Article 4(2)). However, a lower proportion of the total costs charged on network users may be recovered through charges on generation. This facilitates national regulatory authorities including locational signals in the tariff structure, for example in order to send signals on the most appropriate and inappropriate zones to locate new generation in view of local circumstances with regard to network losses and network congestion.

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[13] The producers of energy intensive tradable goods can have a competitive advantages a result of low transmission charges. However, most consumption is not in this category, and the direct effect of generator transmission charges on competition is greater.

Nonetheless distortions to trade could arise where significant differences exist as a result of the recovery of some (differing) proportion of the costs of transmission from generators. Generators will face incentives to locate and generate in areas with lower average generator charges (so called G charges) for access to the transmission network. This can justify either setting out rules to ensure that generators charges are assessed on the same basis across the internal market (in terms of proportion of network costs borne by generators and how network costs are calculated) or directly setting a range of allowable charges for generators.

2.3.1. Who is affected, in what ways, and to what extent?

All users of electricity are affected by final electricity charges. As already noted in the short run total costs of operating the transmission network are largely fixed. Therefore the immediate impact of new rules would be on how network costs are shared by different types of users (e.g. generators, consumers). However, transmission charges can also be used to encourage the most efficient use of the network, thus potentially reducing the cost of electricity.

With regard to transmission tarification, the transmission tariffs in force in Member States already reflect one of the most important requirements of the Regulation in that they are "entry-exit" tariff systems rather than being based on distance.

Harmonisation of G charges, rather than load charges, is more important since electricity production facilities and the location of production facilities are generally more responsive to price signals. Focusing on the absolute value of transmission tariffs for generators, rather than harmonising the basis on which costs are calculated and the proportion of costs allocated to generators can ensure the equivalent outcomes, but still facilitates local TSOs and Regulators taking account of local circumstances. This is the approach recommended by ERGEG in the draft guidelines.

Currently, average charges for generation are low and fall within the ranges referred to in the draft guidelines developed by ERGEG. In 2005 ERGEG prepared these draft guidelines on Transmission Tarification after extensive consultation. The consultation process included a public meeting where the details of how best to ensure a level playing field for generators could be combined with enabling TSOs to recover their costs. The draft guideline prepared by ERGEG represent the consensus view as to the appropriate level of harmonisation.[14]

2.3.2. How would the problem evolve, all things being equal?

The draft guidelines provide a range of the range of 0 – 0.5 per €/MWh for generation charges, but explicitly permit average generation charges to be higher in the case of Nordel, Great Britain, the Republic of Ireland and Northern Ireland. However, these draft guidelines are not yet binding although this was the clear expectation at the time when they were developed. The reason for this is that there was no agreement on how to treat ITC, and as noted it is a requirement of the regulation that these two issues be dealt with together.

[14] The full details of this consultation process can be found at: http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/Transmission%20Tarification%20Guidelines/CD

In the absence of binding European guidelines on Transmission tarification, it is likely that the situation would continue more or less as at present. This would entail a degree of uncertainty as without an obligation to comply with the guidelines, it would remain possible that average charges could be increased by TSOs.

2.4. Does the EU have the right to act and is EU added-value evident

2.4.1. Inter TSO Compensation

The Regulation was adopted under Article 95 of the Treaty. The establishment of an ITC mechanism is a key provision of the Regulation. It is tied to the elimination of specific charges previously placed on cross border electricity flows. ITC is designed to consider transmission from a European level, rather than only looking at national transmission systems. As such, it forms an important element in the development of the internal market in electricity.

Article 3 of the Regulation requires that arrangements be put in place to provide compensation for Transmission System Operators (TSOs) in relation to the costs[15] they incur as a result of hosting cross-border flows of electricity on their network. Discussions about the nature of such arrangements – the Inter TSO Compensation (ITC) mechanism – have been ongoing since the beginning of the process of electricity market liberalization in the European Union (even predating the Regulation).

The Regulation lays down basic principles with regard to tarification and capacity allocation for cross-border access to the interconnected transmission system. However it was also recognised that in an open, competitive market, transmission system operators should be compensated for costs incurred as a result of hosting cross-border flows of electricity on their networks. These costs were to be met by the operators of the transmission systems from which cross-border flows originate and the systems where those flows end rather than directly by undertakings exporting or importing electricity.

The Regulation specifically provides that, acting in accordance with Comitology provisions the "Commission shall decide on the amounts of Compensation payments payable".

Under the Regulation, the Commission may adopt or amend binding guidelines on the ITC mechanism where appropriate and these must also address transmission tarification.

The provisions of the Regulation relating to ITC were reconfirmed by the European Parliament and Council as part of the third package. Compensation for cross border flows of electricity represents a supra-national component to the general system of charging for network access. The principles for the ITC in the regulation represent the high level principles for the regulation the "cross border" element of network usage. These principles continue to represent the best approach to ensuring the efficient use of the interconnected transmission system in Europe.

The ITC mechanism must by definition operate on a cross-border basis, and therefore cannot be a matter for individual member states. Detailed rules for assessing the use of a transmission network, and the costs associated with the network operation are developed by national regulatory authorities in member states. In the absence of a pan-European regulator to set

[15] Costs arise in relation to losses and use of network infrastructure.

supra-national rules, the detail of how such principles should be applied must either be a matter for voluntary agreement of the development of binding guidelines as envisaged by the Regulation. As discussed in Section 2.2 reaching agreement between 35 countries participating in the voluntary ITC mechanism, (with an even higher number of participating TSOs) is particularly difficult.

The appropriateness of adoption of guidelines at this stage is considered in detail in the following sections.

2.4.2. Tariff harmonisation

Clearly EU level action *can* have a role to play in ensuring an appropriate degree of harmonisation. A European overview focussed on preserving the integrity of the internal market helps ensured that potential benefits of harmonisation are considered which take into account the impact beyond national borders. This is relevant for at least two reasons:

- Investment decisions in one member state affect the entire internal market. By setting the framework within which these investment decisions are made investors *and* the relevant authorities of other member states can make their planning decisions with a degree of confidence that changes in neighbouring tariff regimes will not have a major impact on the operation of the local market

- locational signals for generation which consider only the national transmission network will fail to account for how that generation affects the wider interconnected European transmission system. For example, generation located in France, near the German-French border might relieve congestion inside Germany or between Germany and the Netherlands.

As noted already, ERGEG has prepared draft guidelines on Transmission Tarification. There is a high degree of voluntary compliance with these guidelines, which followed an extensive consultation process. When the Regulators, who are responsible for approving tariffs in the Member States, developed the draft guidelines, they did so in the expectation that they would be adopted as binding guidelines.

Under the Regulation, when the Commission first proposes to guidelines on the ITC mechanism on an ITC mechanism these must also cover transmission tarification. Article 8 (3) of the Regulation states that the guidelines shall determine "appropriate rules leading to a progressive harmonisation of the underlying principles for the setting of charges applied to producers and consumers under national tariff systems…"

3. OBJECTIVES

The importance of well functioning Energy markets to ensuring a competitive Europe was reflected in the call by the European Council at Lisbon in March 2000 for rapid work to be undertaken to complete the internal market in the electricity and gas sectors. Liberalisation of energy markets will secure the competitiveness of Europe by delivering *competitive, secure and sustainable* energy Markets. This is the objective towards which all of the work on Energy Market liberalisation is directed.

The Regulation was adopted as one of the measures to speed up liberalisation in the electricity sector. The specific objective of the Regulation is to achieve a fully operational internal market in energy. The aim of the Regulation was to promote an intensification of cross border trade in electricity. This is key element in the liberalisation of energy markets. The objective of the Regulation was to achieve this by establishing *fair, cost-reflective, transparent and*

directly applicable rules. These rules provide for *transparent and non-discriminatory* charges for network use. Such rules are the direct outputs of the Regulation – which are expected to help deliver the outcome of a liberalised energy market securing the competitiveness of Europe.

These objectives apply equally to guidelines developed under the Regulation. Such guidelines are provided for to allow rapid adaptation to changed circumstances. Guidelines should detail further relevant principles and methodologies.

3.1. Inter-TSO Compensation

The Commission agrees with the consensus among TSOs and regulatory authorities that the ITC mechanism should focus primarily on cost recovery, given that efficient network utilisation is addressed by border congestion management mechanisms and locational transmission network access charges for generation and load within national systems. This is in line with the principles for ITC set out in the Regulation.

Drawing on the text of the Regulation and on the work done by ETSO, ERGEG and by consultants engaged by the Commission, in order to constitute *fair, cost-reflective, transparent and directly applicable* rules which support *transparent and non-discriminatory* charges for network use, the following specific objectives for the ITC mechanism should be met:

Accurate

- Should accurately reflect the physical flows of electricity actually measured in given periods of time[16] derived from cross-border flows
- Should determine accurately those responsible for cross-border flows
- Should allow for a correct treatment of perimeter countries.

Compensatory (reflective of costs *and* benefits)

- Should capture both costs imposed on host networks and benefits realised as a result of cross-border flows including the commercial flows related to physical flows
- Should be applicable, as far as possible, to the impact of cross-border flows on both losses and on transmission infrastructure
- Should take account of congestion rents and the income they generate for TSOs in a way that furthers the objectives of the internal energy market

Transparent and Stable

[16] In order to address varying power flows in meshed grid, one should in principle consider all 8760 hourly snapshots in the year. However, as this would require a tremendous effort in terms of data gathering and computations, it is acceptable to represent yearly power flow variations using a limited number of representative snapshots and building a picture from that.

- Should be stable and respond in a reasonably predictable manner to changes in data on cross-border flows and other parameters over time
- Should be capable of specification in a way which creates confidence in the method
- Should be transparent and capable of being understood and verified.

Implementable/ Low administrative burden

- Should be practical and as easy to implement in terms of the data to be collected from TSOs and in term of the application of the methodology using load flow or other forms of model
- Should not result in excessive costs for national regulators and TSOs
- Should be capable of specification in guidelines in a clear and unambiguous manner

3.2. Transmission tarification

The need for fair, cost-reflective, transparent and directly applicable rules applies equally to transmission tarification. In particular transmission tariffs must be non-discriminatory and cost-reflective. The objective of the Regulation is to achieve a *certain degree* of harmonisation to avoid distortions of trade.

