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IMPACT OF REGULATORY ENVIRONMENTS ON INVESTMENT DECISIONS AND TRANSMISSION

Working Group
C1.6

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C6.1

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EXECUTIVE SUMMARY

Efficient operation and investment in electricity transmission plays a critical role in energy markets by enhancing the reliability of supply, reducing risks of trade and enhancing competition. Transmission companies should therefore have strong incentives to account for their impacts on the energy market and invest to an adequate level in the network. An appropriately conceived incentive framework combined with a regulatory framework that provides certainty is crucial to achieving these outcomes.

Transmission companies are natural monopolies and are therefore regulated by the local, regional or national regulator. Economic regulation of such companies seeks to create the same outcomes as delivered by competitive markets;

- The demands of customers should be met at the lowest possible price.
- Firms that are more efficient should be rewarded through higher profits, while customers ultimately benefit through lower prices and better service as these higher profits are competed away, over time.

A regulatory design must be sufficiently robust to meet both the goals of providing sustained incentives for firms to improve efficiency whilst also providing sustained and demonstrable benefits to consumers. A truly effective and sustainable regulatory regime therefore seeks to *align,* rather than trade-off, the interests of consumers and regulated companies.

With the liberalisation and re-regulation of electricity supply industries worldwide, investment decisions in the transmission network have to take into account the expectations and regulations set by Governments and Regulators. Planners need to take into account the expectations of customers in terms of quality of supply and reliability of supply and the expectations of generators to provide unconstrained access, ensuring that the regulatory authorities are satisfied with the efficacy of the proposed investments while meeting the expectations of the various shareholders/stakeholders in terms of rates of return and profits. Transmission Planning requires a mix of engineering, financial, economic, legal and political skills. CIGRE Study Committee C1 set up a working group, C1-6 to investigate the impact of regulatory environments on investment decisions.

In order to understand the impact of regulatory environments on investment decisions, a questionnaire was developed requesting feedback on the following points:

- Identify the changes in the capital/revenue expenditure regulatory environment in various parts of the world and the impact this has had on the capital available for system development.
- Identify any shortfall between the capital/revenue expenditure requested and that allowed, the reasons for any shortfall and the type of projects not allowed.
- Identify the changes in system investment planning guidelines to respond to changes in the regulatory environment.
- Identify the impact that these changes have had on:
    a) revenue available for developing/managing the system
    b) system investment incentives
    c) system maintenance incentives
    d) customer satisfaction
    e) level of system security/reliability
    f) transmission design

The following is a summary of the factors that one needs to consider when determining an appropriate regulatory framework and system planning guidelines;

- Limited knowledge by regulators and their independent consultants during the investment review process often results in transmission projects being delayed.
- Insufficient returns on assets allowed by regulators limit the transmission company's ability to fund new projects.
- The non-recovery of the costs of stranded transmission assets creates greater pressure on transmission companies to ensure robust transmission plans.
- Regulators who have not clearly defined the future course of regulation, create greater uncertainty for investment by transmission companies.
- Regulation has resulted in the planning guidelines becoming more transparent with clearly stated analysis and justification techniques.
- There is no perfect regulatory framework. The development and application of performance indices coupled with formal investment criteria as well as considerable regulatory judgement is an inevitable component of a sound regulatory process.

Thirteen countries responded to the questionnaire. Twelve of the countries which responded indicated that the transmission companies were regulated.

The following is a list of the key findings of the main report;

- There seems to be a trend to move towards incentive based regulation as some countries are moving over to either the price cap or revenue cap regulation. The companies which are currently regulated via the price/revenue cap typically have a 3-5 year regulatory period, whilst those subject to the rate of return regulation have a one year regulatory lag period.
- Most of the regulated transmission companies have a regulatory framework under which the regulator reviews and approves investment in transmission. Many companies believe that the regulators and their consultants do not share the same detailed knowledge and expertise as the transmission planners when making decisions regarding prudent capital expenditure. This has in many instances caused a delay in the timing of investments.
- Many companies also believe that the regulators do not allow sufficient returns on their assets and thus the company's investment planning guidelines have had to be revised (e.g. account for losses for those not done so before) to ensure adequate return on investments. This also creates additional strain on the transmission companies who need to raise capital to fund new projects.
- The non-recovery of stranded assets has created additional financial risk to the transmission companies, thus making the transmission planning process to be more thorough in the evaluation of proposed projects.
- In countries where the regulator has clearly defined the future course of regulation, the transmission companies find it relatively easy to raise capital for new projects and the planning guidelines are revised to fall in line with the regulatory framework.
- When the regulator decides to reduce the level of capital allowed for new projects, refurbishment projects are the ones most likely to be postponed, which has an impact on the future transmission plans. Postponement of refurbishment leads to higher operating expenditures.
- It is critical that changes in the capital/revenue expenditure regulatory framework create the correct signals for investment in the transmission network, which is why the treatment of capital expenditure by the regulator is important. Transmission companies, whose

capital expenditure is treated as a pass-through during the regulatory period, generally do not have any problems making investments and their projects are seldom postponed since any under or over-expenditure does not form part of their allowed revenue. Unanticpated transmission investments poses additional financial risk to the transmission company concerned, especially in the case where transmission investment is not treated as a pass-through. Transmission planning guidelines have thus had to become much more robust and flexible to account unplanned investments.

- Regulation has resulted in the planning guidelines becoming more transparent with clearly stated analysis and justification techniques. Long term strategic direction and investment principles must also be clearly stated especially where restructuring of the electricity industry is being considered. Regulatory decisions are reflected in the transmission planning guidelines through compliance with reliability and quality of supply targets as set out by the regulator.
- Transmission planners need detailed information on the timing, magnitudes and locations of new generating units. The co-ordination between generation and transmission planning, especially in the liberalised industries, has been reduced although in some countries this has brought the transmission and operational planning closer together. This has created greater emphasis on transmission planners;
  - to obtain accurate data and perform detailed sensitivity analysis
  - consider the best cost effective solutions to connect generators and customers as fast as possible
  - ensure that the transmission plans are practical
  - to provide public sound information on the optimal siting of generation from the transmission system point of view.
  - the need for probabilistic planning techniques.
- Regulatory pressure to reduce losses and eliminate congestion, has resulted in a re-evaluation of existing investment planning criteria. The regulator has created incentives such as allowing additional capital expenditure and setting target levels for transmission losses. Congestion costs are now taken into account by the majority of transmission planners as only a few utilities (such as in France and the U.K.) used them before liberalisation.
- There is currently no regulatory framework that can effectively govern transmission investment. The development and application of performance indices coupled with formal

investment criteria as well as considerable regulatory judgement is an inevitable component of a sound regulatory process.

