CEER agenda for discussing and solving cross border trade issues in electricity

(Florence; February 21st./22nd. 2002)

Introduction

1. Promotion and development of cross border, intra-community trade in electricity is a fundamental goal of the European Internal Electricity Market (IEM). A number of issues will have to be solved and/or are in the process of being solved to reach that goal. As a result of the Florence process, a broad consensus has been achieved on a set of fundamental issues concerning the design of cross border trade mechanisms (CBT) for the IEM of the European Union. In January 2001 CEER presented a proposal to accelerate the liberalisation of the IEM[1]. This proposal contained a set of guiding principles for the implementation of the conclusions of the Florence process. In this agenda, as a further follow-up, a work programme is formulated with three separate, but interrelated lines of action. These are actions on inter TSO-payments, on the harmonisation of tarification structures and on interconnectors and congestion management. As to the inter TSO-payments, a concrete outline of the conceptual framework for a scheme for 2003 and beyond is presented.

2. The issue of inter TSO-payments for accommodating cross border flows has to be solved as a matter of priority, since the present temporary scheme is not accepted to be extended beyond 2002. Issues related to the harmonisation of national tarification structures, including relevant signals and incentives to market parties, together with issues related to cross border interconnections and congestions cannot be treated separately from each other and both have a close relationship as well with the inter TSO-payments scheme. Work on these wider issues should be further developed in 2002, leading to concrete results later that year It is essential in this context, that as a part of this wider approach existing intermediate cross-border tariffs are replaced with appropriate locational signals which avoid inefficient use of the network and unnecessary investments.

3. The ultimate goal of this program, to which CEER wants to commit itself in close collaboration with other stakeholders and the European Commission, would be to create a fair level playing field for the IEM where all market parties could act on the basis of sound and effective economic signals for the wider benefit of European electricity consumers and where domestic network tariffs would provide in principle the access to the entire IEM transmission network.

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1 "Proposal of the Council of European Energy Regulators to accelerate the liberalization of the European energy market (January 2001)". The document contains 14 guidelines concerning harmonization of national tariffs, the inter-TSO payments scheme, congestion management and development of trans-European networks. See appendix 1.

CEER considers this as a highly ambitious goal, but believes that a practical approach is possible. In this approach, the focus should be on the development of markets according to their needs, subject to appropriate regulatory oversight within accepted broad principles, including the principle of subsidiarity.

The inter TSO-payment scheme

4. ETSO is ready to implement a temporary, one year mechanism for inter TSO-payments (the 2002 mechanism) by March 1st. 2002, based upon the conditional approval of the European Commission and CEER. The necessary implementing contracts between ETSO-members have or will be signed shortly and, were appropriate, national regulatory approvals are under way.

5. In this document a set of more specific and precise guidelines is set for the mechanism for 2003 and beyond. These guidelines are developed by CEER on the basis of extensive consultations with ETSO and other stakeholders, since the May 2001 Florence Forum[2].
   The document therefore provides the conceptual framework for ETSO to take and prepare for the necessary actions for implementation. CEER does not consider it to be her role to participate in these actions, but does have a role in their further assessment and verification in relation to the conceptual framework. CEER is also available for further advice when the choice of implementing options has a significant impact on the overall outcome of the scheme. CEER expects action to start immediately after the next Florence Forum[3] and invites ETSO to present a detailed timetable for these actions (including the necessary CEER-review) and their full completion and approval by October 1st. 2002.

Statement of conclusions on the mechanism:

6. The mechanism will be based on the inter-TSO payment concept, as agreed in the Florence process. Its implementation will take place no later than January 1st 2003. The mechanism is meant to compensate those countries[4] that incur into extra costs because of cross-border flows, while at the same time the mechanism charges those countries that are responsible for these costs.

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2 These consultations were held on the basis of CEER guidelines and principles contained in the document "Proposal of CEER to accelerate the liberalisation of the European energy market (January 2001)" and the further explanatory document "Guidelines for an inter TSO-payment scheme (February 2001)". Both documents are appended as appendix 1 and 2.

3 February 21st./22nd. 2002.

4 Country and TSO will be used here without any distinction.

7. For compensation of the costs mentioned in paragraph 6, inter-TSO payments will be used and no cross border tariffs. The net outcome of the inter-TSO payments should result in changes to the domestic transmission tariffs in the different countries.

8. Inter-TSO payments are required because of two reasons:
   a. losses that take place in a country because of the existence of cross-border transactions and loop flows.
   b. utilisation of the networks of other systems because of cross-border transactions and loop flows.

9. The mechanism will apply to the 16 countries that presently participate in the IEM, i.e. the 15 EU countries plus Norway. Special arrangements will be established with Switzerland and the perimeter countries outside IEM. The application of inter-TSO payment system to any country, inside or outside the IEM., is conditioned to its acceptance and implementation of the basic rules of transmission open access, as expressed in the EU Electricity Directive.

10. The mechanism consists of three basic steps:
    i. determination of the *compensation* that is due to each TSO because of the costs that are incurred by cross-border flows
    ii. determination of the *charges* that each TSO has to pay in order to compensate others
    iii. application of the *net balance* of compensation and charges of each TSO to its internal network users as a modification of their corresponding network tariff: G for generators and L for consumer loads.

Step 1: Determination of the compensation that is due to each country on the basis of the external use of its network.

11. The compensations shall be based on the costs of losses and the costs and benefits of the use of the networks that result from cross-border transactions, transits and loop flows[5]. In principle the methods to determine the recognised losses and network utilisation will treat the existing networks and the future lines in the same way.

[5] Compensations because of losses associated to cross-border transactions and loop flows are included in the inter-TSO payment mechanism. This does not preclude the use of short-term loss signals within the different countries.

Once the methods to determine the recognised losses and network utilisation are adopted and quantitative results are obtained, the final compensation rules will be defined. In these rules, thresholds will be used for the external use factors[6]. These thresholds could be different for existing networks compared with those for new investments. In determining the thresholds, the benefits of the external network use should be taken into account.

12. To gain acceptance, any compensation or charge that is derived from the scheme must be based on common standards of cost for each type of transmission facility that must be applicable in the 16 IEM countries. The cost of energy to be used in the determination of the compensations due to losses should be based on a standardised approach. Those common standards are applied only for the purpose of this scheme.

13. Allocation methods of losses and network utilisation on the basis of "real network models", -i.e. an accurate representation of the topology of the networks-, will be preferred, once it is shown that they provide results that are superior to the simplified rules of the 2002 mechanism[7]. These methods will be used both to compute compensations and charges. "Real network models" can also provide an automatic verification of the definition of the horizontal network for each country. Such models are presently available and ready to use, although there are still some regulatory choices to be made in their implementation, including the way compensations and charges for losses are computed with real network models.

14. Obtaining the data to feed real network models represents a significant effort, since the required information is not presently available in the required format and must be verified for consistency. Implementation of the mechanism by the specified deadline will require a careful specification of the required resources that are devoted to this task and a timetable indicating when the results must be made available.

15. The implementation of the mechanism requires that satisfactory solutions are found for the treatment of DC links and perimeter countries.

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6 See CEER guidelines 5, 7 and 8. It is to be noted that CEER considers the concept of "external use factors" as an acceptable implementation of its guideline 8.

7 CEER has however an open mind as to the use of other methodologies, for instance as developed on the basis of the study commissioned by the CREG and the Swiss Energy Office

Step 2: Determination of the charges that must be applied to each country because of its responsibility in the extra costs of other countries' networks.

16. It is desirable to obtain the charges as a sub-product from step 1 when allocation algorithms that are based on "real networks" are used. This kind of algorithms ensures that charges for each country are based on the volume of its imports, exports and its location in the IEM transmission network.