Specifically, the aim is to facilitate the efficient utilisation of the interconnected transmission system across Europe and avoid the distortion of investment decisions. However, it is also necessary that member states be able to implement tariffs which encourage efficient network utilisation within their borders.

4. POLICY OPTIONS

This section considers related, but separate issues – in relation to ITC, firstly the scope of Commission involvement, and secondly the design of an eventual ITC mechanism. Separately it considers the policy options in relation to the degree of harmonisation of transmission tariffs.

4.1. Inter TSO Compensation

4.1.1. Scope of EU action

- *Option 1 No new action by Commission (continuation of voluntary approach)*

Under this option, there would be no adoption of the guidelines, considering what is already stated in the Regulation as sufficient. This would leave the ITC mechanism to the TSOs to develop and regulators to agree. This represents a "business as usual" option.

There was no support for this option as part of the consultation process with respondents agreeing that binding guidelines of some level should be produced by Commission action.

- *Option 2 Suppression of ITC mechanism through guidelines*

Although this option was not proposed as part of the consultation process, a number of respondents argued that an ITC mechanism was no longer necessary. This argument follows from the high level of congestion rents being paid by market participants for using scarce interconnection points across the interconnected transmission system.

TSOs are responsible for calculating the transfer capacity on each of their interconnections. They do so based on expected physical flows across the entire interconnected transmission system, including a security margin. Where the volume of desired commercial flows between two countries implies higher physical flows than the overall system can accommodate, the available capacity must be allocated in a market based manner. The revenues from this are termed congestion revenues. These revenues must be used for guaranteeing the actual availability of the capacity, network investments maintaining or increasing interconnection capacity or to reduce national tariffs.

Generally the revenues are shared between the countries on either side of the congested border of the commercial transaction, though this will probably not reflect the actual physical path which the flows of electricity take.

- *Option 3 Adoption of high level principles in guidelines*

Under this option the guidelines would set out the principles to be followed in the development of a detailed mechanism. The responsibility for developing the methodology would lie with the TSOs and ETSO (eventually ENTSO-E).

This option is applicable whether cross border flows either are calculated using either the complex flow based models or simplified import export models discussed below.

- *Option 4 Adoption of guidelines to endorse a detailed mechanism*

This would involve the Commission itself developing clear and detailed guidelines. Discretion left to the bodies responsible for implementation would be minimised[17].

This option is applicable whether cross border flows are calculated using either the complex flow based models or simplified import export models discussed below.

- *Option 5 – A regionalised approach*

The consultation paper requested the views of respondents as to whether it would be appropriate develop guidelines of differing levels of detail for particular regions, and, if so, how interregional transits should be treated.

One in which a regional approach could be adopted would be to base it on the different synchronised systems in Europe. The EU does not operate one synchronised system. Non-synchronous systems must be interconnected using specific equipment including DC cables. These could form the basis for regional ITC mechanisms, with specific rules for transfers between those systems

[17] It will always be necessary to leave flexibility regarding the precise specification of the data to be used in any ITC scheme to allow TSOs and regulators the flexibility to exercise their judgement.

There was no support from any respondents to the consultation to a regionalised approach. However, Portugal did draw attention to the need that the ITC mechanism be able to account for situations where two or more national market were fully integrated, including in relation to the operation of the transmission system. Plans for integration of this type have been put forward for the Iberian peninsula.

4.1.2. Design of ITC Mechanism

Any ITC mechanism will have to include:

- a method to determine the extent to which cross-border electricity flows utilise the network of host countries (in addition to flows caused by national users)

- a method to determine the costs incurred by the hosting networks, used including infrastructure and losses and thus the compensation to be paid to the TSO concerned.

The costs associated with use of infrastructure can be calculated separately from the impact on losses if necessary.

Interconnected transmission systems are affected by changes in demand or production on any part of it. Models must be used to measure utilization and the impact it has on host systems. A model is a simplified abstract view of the complex reality. Models are generally considered effective if they models make sense from the point of view of the user and can serve as a basis for decision making.

There are many variants of model which can be used for assessing the extent and impact of cross border flow. Details of particular models proposed or used in the past are set out at Annex A. Models typically fall into one of two broad types – relatively simple export-import models and complex power flow models. For the sake of simplicity the analysis presented in this report is based on this distinction - however where appropriate the detail of individual models are also presented.

- *Option 1: Simplified import-export model*

A simplified model looks only at the flows of electricity at border points between different control systems. It does not consider the entire interconnected system and how power flows affect each element of it – but rather focuses on individual transmission systems or control areas to make the model tractable.

ETSO proposed a simplified import-export model as part of the consultation process undertaken. This is set out in detail at annex A

- *Option 2 Complex power flow models*

Power flow models attempt to replicate the impact of cross border flows of electricity on the interconnected network in its full complexity. Power flow models are frequently used by TSOs in network planning and similar exercises. They are also used by some TSOs as part of the process of setting locational transmission charges for generation.

ETSO previously developed the IMICA model for use in an ITC mechanism which could be used as the basis for a future ITC mechanism. There are however several other models which also model the impact of injections and withdrawals on the entire system. These include the

Marginal Participation model, the Average Participant Model (which is based on water flow models). Again detailed descriptions of the models are included at Annex A

An alternative approach to modeling the complete European transmission system is to compare actual network use to a counter-factual model without cross border flows. This approach of removing all transit flows from the national system is the basis of the *With and Without Transit Model* (described at Annex A). The *With and Without Transit Model* has been used in recent voluntary agreements for the purpose of assessing losses as a result of hosting transits.

In the ETSO proposal losses would be compensated using *With and Without Transit* approach This represents a marginal approach to establishing losses. The alternative approach is to charge for losses caused by transit on a proportional basis equivalent to the total costs of losses incurred on the host network.

Valuation of infrastructure costs

Infrastructure costs can be calculated in two ways in simple models. Either an assessment can be made of the elements of national networks which are used for cross border flows. Then the identified cross border flows are charged on a proportionate basis to domestic users based on regulatory approved values for that element of the network. This approach was used in the previously applied *Cross Border Trade* model (described in detail at Annex A). Under this approach, the costs associated with lines which are funded either via congestion rents can be excluded.

Alternatively a standardized approach to estimating the cost of making transmission available for cross border flows of electricity. This removes the impact of different regulatory treatment of costs. This approach ignores differences between member states in assessing how to value transmission networks. .

The "Framework Fund" proposed by ETSO to cover the costs associated with using transmission infrastructure essentially involves compensating TSOs for the costs of making infrastructure available for cross border flows on the basis of standardized costs.

4.1.3. Options warranting consideration

In relation to calls for the abolition of the ITC scheme, it is relevant that the regulation provides that "[t]ransmission system operators shall receive compensation for costs incurred as a result of hosting cross border flows". The relevant provisions setting out the principles for ITC were reconfirmed in the third package. Guidelines can be adopted in accordance with the principles of the Article principles set out in the Article describing ITC and detailing methodologies for calculating both cross border flows and the costs of these flows.

Because of the nature of the operation of the interconnected transmission system, the principles that compensation reflect the costs of hosting cross border flows, and that it be based on physical flows of electricity remain the most appropriate basis on which to base compensation. It is not (necessarily) the case that all TSOs who host cross border flows of electricity receive congestion rents. Abolition of ITC could result in countries hosting cross border flows for which they do not receive compensation. Moreover, congestion rents used for the construction of new capacity will reduce overall rents and thereby also reduce the funds available to compensate for cross border flows. In extremis, zero congestion would

result in zero compensation. A mechanism should be available to provide compensation in such circumstances.

The treatment congestion rents can be considered when assessing the extent which mechanisms fulfil the criterion that they be compensatory.

Overall, the model used in an ITC mechanism should be chosen based on an analysis of the merits of each approach. It would therefore not be appropriate to discard either import –export models or power flow based models without careful consideration.

In view of the minimal support for a regionalized approach, it would not be appropriate to pursue this course of action. This does not rule out taking into account particular features of the market and system arrangements applying in particular member states. In fact this is explicitly provided for in the definition of a cross border flow in Article 2 of the Regulation according to which a "control block"[18] covering more than one member states partly or entirely can be treated as a single element for the ITC mechanism.

4.2. Transmission Tarification

Options available in relation to transmission tarification are:

(1) No action – that is the guidelines would conclude that there is no need to go beyond what is already stated in the Regulation;

(2) Adopt the 2005 draft ERGEG guidelines which have been subject to public consultation and discussed extensively by interested parties in the Florence Forum; or

(3) Amend the 2005 draft guidelines particularly in terms of adjusting the range of allowable generation tariffs for using the transmission system. This could either be

   (a) Narrowing the range of allowable tariffs. Scottish and Southern Electricity raised the issue of discontinuities at national borders as a result of the operation of locational signals at the national level in response to the public consultation. They argued therefore that allowed generation tariffs should be limited in absolute terms and not in relation to the average charge in a member state.

   (b) Broaden the range of allowable tariffs – that is increase the maximum allowed average charge for generators for accessing the transmission network.

(4) Introduce "Ramsey Pricing" for load. There were calls from several respondents to the consultation that so-called Ramsey pricing be introduced for load. Ramsey pricing would relate transmission tariffs to the elasticity of demand.

(5) Establish detailed rules setting out both the how national regulators should carry out the assessment of actual costs which correspond to those of an efficient and structurally comparable operator and the proportion of costs to be recovered from generators.

[18] A control block is essentially where several TSOs operate their system as one area for the purpose of managing congestion etc.

Ramsey pricing, set out in option 4, is where charges are set inversely to the elasticity of demand of different customers. Where the fixed costs of the network must be shared among all customers, as is the case with paying for the costs of the transmission network larger customers, whose use of electricity is more responsive to changes in price, should pay less, and domestic or household customers who electricity use is generally unresponsive to price, should pay more. This is arguably economically more efficient as consumption decisions are closest to what they would be were (short run) marginal pricing possible.

Nonetheless, it is undeniable that large energy users create (long run) need for transmission infrastructure. It is proper that they contribute towards realising the need of this infrastructure, and this cost can often only be recovered through transmission tariffs[19]. It is also possible to include connection charges or other reinforcement charges, which might be assessed on an annual basis.