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1. INTRODUCTION

Efficient operation and investment in electricity transmission plays a critical role in energy markets by enhancing the reliability of supply, reducing risks of trade and enhancing competition. Transmission companies should therefore have strong incentives to account for their impacts on the energy market and invest to an adequate level in the network. An appropriately conceived incentive framework combined with a regulatory framework that provides certainty crucial to achieving these outcomes.

Transmission companies are natural monopolies and are therefore regulated by the local, regional or national regulator. Economic regulation of such companies seeks to create the same outcomes as delivered by competitive markets;

- The demands of customers should be met at the lowest possible price.
- Firms that are more efficient should be rewarded through higher profits, while customers ultimately benefit through lower prices and better service as these higher profits are competed away, over time.

A regulatory design must be sufficiently robust to meet both the goals of providing sustained incentives for firms to improve efficiency whilst also providing sustained and demonstrable benefits to consumers. A truly effective and sustainable regulatory regime therefore seeks to *align*, rather than trade-off, the interests of consumers and regulated companies.

With the liberalisation and re-regulation of electricity supply industries worldwide, investment decisions in the transmission network have to take into account the expectations and regulations set by Governments and Regulators. Transmission Planning requires a mix of engineering, financial, economic, legal and political skills. CIGRE Study Committee C1 set up a working group, C1-6 to investigate the impact of regulatory environments on investment decisions. This report provides a summary of the feedback from a questionnaire that was sent out and some conclusions.

In order to understand the impact of regulatory environments on investment decisions, a questionnaire was developed requesting feedback on the following points:

- Identify the changes in the capital/revenue expenditure regulatory environment in various parts of the world and the impact this has had on the capital available for system development.
- Identify any shortfall between the capital/revenue expenditure requested and that allowed, the reasons for any shortfall and the type of projects not allowed.
- Identify the changes in system investment planning guidelines to respond to changes in the regulatory environment.
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    e) level of system security/reliability
    f) transmission design

Thirteen countries responded to the questionnaire with 4 responses from Australia. Switzerland provided very little information as there is no regulator in place. The total number of responses was therefore sixteen.

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Respondents from the following countries assisted in making the project a success ;

- Australia
- Belguim
- France
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- Italy
- Korea
- Qatar
- Romania
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- Spain
- Switzerland
- United Kingdom

3. KEYWORDS

Capital expenditure, Investment, Regulatory framework, System development, System security/reliability, Incentive Based Regulation, Rate of Return, Regulatory lag, Congestion.

4. BACKGROUND TO ELECTRICITY MARKET REGULATORY REGIMES

Regulatory authorities throughout the world have developed different principles to regulate the revenues or prices of electricity network operators. In order to understand and to compare the responses to the questionnaire that have been collected by WG C1.6, it is therefore helpful to begin with an overview of different types of regulatory regimes. This is done in the sections below, where we focus on different aspects of regulatory regimes in a general way rather than describing country-specific regimes as a whole. A country-by-country analysis of the relevant principles will be given in the detailed analysis of the responses received.

4.1 TOTAL EXPENDITURE REGULATION VS. BUILDING-BLOCK APPROACH

A fundamental issue in characterising regulatory regimes relates to the degree of uniformity of the regulatory principles for different elements of a network operator's expenditure. In a total expenditure regulatory regime, one uniform principle of regulation is applied to the total of all cost elements like capital expenditure (Capex) and different elements of operating expenditure (Opex). The opposite option is that different cost elements are treated in different ways, which is referred to as the building-block approach by some regulators.

In theory, it appears logical to view total expenditure as a whole because only the total price matters from the network users' point of view. However, regulatory practice shows that it is often difficult to apply such a uniform approach because different cost elements can be influenced by network operators in very different ways and in different time frames. In particular, the level of Capex can be influenced only by investment decisions which have a long-term effect and often need significant time to be implemented, especially on the transmission level. On the other hand, cost reduction potential on Opex elements like maintenance costs can be realised at a much shorter term.

Reasons to apply different regulatory principles to different cost elements, especially on the transmission level, can be, among others:

- to avoid network operators from postponing necessary investments as a reaction to cost pressure, which can have an adverse effect on system security and reliability and on adequacy of transmission capacities;

- to incentivise cost savings on particular cost elements like cost of losses or cost of congestion management; or
- to take account of the fact that certain cost elements can not or only hardly be influenced by network operators, such as cost of regulating power for frequency control as far as the necessary reserves are already procured by market-based mechanisms.

Therefore, when a building-block approach is applied, the regulatory principles discussed in the sections below can be used in a combined way, with different principles focusing on different cost elements.

4.2 RATE-OF-RETURN VS. INCENTIVE-BASED REGULATION

Traditionally, network operators have been regulated by a "rate-of-return" or "cost-plus" regime where tariffs are derived on the basis of the actual cost of a network operator plus an allowed return on the capital engaged, calculated by a specified rate of return. Under this type of regime, network operators have no incentive to improve their efficiency because any cost reduction causes a subsequent reduction of tariffs and, consequently, a reduction of a company's return.

Therefore, over the last 2 decades, many regulators have started to introduce incentive elements in their regulatory regimes. The essential idea is to allow network operators to earn extra profit when they increase efficiency. This to an extent essentially decouples revenues from cost, for example by defining constant price levels for certain periods of time during which the companies can keep the additional profits they generate by reducing cost.