Step 3: Application of the net balance of compensation and charges of a country to its internal network users.

17. The amount from which the transmission tariff modifications in a given country will be computed is the result of netting out the compensations that are due to the country and the charges to the country because of its responsibility in the extra costs incurred by other countries.

18. The resulting modification to the existing G and L tariffs of the considered country, so that the above mentioned net amount is fully charged or credited to the country, cannot be transaction-based, i.e. it cannot depend on the specific transactions that the market agents within that country are engaged in. It is recommended that, if the net amount happens to be a payment, it should be debited to the L tariffs in importing countries and to the G tariffs in exporting countries. If the net amount happens to be a credit, then it should be used to reduce the L tariffs in exporting countries and the G tariffs in importing countries. These specific recommendations are still open to discussion. In any case, selective allocations on the basis of commercial transactions should be forbidden: surpluses or deficits must be applied to all the G tariffs or to all L tariffs or to both of them[8].

19. CEER and ETSO will establish a joint procedure for the annual ex-post verification of the mechanism with due regard to the subsidiarity principle.

Related issues

20. As to the important related, but seperately treated issues, CEER is ready:
    - to undertake further work and initiatives with ETSO and other stakeholders on the existing guidelines on congestion management and their monitoring review and further development where necessary.
    - to participate in discussions with the European Commission and other interested parties on the harmonisation of tarification structures, including appropriate and relevant signals and incentives to market parties.

8 See CEER guidelines 2 and 6.

Proposal of the Council of European Energy Regulators to accelerate the liberalisation of the European energy market

The Council of European Energy Regulators (CEER) has as a main objective the promotion of the internal energy market.
With respect to electricity, the CEER considers that the introduction of measures to facilitate intra-community trade is a matter of high priority.
To this end a combination of four action-lines are proposed for immediate consideration and implementation:

- The harmonisation of national transmission network tariff systems.
- The introduction of a permanent inter-TSO payment scheme for cross border transits[1].
- The development and implementation of a EU-wide market-based congestion management scheme for relieving congestions that limit cross border transmission.
- The active promotion of Trans-European Networks and the requirement for transparent and public reliability and planning transmission standards.

After some introductory remarks, each of these four action lines will be developed in this paper into a set of 14 comprehensive guiding principles[2]. However, each guiding principle will have to be implemented individually within its own time-frame and according to national regulatory procedures. While implementation of some principles by regulators or other national authorities is straightforward, application of other principles requires further discussion in order to define workable implementation schemes. Full implementation of the principles described below should be achieved before January 1, 2002.

Introductory remarks

Network pricing schemes in each Member State have been designed principally to cater for domestic electricity trading. Substantial differences between network fees in different Member States exist due not only to different investment policies, but also to different cost definitions and different tariff structures. As a result, network users across Europe are charged different tariffs for network connection and usage, something which can hardly be considered either economically efficient or fair within the framework of a single energy market. Furthermore, in some cases, lengthy interconnection access and tariff negotiation procedures increase the net transaction costs of trading across one or more borders.

The electricity network in Europe emerged following the interconnection of several national or regional supply systems for their common benefit in terms of lower costs and higher reliability. The physical

[1] The CEER underlines that the temporary system as agreed upon at the 5th Florence Forum meeting should and can be implemented immediately.
[2] The "Commission pour la Régulation de l'Electricité et du Gaz " (Belgium) does not agree to principles 3, 5 and 8. It considers that, as a principle, all the costs associated with cross-border transmission have to be considered. The maintenance, operation and capital costs of the part of the existing network used by external parties together with the costs of losses and new investments attributable to the external users have to be included into the inter-TSO payment scheme. Therefore, no special treatment for clearly defined existing networks should be included in the list of guiding principles.

interconnection alone might cause loop flows in the interconnected networks, which are amplified as transits by the increasing trading activities across Europe. The current system of national transmission tariff structures fails to take into account either the benefits or the costs of interconnections in a systematic way and, as a result, does not provide economically efficient and fair pricing signals across Europe. Changes to the current system are necessary to remove distortions and send clear economic signals to market participants, including TSOs. In so doing, such reforms will help ensure that a genuinely single European energy market develops.

The development of a single European energy market requires the implementation of transparent and non-discriminatory network access terms; efficient, market based methods of congestion management; and, where it is efficient to do so, the construction of new interconnection capacity. New capacity where it is efficient can, in the first instance, be funded by congestion rents; any surplus over investment costs could be used to lower tariffs generally. Where new investment cannot be funded through congestion rents it may be appropriate to use the TENs (Trans European Networks) programme though it must be stressed that such funding should not act as a barrier to private investment. Either way, congestion rents must not become windfall gains to the TSOs. Moreover, the development of a single European energy market also requires the development of new interconnectors and the reinforcement of existing ones towards the periphery of the EU.

To ensure that trade is genuinely competitive and not distorted, it is essential that network charges are cost reflective. Charges can, however, only be cost reflective if based upon the electrical realities of the European network. The CEER proposes that a set of marginal loss factors be calculated at borders, based upon calculation of nodal prices. To implement this proposal, a Europe-wide load flow modelling capability needs to be developed. This is a key role for the association of European Transmission System Operators (ETSO). The CEER calls upon ETSO to develop, as soon as practicable, this capability.

In order to ensure the efficient and reliable functioning of the interconnected European electrical system under new trading arrangements, appropriate rules relating to system security and reliability, taking into account specific national network structures, must be developed and put in the public domain. ETSO should take a lead in this process.

Guiding principles for the development and implementation of a EU-wide transmission network tariff system

The general condition

¡Error!Marcador no definido. **Independence of TSOs**

In order to ensure confidentiality and non-discrimination, any Transmission System Operator (TSO) belonging to a vertically integrated electricity company must, as a minimum requirement, have an unbundled legal, administrative and managerial structure, clearly separated from trading activities.

Harmonisation of the national tariff systems

¡Error!Marcador no definido. **Network tariffs should be non-transaction based**

Network tariffs should not depend on the nature of the commercial transactions involved, both for domestic and for cross border transmission.

¡Error!Marcador no definido. **Economically efficient locational signals should be based on charges for network losses**

Generators and loads should be charged on the basis of marginal losses, which can be done either through electricity nodal pricing or through separate explicit charges to cover losses which typically will be differentiated by location, by connection voltage level and by time-of-day/season to reflect variations in the level of losses. Individual control areas will not be required to implement nodal pricing but nodal pricing will be used to calculate marginal loss factors at border areas. These loss factors will be applied to energy flows at borders and used to calculate the inter-TSO payments made under guideline 5. Charging generators and load on the basis of marginal losses will result in net revenues which should be applied towards covering infrastructure network costs.

¡Error!Marcador no definido. **Network infrastructure costs should be mostly charged to loads**

Network infrastructure costs to be covered through transmission charges are the costs associated with network assets, net of any revenues from loss charges, congestion charges or inter-TSO charges/revenues. On the assumption that generation is more sensitive than load to differences in transmission charges, the most economically efficient way would be to recover all such costs through a charge on load. This is the present situation in the majority of Member States. However, where the geographical imbalance between generation and demand is very high, putting the network under stress, it is considered fair to allocate to generators more of the infrastructure costs than what would be implied by the extra revenues associated with losses and congestion charges. In order to create a level playing field for generators, their share of total network infrastructure costs should not exceed 25%.

Inter-TSO payments scheme

¡Error!Marcador no definido. **The inter-TSO payment scheme should only consider losses and new investments**

As a underlying principle, no other costs should be attributable to cross-border transmission beyond the costs of losses and justifiable new investments.