The design of tariff for customers will be based on local circumstances. Setting this policy at a European level could only be justified if there was an unambiguous impact on the internal market. The Regulation makes clear that there is a high degree of discretion in the setting of tariffs for load. Article 8(3) states that "Any harmonisation in this respect shall not prevent Member States from applying mechanisms to ensure that network access charges borne by consumers (load) are comparable throughout their territory" or with Article 4(2) which states " This shall not prevent Member States from … applying mechanisms to ensure that network access charges borne by consumers ("load") are uniform throughout their territory".

These provisions reflect the need for proportionality in setting out European rules governing tariff setting and, in particular, the need subsidiarity in the design of tariff regimes in Member States. Whether or not to introduce a tarification system based on Ramsey pricing for charging load for the use of the transmission network should remain a matter for the national regulatory authorities and the Member States.

Therefore only options 1, 2, 3 and 5 warrant further consideration.

5. ANALYSIS OF IMPACTS

5.1. Inter TSO Compensation

5.1.1. Scope of EU action

Economic, social and environmental impacts

The internal market in energy has significant and positive impacts on social, economic and environmental issues. As discussed earlier the objective of the regulation is to provide clear, fair, and directly applicable rules to ensure that the internal market functions effectively and efficiently. The appropriate design is considered separately, but in principle an accurate, compensatory, and transparent ITC mechanism that facilitates the effective functioning of the internal market can be designed at any level.

The level at which the ITC mechanism is designed will have only a minimal effect on the costs of implementing and complying with the rules developed. In particular it will not affect

[19] It is also possible to include connection charges or other reinforcement charges.

the obligations imposed upon TSOs or regulators in relation to collecting or processing information.

Therefore, the relevant question when assessing the level at which action should be taken is the probability that it will result in an effective, efficient and coherent mechanism – and the costs which will be incurred in developing this mechanism. This is considered in more detail below.

Impacts on third countries

TSOs from non Member States have been participants in the voluntary ITC mechanisms, even where there are no legal obligations in this regard. For countries which have not adopted the Energy *Acquis*, it is envisaged that the final ITC mechanism would be open to non-EU member to join as well as extending to EEA/ Energy Community members. This would be on a non-discriminatory basis – third countries would be treated on the same basis as Member States.

Countries which did not join the mechanism would have a fee applied to their electricity exports to countries participating in the scheme. This would serve to ensure that such exports were treated equivalently with power flows originating within the system. This has been a feature of all voluntary agreements to date.

Non member states, including Switzerland, which currently does not apply the *Acquis* in relation to electricity, have been fully involved in the consultation process. They have also been involved in discussion of this issue at the Florence forum. In considering this issue the position of Switzerland and the positions of Swiss companies have been properly taken into account. This is appropriate not least in view of the important role that this country plays in the interconnected transmission system.

5.1.2. Design of ITC Mechanism

Economic impacts

The economic impact of the choice of ITC mechanism is not clear cut. As already noted the direct impact of an ITC mechanism is purely distributional. The overall costs of operating the interconnected system are unaffected by the distribution of payments – provided of course that the rules of the rules of the internal market are otherwise followed.

Different mechanism designs result in different payments by individual TSOs. These would in turn be passed on to consumers through different network charges. On its face the decision as to the design of the ITC mechanism (in fact the decision to introduce an ITC mechanism in the Regulation) has a direct effect on particular regions, and individual consumers[20]. When considering the mechanisms it should be recalled that:

[20] By definition all regions and all consumers are affected as their total transmission costs must either increase or decrease once an ITC mechanism is implemented. However considering these impacts of the ITC scheme in isolation from the wider benefits of the internal market for electricity would be misleading. As already noted the internal market for electricity brings about significant economic, environmental and social benefits for all of Europe's citizens and industry.

- This redistribution is the rationale behind ITC. The precise aim of the ITC mechanism is to ensure to the costs incurred are apportioned in an **accurate, transparent and compensatory** way.

- While large in absolute terms, total compensation payments are marginal in terms of the end result on electricity bills – generally less than 0.06% of average retail prices in terms of total costs. The differences in payments to countries implied by different options are even smaller.

In principle all the design options under consideration are compatible with the wider aims of the internal market in electricity. The four objectives of the ITC mechanism, – accurate, transparent, compensatory, and implementable – are designed to ensure that the ITC mechanism contributes to wider objectives for the internal electricity market in the most effective and coherent manner. Each of the design options can facilitate the alignment of ITC with other mechanisms intended to encourage the investment necessary to support cross-border power flows. How well the options contribute to the wider goals of the internal market is a function of the extent they meet the objectives for ITC.

By ensuring that costs passed on to domestic users of the transmission system are cost reflective, these criteria also address concerns expressed by some system users as part of the consultation exercise that tariff charges reflect excessive ITC costs incurred by their TSO.

The effects of the various options on the internal market and trade are positive in so far as they meet the direct objectives for the ITC mechanism. In itself a complex model will not have a more positive impact than a simplified model, or vice versa.

The administrative burden of the various criteria is considered at section 6 below as part of the assessment of the implementability of the options. Broadly speaking, more complex mechanisms will place a higher burden on TSOs. However, as the ITC scheme only directly affects TSOs, it should be noted that there is no administrative burden on network users or market participants. In the context of ITC, while the costs associate with designing and implementing a model are real, they are relatively insignificant in comparison to the overall level of funds redistributed which are at least in the tens of millions of euros.

The assessment of how accurate, transparent, compensatory, and implementable the various options are is considered in Section 6.

Social and Environmental impacts

The detailed design of the ITC mechanism in itself does not have a particular social or environmental impact (although the internal market in energy itself does have significant and positive impacts on these issues). This is because the ITC scheme only directly affects TSOs. The secondary impact of the distribution of total network costs for the interconnected European transmission system does not have any significant social or environmental impacts.

5.2. Transmission tarification

Currently national regulators apply transmission tariffs on generation in accordance with the national requirements in terms of providing effective locational signalling and general environmental requirements. They generally do so within the bounds of the 2005 draft guidelines developed by ERGEG, to which all regulators agreed. Overall there has been a

tendency towards generation transmission charges being set at zero since the beginning of the liberalisation process in Europe.

The average level which the voluntary guidelines allow were set taking account of the fact that congestion between different systems means that prices do not equalise across Europe. For this reason the conclusion of the consultation process undertaken by ERGEG in developing the voluntary guidelines was that there is some scope for a variation in average G-Charges without undermining the internal market. There is little evidence that this range of transmission charges currently has a negative impact on competition in the internal market in electricity.

Economic impacts

The impact of formally adopting the 2005 ERGEG draft guidelines on transmission tariffs or continuing with the current voluntary approach should be largely similar as there is a reasonably high level of voluntary compliance with the 2005 draft guidelines. Absent formal adoption national interests could at some point supersede compliance with the European view embodied in voluntary compliance with the 2005 Draft Guidelines. The incentive could be to increase charges, and so provide a (short run) benefit to consumers.

This creates a degree of legal and regulatory uncertainty, which has the potential to undermine investment decisions in the internal market.

As generators can be expected include transmission charges they face in the price at which they sell electricity, changing the average charge to zero should in theory have no effect on relative prices within a particular system or on the final prices that customers pay for electricity. However, this would not happen immediately for a number of reasons. For example most contracts would still be based on the higher charges. In the short run generators would have a windfall gain, while customers would have a have to pay higher network charges without a corresponding reduction the commodity price of electricity.

If regulators and TSOs wished to maintain the locational signals which they currently have in place it would entail adopting potentially (very) significant "negative charges" (i.e. paying generators to use the transmission system). In practice this could lead to difficulties in implementation. If locational signals within member states were reduced, it could lead to increased network costs, which would affect costs for all electricity consumers.

Many respondents to the consultation process argued that significant beneficial impacts in terms of the effective functioning of the internal market which would result from harmonised transmission tarification. The general preference was to move towards a narrower range with an average charge of zero in the medium term. ETSO argued for keeping applying the 2005 draft Guideline but with a slight increase in the allowable average G-charge in the Nordel system.

Apart from this suggestion by ETSO there were no calls for widening the range of permissible G=Charge. Doing so could result in windfall losses for generators who had located based on the expectation that they would have to pay lower network charges. There is little or no evidence that the current range of permissible charges undermines locational signals.

The alternative to setting an allowable range of generator charges is to focus on the methodology underlying the calculation of tariffs should ensure that all generators are treated equivalently. On this basis it would be expected to have a positive impact on the internal

market. However, set against this is the potential for the loss of "local knowledge" which regulators can bring to the process of assessing TSOs costs. This represents a core competency of regulators. Moreover the treatment of certain costs often is based on the particular historical and institutional situation in a Member State. EU level rules on these matters risk creating uncertainty for TSOs, without a beneficial impact on the coherence of "G" charges.

Environmental impacts

Some member states use "G" charges for transmission to encourage the production of electricity in locations where it is felt to be most efficient, and to reduce overall losses on the transmission system. Narrowing the range of allowable could undermine the effectiveness of locational signals within Member States for the reasons outlined above. This could have the impact of increasing the total amount of primary energy consumed in the production of electricity.

The alternative approach of focusing on the methodology underlying the calculation of tariffs would have to deal with the particular role that the TSO has, for example, in the development of renewable generation as sometimes these costs are passed on to consumers through transmission charges.

Social impacts

European rules governing the harmonisation of transmission charges should not have any significant social impacts. This is because only generators are affected by the options considered are directly affected and there are no significant indirect effects.

6. COMPARING THE OPTIONS

6.1. Inter TSO Compensation

6.1.1. Scope of EU action

Experience since the adoption of the Regulation, in particular the fact that national TSOs have indicated that they face increasing difficulty agreeing an ITC mechanism amongst themselves, clearly indicate that voluntary agreement is unlikely to produce an agreed ITC mechanism. ERGEG have debated extensively the appropriate form of an ITC mechanism, without reaching a consensus.