However, incentive mechanisms also require companies to declare their cost to regulators, because a complete decoupling of cost and prices is neither possible nor desired:

- On the one hand, network users can only benefit from network operators' cost reductions (i.e. increasing "productive efficiency") as far as prices are also reduced accordingly ("allocative efficiency"). Regulators have to make sure that extra profits for network operators and price reductions for network users are kept in an adequate balance. This requires an assessment of the actual cost of network operators not only at the outset of an incentive-based regulation, but also after certain periods of time which are usually known as regulatory periods.

- On the other hand, the conditions under which a network is operated change over time. This is, among others, due to changes of the network users' demand, changes of prices of the input factors for network operation, or the development of technology. A regulator can try to estimate the impact of such developments on cost for short periods, but in the longer term, it is necessary to regularly assess the actual cost development of either the individual companies or the sector as a whole.

4.3 PRINCIPLES OF COST CALCULATION AND ASSESSMENT

The calculation and the regulatory assessment of network cost which, as stated above, is required in any regulatory regime, has to follow clearly defined principles. There is usually an agreement that Opex elements are taken more or less directly from the companies' financial statements, whereas Capex is calculated based on principles that are specifically defined for the purpose of regulatory cost assessment and often differ from the requirements for financial statements. Capex is basically composed of two elements, the depreciation on assets and the cost of capital engaged. Regulators often define standardised depreciation periods, standardised rates for the cost of capital (e.g. by a "weighted average cost of capital" approach – WACC) and other parameters for the determination of Capex.

Besides defining principles and parameters for cost calculation, an essential issue in cost assessment is to decide which cost elements are taken into account for the determination of network prices:

- On the one hand, regulators usually check that only those costs are taken into account that are actually related to the network operation business. This is particularly relevant for vertically integrated utilities and for other companies that have other business units in different markets.
- On the other hand, some regulators accept that only part of total cost be included in the price calculation that is actually necessary to fulfil the supply task within a network operator's area. This can mean for example that the cost of "stranded assets" are not accepted, i.e. past investments that turn out to be unnecessary later on.

This latter aspect can carry a high risk for network operators especially when cost assessment is only done "ex-post", i.e. after decisions have been taken and the corresponding costs are

already incurred. Therefore, particularly in relation to investment decisions, many regulators require network operators to declare investment decisions and the related impact on cost in advance, so that projects can be approved or rejected by the regulator "ex-ante". By approving an investment decision, the regulator commits to accepting the related cost later on, when the project is actually implemented. The ex-ante approach is the most efficient approach currently used by regulators. In many countries, transmission investment is driven by the need to maintain the minimum reliability standards.

This approach implies two fundamental problems however: Firstly, it requires the regulator to take a part of the responsibility to decide about the adequacy of the network operators' decisions, which is usually not desired by regulators. Secondly, it implies a major problem of information asymmetry, because neither the regulator nor external experts assigned by the regulator can judge the necessity of specific investments as well as the network operator can.

4.4 PRINCIPLES OF INCENTIVE-BASED REGULATION

As mentioned earlier, the essential idea of incentive-based regulation is to decouple revenues from actual cost for a certain period of time, the "regulatory period", so that a cost reduction leads to additional profits for a network company. This can be done by defining maximum levels of either the prices for network services ("price-cap regulation") or the total revenues to be allowed e.g. within one year ("revenue-cap regulation"). In the latter case, it is up to the network operator to break down the allowed revenue to appropriate price levels.

An important difference between these two approaches relates to the implications of changes of the price-relevant output quantities like peak load or energy delivered. In a price-cap regime, changes of the output quantities leads to corresponding changes of a company's revenues, whereas in a revenue-cap regime, revenues are not affected by changes of the output quantities. In practice, none of these extremes appears to reflect the cost impact of changing output quantities correctly. Therefore, "hybrid" approaches have been developed by many regulators, which combine properties of both the price-cap and the revenue-cap regulation. An example of this can be a revenue-cap regime where the cap is however

modified during the regulatory period in a clearly defined way according to the actual development of output quantities.

Besides this impact of changing output quantities, there are other reasons why price or revenue caps are typically not kept constant during the regulatory period. Firstly, it is necessary to take account of the general development of price levels which is usually done by adjusting price or revenue caps in accordance with an appropriate price level index like the "retail price index" (RPI). Secondly, it is usually intended that network users benefit from a part of the potential cost reductions of transmission companies during the regulatory period. To achieve this, a so-called X-factor is included in the regulation formula that reflects the anticipated level of cost reduction during the period. Altogether, these factors can be combined in a "RPI – X" type formula that determines the annual adjustment of the price or revenue caps.

Some regulators divide the X factor up into two factors which reflect, on the one hand, the general productivity growth to be expected from the network sector as a whole, and on the other hand, a productivity improvement that is expected to be achieved by an individual company because of its individual efficiency level. Regulators apply different approaches to estimate the individual efficiency of companies, for example by comparing companies with each other ("benchmarking") or by running analytical cost models that design a cost-optimal network for a given supply area and estimate the corresponding cost.

An important characteristic of a price-cap or revenue-cap regime is the length of the regulatory period. The longer the period is, the more predictable is the regime from the network operator's point of view, and the more effective are its incentive properties, however if the capex is uncertain, there is a level of unpredictability. This is particularly important with a view to investment decisions because of the necessary long-term perspective of cost recovery. On the other hand, long regulatory periods can cause a large mismatch between allowed revenue and actual cost as a consequence of unforeseen developments. For these reasons, defining the length of the regulatory period requires a trade-off between different objectives. In practice, regulatory periods usually have a length between 2 and 5 years.
The incentive properties of long regulatory periods are however limited if there is significant uncertainty about the development of capex.

At the end of a regulatory period, price or revenue caps are typically reviewed, based on an assessment of the actual cost levels of the individual companies. An alternative to this approach with even stronger incentive properties is the so-called “yardstick competition” approach in which price or revenue caps are not reset to the individual company’s actual cost level, but rather adjusted by the whole sector’s cost development rate. This approach introduces an artificial form of competition between the companies because those companies that are able to outperform all the other companies will earn the highest profit. A major drawback is however that it is more difficult with this approach to take account of well-justified differences between the cost developments of different companies, caused by changes in the individual operating environments which cannot be influenced by the companies themselves.