¡Error!Marcador no definido. **The allocation of inter-TSO payments or revenues on national network tariffs should be harmonised**

Payments and revenues from this scheme should be allocated to all network users and be fully compliant with the general principles for transmission network tariffication. As a result, it is recommended that payments be debited to all L's in importing systems and all G's in exporting systems and to use revenues to credit all L's in exporting countries and all G's in importing countries. In so much as the system allows any flexibility, it is important that selective allocations are forbidden: surpluses(deficits) must be applied to all G or all L or both.

¡Error!Marcador no definido. **New investments considered under the inter-TSO payments scheme require unambiguous rules**

Unambiguous rules should be developed in order to identify those reinforcements which are – totally or partly – justified on the basis of loop flows and transits. Such investments will be referred to as CBT investments.

One or more TSOs may propose an investment for consideration as a CBT investment. The responsibility to make planning decisions about CBT investments should be clearly allocated to one or more parties, which will be commercially accountable for that decision. The costs of the CBT investments should be shared among those parties benefiting from them, according to rules yet to be developed by CEER and ETSO. New CBT investments should, in the first instance, be funded through congestion rents. There may also be a role for the European Commission's Trans-European Networks (TENs) programme where expected congestion are insufficient or there is market failure and private finance cannot be raised.

¡Error!Marcador no definido. **Infrastructure costs for clearly defined existing networks**

TSOs operating systems which are used for transit or loop-flows may have part of their existing network costs compensated by other TSOs. This can be achieved either via the inter-TSO payment scheme as an exemption from guideline 5 when incremental flows from CBT are disproportionately large in comparison to domestic consumption and precisely because of their peculiar situation, or through bilateral or regional arrangements. The compensation mechanism must not distort trade within the internal market.

ETSO should propose to regulators the harmonised rules upon which exemptions should be based. Regulators will assess the rules and the proposed exemptions in relation to the distribution of the total L & G tariffs across Europe and to the benefits the exempted network offers to all network users. To be exempted the volume of transits alone will not be regarded as a sufficient criterion. In addition, a large proportion of network flows will have to be from external parties for a TSO to be able to claim an exemption. An evaluation of the benefits to the TSO

claiming exemption that may be derived from the existence of the interconnection and transit flows should also be taken into account.

Congestion Management schemes

¡Error!Marcador no definido. **Public standards and rules**

TSOs should provide non-discriminatory and transparent standards outlining the congestion management methods they will apply and under what circumstances; these methods should comply with the guidelines set out in the conclusions of the Sixth Florence Forum which are being further developed by the European Commission and the CEER. These standards should be described in open and public documents. The rules should deal with short-run congestions in an economically efficient manner whilst simultaneously providing incentives for efficient network and generation investment in the right locations.

¡Error!Marcador no definido. **Use of congestion rents**

Congestion rents should be used for redispatching or counter trading in order to comply with the firmness of the capacity which was made available. Where economically efficient new interconnection investments can take place, these should be funded in the first instance from the surplus from existing and anticipated congestion rents and losses. In contrast, where new investments would not be economically efficient, despite an interconnection being congested, then congestion rents should either i) go to fund upgrades elsewhere that *are* economically efficient and will enhance cross-border capacity; or ii) be returned through reduced G and L charges. Under no circumstances should congestion rents become windfall revenue for the TSOs. Finally, all new CBT investments should be subject to conditions which ensure competitive and non discriminatory access, including financial as well as physical access rights and use-it-or-lose it provisions.

¡Error!Marcador no definido. **Information exchange**

TSOs should implement appropriate co-ordination and information exchange mechanisms. These are essential for providing fair and secure access to networks within the EU internal electricity market. TSOs should publish all relevant data concerning cross-border transfer capacities. In addition to winter and summer available transfer capacity values which the TSOs currently publish, estimates of transfer capacity for each day should be published at several time intervals before the day of transport. A minimum requirement should include the provision of accurate week-ahead estimates to the market. TSOs should also endeavour to provide month-ahead information. A description of the firmness of the data should be included. The TSOs should publish a fully justified general scheme for calculation of the total transfer capacity and the transmission reliability margin based upon the electrical and physical realities of the network (total transfer capacities should not be net of contracted flows). Such a scheme should be subject to approval by the regulators of the respective Member States.

¡Error!Marcador no definido. **Principles and procedures to develop and implement Congestion Management Schemes**

Network congestion problems should be addressed with market based solutions and should give appropriate price signals to both market parties and TSOs. Price signals should be directional. In the short term, implicit and explicit auctions together with cross border coordinated redispatching are the most feasible methods. Explicit auctions should be based on the guidelines agreed upon at the Sixth Florence Forum meeting. Specific arrangements should be decided bilaterally on the basis of these rules. A joint Working Group of the European Commission, the CEER, TSOs, and Member States should examine these arrangements and should, together with other interested market parties, develop proposals for structural market based solutions in the course of 2001. A combination of market splitting and counter trading is to be explored as the route to be developed with a view to full implementation when the internal energy market has been fully set up.

Trans-European Networks and reliability standards

13. Trans-European Networks

Using the powers given by the EU Treaty, the European Commission should actively promote the development of Trans-European Networks (in particular the development of the interconnectors required for the effective integration of peripheral countries to the internal electricity market) applying appropriate financial, administrative and political instruments. Regulators are willing to co-operate with the European Commission on the identification of existing or potential bottlenecks.

14. Security and reliability standards

A comprehensive set of security and reliability standards to be observed by TSOs and network users should be developed and put in the public domain in order to ensure the efficient and secure functioning of the interconnected system and appropriate quality of electricity supply, taking into account specific national network structures.

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COUNCIL OF EUROPEAN ENERGY REGULATORS

GUIDELINES FOR AN INTER-TSO-PAYMENT SCHEME

Discussion Paper for Technical Consultations

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1 Introduction and background

1.1 *Scope of the paper*

The Council of European Energy Regulators (CEER) has as a main objective the promotion of the internal energy market. With respect to electricity, the CEER considers that the introduction of measures to facilitate intra-community trade is a matter of high priority. To this end a combination of four action-lines are proposed for immediate consideration and implementation:

- The harmonisation of national transmission network tariff systems.
- The introduction of a permanent inter-TSO compensation scheme for cross border transmission[1].
- The development and implementation of a EU-wide market-based congestion management scheme for relieving congestions that limit cross border transmission.
- The active promotion of Trans-European Networks and the requirement for transparent and public reliability and planning transmission standards.

This paper describes the principles, guidelines and subsequent clarification comments, which shall provide direction to the development and implementation of a permanent inter-TSO payment system for cross border transmission (CBT) and which are provided for discussions with stakeholders.

The “Commission pour la Régulation de l’Electricité et du Gaz “ (Belgium) does not agree to principle 2 and guidelines 1 and 3. It considers that, as a principle, all the costs associated with cross-border transmission have to be considered. The maintenance, operation and capital costs of the part of the existing network used by external parties together with the costs of losses and new investments attributable to the external users have to be included into the inter-TSO payment scheme. Therefore, no special treatment for clearly defined existing networks should be included in the list of guiding principles.

1.2 *Cross Border Transmission*

The interconnected power system in Europe shall provide the basis for a competitive and reliable internal electricity market. The physical power flows crossing the borders of the interconnected systems are partly caused by cross-border trading activities, but may also result from parallel flows and inadvertent energy exchange.

The transmission service provided by the various TSOs in order to enable this physical exchange of electric energy across the systems facilitates the internal energy market. This service is referred to as cross border transmission (CBT). The following guidelines shall provide guidance to the development and implementation of a tariff system to cover the costs associated with the provisions of this CBT.

[1] The CEER underlines that the temporary system as agreed upon at the 5th Florence Forum meeting should and can be implemented immediately.