Stakeholders have asked the Commission to develop binding Guideline effectively as an "honest broker" without a direct stake in the final rules. The content (and hence ultimate impact) of guidelines developed by the Commission should represent accurate, compensatory, transparent and implementable rules which support the internal market in electricity. This would ensure that the costs of operating the interconnected European transmission system are fairly shared between fairly between individual TSOs and hence end users.

Negotiation between TSOs is likely to require the commitment of significant resources by the TSOs – potentially at quite a high level[21]. As long as ITC remains an unresolved issue it will

[21] The time and effort, on the part of senior executives, in developing ITC schemes is the significant (opportunity) cost in dealing with ITC. The topic has been under consideration since 1999 and has been

inevitably occupy the time of senior individuals within the National Regulatory Authorities and TSOs. This has been the experience to date in the development of the several voluntary schemes. It is individually rational to commit these resources to the ITC project as long as each TSO and regulator considers that it has to protect its own interests. Moreover, each stakeholder effectively holds a veto in what is, by itself, a "zero-sum" issue.

The opportunity costs associated with the time dealing with ITC is important. There are only a limited number of areas that the most senior people in TSOs or national regulators can address at a time. In particular it distracts from other important work in the internal market[22].

It is impossible to know with certainty the final outcome negotiations. It is probable that, if agreement could be reached, it would reflect the broad support for a simplified import-export model expressed in responses to the public consultation. However, lack of agreement is very probable. This would at the least frustrate the further integration of the internal market in electricity, and could even lead to regression if individual TSOs began to reimpose import and export fees or transit fees on the basis that they were entitled to compensation for the costs of hosting cross border-flows.

By contrast binding guidelines on the ITC mechanism, and on transmission tarification, will support completing the internal energy market and improving security of supply. They will help ensure full implementation of the Regulation. This is the clearly expressed view of all major stakeholders - in particular those who would be responsible for designing a voluntary mechanism. It is reasonable to conclude that that it necessary for the Commission to introduce guidelines at some level.

Only a small minority of respondents to the December consultation paper (France, AEEG - the Italian regulator and E-on UK) felt that the right approach was for the Commission to set out high level rules. By contrast there was a high level of support for the development of detailed guidelines by the Commission. ETSO, the industry representative body who would have to develop detailed methodologies if the guidelines were confined to high level principles, and Eurelectric both support the Commission producing detailed guidelines.

Stakeholders recognise the potential for difficulty in achieving agreement on the detailed design of an ITC mechanism, and the potential that it would require significant and ongoing commitment of resources. This is because higher level principles would leave many areas for disagreement among the parties in the design of the mechanism, it also means that there is uncertainty as to whether it is actually possible to implement such an approach. As with the voluntary model it is likely to require an ongoing commitment of resources by TSOs to the development and agreement of an ITC mechanism.

A clear methodology established in detailed guidelines should also be adaptable as the inputs should change with circumstance. Moreover, the procedure for adapting or reviewing the guidelines produces is not overly burdensome (the reason why guidelines are a matter for Comitology) and would be able to adapt to clearly changed circumstance. This could also

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a topic at multiple meetings of the Florence Forum. The direct costs for expert consultants who would be needed to develop a scheme are between €750 per day and €1500 per day. Although important in terms of cost control on an individual project, such costs are not the most significant aspect of the problems associated with the development of an ITC mechanism.

[22] For example, in the whole workstream for the development of improved cross border capacity calculation models, or the alignment of market design features to support pan European trading.

serve to increase uncertainty. For this reason developing detailed guidelines for the ITC mechanism is proportionate.

	Voluntary agreement	*Binding Guidelines (high level)*	*Binding Guidelines (detailed)*
Effective	Low	Medium	High
Efficient	Low	Medium	High
Coherent	Low (potentially very low)	Medium	High

6.1.2. Design of ITC Mechanism

Objectives and choice criteria

In section 4 above the objectives for the ITC Mechanisms were that it should be accurate, compensatory, and transparent. These follow from the objectives of the Regulation for fair, cost-reflective and transparent rules to ensure that the wider objectives for the internal electricity market can be met. In particular ensuring that the chosen methodology is transparent and compensatory ensures that the eventual ITC scheme is non-discriminatory.

The three standard criteria for assessing a proposal are whether it is effective, efficient and coherent.

In the context of ITC the efficiency or cost effectiveness the various options is not a primary concern. This is because even development costs of several million Euro, once appropriately amortized, would have a marginal impact on any estimate cost-effectiveness. Likewise operational costs of up to €1 million per annum (higher than what would be expected for any mechanism) would be small in comparison to ITC payments unlikely to be less than €100 million, congestion rents of over €1.5 billion, and a total value of cross border trade in electricity of €10 to €15 billion. Moreover, the costs of the different options for TSOs and national regulators are captured in the objective that the chosen ITC mechanism be implementable and have a low administrative burden. For these reasons the calculation of a "cost efficiency" index for the various ITC options is unnecessary. Instead a comparison of the relative effectiveness of the various options is to be preferred.

The objectives for the ITC mechanisms follow from the Regulation. In particular, the objectives that the scheme be accurate and compensatory follow from the overall objective of creating a fair and non-discriminatory market for electricity across Europe. There are no direct conflicts as regards other Community policy from any of the options. On this basis the coherence of each of the options is directly related to its effectiveness at achieving its objectives. Therefore it is appropriate to confine the analysis of the various options to their effectiveness at achieving the objectives of the ITC mechanism.

The assessment of the effectiveness of the different options which follows is based on a number of sources in particular

- The experience of ETSO in developing and applying several models and the utility they exhibited as a basis for ITC mechanism
- The responses of Stakeholders as part of the public consultation process, including discussions with ETSO and individual TSOs
- Discussions with stakeholders at the Florence Forum including the Florence Forum held in June 2009
- Expert advice the Commission received from consultants in 2008 and the Concentec Frontier Economics Report produced in 2006[23] along with other reports examining various methodologies[24].

Assessment

Accuracy

The factors assessed under this objective are:

- Should accurately reflect the physical flows of electricity actually measured in given periods of time derived from cross-border flows
- Should determine accurately those responsible for cross-border flows
- Should allow for a correct treatment of perimeter countries.

Accuracy is best understood as the degree of closeness of a measured or calculated quantity to its actual or true value. For the purposes of designing an ITC mechanism it also encompasses the concept of precision. However, accuracy also encompasses the sensitivity of the model to the assumptions which underlie its specifications. If a model is highly sensitive to the precise specifications, where there are reasonable alternative approaches, it is difficult to have confidence that the results of the model reflect its true or actual value[25].

Power flow based models should reflect the actual behaviour of the European transmission system. This allows such models to accurately reflect physical flows of electricity, and *(except for the WWT model)* determine those responsible for cross border flow including perimeter countries[26]. Experience with such models has been that the actual results are highly volatile and often counter-intuitive when used for ITC purposes. This is particularly true of the

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23 Frontier Economics & Consentec, "*Study on further issues related to Inter TSO compensation mechanism"*. Study for the European Commission, DG TREN, 2006. Available at: www.europa.eu.int/comm/energy/electricity/publications

24 A full list of papers can be found at in the References section to the public consultation document.

25 This is distinct from the concern that the model be stable and respond in a predicable manner to changes in cross border flows. If the underlying reality is that cross border flows have "tipping point" effects then an accurate model will reflect this in its outputs – even if that is unstable.

26 Except for the WWT model, because power flow models result in both payments and receipts being set at high levels (leading to much lower net payments for participating countries), the treatment of non-participating countries requires adjustment to better reflect the mutual impact of grid flows which cannot be fully modelled.

IMICA model but also the Marginal Participation model, often considered to best represent the physics of the transmission system in its modeling. This is in large part because power flow models cannot capture the full detail of the underlying system, so rely on approximate equations. Unfortunately they are usually sensitive to small changes in the exact form of these equations.

The assessment undertaken by Consentec and Frontier Economics in 2006 included a sensitivity analysis of various models which concluded that "without limiting the payments [in the Marginal Participation and WWT models] the identified compensation for one single line can make a complete scenario useless (or even worse a single scenario can significantly distort the overall result). This requires setting of capping factor which "could be set to any value". Similarly, the outcome of the decision as to how to model points on the grid which both act as load centres but also inject power has significant impact on the result of flow based models (except WWT). This means that in order to achieve consistency a harmonised approach is to be recommended. However, the approach to take is to an extent arbitrary, and based on modelling conventions.

Overall therefore power flow models promise a high degree of accuracy - but slight imbalances when modelling a complex system have large effects. Based on the experience with IMICA, and other complex models there can be little confidence that they truly provide the promised increased accuracy when reflecting the actual flow.

The problems discussed above are most relevant when the model used to assess the impact of individual injections or withdrawals from the power system. It is less problematic when assessing losses by using a single counter-factual such as removing all transit flows from the national system as is done using the *With and Without Transit Model*. Many respondents to the consultation process, including ETSO supported the use of this model for the estimation of loses. In this case the construction of the counterfactual is both simpler in theory (each system is less complex than the pan-European interconnected system), and has proved less controversial in practice, than modeling the impact of cross border flows across the entire interconnected system. Such a model could then be combined with a simplified import and export approach to assess costs not covered by losses.

Simplified import-export models neither promise nor deliver a high degree of accuracy. There is attempt to link them to the laws of Physics. However import export models do give a good overall approximation of the transits which use a host network and it is relatively easy to incorporate hourly use of the network use for the entire year. This level of confidence in the overall picture of the total amount transits hosted by networks largely offsets the shortcomings of import export models in terms of identifying precisely how cross border flows originated.

Transparency and Stability

The factors assessed under this objective are:

- Should be stable and respond in a reasonably predictable manner to changes in data on cross-border flows and other parameters over time

- Should be capable of specification in a way which creates confidence in the method

- Should be transparent and capable of being understood and verified.

Regulators and TSOs need to understand the ITC mechanism to verify payments from the ITC scheme and, equally importantly, to set forward looking tariffs. A transparent and stable model therefore also allows TSOs and regulators to better plan the management and development of the system.

Complex power based models lack transparency. The complexity underlying their design means that significant resources must be invested in order to confirm the results. The models' sensitivity also reduces transparency, as confidence is required not only in the model itself but also in the underlying data. The sheer volume of this data means that, even for TSOs, it is very difficult to understand, and verify all of the inputs. On top of this because of the issues relating to the specification of the model discussed already, participants and other stakeholders would have to invest significant resources in reviewing the specification of the model.