The aforementioned approaches to incentive-based regulation have in common that the companies’ actual costs are only assessed at the outset of each regulatory period, but not during the period. As an alternative to this, incentives can also be associated directly with the actual cost development during a regulatory period. An example for this approach is the so-called “sliding-scale regulation” where the network operator is allowed to keep a specified proportion of a cost reduction as an additional profit. This mechanism is sometimes applied to specific cost elements like, for example, the cost of losses.

4.5 REGULATION OF QUALITY OF SUPPLY

It is obvious that a robust regulatory regime needs to take into account the level of the quality of supply in an appropriate way. If there are no agreements or regulations on the desired level of quality of supply at all, network operators could feel motivated to let quality degrade as a reaction to cost pressure in the regulated environment.

Quality of supply implies a multitude of issues such as safety aspects, system security, power quality, network reliability and “commercial quality”. Over the last few years, many regulators have introduced mechanisms to explicitly account for the different types of quality indicators as a part of the regulatory regimes, especially in incentive-based regulation. These mechanisms however relate mainly to quality issues in distribution networks.

On the transmission level, quality issues are usually regulated by the rules and quality criteria that network operators have created and agreed among themselves, partly on the level of (international) interconnected power systems. For regulators, these rules and criteria (e.g. system investment planning guidelines) become relevant when they assess the cost levels of network operators and, in particular, when they assess the adequacy of specific decisions like investment decisions planned by the network owners. Some regulators also review the existing rules and criteria for quality issues, whereby a close consultation with the network operators is indispensable.

5. FEEDBACK AND ANALYSIS FROM SURVEY

5.1 DESCRIPTION OF THE CURRENT REGULATORY ENVIRONMENT

Of the thirteen countries which responded, twelve countries have regulated Transmission companies and one non-regulated (Switzerland). Australia submitted four responses from different states. The type of regulation differed as follows:

- six are subject to rate of return regulation,
- One is subject to price cap regulation,
- Five are subject to revenue cap regulation,
- Two are subject to hybrid form of regulation and
- One is subject to internal regulation

There seems to be a trend to move towards incentive based regulation as some companies are moving over to either the price cap or revenue cap regulation. The companies which are currently regulated via the price/revenue cap typically have a 3-5 year regulatory period, whilst those subject to the rate of return regulation have a one year regulatory lag period.

Of the transmission companies surveyed; five are independent transmission companies, eight are integrated transmission companies and two are combined transmission and distribution businesses with plans to move towards independent transmission companies.

5.1.1 What is the impact of changes in the capital/revenue expenditure regulatory framework on the capital available for system development?

The average growth in demand over the last 5-10 years has varied from 0.8% to 8.8% per annum (refer to table 1).

Table 1 : Average Growth of the last 5 years

Country	Utility/Respondent	Average demand growth
Australia	Powerlink Transend Networks Vencorp Western Power	2-4.4% per annum
Belgium	Elia	1.8% per annum over the last 5 years
France	RTE	< 2% per annum
Germany	Consentec & VDN	0.8% per annum
Italy	TERNA	2% per annum
Korea	Korea Electric Power Corporation (KEPCO)	8.8% per annum
Qatar	Qatar General Electricity and Water Corporation	7.7% per annum
Romania	Institute for Studies and Power Engineering	3.6% per annum
Russia	Federal Grid Company of Unified Energy System	3% per a annum from 1998-2005
South Africa	Eskom	2% per annum
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	5% per annum
Switzerland	Atel Transmission Ltd	1.5% per annum
United Kingdom	National Grid	1-2% per annum

- Twelve transmission companies indicated that there is a regulatory framework in place which reviews and approves capital expenditure. Capital expenditure is approved by a Government ministry in the other two companies.
- Capital expenditure has increased significantly in three companies over the last five years, whilst in others it has remained fixed or not changed. Although the average demand

growth has been high in some countries, the level of capital expenditure is also determined by how much spare capacity is available on the transmission network at the time, the age of the network and the demand for connection switching (new generation connection and demand growth).

- Capital expenditure in all the regulated transmission companies is done through the compilation of forward looking (3-10 years) network expansion plans which meets approved reliability criteria and which considers various load forecast and generation siting scenarios.
- Six of the surveyed transmission companies treat capital expenditure as a complete pass-through during the regulatory period whilst five others treat it as part of the revenue requirements. Some companies have been allowed a pass-through only for specific projects which have some huge element of uncertainty and financial risk. The regulator in one country ensures that the approved capital expenditure requested by the transmission company is used accordingly by conducting capital expenditure reviews at the end of the regulatory period. No comments were received from the other transmission companies regarding this point.
- Most of the regulated companies especially those subject to price/revenue cap regulation have seen an increase in their debt to equity ratio. The higher debt/equity ratios indicate the use of cheaper debt financing up to a point which means companies have to borrow much more to finance their investments. However, too much debt will prevent companies from being able to borrow money to finance any investments. Regulators generally set an optimal target debt/equity ratio for the transmission company.
- The tariffs in six of the transmission companies have over the last five years increased whilst the others experienced decreases (3) or no change. The return on capital/assets is determined using the Weighted Average Cost of Capital (WACC) in most companies. Although the regulators in most of the countries set a target gearing ratio, it is the Transmission companies themselves who have manage the gearing ratio according to their business needs. Majority of the respondents indicated that the regulator does not allow them to earn adequate return on their assets.
- Fifty percent of the transmission companies surveyed indicated that the regulator does distinguish stranded from non-stranded assets, however there are only two instances in which the regulator has allowed for the recovery of the costs of stranded assets. Majority of the transmission companies surveyed indicated that the existing transmission pricing

mechanism does not provide full cost recovery and provides limited or no signals to transmission users.