1.3 *Basic assumptions*

The Florence process has demonstrated quite clearly that there is hardly one single best solution to solve the CBT tariff problem. The CBT tariff structure must be based on sound principles of engineering and economics, while meeting the legitimate interests of the different stakeholders in the EU Internal Electricity Market: consumers, producers, traders, TSOs, power exchanges and being in agreement with the regulatory policies of the European regulators.

2 The purpose of an inter-TSO payment system

2.1 *General*

Before implementing a permanent system for CBT, it is important to discuss the relationship between the inter-TSO payment scheme and the 'domestic' transmission tariffs. The major reason to have a separate inter-TSO payment system next to the 'domestic' transmission tariff system is to enable cross-border trade in a pan-European system of different national transmission pricing schemes. The inter-TSO payment system, combined with the domestic transmission tariff structure, shall provide appropriate long-term and/or short-term signals to the network users. While doing this, it also provides a fair allocation of costs among the various network users in all the Member States. In this way, generators and loads shall contribute to the overall network costs, not only to the costs of their 'own' network.

In principle there are three options for the structure of a CBT tariff system:

A: NO SEPARATE INTER-TSO PAYMENT SYSTEM AT ALL

This would result in a system consisting of individual 'domestic' network tariff systems for each TSO, with each one considering its own costs and its own physically connected network users. Such a system would not reflect any costs or benefits caused by 'foreign' network users.

B: SEPARATE INTER-TSO PAYMENT SYSTEM

A separate tariff system would be developed for exports, imports, and/or transits. Exports, imports and transits would need to be defined based on physical flows, rather than on commercial trade. It is important to note that – according to the basic criterion stated above - all network users would be charged their respective tariff component resulting from the inter-TSO payment system, irrespective of their commercial transactions. The inter-TSO tariffs can therefore be regarded as another element of the connection-to and use-of-network charge.

C: A MULTI-SYSTEM TARIFF SYSTEM

For all or part of the transmission network costs (existing assets, new assets, losses and congestions) a multi-system tariff system would be developed. In theory, only one tariff system would exist, considering the connection and use of the entire EU-wide transmission network. Although this would be the theoretically most advantageous approach, it would hardly be realistic since it requires substantial harmonisation EU-wide.

The permanent approach shall provide substantial advantages to option A.

2.2 *Efficient long-term and short-term signals for the network users*

In general, each network user should pay the costs that are attributed to him with an efficient cost allocation procedure. In a regional context, in general this means that the allocation should consider the entire region. The charges to be finally allocated to the network user in the regional context may be higher, lower or also equal compared to the charges obtained from the isolated network.

Presently, domestic transmission charges have been developed and implemented in the different countries. These tariff systems reflect the costs in the domestic network, but they ignore the regional (multinational) context. Due to the tariff differentials between the various countries, the current tariffication methodology provides – and this is mostly unintended – locational long-term and short-term signal to the network users across the entire system. These signals result from the different tariff structures, different accounting and regulatory principles, etc. and do not necessarily promote an economically efficient use and expansion of the entire network. The pricing signals provided by the inter-TSO tariffs should contribute to better and more economic efficient pricing signals across the system.

2.3 *Cross-border transmission costs*

In order to discuss the above-mentioned issues about an economic efficient inter-TSO payment system, it is necessary to define what the potential CBT costs are. Generally, one can define four groups of costs:

- Total costs (capital and O & M costs) of the existing Horizontal Network, which are partly or fully used for CBT.
- Total costs (capital and O & M costs) of the fraction of new assets, used by CBT.
- Variable costs (losses) in the entire network, caused by CBT.
- Costs associated with the management of congestions, caused by CBT.

It is very difficult and sometimes arbitrary to determine the fixed and variable costs in the network, caused by CBT. That is why the final approval on the nature and the amount of the costs to be included in inter-TSO payment system is left to the discretion of the regulatory authorities, although the basic transmission pricing principles establish the basis for this approval (see Appendix 2). It must be also noted that physical imports, exports and transits not only cause costs, but may also cause direct and indirect benefits to the agents of each particular system. For example, investments can be saved and losses can be reduced by CBT. It is therefore often easier to develop one single comprehensive tariff system, reflecting the costs of all flows in the network, rather than to distinguish between ‘domestic’ transmission and CBT. This is particularly valid for losses.

3 The transitory approach

The transitory approach that was supposed to be implemented by October 1st 2000 means a significant advance with respect to the present situation. The existing national charges to cross-border transactions will be abolished, therefore eliminating pan caking and facilitating trade. However, as a result of a difficult compromise, the transitory approach has also important shortcomings. This is why it was agreed at the 5th Florence meeting the development of a sound permanent approach that could overcome the weaknesses of the transitory approach as much as possible.

The major weaknesses of the transitory approach are the following ones:

- Most regulators question the basis of the approach, that is, the acceptance of compensations of partial costs of the existing horizontal networks attributable to cross-border trade. The approach is based on the complex determination of the costs of the horizontal network and it requires a complex settlement procedure. Most important is that it assumes that transits always cause extra costs and neglect the fact that transits may lead to benefits. The reasons for this position are presented in Appendix 2.
- Several parties share the costs of a fund. This reduces the accountability of each TSO for the size of the fund and creates additional difficulties for efficient regulation of the TSOs.
- The allocation key that is used to charge TSOs is flawed, as not only exports but also imports should be included and location factors should be taken into consideration.
- Harmonising criteria are needed with respect to the application of the net outcome of compensations and charges for a TSO to its network users.
- The treatment of losses does not produce economically efficient results.

4 Guidelines for an inter-TSO payment system

The following sets out the general principles and guidelines in sufficient detail to provide a framework for ETSO to develop and propose a more elaborated inter-TSO payment system for implementation. The principles described in this document are principles applicable to network tariff systems in general and having particular relevance for cross-border transmission. The guidelines are specific provision for the inter-TSO payment system. CEER will review the ETSO proposal for assessment and approval on the basis of these principles and guidelines.

GENERAL PRINCIPLES

Principle 1: Network tariffs should be non-transaction based

Network tariffs should not depend on the nature of the commercial transactions involved, both for domestic and for cross border transmission.

Principle 2: Economically efficient locational signals should be based on charges for network losses[2]

Generators and loads should be charged on the basis of marginal losses, which can be done either through electricity nodal pricing or through separate explicit charges to cover losses, which typically will be differentiated by location, by connection voltage level and by time-of-day/season to reflect variations in the level of losses. Individual control areas will not be required to implement nodal pricing but nodal pricing will be used to calculate marginal loss factors at border of the control areas. These loss factors will be applied to energy flows at borders and used to calculate the inter-TSO payments made under Guideline 1. A possible methodology is described in Appendix 3. Charging generators and load on the basis of marginal losses will result in net revenues, which should be applied towards covering infrastructure network costs.

Principle 3: Network infrastructure costs shall be mostly charged to loads

Network infrastructure costs to be covered through transmission charges are the costs associated with network assets, net of any revenues from loss charges, congestion charges or inter-TSO charges/revenues. On the assumption that generation is more sensitive than load to differences in transmission charges, the most economically efficient way would be to recover all such costs through a charge on load. This is the present situation in the majority of Member States. However, where the geographical imbalance between generation and demand is very high, putting the network under stress, it is considered fair to allocate to generators more of the infrastructure costs than what would be implied by the extra revenues associated with losses and congestion charges. In order to create a level playing field for generators, their share of total network infrastructure costs should not exceed 25%.

THE INTER-TSO PAYMENT SYSTEM

Guideline 1: The inter-TSO payment scheme should only consider losses and new investments

As an underlying principle, no other costs should be attributable to cross-border transmission beyond the costs of losses and justifiable new investments.