Simplified import-export models are by their nature much easier to understand. They also have more limited inputs. On this basis stakeholders find it relatively simple to verify the results of the model. There was widespread support in the consultation process for the use of such models on this basis.

Compensatory

The factors assessed under this objective are:

- Should capture both costs imposed on host networks and benefits realised as a result of cross-border flows including the commercial flows related to physical flows

- Should be applicable, as far as possible, to the impact of cross-border flows on both losses and on transmission infrastructure

- Should take account of congestion rents and the income they generate for TSOs in a way that furthers the objectives of the internal energy market

Insofar as they are accurate the undoubted benefit of complex power flow based models is that they should be able to properly identify both the costs and benefits of hosting cross border power flows, up to the impact on individual transmission lines. Moreover, it is also possible to identify those injections and withdrawals of power (at a nodal level) which cause cross border flows, meaning that charges can be levied on the TSOs whose users are responsible for the costs incurred. It also means that it is relatively simple to remove compensation due for lines which congestion rents already pay finance.

Simplifications involved in an import-export model on the other hand mean that cross border flows cannot be clearly linked to individual withdrawals and injections of power. Both payments and receipts are based on the total imports and exports. Moreover, because imports and exports are assessed on a system basis, the impact on individual lines is not isolated. However, regulators and TSOs already generally consider national systems as a whole. Planning and charging is usually implemented on a system wide basis. Users are generally not

charged on the basis of the precise lines which they use[27]. This reflects the very strong network effects which are present in Electricity transmission, and which were described in Section 2. A simplified model requires that a portion of this overall cost be attributed to cross border use.

Overall this approach is broadly similar to the approach adopted by national regulators when regulating network tariffs. This usually involves assessing the allowable revenue that TSOs may recover for the use of infrastructure, which is generally considered separately from costs associated with losses.

Valuation of infrastructure

In the Consultation process, there was support for valuing infrastructure both on the basis of standardised costing and for using regulatory approved values. The Regulation specifically sets down that costs shall be based on forward looking long run average incremental costs and an appropriate proportion of the costs of existing infrastructure, which are generally not used by Regulators.

Basing compensation for the use of infrastructure on regulatory approved values should mean that domestic tariffs and ITC compensation payments are consistent. However, for this to actually hold in practice the basis on which transmission tariffs are charged and calculated would have to be fully harmonised. While there might be benefits from such an approach, there are also strong arguments in favour of maintaining a national approached.

Consequently the national level assessments cannot be simply reapplied for the purpose of ITC. At present there are variations in the definition of transmission between member states. Moreover, not all minimum, transmission lines are used for cross-border flows. The CBT Model previously developed by ETSO, used regulatory approved values, but only after a detailed process of defining the "horizontal network". Continuing such an approach is feasible, but does involve unpicking the regulatory decisions at a national level.

Although some studies[28] have shown wide variation in long run average incremental cost between countries, this is in part due to different methods evaluating the costs associated with transmission. Long run average incremental costs can also be assessed at a European level, This would involve assessing the incremental cost of additional cross border flows in Europe, which can and do utilise the entire interconnected system. It would also take account of the fact that the precise flows of electricity ware not known in advance. Moving to a standardised costing approach has a number of other advantages. For one, it acts as a form of incentive regulation for TSOs and national regulators. Where they can hold their national costs below the average there is a benefit for the users of that network. It also avoids the need to harmonise the calculation of the costs of the transmission network, where member states and regulators treat them in differing ways for particular historical reasons.

ETSO's suggestion in their response to the consultation paper is generally along these lines. ETSO argued that costs not associated with losses - in particular those associated with

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27 Some national transmission charges for generators do reflect how the generation affects overall system development through locational signals. This applies for example in Great Britain.

28 Frontier Economics & Consentec, *"Study on further issues related to Inter TSO compensation mechanism - assessment of cost level data"*. Study for the European Commission, DG TREN, 2007. Available at: www.europa.eu.int/comm/energy/electricity/publications.

infrastructure development - should be covered by a framework fund to be divided among those countries hosting cross border flows. The size of the fund would be established by the Commission and payments into and receipts from the fund would be based on imports and exports of electricity. The ETSO submission represents an agreed position of all participating TSOs and is the outcome of extensive internal discussion.

Treatment of lines with dedicated funding

Some individual lines in the interconnected European transmission system are financed directly rather than through general tariffs. This can be either because they are so called "merchant lines" which do not apply the congestion management guidelines, or because they are directly financed from congestion rents. Compensating TSOs for the costs of making such infrastructure available to cross border trade could amount to double payment.

Complex power flow based models allow this to be done directly in relation both to compensation due (by identifying the actual lines used to transport electricity) and the amount of cross border trade. Simplified import- export models can exclude such lines from the calculation of transits.

Implementability /Low Administrative burden

The factors assessed under this objective are:

- Should be practical and as easy to implement in terms of the data to be collected from TSOs and in term of the application of the methodology using load flow or other forms of model
- Should not result in excessive costs for NRAs and TSOs
- Should be capable of specification in guidelines in a clear and unambiguous manner

ITC guidelines would not introduce significant new information obligations on TSOs. Data collection costs for either a simplified import export model or a complex power flow model should not be significant as the required data is already collected and has indeed been used in the voluntary schemes developed thus far. It is possible that there would be additional costs necessary in quality assuring the data which would arise in the detailed design phase of a complex power flow model. The costs associated with developing a full power flow model could be in the order of several million euros (taking account of all the costs involved on the part of all involved TSOs).

However, a complex mechanism would have to be subject to significant design and testing procedures before it could be implemented. In the consultation process one respondent argued that this was not of particular importance as the affected parties were TSOs who already had access to the data and possess the requisite technical knowledge to review the model. Experience with the IMICA model shows that important problems can present themselves during the application of any model. This would increase the burden on TSOs who would have to carry out the bulk of this work and on national regulators who would oversee it.

Simplified import-export models are easy to implement and apply. The additional resources required by TSOs or national regulators required to oversee a simple export system would be minimal.

6.1.3. Summary ITC Mechanism

Complex models offer significant advantages in terms of identifying how and where costs were incurred. However, they are not transparent and require a significant amount of effort to verify for stakeholders as well as being difficult to implement. By contrast simple models are easy to understand and easy to implement.

Moreover the advantages of complex power flow models in linking compensation to individual injections and withdrawals of power this are only relevant insofar as the causes are accurately identified. Overall the responses to the Consultation paper, and the work carried out for the Commission by specialized consultants confirm the validity of concerns in relation to the accuracy of power flow models.

	Accuracy	*Transparency*	*Compensatory*	*Implementable /Low Administrative burden*
Simple (Import Export)	Medium (low for losses)	High	Medium	Medium-High
Complex (Power Flow)	Low – due to uncertainty and sensitivity to assumptions	Low (Higher when simplified counterfactual used for losses)	High	Medium
	(Higher when simplified counterfactual used for losses)			

Conclusion 1

A simple import export model is to be preferred when designing the ITC mechanism in regard to infrastructure usage.

Separating the treatment of losses from infrastructure use allows the advantages in terms of accuracy associated with power flow to estimate losses incurred as a result of cross border flows to be retained. It is appropriate to take into account that losses are treated differently in various member states. This is possible where the entire system is considered against the counterfactual where cross border flows are removed, meaning that the level of compensation can be tailored to the particular system in place in each member state.

The responses to the Consultation paper, and the work carried out for the Commission by specialized consultants support the view that this approach can provide a effective, efficient and coherent method of assessing the impact of cross border flows on system losses.

Conclusion 2

The *With and Without Transit* model should be used for assessing losses.

The costs associated with cross border use of infrastructure can be either based on the assessment of infrastructure costs on a national level, or standardized costs based on a Europe wide assessment. Using national assessments means that close to the ground knowledge of national regulators is incorporated. Domestic and non-domestic users are also charged on the same basis for using the same infrastructure.

However, the national level assessment cannot be simply reapplied at the European level. As noted already, there are many different costs included in transmission tariffs. At a minimum, transmission lines which are not associated with cross-border flows should be removed from the estimation of transmission infrastructure costs at the national level. Additionally, costs which have been bundled into the assessment of the costs of infrastructure have to be removed. This might include stranded costs of various kinds incurred by the TSO, which it is allowed to recover from all network users.

By contrast, standardised costings based on a Europe-wide assessment creates a form of incentive regulation for TSOs and national regulators. Where they can hold their national costs below the average there is a benefit for the users of that network. It also avoids the need to harmonise the calculation of the costs of the transmission network, where member states and regulators treat them in differing ways for particular historical reasons or otherwise unpickl regulators' decisions. Compensation based on a consistent costs reflective estimate ensures non-discrimination between TSOs (and users) on a European level. These points speak strongly in favour of a form of standardised costs.

The starting point of the Regulation is that costs should be assessed based on long run average incremental cost. The focus on incremental cost is appropiate as it reflects the additional costs of hosting cross border flows on networks which were originally developed for national use (including security of supply). Therefore, for the purposes of assessing the value of infrastructure used, the most effective way to ensure that the system is compensatory is to make an overall (that is Europe wide) assessment of the incremental cost of infrastructure for hosting cross border flows of electricity.

Any such assessment should be subject to periodic review. As this is a highly technical area, it is proper that it should be based on an assessment of these costs by the newly established Agency. This technical assessment should be carried out under the second subparagraph of Article 9 (2) which provides for the Agency to be commissioned with additional tasks of a technical nature. Until such time as the Agency is formally established, ERGEG could act in an advisory capacity to the Commission who would have responsibility for making the assessment.

The ETSO model is in line with the assessment of the mechanism design which best meets the objectives for the ITC scheme. It can also secure widespread support from interested parties. This model can form the basis of the detailed guidelines adopted by the Commission.

Conclusion 3

A fund should be established to compensate all TSOs for the infrastructure costs associated with cross border flows. The technical assessment of the historical and Long Run Average Incremental Costs to be compensated should be assessed by the newly established Agency for the Co-operation of Energy Regulators.