- Most regulators have allowed the transmission companies to retain any efficiency savings made during the regulatory period. Only one regulator prevents the company from retaining efficiency gains associated with capital expenditure.
- Fifty percent of the companies surveyed, indicated that they can easily obtain capital to fund new investments during the regulatory period. These companies are typically found in the richer countries.
- Only fifty percent of regulators have clearly defined the future course of regulation. It is interesting to note that in countries where the regulator has clearly defined the future course of regulation, the transmission companies do not have problems raising capital for new projects. This is possibly due to the decreased uncertainty faced by investors regarding their long term return on investment.

5.1.2 Reasons for any shortfall between the capital expenditure requested and that allowed.

The regulators decision regarding capital expenditure has in fifty percent of the companies caused a delay in the timing of the investments whilst in the other companies the regulators decision has had no effect. Two companies indicated that the regulators decision has improved the timing of investments.

In determining the optimal levels of capital expenditure requested by each transmission company, the regulator has typically done the following;

- Checked that the investment levels do not cause tariff increases beyond inflation.
- Considered past spending patterns and future load growth.
- Reviewed necessity of any new transmission project.
- Reviewed and scrutinized long term plans.

Capital expenditure is required mainly for system reinforcement, refurbishment, new/existing customer projects and support services. Although the regulators in each country are not biased towards reducing or increasing the capital expenditure budget for specific types of projects, there is a general view that refurbishment projects are the most likely to be postponed when sufficient funds are not available.. In some countries the regulator has recognized that a significant amount of capital expenditure is required for refurbishment and replacement of

aging assets (such as the UK). The fact that regulators recognize these differences is important.

When any unplanned investments are likely to occur, the transmission companies whose capital budget is treated as a complete pass-through generally do not have any difficulties undertaking the investments provided they can raise the required capital. Companies whose capital expenditure is not a pass-through have to prove to the regulator that such expenditure is prudent during or after the regulatory period. There is therefore a risk that these companies may incur financial losses and may be reluctant to consider unplanned investments. If the project is truly needed then the utility will have to spend to maintain the reliability and it is the management's accountability to ensure that it is done. Such companies have in some cases postponed/deferred refurbishment projects in order to accommodate unplanned customer projects thus receiving income whilst the quality and security of supply diminishes.

The transmission companies have handled unplanned capital expenditure in the following ways;

- Seek a pass-through.
- Postpone/defer other investments.
- Use of extra budget in reserve (1 company).
- Take external loans approved by the regulator.
- Re-prioritize projects based on their impact to system reliability and quality of supply.

The following factors are considered to be the main barriers to transmission investment. Their respective importance is different depending on the company's requirements;

- Sourcing financing.
- Adequacy of revenue allowed.
- Permits/servitudes authorisation
- Long decision making processes.
- Environmental constraints.
- Tariff increases and inappropriate pricing structures.
- Social/public opposition/civil petitions.
- Regulatory decisions
- Lack of co-ordination between generation and transmission companies

Many companies believe that the regulator's views on financing, revenue determination, tariff increases and decisions on investment plans create major barriers to investment in the transmission network. Many companies also expressed the view that the regulators or their independent consultants do not necessarily have the same detailed knowledge and expertise as the transmission companies when making decisions about prudent capital expenditure.

The regulators who employ staff from industry seem to be able to make more efficient judgments. In the UK, the utility and the regulator have used the same consultants to evaluate expansion plans.

5.1.3 Changes in system investment planning guidelines to respond to changes in the regulatory environment

Regulation has resulted in the planning guidelines used by transmission companies becoming more transparent, with clearly stated analysis and justification techniques. Long term strategic direction and investment principles must also be clearly stated especially where restructuring of the electricity industry is being considered. Regulatory decisions are reflected in the transmission planning guidelines through compliance with reliability and quality of supply targets as set out or validated by the regulator. In France, RTE makes proposals to the regulator as far as planning guidelines are concerned. These proposals are reviewed by the CRE in order to get its acceptance. The guidelines are also submitted to the responsible Government Ministry.

The location of new generation or load has a huge impact on transmission investment decisions. Fifty percent of the transmission companies surveyed ensure that there is continuous coordination between generation, transmission and customers during the planning process. Most of the Transmission companies agree that the transmission planning guidelines needs to be more flexible whilst acknowledging that it is difficult to achieve. Even in the countries where the load growth is low, there may be strong incentives to develop certain types of generation (e.g. renewable). It may result in an important amount of generation projects spread all over the countries that raises important planning problems related to the uncertainties on location decisions. In all the countries, the factors which influence the timing transmission of investment decisions include;

- Refurbishment of generating plants
- Commissioning of new generating plants
- De-commissioning of existing generating plants
- Generation mix
- Policies and incentives concerning renewable energies

In countries where a huge amount of renewable generation (e.g. wind power) has been built, the location decisions have resulted in more robust transmission planning guidelines. Flexibility is needed on the regulators' side as well. Other companies, where there is no or limited co-ordination between generation and transmission (especially in restructured industries), find it difficult to execute investments on time and their planning guidelines have also become more robust. Information certainty is a key factor in making optimal investment decisions.

In most transmission companies, small scale investment has to a very limited extent been able to defer major capital expansion; however the planning guidelines have changed to consider such alternatives. Regulators have put pressure on transmission companies to reduce losses and eliminate congestion on the transmission network when these issues were not taken into account before. Incentives to reduce congestion and losses have been created through additional capital expenditure and targeted losses allowed. The planning guidelines must ensure that such objectives are being met, i.e. savings from losses and congestion are included in the investment appraisal.

Most transmission companies believe the regulatory period to be adequate and have thus provided more accurate forecasts of capital expenditure over the regulatory period. Where the regulator claws back unspent capital, the transmission companies are under greater pressure to ensure that the capital is spent timeously, else they would probably get less capital during the next regulatory period. There is a risk that cheaper or more expensive long term network expansion alternatives may be ignored so as to limit the transmission company's exposure to financial risk.

The planning guidelines have had to be revised to account for each of the above factors to ensure timeous investments.

For most transmission companies, the nature of regulation has not resulted in national and cross border needs being ignored. Cross border needs are normally achieved through good faith between the parties concerned.