Guideline 2: New investments considered under the inter-TSO payments scheme require unambiguous rules

Unambiguous rules should be developed in order to identify those reinforcements, which are – totally or partly – justified on the basis of parallel flows and transits[3]. Such investments will be referred to as CBT investments.

One or more TSOs may propose an investment for consideration as a CBT investment. The responsibility to make planning decisions about CBT investments should be clearly allocated to one or more parties, which will be commercially accountable for that decision. The costs of the CBT investments should be shared among those parties benefiting from them, according to rules yet to be

[2] At least losses shall be taken into consideration for providing short term locational signals. Other short term signals (by e.g. congestion management) may be taken into account as well.

[3] In this context parallel flows and transits refer to all physical flows across borders.

developed by CEER and ETSO. New CBT investments should, in the first instance, be funded through congestion rents. There may also be a role for the European Commission's Trans-European Networks (TENs) programme where expected congestion are insufficient or there is market failure and private finance cannot be raised. Clarification comments are provided in Appendices 4 .

Guideline 3: Infrastructure costs for clearly defined existing networks

TSOs operating systems, which are used for transit or parallel flows, may have part of their existing network costs compensated by other TSOs. This can be achieved either via the inter-TSO payment scheme as an exemption from guideline 1 when incremental flows from CBT are disproportionately large in comparison to domestic consumption and precisely because of their peculiar situation, or through bilateral or regional arrangements. The compensation mechanism must not distort trade within the internal market.

ETSO should propose to regulators the harmonised rules upon which exemptions should be based. Regulators will assess the rules and the proposed exemptions in relation to the distribution of the total L & G tariffs across Europe and to the benefits the exempted network offers to all network users. To be exempted the volume of transits alone will not be regarded as a sufficient criterion. In addition, a large proportion of network flows will have to be from external parties for a TSO to be able to claim an exemption. An evaluation of the benefits to the TSO claiming exemption that may be derived from the existence of the interconnection and transit flows should also be taken into account.

Guideline 4: Harmonisation of Inter-TSO tariffs

Payments and revenues from this scheme should be allocated to all network users and be fully compliant with the general principles for transmission network tariffication. As a result, it is recommended that payments be debited to all L's in importing systems and all G's in exporting systems and to use revenues to credit all L's in exporting countries and all G's in importing countries. In so much as the system allows any flexibility, it is important that selective allocations are forbidden: surpluses (deficits) must be applied to all G or all L or both. [4]

Further planning

Based on these principles, guidelines and clarifying comments, ETSO shall develop and propose a more elaborated CBT tariff system for implementation to CEER. The general process is indicated below.

- ETSO shall submit a proposal for the elaborated CBT tariff structure before the spring Florence Forum in 2001.
- CEER will review, assess and approve the ETSO proposal on the basis of the guiding principles and the boundary conditions as agreed on the 6th Florence Forum.
- ETSO shall review its proposal on the basis of the comments and response from CEER and shall present a final draft before the autumn Florence Forum in 2001.
- The final system shall be implemented and be operational on 1st January 2002.

[4] The inter-TSO payment scheme may lead to additional payments and revenues of the TSOs. The TSOs may allocate only the annual net payments or revenues to its network users via additional inter-TSO tariffs. The inter-TSO-tariffs shall support the overall harmonization process of transmission tariffs and lead to economic efficient signals across the entire European system.

Appendix 1 Short Glossary

Cross Border Transmission (CBT)
The transmission service provided by a TSO, resulting from all physical flows across borders, including imports, exports and transits.

CBT investments
An investment in a new network and control assets, required to enable CBT and compliant with guideline 2.

Inter-TSO payment scheme
A payment scheme between the TSOs, reflecting the benefits and costs associated with enabling CBT.

Inter-TSO tariffs
Part of the network user tariff structure, reflecting the net revenues or costs to a TSO as a result from the Inter-TSO payment scheme.

TSO
TSO (Transmission System Operator) refers to one or more operators of the national transmission systems in the Members States.

Appendix 2 Review of principles of transmission pricing

The fundamental principles of transmission pricing are presented in this appendix in a very schematic way. Transmission pricing is the allocation of the regulated annual revenues of the transmission activity to the network users. Transmission pricing encompasses two types of economic signals: long-term & short-term signals.

Short-term signals are nodal prices (i.e. geographically differentiated short-term marginal costs). Nodal prices implicitly include the effect on prices of losses & congestions. They send adequate signals for decisions concerning the economic operation of generators & loads. Strict application of nodal prices results in a net amount of revenues, which should be applied to partly pay for the cost of the network. However, these funds are usually very insufficient to cover the total network costs (cost recovery by nodal prices typically does not exceed 20% of total transmission costs).

Additional long-term signals result from the necessity to recover the remaining transmission network costs. These costs have to be assigned to the network users so that distortion of economic efficiency is minimised. These long-term signals can also be meant to inform new generators and loads about the transmission network costs incurred when they locate in one part of the network instead of on another one. Then, two non-conflicting criteria can be used to allocate these costs:

- According to the first criterion, the remaining transmission network costs should be considered to be sunk costs. The most efficient way of allocating sunk costs so that economic distortion is minimised is to use the principles of Ramsey pricing (allocate the costs to the network users according to the inverse elasticity rule).

- The second criterion is to send price signals that induce the network users to adopt the same long-term decisions (what to invest, when and where to locate the investment) that they would have adopted under central planning. Then, conceptually, the solution is to charge in proportion to the benefits that the transmission network provides to each one of the users. Some measure of electrical use is typically a reasonable approximation (and much easier to compute) than benefits. Note that those who most benefit are the ones more willing to pay, so the second criterion is not in opposition with the first one in general terms.

Application of the general principles.
The application of these general principles will be examined now. These are some basic criteria:

- If the transmission network is well meshed and there are no clear locational signals to be sent, then the beneficiaries of the network are not defined clearly. The inverse elasticity rule (i.e. Ramsey pricing), in a context of competition on the generation side, advises to charge sunk costs mostly to consumers (generation in a competitive environment is very elastic to prices), and more to the least elastic consumers.

- If the transmission network is such that long-term locational signals are needed, -because of systematic structural limitations of the network-, then the allocation of transmission sunk costs should be used to send these signals. Note that these long-term signals are no longer useful for existing generators and loads; they are meant to promote adequate siting of the new facilities. However, because of basic non discriminatory criteria, all network users must be subject to the same charges.[5] Note that it does not matter how much of these charges is recovered through generators and how much through consumers (in general, if there is serious competition in generation, the consumers will end up paying the entire bill). What matter are the differences in charges among generators when they are placed in different locations, so that they have the right incentive to locate in the network and, similarly, the differences in charges among consumers.

These criteria are equally valid in an international context. At the multi-system level, one may also want to send signals in order to indicate the most appropriate and inappropriate zones to locate new generation and load. If the problem is a serious one, for instance, if installation of new generation in a zone will require the development of international reinforcements, then the long-term signals are needed. If these signals are computed using the existing network and trying to determine how much each country uses (or benefits from) the networks of other countries, then one will arrive to a procedure where the cost of the horizontal network of each system will be allocated to its national & international users. However, the inconveniences of this approach may overcome its advantages, as it will be discussed below.

Conclusions.

Long-term locational signals at individual system level. At a single country level, in those countries where there is little connection between future network reinforcements and siting of new generation and demand, i.e. in those countries where it is deemed that there is little need for long-term locational signals in transmission, sunk transmission costs may be allocated to generators and consumers without any geographical differentiation. This seems to be the case in most EU Member States. In those countries where long-term location signals appear to be adequate (e.g. England & Wales, Norway or Sweden), transmission charges may have geographical differentiation.