6.2. Transmission tarification

The general presumption must be that, in accordance with the principle of subsidarity, national regulators are best placed to set the appropriate level of transmission tariff for systems which they oversee. Nonetheless, as set out in the preceding sections, there are good grounds for establishing a framework within which regulators exercise their powers. These are accepted by the regulators themselves, who, as discussed, drew up draft Guidelines in 2005 on allowable G-Charges.

Neither as part of the consultation process or in the work undertaken by the consultants engaged by the Commission was significant evidence put forward to indicate a need at this point to adopt a different range of allowable G-charges than those provided for in the 2005 draft guidelines. Given the potential for adverse outcomes either in terms of costs faced by consumers of electricity or the effectiveness of locational signals within Member States, it is therefore not appropriate at this stage to make such changes to the regulatory regimes prevailing in Member States. However, the views expressed by respondents to the consultation clearly indicate that this is worth keeping under review, and in particular whether the variations in G charges are having a detrimental impact on cross border trade.

A "no EU level action" approach would in many respects have the same outcome as formally adopting the draft guidelines, as the policy environment would remain largely similar. However, uncertainty as to the evolution of transmission tarification across the internal market would continue. In this light it is important to note the consultation process indicated widespread support for formally adopting the 2005 draft guidelines. Moreover, when they were developed it was clearly envisaged that they would serve as the basis for binding guidelines under the Regulation.

Adopting the 2005 draft guidelines would serve to increase the legal certainty for market participants. It would not adversely affect the ability of TSOs and regulators to include effective locational signals within their territory. It would thereby have a clear and positive impact upon the coherence of the rules governing the internal market in electricity, without

undermining either the effectiveness or efficiency of the current regime where there is a wide degree of discretion for national regulators.

The alternative approach of focusing on the methodology underlying the calculation of tariffs potentially would ensure that generators were treated equivalently. However, the rules would necessarily be quite complicated – dealing with matters of regulatory policy such as cost of capital, detailed treatment of infrastructure costs, treatment of losses, congestion management etc. Inevitably much regulatory discretion which exists at a national level would end up being removed, and this could have significant adverse consequences, and go against the principle of subsidarity. This is particularly relevant when the desirable outcome of a level playing in the internal market in electricity can be more simply achieved by focusing on "outputs" – that is the actual charges faced by generators – without restricting the discretion of national regulators.

Conclusion – tariff harmonisation

In light of the significant support for the adaptation of the 2005 draft guidelines, and the extensive consultation processes involved in their development, it is appropriate to formally adopt these guidelines along with those relating to the ITC mechanism.

7. MONITORING AND EVALUATION

The effectiveness of the new arrangements in meeting the objectives of the regulation should be subject to review after five years by the Agency for the Co-operation of Energy Regulators to be established under the forthcoming Agency Regulation, or earlier on the initiative of the Agency in line with Article 5 of the Agency Regulation.

In relation to transmission tarification, this review should specifically consider both the appropriateness of considering the variance of average tariffs – between and within countries - as well as their median value. Moreover, the Agency should continue to assess the ongoing scope for the harmonisation of the principles underlying the setting of transmission tariffs.

If appropriate the guidelines would then be amended in accordance with the provisions of the Regulation.

ANNEX A

Description of With and Without Transits WWT[29]

In order to determine the amount of compensations for each entity two network situations are compared for each regarded point of time, aiming at building a set of power flow snapshots representative for the whole year. One situation is the reference case containing actual power flow data from a specific moment in time, including transits. The other is a modeled situation after removing transits[30] in order to estimate the power flows caused by domestic network utilization. The flows caused by transits are defined as the difference of the actual flows (with transits) and domestic flows (without transits).

Summing up the impacts on each considered network element due to transits leads to the compensation for an entity. Costs must be defined at network component level but can in principle be any combination of regulated cost or long-run average incremental cost. The fund is financed following the same rules as for the ETSO CBT mechanism, including the treatment of perimeter countries.

Description of ETSO proposed model

[Insert ETSO Model here]

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29 More details on the method are available from "Cost components of cross border exchanges of electricity", Universidad Pontificia Comillas. Study for the European Commission, DG TREN, November 2002. Available at: www.europa.eu.int/comm/energy/electricity/publications

30 Defined identically as in the ETSO CBT mechanism

Cross Border Trade Model

A simple mechanism is one that is not based on power flow computations, requiring thus a reasonably low effort in terms of data management. A good example of such method could be the ETSO **CBT** mechanism[31]. Following this method, inter-TSO compensation is calculated based of the two components:

- Estimation of cross-border flows considered to be transits. These are defined on a control zone basis as a minimum of the physical imports and exports Min(Imp, Exp). Further, the hourly transit values are aggregated over settlement periods, i.e. months.

- Estimation of the required compensation (i.e. costs claim), being the extra costs born by hosting these cross-border flows, based on the value of the horizontal network (describing the relevant network elements) and a key used to define the extent of its use for hosting cross-border flows as compared to feeding the national demand.

- The sum of compensations of all participating entities (i.e. the *fund*) is financed from two sources: (i) entities participating in the ITC mechanism according to the "*net flow*", i.e. the net import or export of each entity on an hourly basis, aggregated for a monthly settlement, and (ii) the so-called perimeter countries (these countries have at least one border to the ITC area but are not participating in the ITC mechanism) through being charged an explicit injection fee.

This method has been applied for ITC compensation in 2005-2006. It has been noted above that the method has some inherent flaws. These originate from the fact that the transit flows are considered in an aggregated manner, i.e. per country, impairing a correct consideration of the complexity of power flows in the meshed grid, and rendering inability to handle loop flows[32]. Additionally, the method is unable to capture the benefits of hosting transits, such as transit flows relieving the structural transmission constraints and/or reducing losses. In order to tackle some of these issues a number of modifications of the method could be considered, such as stepping away from the current definition of the control zones by national frontiers

[31] The method is explained in greater detail in "ETSO Proposal for 2005 CBT mechanism", available at: www.etso-net.org

[32] A loop flow is where electricity leaves a particular control area, is transmitted across another network before returning to the source network where it is consumed.

towards control zones based on TSO control areas. Going even further, TSO control areas could also be split into smaller areas. This in turn could allow less loss of information as is inevitable when the complex nodal reality is substituted by a zonal approximation.

PROS	**CONS**
Very simple method, no power flow computations required	Notion of aggregated import seems inaccurate consideration cross-border exchanges in the meshed grid
Transparent and predictable	Inability to tackle loop flows

Average Participation AP

AP takes into account each individual load and generator, assuming that electricity flows can be traced. The basis of this method is an assumption that at any network node the inflows are distributed proportionally to the nearest outflows. This can be interpreted as a "water flow" view, because the flow on lines with a net outflow are deemed to be exclusively created by flows on lines with a net inflow to a considered node. Under this approach, for each generator injecting power, paths are identified for power flows until they reach load nodes where they end, the same being done in reverse for loads withdrawing power. This allows responsibilities to be allocated for flows on each considered network element to single generator and load. The cost of each line or transformer is then distributed to the different users according to how much the flows starting at a certain load/generator have circulated along the corresponding network element, aggregated later at national levels to determine payments.

Since the method treats load and generators separately, the flows on each network element are identified twice (one by tracing downstream from generators, and one by tracing upstream from loads). Hence, an ex ante weighting factor is required, defining which share of the costs to be borne by loads and generators. This is usually considered to be 50%.

PROS	CONS
Payment based on geographical constellation of networks	Based on water flow algorithm – validity for electricity network questionable
Considers all cross-border flows	Need for a consistent set of power flow data for the whole

	ITC region
	Relative complexity due to amount of data to be considered

Marginal Participation MP

Similar to AP, the MP algorithm considers the impact of each load and generator on flows on lines and transformers, aiming at allocating the responsibilities for flows on each considered network element to specific generators and loads.

The basis for the method is a set of sensitivities, known as Power Transfer Distribution Factors (PTDF), that represent how much the flow in a line/transformer increases in relation to an assumed incremental injection at a given node. The results are consistent with the laws of physics and observed power flows. The total participation of each node in a particular line flow is calculated by multiplying the amount of its injection by the relevant PTDF. The cost of each network element is allocated to the different loads and generators according to their relative participation to the physical flow in this element. Similarly to the AP method, obtained nodal compensations are aggregated on national level to determine final payments.

The MP method is said to be sensitive to the choice of the reference node when defining the PTDF matrix. However, this can be tackled by defining a virtual reference node, as discussed in[33].

PROS	CONS
Based on power flow computations	Need for a consistent set of power flow data for the whole ITC region
Considers all cross-border flows	Complexity of calculations and data management
Correct identification of benefits	Limited predictability and volatility of results, leading to unintuitive results, high required compensations

Improved Modeling for Infrastructure Cost Allocation IMICA

IMICA is a mechanism that was proposed by ETSO in May 2006. It determines the impact that cross-border transactions in a region have on the transmission grid of

[33] Study on further issues related to Inter TSO compensation mechanism, report to the EC by Consentec and Frontier Economics, 2006.

third countries. The key element is estimation of the transit key serving as the basis for the costs claim.

The process starts by estimating the sensitivity factors to define the impact of all possible transactions between control zones A and B on a non-involved C, expressed in MW.km. Additionally, “bilateral reference exchanges” between each exporting country and each importing country are estimated on hourly bases. Compensations are calculated using a transit key defined as the total hourly MWh.km transited through a country (sum of all reference exchanges between third countries weighted by the net corresponding sensitivity factors aggregated over a period of time i.e. one year) over the total of MWh.km in all grid elements of the country.

Required compensations are obtained by applying the transit key to the total cost of the grid infrastructure of a country. Contributors to the compensation fund are obtained by identifying the importers and exporters that are responsible for corresponding reference exchanges.

PROS	CONS
Compensations based on transit key defined in MWh.km,	Important volatility of the results
Tackling loop flow using “sensitivity factors” for cross-border exchanges	Unintuitive results
	Too high compensations

Annex B - Summary of Responses To December Consultation

Responses were received from a wide range of organisations including, Government ministries, Regulators, industry associations, and individual Transmission System Operators and companies. Almost all respondents agreed that there the need for Commission action and that such action should involve detailed guidelines. This reflected the difficulty in achieving agreement on a voluntary scheme.