Some transmission companies have been negatively affected by the regulator's decision regarding cross border needs. The following solutions were suggested;

- Review tariff structure and prices.
- Move to nodal or regional pricing.
- Have auction markets at cross border interconnections which can be used to finance network reinforcement projects.
- Align generation and transmission planning.
- Assistance during public petitions.
- Compensation to municipalities and land owners.

5.2 IMPACT OF REGULATORY CHANGES

5.2.1 Revenue available for developing/managing the network

The majority of the transmission companies surveyed indicated that the regulator has put in place indices to evaluate the performance of the power system and the benefits of investments made.

The revenue allowed by the regulators does allow for the minimum amount required to operate, develop and maintain the network. Although regulation has to some extent increased the number of revenue orientated performance indices, it has definitely made all the regulated transmission companies more aware of revenue orientated benchmarking.

5.2.2 System Investment Incentives

Most transmission companies agree that the regulators allow for a realistic depreciation period in their pricing policy but they do not believe that operational life expectancy aligns with the

financial life expectancy of the plant and equipment. They also agree that tariff increases allowed by the regulator have accommodated the necessary transmission network investment.

Regulation has to some very limited extent increased the number of system investment orientated performance indices, but it has in only fifty percent of the regulated transmission companies increased the awareness of system investment orientated benchmarking.

5.2.3 System Maintenance Incentives

A large number of the transmission companies surveyed believe that although regulation may lead to cost cutting of maintenance practices; it is more common to defer maintenance projects. A large number also believe that regulation has lead to the enhancement of maintenance practices due to the regulators' requirement to be more efficient.

Although regulation has in most cases increased the number of maintenance orientated performance indices, it has definitely made many of the regulated transmission companies more aware of maintenance orientated benchmarking.

5.2.4 Customer Satisfaction

Fifty percent of the respondents indicated that regulation has negatively affected the customers' satisfaction regarding the price paid for electricity. There is a mixed response about the reliability and quality of supply which customers receive. Some believe that the regulators decision has positively affected customer satisfaction and others not.

Regulation has definitely increased the number of customer satisfaction orientated performance indices, and it has definitely made many of the regulated transmission companies more aware of customer service orientated benchmarking.

5.2.5 Level of System Security

Fifty percent of the transmission companies believe that regulatory decisions will lead to the future improvement in the level of system security while twenty five percent disagree. Regulation has definitely increased the number of system security orientated performance

indices, and it has definitely made many of the regulated transmission companies more aware of system security orientated benchmarking.

5.2.6 Transmission Design

Fifty percent of the transmission companies agree that regulation has influenced them to produce more effective transmission network designs whilst twenty five percent disagree. More than eighty percent of respondents agree that cost saving designs have not compromised safety issues although only about forty percent believe that such cost driven designs have positively affected the reliability and security of the power system.

Regulation has in most cases not really increased the number of design orientated performance indices, and it has also not really made many of the regulated transmission companies more aware of design orientated benchmarking.

Regulators may not be looking at detailed designs due to lack of expertise. Where there is expertise, there is some in-depth assessment of the effectiveness of the network design.

6. SUMMARY OF KEY FINDINGS

The following is a list of the key findings of the report;

- There seems to be a trend to move towards incentive based regulation as some countries are moving over to either the price cap or revenue cap regulation. The companies which are currently regulated via the price/revenue cap typically have a 3-5 year regulatory period, whilst those subject to the rate of return regulation have a one year regulatory lag period.
- Most of the regulated transmission companies have a regulatory framework under which the regulator reviews and approves investment in transmission. Many companies believe that the regulators and their consultants do not share the same detailed knowledge and expertise as the transmission planners when making decisions regarding prudent capital expenditure. This has in many instances caused a delay in the timing of investments.
- Many companies also believe that the regulators do not allow adequate returns on their assets and thus the company's investment planning guidelines have had to be revised (e.g. account for losses for those not done so before) to ensure adequate return on investments. This also creates additional strain on the transmission company's which need to raise capital to fund new projects.
- The non-recovery of stranded assets has created additional financial risk to the transmission companies, thus making the transmission planning process to be more thorough in the evaluation of proposed projects.
- In countries where the regulator has clearly defined the future course of regulation, the transmission companies find it relatively easy to raise capital for new projects and the planning guidelines are revised to fall in line with the regulatory framework.
- When the regulator decides to reduce the level of capital allowed for new projects, refurbishment projects are the ones most likely to be postponed, which has an impact on the future transmission plans. Postponement of refurbishment leads to higher operating expenditures. In the UK, the regulator has provided incentives for the utility to perform refurbishment.
- It is critical that changes in the capital/revenue expenditure regulatory framework create the correct signals for investment in the transmission network, which is why the treatment of capital expenditure by the regulator is important. Transmission companies, whose capital expenditure is treated as a pass-through during the regulatory period, generally do

not have any problems making investments and their projects are seldom postponed since any under or over-expenditure does not form part of their allowed revenue. Unplanned transmission investments poses additional financial risk to the transmission company concerned, especially in the case where transmission investment is not treated as a pass-through. Transmission planning guidelines have thus had to become much more robust and flexible to account unplanned investments.

- Regulation has resulted in the planning guidelines becoming more transparent with clearly stated analysis and justification techniques. Long term strategic direction and investment principles must also be clearly stated especially where restructuring of the electricity industry is being considered. Regulatory decisions are reflected in the transmission planning guidelines through compliance with reliability and quality of supply targets as set out by the regulator.
- Transmission planners need detailed information on the timing, magnitudes and locations of new generating units. The co-ordination between generation and transmission planning, especially in the liberalised industries, has been reduced although in some countries this has brought the transmission and operational planning closer together. This has created greater emphasis on transmission planners;
  - to obtain accurate data and perform detailed sensitivity analysis
  - consider the best cost effective solutions to connect generators and customers as fast as possible
  - ensure that the transmission plans are practical
  - to provide public sound information on the optimal siting of generation from the transmission system point of view.
  - the need for probabilistic planning techniques.
- Regulatory pressure to reduce losses and eliminate congestion, has resulted in a re-evaluation of existing investment planning criteria. The regulator has created incentives such as allowing additional capital expenditure and setting target levels for transmission losses. Congestion costs are now taken into account by the majority of transmission planners as only a few utilities (such as in France and the U.K.) used them before liberalisation.
- There is currently no regulatory framework that can effectively govern transmission investment. The development and application of performance indices coupled with formal

investment criteria as well as considerable regulatory judgement is an inevitable component of a sound regulatory process.