Long-term locational signals at international level: Conceptually, it is correct to send long-term locational signals at international level. This is exactly the reason why the cost of future reinforcements, when caused by international trade, should be shared by the systems that benefit from them and result in the need for inter-TSO payments. This guarantees a fair allocation of the cost of future reinforcements and therefore removes potential obstacles to the construction of these facilities. It is more questionable to use the cost of existing facilities to build the long-term signals, because of several pragmatic reasons:

[5] Note that signals derived from losses and congestions are short-term ones; they cannot generate the complete revenues for the required investment since: a) in general they will be too weak for that, due to the typical over-investment in transmission; b) these signals will typically be much reduced, -even almost disappear-, once the reinforcement is built.

- The EU network has not been built -and it is not currently planned- as a single network, and the agreed cross-border tarification scheme does not start from a uniform EU-wide connection charge, but from a patchwork of G_ks and L_ks. Under these circumstances, it may be more reasonable to leave the job of sending locational signals to congestion management, losses and the assignment of costs of future investments. Besides, the additional long-term signal would be diluted in the present differences between the national connection charges.
- The signal may require a large volume of inter-TSO payments, what could generate political opposition, as well as windfall profits for some systems, whose network was designed mostly for domestic trade.
- The need for such long-term signals at international level within continental EU has yet to be proved[6].

Since this was an open issue that required a regulatory input, in the course of the present study the members of the WGCBT were asked to give their opinion on whether some costs of the existing network should be considered or not in the economic compensations between TSOs. The answer of the majority of the members of the WG was that no other costs of the existing network, beyond the (short-term) costs of losses and congestions, should be considered in the EU Internal Electricity Market.

One last -and fundamental- conclusion from the basic principles concerns harmonisation of the internal allocation within each TSO of the net outcome of any economic compensations at TSO level. It has been clearly seen that the nature and the purpose of these compensations is to provide long-term signals for location in the network. Then, the allocation of inter-TSO payments at national level *must be transaction-independent*. A simplified[7] rule that is in agreement with the basic principles is the following one: in exporting (importing) countries a positive net inter-TSO payment should be charged to *all* generators (consumers). Similarly, in exporting (importing) countries a positive net inter-TSO revenue should be credited to *all* consumers (generators). (A justification to this rule is provided separately at the end of this appendix).

Inter-TSO compensations that are derived from losses require a separate discussion, but the conclusion is the same. The economic signals derived from the application at TSO level of the resulting allowances (compensations minus charges) should reflect the effect that nodal prices or loss factors[8] would have on the network users at TSO level. Nodal prices apply to all network users, regardless of the commercial transactions.

Justification of the recommendation of charging any possible net payment of a TSO (for instance, because of sharing the cost of a new investment) to *all* generators when the TSO is exporting and *all* the consumers when the TSO is importing.

[6] Another matter is the need for short-term signals related to congestions, which is absolutely clear.

[7] It is a simplification to treat each country as a single exporting or importing node. It is clear that the simplification can be improved by conveniently dividing some countries into several importing and exporting areas.

[8] Network congestions are ignored here.

There are several reasons why a TSO may incur in some net payment (or receive a credit) that must be assigned somehow to its network users:

a) Bilateral compensations between neighbouring countries because of losses.
b) Sharing the cost of future investments between several TSOs.
c) Exceptional compensations to some "comparatively small and heavily transited" TSOs.

First, it will be shown that, regardless the reason behind the net payment (or credit) for a given TSO, the charges to be applied to its network users in order to recover this cost (or to receive the credit) must be independent of the nature of the commercial transactions of these network users. Next, it will be shown that, also regardless of the reason behind the net payment (or credit), the charge (credit) must be applied to *all* generators whenever the TSO is exporting and to *all* consumer entities whenever the TSO is importing.

The two basic cases where payments among TSOs may take place will be examined separately. The first one is compensations because of losses. The second one is compensations related to infrastructure: future investments and exceptional transitory compensations.

A. Compensation of losses.

The economic signals derived from the application at TSO level of the resulting net allowances, -compensations minus charges of the loss compensation mechanism (see Appendix 2)-, should reflect the effect that nodal prices or loss factors[9] would have on the network users at TSO level. Nodal prices apply to all network users, regardless of the commercial transactions.

What effects would losses have on the network users? Start with a reference situation with multiple interconnected TSOs where, for simplicity, it will be assumed that each one has a single market price (instead of multiple nodal prices). In the absence of congestions and network losses, and with fully developed international trading mechanisms, the market prices for all TSOs should be the same. With congestions and no losses, there would be several subsets of TSOs separated from one another by congestions and where the prices of the TSOs in any subset would also be the same.

The effect of adding losses to this reference model would roughly be to lower the market price in the exporting TSOs and to increase the price in the importing TSOs. Of course the relative location of the TSOs also matters. Then, in order to represent approximately the same effect with the modifications to G & L because of inter-TSO payments, one should apply the following rules:

- If the allowance is negative (compensation < charge), i.e. the TSO has to pay more than to receive:
- In exporting TSOs charge the allowance to generators (increase G).
- In importing TSOs charge the allowance to consumers (increase L).
- If the allowance is positive (compensation > charge), i.e. the TSO has to receive more than it has to pay.

[9] Network congestions are ignored here.

- In exporting TSOs apply the allowance to consumers (reduce L).
- In importing TSOs apply the allowance to generators (reduce G).

B. Compensation of some infrastructure costs.
In this case the rule is a consequence of the procedure that is adopted to allocate the compensation due to a TSO (e.g. because of a new investment in this TSO that is benefiting also other TSOs, or because of an exceptional compensation) to other TSOs.

According to the conclusions of the 5th Florence meeting, the allocation procedure should be based on some measure of both the importing and exporting activity of each TSO, taking into account location factors. Ignoring location factors for the sake of simplicity (see in Appendix 3 how they can be accounted for), a good measure of the importing and exporting activity of a TSO k would be to obtain the sum Sk of the absolute values of the net hourly physically measured exports or imports for one year, based on historical data.

Therefore, it is clear that, when the TSO k is a net exporter, it is the generators within the TSO k the ones to be charged, and equivalently for the loads when the TSO k is importing. And the charge must be applied to *all* generators or to *all* loads, since network charges must be independent on commercial transactions. All generators within TSO k are equally responsible of the existence of a net export flow out of TSO k, when the network is contemplated from a EU-wide perspective.

In conclusion, in exporting (importing) countries a positive net inter-TSO payment should be charged to all generators (consumers). Similarly, in exporting (importing) countries a positive net inter-TSO revenue should be credited to all consumers (generators).

Appendix 3 Example of a EU-wide tariff structure for losses

It is desired to determine a loss mechanism that sends adequate location signals and compensates, when needed, for CBT incurred losses.

Background.
The CEER proposal on Harmonization concludes, -regarding losses-, that **"***generators and loads must be charged for the losses each one of them is responsible for*. This implies charging *on the basis of marginal losses*, what can be done either through electricity nodal pricing or through separate explicit charges to cover losses, which typically will be differentiated by location, by connection voltage level and by time-of-day/season to reflect variations in the level of losses. Charging generators and load on the basis of marginal losses will result in net revenues, which should be applied towards covering infrastructure network costs. The CEER may consider whether the principles upon which losses are charged should be harmonised".

At the 6th Florence meeting, it has been expressed the need to consider the transmission network at European level and, when necessary, to make use of EU-wide power flows. The WGCBT has clearly indicated in the answers to the questionnaire that: a) losses should be considered and, ideally, EU-wide nodal prices or loss factors should be applied at each node of the transmission network; b) while this is not possible, it is recommended to use adequate approximations but only if they can be implemented by the TSO with reasonable effort in a reasonable time frame; c) the use of a general compensation fund should be avoided.