Several respondents questioned whether there was a rationale for an inter-TSO compensation (ITC) scheme in the light of developments in the internal market in electricity since the adoption of the Regulation.

Only a minority of respondents (notably the French ministry and E-on UK) felt that the correct approach was for the development of high level principles by the Commission with the final scheme subsequently being designed by participants. There was a high level of support for the development of detailed guidelines by the Commission. In this regard it is instructive that Eurelectric, and ETSO – the industry representative bodies who would have to develop detailed methodologies if the guidelines were confined to high level principles – both support the Commission producing detailed guidelines.

ETSO submitted the proposed mechanism which they felt could form the basis of detailed guidelines from the Commission. This proposal was agreed to by all members of ETSO, including non-EU members.

The Institute for Electric Power Systems at Leibniz University Hannover, as an independent and non-affiliated institution also made a substantive proposal for an ITC mechanism.

Overall, responses from actors in net paying countries, in particular exporting countries tended to argue for steps which would reduce the scope of ITC and minimise net payments. Transit countries on the other hand, tended to argue for approaches which emphasised the impact of external use of national networks.

Need for ITC mechanism

As already noted, almost all respondents agreed that there was a need for detailed guidelines from the Commission on ITC. However two ministries, France and Norway, argued that an ITC mechanism was unnecessary. Both argue that the need for ITC, as included in the Regulation, has been superseded by the volume of congestion rents. France, in particular, ties ITC together with the removal of long term interconnection capacity contracts, and in this context notes that Switzerland is the largest beneficiary of ITC, despite retaining such contracts.

The Finnish ministry of Employment and the Economy argues that only the costs of losses – which are a direct result of transit flows should be compensated. This is supported as a fall back position by the relevant ministries in France and Norway in the event that ITC is maintained. The Norwegian and Finnish regulators also support this position. Industry organisations from Norway (EBL) Sweden (Svensk Eergie) and Spain (UNESA) also make this argument as does Vattenfall.

Set against this the regulators from Hungary, Austria, Switzerland and Germany argued strongly that a robust ITC scheme is required, and that it is essential that it also cover the costs of infrastructure use.

Similar arguments are put forward by TSOs from countries which typically carry out a transit function. These arguments are put in the context of general support for the proposed ETSO solution. The German association of TSOs argues that the net payments for infrastructure use should be approximately €400 Million.

Detail of ITC mechanism

There are two broad types of model on which an ITC scheme can be based – simple import export models and more complex power flow models. Support for more complex mechanisms was relatively limited. Ofgem, the Regulator for Great Britain, argued strongly in favour of such a mechanism on the basis that it would best meet the need to ensure efficient development and use of the transmission system. This position was also supported by the Hungarian Regulator and the Serbian regulator. ERSE, the Portuguese regulator, argued in favour of adopting a methodology that truly reflects the complexities of electricity systems. They noted that they had held this position irrespective of the impact of alternatives on net Portuguese payments

Other respondents argued in favour of simple mechanisms in particular for the assessment of infrastructure use. Several respondents including National Grid, the TSO in Great Britain argued that while complex power flow based models where theoretically preferable, in practice the complexity and multilayered nature of the pan European transmission system warrants using a simplified approach.

ETSO's proposal was based is based on a simplified import export model. This is used to distribute a so-called Framework Fund to compensate countries hosting cross border flows.

There was substantial support for using the *With and Without Transit* model for assessing losses. EMV, the Finnish Regulator explicitly argued in its favour, as did the Hungarian regulator, the Italian Regulator and the Norwegian industry association EBL. It is also central to the ETSO proposal where it is used assess the compensation due for losses incurred. The arguments put forward in favour of this model are that it accurately represents individual transmission systems without requiring the complexity of analysing the overall transmission system.

Transmission tarification

There was widespread support for adopting the 2005 draft guidelines on transmission tarification produced by ERGEG. However, there were also a number of calls for a reduction in the average transmission charge faced by generators – with a number of respondents arguing that this should eventually be reduced to zero.

ANNEX C ARTICLE 8 OF REGULATION 1228/2003

Article 8 reads:

Guidelines

1. Where appropriate, the Commission shall, acting in accordance with the procedure referred to in Article 13(2) [Comitology Procedure], adopt and amend guidelines on the issues listed under paragraph 2 and 3 and relating to the inter-transmission system operator compensation mechanism, in accordance with the principles set out in Articles 3 [Inter TSO compensation mechanism] and 4 [Charges for access to network]. When adopting these guidelines for the first time the Commission shall ensure that they cover in a single draft measure at least the issues referred to in paragraph 2(a) and (d), and paragraph 3.

2. The guidelines shall specify:

(a) details of the procedure for determining which transmission system operators are liable to pay compensation for cross-border flows including as regards the split between the operators of national transmission systems from which cross-border flows originate and the systems where those flows end, in accordance with Article 3(2);

(b) details of the payment procedure to be followed, including the determination of the first period of time for which compensation is to be paid, in accordance with the second subparagraph of Article 3(3);

(c) details of methodologies for determining the cross-border flows hosted for which compensation is to be paid under Article 3, in terms of both quantity and type of flows, and the designation of the magnitudes of such flows as originating and/or ending in transmission systems of individual Member States, in accordance with Article 3(5);

(d) details of the methodology for determining the costs and benefits incurred as a result of hosting cross-border flows, in accordance with Article 3(6);

(e) details of the treatment in the context of the inter-TSO compensation mechanism of electricity flows originating or ending in countries outside the European Economic Area;

(f) the participation of national systems which are interconnected through direct current lines, in accordance with Article 3.

3. The guidelines shall also determine appropriate rules leading to a progressive harmonisation of the underlying principles for the setting of charges applied to producers and consumers (load) under national tariff systems, including the reflection of the inter-TSO compensation mechanism in national network charges and the provision of appropriate and efficient locational signals, in accordance with the principles set out in Article 4.

The guidelines shall make provision for appropriate and efficient harmonised locational signals at European level.

Annex D Commercial transactions and physical flows

Due to the physical laws governing electricity, export transactions often cause physical flows in countries which are not on the – theoretical – direct path of the electricity. Such transit flows are commonly denominated as “loop-flows” or “parallel-flows”.

The diagram below is a simplified version of an illustration from "Regional Flow Based Allocations: State of Play" published by ETSO in March 2007. It illustrates the potential impact of a commercial trade of 100 MW between Germany and France on the actual flows on the transmission network. The commercial transaction is indicated by the red directional arrow. Physical flows are represented by the blue arrows.

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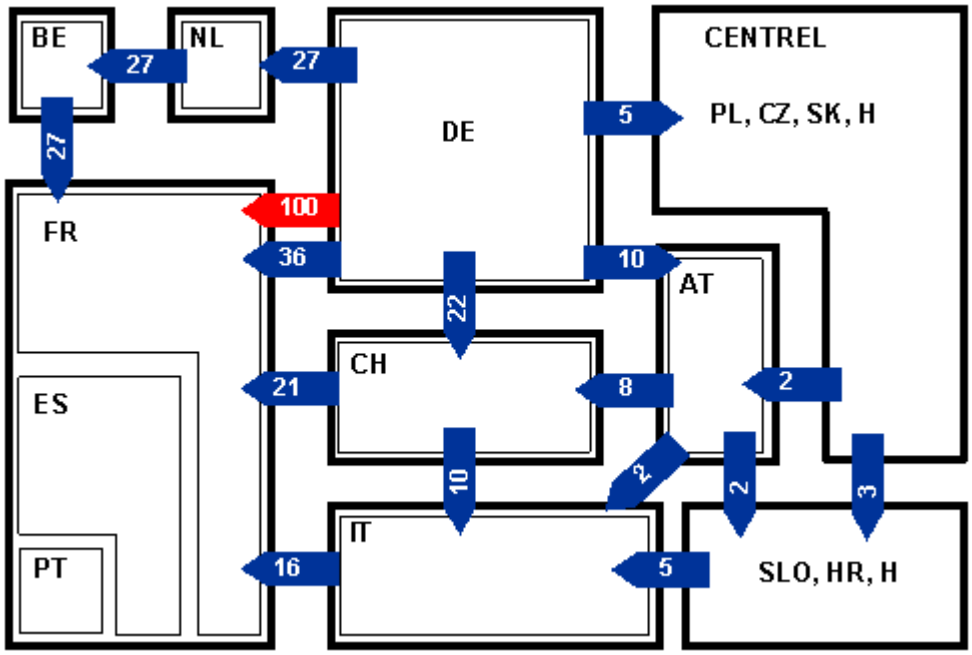

Potential impact of 100 MW commercial transaction on physical flows:

– Each individual system is assumed to be in balance initially

– As a result of the commercial transaction an additional 100MW of power is injected into the German grid. Simultaneously load is increased by 100 MW in France.

– Power flows out of Germany immediately increase by a total of 100 MW. However, not only the German-French border is affected, rather all Germany's interconnections are used

– Power flows into France immediately increase by a total of 100 MW. However not only the French-German border is affected, rather France draws in power from several neighbours

– Each country system which has "imported" from Germany must the "export" the same amount of electricity in order to keep its system in balance. This leads to secondary and even tertiary effects as the entire interconnected system is used to "transport" the electricity from Germany to France.

Annex E Current Structure of Tariffs

ETSO publishes an annual comparison of the structure of tariffs[34]. This takes into account all of the energy transmission charges. Consequently the tariffs analysed include not only components connected to typical TSO activities but also other regulatory charges not directly related to transmission costs. The components taken into account by ETSO are:

- Infrastructure charges
    - operational and capital,
- loss compensation costs,
- internal congestion management costs (excluding costs of auctions or market splitting),
- costs of supply of system services (e.g. Black Start capability),
- costs of system balancing,
- stranded costs, (if applicable)
- incentives for renewable (if applicable)

These elements are covered differently in different markets. For example in GB and Ireland, generators' output is adjusted by so-called Transmission Loss Adjustment Factors, meaning that losses are directly recovered from the market; in most countries this is recovered from all system users.

Some of the main variations are set out in the following pages.