7. CONCLUSION

The report has discussed the impact of regulatory decisions on levels of transmission investment. Economic regulation produces benefits for transmission customers because it aligns asset owners' incentives with the goals of increasing the efficiency of investment decisions. It motivates transmission companies to take steps to protect the recovery of the investments by finding economic solutions to grid problems and to meeting reliability standards and growth in the demand for transmission capacity. However one must note that in general, Transmission companies have traditionally focused on ensuring that system reliability and efficiency of investments are met, but the advent of regulation has assisted in creating more transparency.

Regulation should therefore ensure that a transmission company is both efficient and financially sustainable. The regulators in the various countries make decisions based on external factors such as social, political and environmental challenges faced in each country. Even though all of the transmission companies which responded to the survey are at various stages of the liberalisation process, they are still affected by regulatory decisions. Efficient transmission investment is also a key ingredient in the success of a competitive electricity industry.

The existing economic regulatory frameworks used by regulators begs the question of whether regulatory decisions have resulted in efficient levels of transmission investment. The fact that regulatory frameworks are imperfect means that the transmission company and the regulator in each country has no choice but to draw on available experience and regulatory tools to develop and apply the best feasible regulatory frameworks. One component of such a regulatory framework is to have greater information sharing between the utility and the regulator. The planning process has also allowed for achieving greater coordination between the relevant stakeholders as well as being able to cater various scenarios for achieving the desired reliability.

Increased commitment and transparency of regulators has increased the ability to finance new projects. External forces such as public opposition which are beyond the regulator's control also impact planning criteria and sometimes delay investments.

The report has highlighted many challenges being faced by regulators and transmission planners in stimulating efficient levels of transmission investment. The task of meeting these challenges should form the basis for new research projects.

Possible new workgroups are;

- Consider the impact of IBR vs ROR on investments in transmission.
- Information certainty is a key factor.—Consider at how TSO's exchange information between Generators and TSO's.

8. REFERENCES

[1] Cigre Paper C1-113, “Impact of Regulatory Environments on Investment Decisions,” Working Group C1.6.

9. APPENDIX A : Summary of Responses

9.1 Description of current Regulatory Environment

Country	Respondent	
Australia	Powerlink Queensland	Powerlink Queensland is an independent Transmission company which is regulated by means of the Revenue Cap approach. The revenue cap is reset every 5 years. Passthroughs are allowed for certain costs such as grid support payments and insurance. Capex regulation is in the process of changing from an ex-post regime to an ex-ante regime.
	Transend Networks Pty Ltd	Transend Networks Pty Ltd is also an independent Transmission company which is regulated by means of the Revenue Cap approach. The revenue cap is reset every 5 years. Passthroughs are allowed for certain costs such as grid support payments and insurance. Capex regulation is in the process of changing from an ex-post regime to an ex-ante regime.
	Vencorp	Vencorp is an independent Transmission company which is regulated by means of the Revenue Cap approach. The revenue cap is reset every 5 years. The transmission arrangements that apply in Victoria are unique within Australia's National Electricity Market. Under a jurisdictional derogation from the National Electricity Rules (formerly the National Electricity Code) the network planning function and the ownership of transmission assets are separate and governed by separate transmission businesses. Under the derogation VENCorp, as a not-for-profit statutory authority, has responsibility for planning and directing augmentations to the shared transmission network. VENCorp does not own any transmission assets itself. It sources bulk network services from the transmission businesses that own and operate the Victorian transmission system. The Australian Energy Regulator (formerly the Australian Competition and Consumer Commission) determines VENCorp's revenue cap for each financial year. However, as VENCorp does not own or operate any transmission assets, its revenue cap is set with reference to its expected operating budget and the likely augmentations required for the efficient operation of the Victorian network with a pass through provision for any unforeseen augmentations. Augmentations only proceed on the basis of passing the regulatory test

	Western Power Corporation	Western Power Corporation is an integrated Transmission company which is regulated by means of the Price Cap approach. The price cap is reset every 5 years. Passthroughs are allowed for certain costs such as grid support payments and insurance. Capex regulation is in the process of changing from an ex-post regime to an ex-ante regime.
Belgium	Elia	Elia is an integrated Transmission company which is regulated by means of the Rate of Return approach determined annually. There is no difference in the regulation about Capex and Opex. The regulator looks at the total costs including the depreciation and financial costs of the investments. There is a new law according which the regulatory lag period will be brought to four years. The execution decrees have to be published.

France	RTE : Gestionnaire du Réseau de Transport d'Electricité	RTE is an integrated Transmission company which is regulated by means of the rate of return approach. The regulation in France is a "cot plus" regulation. The yearly capital expenditure of RTE must be approved by the French regulator and the revenue of RTE is regulated by the transmission tariffs that are proposed by the regulator and approved by the Ministry of Energy. The company's performance is reviewed every 2-3 years by the regulator.
Germany	Consentec & VDN	Currently there are 4 Transmission System Operators (TSOs) in Germany, each of which is the TNSP and the SO for the system in its control area, i.e. 4 integrated Transmission companies. Each company is currently regulated by means of the Rate of Return approach. Regulator has plans to move over to Incentive Based Regulation in 2008.
Italy	GRTN	GRTN is an independent Transmission company which is regulated by means of the Hybrid approach. The company's performance is reviewed every 4 years by the regulator.
Korea	Korea Electric Power Corporation (KEPCO)	KEPCO consists of both the transmission and distribution business. In 2001, 6 generation companies and KPX(SO) had been separated from KEPCO. The last type of transmission company is not yet determined. KEPCO plans to establish a strategic business unit, but government plans to establish an independent transmission company. The labor union's opinion is also the factor of uncertainty. KEPCO is regulated by means of the Rate of Return approach.
Qatar	Qatar General Electricity and Water Corporation	The Qatar General Electricity and Water Corporation (Kahramaa) acts as regulator, and Transmission and Distribution System Owner and Operator for electricity and water. As part of a Privatisation Study of the Transmission and Distribution Networks, a recommendation was made by a consultant that an independent regulator be established. The Kahramaa Management Board recommended that this remain a vision for the future for the State of Qatar. Such a concept has been incorporated into a draft Strategy for Electricity and Water for the State of Qatar. It is believed that a system of regulation independent from public and private interest groups and providing more certainty in regulation would facilitate regional market development and private investment. Moreover, potential developers will feel more assured and comfortable with independent regulation.
Romania	Institute for	Romania has an integrated Transmission company which