In summary, the objective is that the individual generators and consumer entities receive loss signals depending on where they are located and their inputs to or outputs from the network, and that the individual systems (TSOs) receive an adequate compensation for the losses incurred in their networks and that they have to provide. The mechanism of economic compensations should be based on bilateral transactions and not on a common compensation fund.

The proposed approach.
The proposed methodology is based on the concept of EU-wide nodal pricing but the specific procedure to be used, at least in a first phase of implementation, does not require the application of nodal prices –neither at national nor EU-wide level–. It does not require the existence of an EU compensation fund, either. The presentation of the proposed methodology is done in two steps. First, a conceptual reference situation with full regional nodal pricing will be described, so that the fundamentals of the method are understood. Second, a valid approximation of the reference case to the present conditions of the EU Internal Electricity Market is proposed as the recommended procedure.

A. The conceptual reference case.

The reference case is characterized by[10].

- A well-defined regional transmission network, RTN. See figure 1 for a schematic representation of a regional transmission network encompassing several countries.
- A centralized algorithm that computes nodal prices just for the RTN.
- While some countries use nodal pricing internally, other countries do not.

Under these conditions, the recommended procedure to deal with losses is the following one:

i) Apply nodal prices at the nodes of the RTN (generators are paid and consumers pay nodal prices). This results in:
   - Complete application of short-term economic signals to all users of the RTN (both to users directly connected to the RTN and, if the countries pass the signals internally, to all users).
   - A net revenue NNR (nodal net revenue), which should be used to reduce total charges of the RTN to its users. The problem now, in a regional context, is how to allocate these revenues to each country. Note that, if we ignore congestions, NNR only consists of charges related to losses. Any "compensations" between countries because of losses must be implicit in NNR.

ii) Consider now the existing political borders. Now, in each country c apply nodal prices both at the internal nodes of the RTN and also at the new nodes that have been created at the borders between country c and the neighboring countries (see Figure 1). The result is a nodal net revenue NNRc for country c.

iii) It is obvious to check that the sum of the NNRc for all countries c in the region is the total NNR calculated before. The amount of the total revenues NNR of the RTN that corresponds to country c is precisely NNRc.

iv) Some entity[11] collects NNR by applying nodal prices to all physical flows entering or exiting the RTN. This amount is distributed as NNRc to every country.

> *Note that, in the steps above, all nodal prices could have been split into two components: a production component (common for all prices) and a loss factor, which is different at each node (network constraints are ignored here)[12]. For each country the production component, when applied to each internal node and the flows at the borders, results in an economic loss that is equal to the value of its internal losses when valued at the production component. On the other hand, the application of the loss factors for each country, -both at the internal nodes and the borders-, results in revenues for the country approximately equal to double of the economic value of losses. Therefore, there is a net surplus -after recovering the cost of losses- approximately equal to the economic value of losses, which can be used to pay for a part of the network costs. More specifically:*

[10] The situation described here is not fictitious. It corresponds to the on-going implementation of the regional market in Central America, involving six countries: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama.

[11] The Regional System Operator, in the Central American case.

[12] The split cannot be defined in a unique way. It depends on the choice of the "slack node" that is necessary to make when computing the loss factors.

Revenues R_A of system A because of losses:

$$R_A = \sum_k PN_{INTk}(D_{INTk} - G_{INTk}) + \sum_k PN_{BORk}(EXP_{BORk} - IMP_{BORk})$$

where PN_{INTk} is the nodal price at any internal node k of system A, PN_{BORk} is the nodal price at any node k where the regional transmission network crosses any border of system A, D_{INTk} and G_{INTk} are the withdrawals of power at the internal nodes of system A, and EXP_{BORk} and IMP_{BORk} are the export and import physical flows measured at the borders of system A.

If the nodal prices are decomposed into a single market price and node-specific loss factors LF, then the system experiences a net economic deficit equal to the total volume of transmission losses in the system times the market price. On the other hand, application of the loss factors results in a net revenue:

$$\sum_k LF_{INTk}(D_{INTk} - G_{INTk}) + \sum_k LF_{BORk}(EXP_{BORk} - IMP_{BORk})$$

which is approximately equal to twice the total volume of transmission losses in the system times the market price. It is important to notice that the second term in the expression above accounts for all the contribution from neighboring countries to the losses in system A and that it can be easily expressed in terms of bilateral transactions with the neighboring systems to system A.

B. The present case of the EU Internal Electricity Market.

The EU case is characterized by:

- A regional transmission network, RTN, still to be defined precisely. Interconnections of the RTN between countries are well defined.
- No centralized algorithm to compute nodal prices for the RTN exists, and there are no immediate plans to have one.
- A few countries use some kind of zonal pricing internally, while most of the countries do not use nodal pricing at all. Some countries use or have proposed to use loss factors internally.

It is possible to arrive to a result that is quantitatively equivalent to the result of the conceptual reference case, without having to resort to a central institution or to a regional fund where NNR is collected before being distributed to each country. How can this be done?

i) Leave to subsidiary the possible application of regional nodal prices at the internal nodes of the RTN in each country and concentrate on the net payments that, because of losses[13], the nodal pricing mechanism above has established that the countries are supposed to make to one another.

ii) Look only at the nodal prices and the physical flows at the new fictitious nodes at the political borders between the countries. Decompose the nodal price at each one of these new nodes into: a) the regional marginal cost of generation[14]; b) the loss factor at the node[15]. Then, it suffices that all pairs of neighboring countries determine the amount that one of them will compensate to the other, based on the measured physical flows between the two of them and the loss factors at the corresponding points of the common border.

More specifically, the bilateral compensation between two neighboring countries can be computed from the following expression:

$$\sum_{k} LF_{BORk} \ (EXP_{BORk} - IMP_{BORk})$$

where all the loss factors LF_{BORk} must be computed at European level.

The computation of all loss factor at European level introduces a technical complexity in the determination of the compensations between neighboring countries. The problem would not exist with an EU-wide power flow, from which the loss factors in all nodes of the regional transmission network could be calculated, and a single slack node ("slack Europe") would be used in all computations. But, presently, it is more frequent to have available zonal power flows, involving only a subset of countries (e.g. Scandinavian countries, France plus the Iberian peninsula, etc.). In this situation, it is suggested to use the following expression[16], which allows to refer the computation of all loss factors in a border to a nearby "slack of the zone" and then refer all these loss factors to the European reference slack by the use of a single factor for all of them:

$$1 + LF_{EUROPE\ k} = (1 + LF_{ZONE\ k}) \ . \ (1 + LF_{SLACK\ ZONE/SLACK\ EUROPE})$$

[13] Congestions are ignored, since only the loss component of the nodal prices (and not the eventual congestion component) is of interest here.

[14] When a centralized regional market operator exists, some characteristic node may be defined as the slack and the marginal cost of generation and all loss factors may be referenced to it. Otherwise, as it is the case in the EU Internal Electricity Market, it is recommended to concentrate on the computation of the loss factors directly and to leave to the commercial transactions the decision of the generation price to be used in these exchanges.

[15] As the nodal prices are computed at regional level, so it must be done with the loss factors. This requires the selection of a slack node at regional level, so that all loss factors are computed with the regional slack node reacting to all incremental changes in generation or demand. A simplification may be to compute the loss factors within a zone (e.g. Scandinavia, Iberian peninsula, England & Wales, Northern Continental Europe, etc.) and then refer all of them as a block to the regional slack node.

[16] The proof for this expression, as well as the properties of the decomposition of nodal prices into a market price component and a network component, can be found in the paper "Computation and decomposition of spot prices for transmission pricing", M. Rivier, I. J. Pérez-Arriaga, Proceedings of the 11th Power Systems Computation Conference (PSCC), Avignon, France, September 1993.

