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ENERGY REGULATION BRIEF

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# ELECTRICITY TRANSMISSION PRICING: THE EUROPEAN PERSPECTIVE

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How can anyone trade electricity, without ultimately being able to transmit it? The EU Directive on the internal electricity market came into force in most Member States on 19 February 1999.[1] Electricity markets are being developed, or are already active, all around Europe. However, whilst *trading* opportunities are increasing rapidly, traders still find it difficult to *transmit* power to, from and between these markets, especially when cross-border movements are involved.

In May 1999, in Florence, Italy, European electricity regulators and transmission system operators (TSOs) discussed the pricing of electricity networks. The *draft* Communiqué circulated at the end of this conference[2] set down some guidelines for future transmission prices in Europe. The Communiqué advocated certain approaches and instructed European TSOs to develop some proposals. If adopted, these proposals will have a profound effect on the opportunities and margins available to electricity companies and traders. However, the Communiqué remains subject to debate.

This brief summarises recent NERA research into the structure of charges for electricity transmission around the world. We begin by reporting the results of a comparative investigation into the level of transmission charges in key markets.

## The Level of International Transmission Tariffs

NERA reviewed the transmission pricing systems current in May 1999 for nine jurisdictions in Europe, Australia and the United States. The results are shown below.

**Table 1**
**International Comparison of Network Access Tariffs as of May 1999**
**(US cents per kWh)** [1]

| Country | Transmission EHV (130-350 kV) | Transmission HV (40-130 kV) | Distribution (1-40 kV) |
|---|---|---|---|
| England and Wales[2] | 0.24 | 1.31 | 1.47 |
| France | 0.71 | 0.91 | 1.47 |
| Netherlands | 0.71 | | |
| Norway | 0.34 | 0.36 | 1.07 |
| Spain | 0.85 | 0.98 | 1.34 |
| Sweden | 0.14 | 0.45 | 0.99 |
| Victoria[3] | 0.43 | 0.36 | 1.12 |
| California | | 1.85 | 2.31 |
| Massachusetts | | 0.25 | 4.09 |
| Average | 0.49 | 0.81 | 1.69 |
| Assumed peak load (MW) | 50 | 30 | 5 |
| Assumed average annual load | 74% | 74% | 60% |

1. *Source: NERA analysis. EHV refers to extra high voltage, HV to high voltage. "Transmission" includes charges for generation and load. Distribution tariffs include transmission charges.*
2. *For the case of England and Wales, transmission tariffs are taken from the National Grid Company. Distribution tariffs are for SWALEC.*
3. *The EHV transmission figure for Victoria lies somewhat above the HV transmission figure because (1) the per kWh component of the EHV figure is based on the average energy price across transmission supply points; (2) the HV figure is based on the network tariffs of one particular company (AGL); and (3) it is unclear which transmission supply points are used by AGL.*

[1] EU Directive 96/92/EC. In Belgium and Ireland the Directive will enter into force one year later, and in Greece two years later.

[2] "Third Meeting of the EU Electricity Forum, Florence 20th-21st May 1999, Conclusions of Regulators and Member States".

These results show wide variation in network charges. However, these variations are not in general caused by differences in efficiency. Instead, they reflect – and highlight the importance of - tariff-setting methodology.

## Desirable Characteristics for Transmission Prices

The draft Communiqué maintains that transmission tariffs should abide by the principles of cost reflectiveness, transparency and non-discrimination, and should respect national and Community competition rules. These principles are widely accepted but what do they mean in practice?

Prices can "reflect costs" in many different ways. To promote *economic efficiency, social welfare* and *least-cost operation*, prices should ideally reflect *marginal* costs. However, transmission networks consist of long-lived investments subject to economies of scale. In these conditions, marginal costs are difficult to define. Setting prices by some definitions would (at best) offer no incentive for efficient investment and (at worst) bankrupt the transmission company. Transmission prices must compromise between signalling short-run marginal costs and offering *reasonable assurance of cost recovery over the long-run*, or else the industry will not function efficiently.