[34] The latest versions can be found at : http://www.entsoe.eu/_library/publications/etso/Final_Synthesis_2008_final.pdf

Costs included in the comparison transmission tariffs

	OPEX except system-services, losses and ITC	Losses cost	ITC cost/revenue	System-services						
				Primary reserve	Secondary reserve	Tertiary reserve	Internal Congestion management	Congestion management on interconnections	Black -Start	Voltage Control Reactive Power
Austria	C	C	C/B	N	C	N	C	C/B	C	C
Belgium	C	C	C/B	C	C/B	C/B	C	C/B	C	C
Bulgaria	C	C	N	C	C	C	N	N	C	C
Czech Rep.	C	C	C/B	C	C	C	C	N	C	C
Denmark	C	C	C/B	C	C	C	C/B	C/B	C	C
Estonia	C	C	C	N	N	C (110 kV)	N	N	C (110 kV)	C
Finland	C	C	C	C	N	C	C	C	C	C
France	C	C	C	C	C	N	C	N	C	C
Germany	C	C	C/B	C	C	C	C	C/B	C	C
Great Britain	C	C	N	C	C	C	C	C	C	C
Greece	C	C	N	C	C	N	N	C	N	N
Hungary	C	C	C/B	C	C	C	C	N	C	C
Ireland	C	N	N	C	C	C	N	N	C	C
Italy	C	C	N	C	C	C	C	N	C	C
Lithuania	C	C	C	N	C	C	N	N	C	C
Netherlands	C	C	C	C	C	C	C	N	C	C
Norway	C	C	C	C	N	N	C	C	N	N
Poland	C	C	C	C	C	C	C	N	C	C
Portugal	C	C	C/B	C/B	C	C/B	N	N	C/B	C/B
Romania	C	C	C/B	N	C	C	C	C/B	C	C
Slovak Rep	C	C	C/B	C	C	C	N	N	C	C
Slovenia	C/B	C/B	C	N	C	C	N	N	C	C
Spain	C	C	C	C	C	C	C	C	C	C
Sweden	C	C	C/B	N	N	C (1/3)	C	C/B	C	C

- Where:
  - C if cost is covered by the transmission invoice
  - C/B if cost less benefit is covered by the transmission invoice (C/B it is just to indicate if a certain cost covered by tariff is also compensated by revenues. The best examples are ITC, congestion costs, balancing. For instance if you have congestion rents and you deduct them from your congestion costs, you obtain the amount to be covered by tariffs. In that case it is C/B and not only C)
  - N if cost is not included in the transmission invoice

Remarks:

- This table contains indication of different costs covered by charges that have been included in the calculation of the price used for the comparison. Some of these charges may not be included in the TSO transmission tariff.

Main characteristics of the TSO tariffs in Europe

	Sharing of network operator charges		Price signal		Are losses included in the tariffs charged by TSO?	Are system services included in the tariffs charged by TSO?
	Generation	Load	Seasonal / time-of-day (1)	Location		
Austria	18%	82%	-	-	Yes	Through a specific component to generators
Belgium	0%	100%	xxx	-	Not included for grid >=150 kV	Tariff for ancillary services
Bulgaria	0%	100%	-	-	Yes	Yes
Czech Republic	0%	100%	-	-	Yes	Tariff for ancillary services
Denmark	2-5%	95-98%	-	-	Yes	Yes
Estonia	0%	100%	Only in 110kV tariffs	-	Yes	Only in 110kV tariffs
Finland	12%	88%	x	-	Yes	Yes
France	2%	98%	-	-	Yes	Yes
Germany	0%	100%	-	-	Yes	Yes
Great Britain	27% TNUoS Tariff (2) 50% (2) BSUoS Tariff	73% TNUoS Tariff 50% BSUoS Tariff	xx	TNUoS - locational; BSUoS - non-locational	No, recovered in the energy market	Included in BSUoS Tariff
Greece	15 % Use of system 0 % Uplift charges	85 % Use of system 100 % Uplift charges	x	Different generation zones Use of system charges	No, recovered in the energy market	Included in Uplift charges
Hungary	0%	100%	-	-	Yes	Yes
Latvia	0%	100%			Yes	Yes
Lithuania	0%	100%	-	-	Yes	Yes
Ireland	20%	80%	-	Generation only	No, recovered in the energy market	Yes
Italy	8%	92%	-	-	No	Yes
Netherlands	0%	100%	-	-	Yes	Tariff for ancillary services
Norway	35%	65%	xxx (via losses)	Location	Yes	Yes
Poland	0,50%	99.5%	-	-	Yes	Yes
Portugal	0%	100%	xx	-	No, recovered in the energy market	REN recover system services costs directly from market agents' payments (not through a regulated tariff).
Romania	22,62% use of system 0% system services	77,387% use of system 100% systems services	-	6 G zones =6 G tariffs values 8 L zones =8 L tariffs values	Yes	Tariff for ancillary services
Slovak Rep.	0%	100%	-	-	Through a specific fee	Through a specific fee
Slovenia	0%	100%	xx	-	Yes	Tariff for ancillary services
Spain	0%	100%	xxx	-	No, included in energy price	No, included in energy price
Sweden	25%	75%	xx (via losses)	Location	Yes	Yes

Remarks:

(1) The "X" indicates time differentiation. With one "X", there is only one time differentiation ("day-night", "summer-winter" or another one). With two "X" (or more), there are two (or more) time differentiations.

(2) TNUoS: Transmission Network Use of System; BSUoS=Balancing Services Use of System

Annex F Pricing principles for the use of electricity network infrastructure

Setting regulated tariffs for access to all electricity networks, as with all economic regulation, requires the protection of customers interests by controlling charges imposed on users.

For the network operator or owner, allowed tariffs and charges can be directly set by the economic regulator; alternatively total allowable revenue can be set (which when combined with a methodology setting out how costs are attributed to different classes of user effectively amounts to the same thing).

In setting tariffs the economic regulator can either engage in a detailed review of costs (including direct curbs on expenditure) or design incentives to encourage efficiency or technical innovation. Subject to whatever incentive mechanisms are in put place, the aim is to ensure that the total costs of (and efficient) network owner can be recovered from network users.

However, economic regulators generally also aim to facilitate economic efficiency by ensuring that network users face charges which reflect the economic costs which use imposes upon the system. Users decisions made based on regulatory approved tariffs should be consistent with the best outcome for the entire network.

Both producers and consumers can affect total transmission costs through the initial costs associated with connecting them to the network, and through the manner in which they use the system. Consequently, charges faced by users can be both for the actual use of the system and the costs of connecting to the system.

Losses and Congestion

Costs directly related to energy throughput (in particular losses and congestion management) must to be recovered by the system operator.

A number of market design approaches attempt to integrate elements of transmission pricing, in particular relating to internal congestion management and treatment of losses into to the market price. One example of this is locational pricing, also known as nodal pricing. This is not generally used in Europe but is relatively common in the USA. Under this model the wholesale price of electricity is set at the marginal price (technically the shadow price) of electricity at each node or point on the system. This marginal price includes any losses incurred bringing the electricity to that point. Moreover, the price differences at each point mean that congestion costs should not be incurred by the system operator, but are directly reflected in the energy prices faced by consumers and producers. The price differences between nodes can be used to create incentives for private operators to build so-called "merchant" lines.

In practice, many of the system constraints must be set by the system operator based on system modelling. They are also subject to change with network conditions. It is not clear that a true locational price is actually calculated as redispatch and other "out of merit" operation is usually necessary.

In Europe, rather than calculate a price for each node, price zones generally covering an entire country, have been established. The costs of congestion and losses are then managed by the system operator as part of its regulated activities. The expected impact of losses or congestion on costs is often reflected through other methods which do not directly impact on the energy price[35]. This allows the development of a single reference price for a country. Moreover this reference price should be relatively predictable as it is not affected by complicated network flows. The TSO also sees the trade-off between the costs it incurs in managing congestion on the network and the cost of network upgrades.

Connection charges

As only the largest consumers are directly connected to the transmission network, transmission connection charges are generally only relevant for generators[36]. Connection charges can be either "shallow" or "deep".

– Shallow charging means only costs which are exclusively associated with the new connection. However, this does not account for the wider impact on the network of the connection. This can result because the overall pattern of electricity flows changes significantly as a result of the new connection.

– Deep charging means the connection charge reflects indirect costs associated with additional upgrades to the network. An example of this would be the addition of new circuit breakers at another point on the system needed as a result of the new connection. However, Deep charges for connection may result in 'initial contributors' paying for network assets subsequently used by later connections to the same part of the network. The 'second comer' could therefore 'free-ride' on the assets paid for by the initial connection. For this reason shallow or "shallowish" charging is often preferred as it avoids the need for a system of rebates and leaves the overall planning and management in the hands of the TSO.

While connection charges can contribute to the efficient management and development of the network, at some point a prior investment in system capacity must have taken place. This connection cannot be covered by deep charges (or else there would be no network to connect to). Thus even with even with a system of connection charging in place, the high capital costs of network provision will still need to be recovered. Most of this will be cost related to prior investment in system capacity.

Network infrastructure costs

For most systems this is the largest component of transmission costs. These costs are sunk, and could not be recovered if system use was based on marginal cost principles. As discussed in section 2.2, it is generally considered preferable that most of these costs be placed on consumers. Firstly, this is because, in a competitive market, generators will pass on these costs to consumers, meaning that the final incidence of the charge should not be affected by where it is initially placed. Secondly, a variable charge can affect production decisions meaning that the potential for market distortions is greater when generators are charged.

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35 For example the Transmission Loss Adjustment Factor applied in the UK and Ireland is based annual ex-ante modelling, and does not reflect the actual losses incurred on any particular day. Management of these losses remains the responsibility of the TSO.

36 Distribution system operators can be charged for connection, in particular for capacity upgrades. The costs associated with this will be passed on to consumers.

Ramsey pricing (for load), as discussed at section 4.2, is an extension this second principle. However, even where it is considered appropriate set variable transmission charges based on Ramsey principles, regulators may also consider it appropriate to introduce annual connection charges, or similar "step" charges, for large industrial users in an effort to ensure that they bear some of the long term costs of the system.