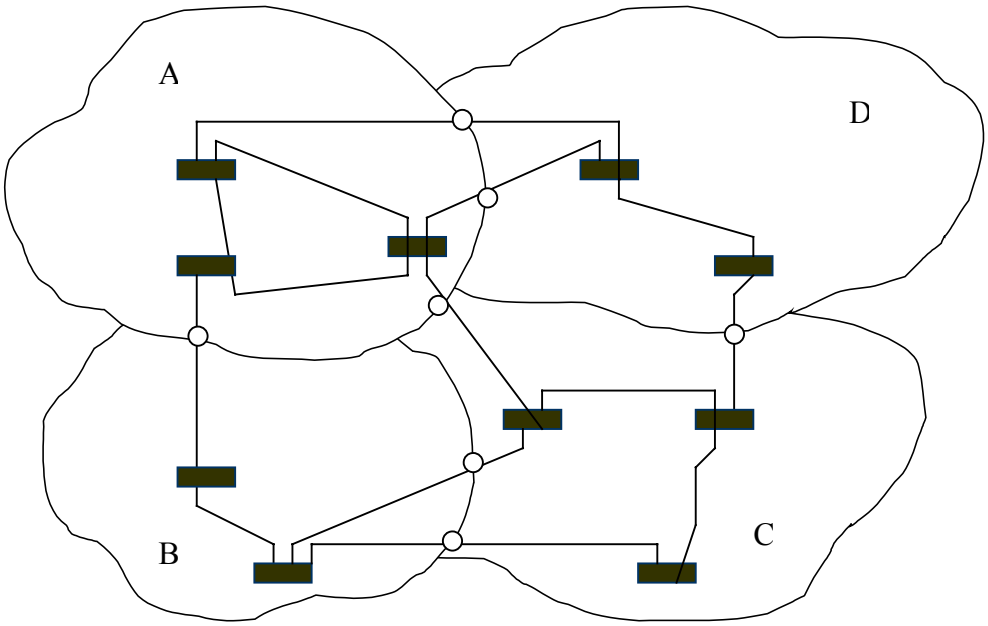

Figure 1 The regional transmission network RTN.

Appendix 4 Identification of New CBT Investments

The problem

It can be stated that the transmission networks of the various TSOs in the European Union are well developed from a national point of view. However, most of these networks have been designed to facilitate the transmission of energy in the respective domestic markets and also to ensure some technical support from neighbouring countries in case of emergency. In general, these networks have not been developed to facilitate international trade. As a consequence, the emerging international trade has disclosed the existing of systematic bottlenecks in the new transmission system. These bottlenecks have been described and identified by the UCTE.

Besides to these systematic bottlenecks, there are also occasional bottlenecks, which emerge and disappear in the network. It is one of the central issues related to CBT to determine how both the systematic and the occasional bottlenecks can be relieved in an economically sensible way.

The lack of economic incentives at Members State level to build network reinforcements that also benefits agents in other member states is one of the most significant problems of an efficient CBT structure. Developing cost allocation rules for these investments cannot be easily achieved as several countries may have to be involved. It is not clear who should propose the construction of these reinforcements, who should built them and, finally, who should pay for them, given that several – even not neighbouring – countries are involved in the process.

Non-economic issues are sometimes a more serious threat to the development of an efficient transmission network than the above-mentioned economic issues. These issues relate to environmental impact, lack of political willingness or regulatory impediments of different kinds. Institutional support at EU level is absolutely necessary in those cases where reinforcement projects run into this kind of problems.

The general theoretic solution to the economic problem is that all economically justified transmission network reinforcements shall be built (i.e. the long term costs of the new investments are less than the avoided sum of losses and congestions costs). In practice, this solution is more difficult than it seems on a first sight. Congestion rents, for example, will disappear when a new investment is built and losses will change as well. It is therefore difficult to attract enough capital from congestion rents to finance a new CBT investment. Simplifications and assumptions are required when applying this theory in practice. The remainder of the appendix shall offer some preliminary clarification on this issue.

What is a CBT reinforcement?

The cost of any reinforcement could be allocated among the TSOs who benefit from it. This would result in a situation where the cost of a reinforcement is distributed among the TSOs and where TSOs would – preferably – add this cost to the rate base of their own networks tariffs. This may result in a fund system for CBT investments.

To discuss this question it is important to analyse what a CBT reinforcement actually is.

- A CBT reinforcement may consider only reinforcements between the borders of different TSOs , e.g. it relates to tie lines.
- CBT reinforcements may also include reinforcements deep in the horizontal networks of the TSOs. These have to be clearly identified and accepted as CBT reinforcements by the stakeholders.

The partly compensation of specific reinforcements deep in the horizontal network leads to the well-known debate of deep versus shallow entry/exit costs. Specific charging for network reinforcements deep in horizontal networks requires that the beneficiaries of that reinforcement are unambiguously identified. This usually is a very complex and arbitrary exercise. Even more, the beneficiaries of a specific investment may change during the course of time. Further, new CBT investments and extra costs may occur when existing parties disconnect from the network or physical imports, exports or transits are reduced. Who shall pay for these costs?

The issue is very similar to the connection cost issue. Due to the difficulties associated with the application of the 'deep entry/exist costs' approach, most TSOs decided to apply the 'shallow entry/exist costs' methodology. Only costs associated wit the direct connection, i.e. the 'radial' facilities, are charged for a new connection. Costs associated with reinforcements deep in the horizontal networks are only applied in very special cases. Taking today's practise of connections costs as a reference for new CBT investment costs, it may seem appropriate to include only shallow CBT investments into the inter-TSO payment scheme. Shallow CBT investments are defined as investments interconnecting two or more transmission systems of TSOs, i.e. cross border network assets.

Who is responsible for system expansion

The remaining, probably most fundamental issue related to new investments in the pan European electricity network is to determine what party is economically accountable for the most economic efficient expansion of the entire system. Taking account of the conclusions attained in section 2.2, it may be stated that each TSO is responsible for the expansion of its own network, irrespective whether the network is used for domestic or CBT. Exemptions to that rule may be allowed. More critical is the identification of the party who is economically accountable for investments at the borders between the TSOs. For example, the two TSOs the new tie line is physically connecting, could have to make the investment and would be economically accountable. It seems that some arrangements are necessary - either developed by the TSOs themselves or enforced by CEER – to define who shall be economically accountable.

In each horizontal network a TSO has the responsibility to ensure that trade is possible. He shall provide efficient transmission capacity to facilitate all desired trades. This responsibility is usually enforced by economic incentives making the TSO accountable for his investment or non-investment (e.g. auctions, counter trade) decision to relief bottlenecks. The same obligation shall be required at the borders.

For example: three interconnected systems A, B, and C provide a joint market place. A bottleneck occurs between A and B. Who will take the costs of relieving this bottleneck and who shall make the decision of new investments? A procedure needs to be developed which unambiguously allocates the costs of this bottleneck to the three parties and which allocates the costs of a new tie line.

Summary

The following provisions shall clarify the issue of defining new CBT investments:

- Usually only the costs related to new investments at the borders between TSOs may be considered CBT costs.
- New investments in horizontal networks of the TSOs shall usually not be considered a CBT investment. Declaration of reinforcements in the horizontal network as CBT costs requires special approval of the CEER.
- New CBT investment costs can be funded by several or all TSOs and form part of the inter-TSO payment system.
- Unambiguous rules and procedures need to be developed to identify the party, parties or organisations accountable for ensuring 'unconstrained' trade across the borders of TSOs. This body / these bodies shall be economically incentiviced, e.g. shall share some of the costs and benefits associated with keeping or relieving bottlenecks at the borders.