"Transparency" (or "simplicity") allows everyone to understand how tariffs are calculated. Predictable tariffs assist long-term planning and also reduce the "*transactions costs*" of organising a power trade.

Network tariffs need to abide by the principles of competition policy. Any network company may be penalised for *abusing a dominant position*, whether by charging excessive prices, by discriminating between users, or by acting in a predatory manner.[3] In Germany and Austria, practically the *only* regulation of network pricing is through the principles of competition law.

In addition, decisions about transmission charges are constrained by *social objectives*, such as the costs of public service obligations (PSOs), the desire for a national uniform tariff or (conversely) national policies to favour particular consumer groups. Interactions between PSOs and the EU Directive will be subject to European Treaties and laws.[4]

European regulators therefore operate within many constraints in setting transmission prices. Below, we discuss how transmission prices will meet their aims, by considering the following questions:

1. *What costs* are included in transmission revenues?
2. *What is the structure of charges* that determines how much a network user pays for transmission (eg by usage, capacity, direction of flow…)?
3. *Who pays* the network charges – generators, distribution companies, traders or consumers?
4. *How do transmission charges vary by location*, if at all, to reflect variations in transmission losses, congestion on the network ("constraints") and the voltage of connection?

## Costs Included in Transmission Revenues

In Spain, the Netherlands and the US, charges for use of the network include the costs of transition (including stranded costs) and other social policies.[5] The same costs are sometimes recovered through other non-avoidable charges (such as the fossil fuel levy in England and Wales). The level of transmission charges may therefore vary from one jurisdiction to another – but only because customers pay the same costs in different ways.

[3] Such behaviour is prohibited by European Law. The German Federal Cartel Office recently issued a decision requiring network companies not to discriminate in favour of their own trading businesses.

[4] EU Directive 96/92/EC, paragraph 18 of the preamble.

[5] As of the summer of 1999, the European Commission was appraising proposals from six Member States for recovery of stranded costs using criteria applicable to "state aids".

## The Structure of Charges

Most "cost-reflective" network tariffs include a high proportion of capacity (kW) and fixed (monthly or annual) charges, rather than energy (kWh) charges. More controversial is the nature of the service offered by a network. At the European level, debate is raging over the choice between "transactions-based" tariffs and "point-of-connection" tariffs.

A "transaction-based tariff" is specific to a particular *sale of power* from a named seller to a named buyer. Examples include various "point-to-point" tariffs and "distance-related pricing". The German industry agreement of 1998/99 ("Verbändevereinbarung") adopts a "distance-related" tariff, but the draft Communiqué rules out "transactions-based" charges. Of the systems in our survey, only Massachusetts has adopted this approach.

Every other network in our survey uses "point-of-connection" tariffs, ie tariffs that depend on the characteristics of the *individual seller or buyer*. They allow anyone connected to a network to trade with anyone else connected to the same part of the network. Point-of-connection tariffs reduce the transactions costs of making a deal, which tends to promote competition and efficiency. However, annual tariffs rarely reflect the cost structure of long-term investments in transmission as accurately as a contract that is long-term (and transferable).

The European Commission has yet to consider the kind of capacity reservation schemes familiar to observers of the US gas and electricity sectors.

## Who Pays Network Charges?

Most point-of-connection tariffs are divided between generation and load components, with load paying the larger share in all cases. Sometimes, network companies do not levy charges on existing generators, in case a contribution towards non-marginal "sunk" costs would distort despatch and trade.[6] Both generators and load may still be required to pay the marginal costs of connecting to the network.

In the draft Communiqué, the European Commission appears to have rejected the idea of a separate tariff component for "transit" (ie for "wheeling" power right across a network). However, transit flows do sometimes affect the costs of generation, due to losses, congestion or loop flow. The draft Communiqué therefore asks the TSOs to prepare a proposal for identifying and settling such costs by the end of October 1999, in time for the next meeting of the regulators' conference. Any such proposal will have to adopt a specific view on the allocation of costs *by location*. This is one of the most disputed areas of network tariff design.

## Variation by Location

Some network charges include an allowance for the extra generation costs caused by *energy losses* and *network congestion*, which vary by location. Other systems recover these costs through an electricity pool.[7] The number of options is in any case limited.

Most systems allocate transmission and distribution losses to consumers at an average rate, although generators embedded in distribution networks may be rewarded for reducing losses.[8] Network congestion involves more difficult decisions in any liberalised electricity system but is essentially dealt with in one of two ways: *zonal pricing* or *counter trading*.[9]

*Zonal pricing* breaks up a network into a number of separate markets or "zones", each with a different price; traders must then pay a fee to move power from one market to another.[10] Traders may pay to lease transmission capacity between two markets (as between England and France). Alternatively, system

6 Charging sunk costs to load (consumers) is generally more efficient, becase their behaviour is less price-sensitive ("less price elastic").

7 Where available, we have included information on losses and congestion in our cost comparisons.

8 For a discussion of the factors relevant to allocation of physical losses, see NERA, *Allocating Transmission Losses: Methods and Criteria, A Submission to the Design and Implementation Steering Group*, 24 February 1999.

9 For a discussion of the merits of the two systems, see NERA, *Efficient Transmission Pricing in Norway and Sweden*, February 1997 (also available via the Harvard Energy Policy Group).

10 "Nodal pricing" is a specalised variant in which every point of connection has a different price. Nodal pricing has been applied in New Zealand and the PJM (Pennsylvania - New Jersey - Maryland) Power Pool.

operators may set a short-term toll per kWh, to auction the available capacity (as in Norway, California, New York and the PJM Power Pool). The draft Communiqué anticipates specific charges for DC interconnectors and "severe flow-gates", which would effectively divide Europe into a number of markets, each with a distinct price. Member States would be free to decide how to allocate scarce transmission capacity using any transparent method (auction, first-come-first-served, pro rata, etc).

In a *counter-trade* system (as used in England/Wales and Sweden), there is only one market for electricity. If traders sell too much power over a network constraint, the TSO makes an offsetting trade in the opposite direction (a "counter-trade"), to bring actual flows in line with available capacity. This counter-trade usually makes a financial loss, which has to be recovered. In England/Wales and Sweden, the transmission company meets some or all of the loss out of a fixed revenue, so it has an incentive to invest in alleviating constraints. Their tariffs incorporate cost signals that encourage generation and load not to worsen congestion.

The TSOs must now work out how to allocate among themselves the costs of counter-trades caused by loop flow at a European level. The TSOs must decide whether to share the costs widely, or to charge them to those traders who cause them. Unless the costs of loop flow are identified and allocated transparently, it will be hard to provide incentives for efficient trading. In practice, identifying such costs would benefit from zonal pricing of electricity, or the creation of more electricity markets, as experience in Scandinavia and the US demonstrates.

## Where Next?

There seems to be broad agreement that the bulk of network costs should fall to load (distribution companies and consumers), rather than to generation or transit, to avoid distorting despatch and competition in the electricity market. The main item of concern to consumers is the absolute level of charges, which depends on the level of stranded costs, the cost of social obligations and the treatment of transmission constraints. In the end, all these decisions will be a matter of local choice, based on the economic principles of regulation and social policy.

For efficiency, network tariffs must reflect variation in transmission costs at different locations and voltages. These cost differences are important at a European level and require explicit recognition of transmission constraints. However, not everyone has access to information about transmission constraints, especially in the short-term. Some attempts to provide "cost-reflective" price signals by location will undoubtedly bring allegations of *discrimination*. Answering such allegations will require close examination of the costs of electricity transmission and local market prices.

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