	Studies and Power Engineering	is regulated by means of the Revenue Cap approach. The revenue cap is reset every 5 years.
Russia	Federal Grid Company of Unified Energy System	Russia has an independent Transmission company which is regulated by means of the Rate of Return approach determined annually.
South Africa	Eskom	South Africa has an integrated Transmission company which is regulated by means of the Rate of Return approach determined annually. The regulator has decided to use the Revenue Cap approach in 2006 to regulate the Transmission company. The duration of the first regulatory period will be 3 years.

Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	REE is a regulated integrated Transmission company. The remuneration of new transmission facilities is established individually for each type of facility (overhead lines, underground lines, substations bays, transformers, reactances and control centres) and recognises the following cost items: Investment costs, Operations and Maintenance costs and Overhead costs.
Switzerland	Atel Transmission Ltd	Atel Transmission Ltd is not regulated.

What is the impact of changes in the capital/revenue expenditure regulatory framework on the capital available for system development

Country	Respondent	Average demand growth
Australia	Powerlink Queensland	4.1% over the last six years
	Transend Networks Pty Ltd	2% per annum
	Vencorp	3% per annum
	Western Power Corporation	4.4% per annum
Belgium	Elia	1.8% per annum over the last 5 years
France	RTE	<2% per annum
Germany	Consentec & VDN	0.8% per annum
Italy	GRTN	2% per annum
Korea	Korea Electric Power Corporation (KEPCO)	8.8% per annum
Qatar	Qatar General Electricity and Water Corporation	7.7% per annum
Romania	Institute for Studies and Power Engineering	3.6% per annum
Russia	Federal Grid Company of Unified Energy System	3% per a annum from 1998-2005
South Africa	Eskom	2% per annum
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	5% per annum

Switzerland	Atel Transmission Ltd	1.5% per annum

Country	Respondent	Q2 a,d,c,e,f
Australia	Powerlink Queensland	The regulator reviews and approves capital expenditure. Network capital expenditure is forecast through development of forward looking augmentation development plans which ensure reliability criteria can be addressed taking account forecast load growth. Scenarios may be used to take account of uncertainties with load or generation developments. Replacement capex is forecast based on an asset renewal program required to ensure plant serviceability can be achieved. Non-network (e.g. IT, vehicles, office buildings etc)is also forecast based on foreseen future needs. Although capital expenditure is part of the revenue cap there is a review at the end of the regulatory period where the regulator reviews what has been spend and has the right to claw back any under spend or allow any prudent over spend of the capital expenditure allowance. This is termed an ex-post regime. Australia is moving to an ex-ante regime where capital expenditures are reviewed in more detail when setting the revenue cap and any under-spend is kept by the company and any revenue recovery on capital over-spend is lost for the period (although it may be included in the asset base for the next period). The average capital in the current reset period is around $155million per annum.It is expected to increase to around $300million per annum during the next reset period.

	Transend Networks Pty Ltd	The regulator reviews and approves capital expenditure. Capital expenditure is divided into: 1. refurbishment and replacement of existing equipment; and 2. system augmentation. For refurbishment and replacement the capital expenditure is based on detailed work plans supported by asset management strategies For system augmentations a number of future environmental scenarios are developed eg significant expansion in wind generation, high and low load growth. A probability is assigned to each scenario and augmentation projects under each scenario developed and costed. The final amount is the probability weight sum of each of the scenarios. Although capital expenditure is part of the revenue cap there is a review at the end of the regulatory period where the regulator reviews what has been spend and has the right to claw back any under spend or allow any prudent over spend of the capital expenditure allowance. This is termed an ex-post regime. Australia is moving to an ex-ante regime where capital expenditures are reviewed in more detail when setting the revenue cap and any under-spend is kept by the company and any revenue recovery on capital over-spend is lost for the period (although it may be included in the asset base for the next period). The business need for capital expenditure has increased. For any transmission company that is under the ex-post regime the regulator has said they will review the capital expenditure at the end of the regulatory period and may claw back any non-prudent expenditure or any capital expenditure not spent however it is unclear how this will be done.

	Vencorp	The regulator reviews and approves capital expenditure. As noted above, VENCorp is responsible for directing augmentations to the system. As such, its capital expenditure forecasts only relate to network augmentations. Under the National Electricity Rules VENCorp is required, annually, to produce a planning review which documents network constraints and possible options to address those constraints. After considering the likely outcomes from the Annual Planning Report VENCorp makes an assessment as to what is likely to satisfy the regulatory test and when and uses this in support of its revenue cap application. Capital expenditures are treated as part of the revenue cap, however VENCorp is able to seek a re-opening of its revenue cap should unforeseen augmentations arise. VENCorp's forecast capital expenditure has tracked closely with its actual capital expenditure. The regulator monitors actual capital expenditure out-turns with forecast out-turns annually. It also has the ability to conduct an ex-post regulatory assessment at the commencement of the new regulatory period.

	Western Power Corporation	The regulator reviews and approves capital expenditure. Capital expenditure is divided into: 3. refurbishment and replacement of existing equipment; and 4. system augmentation. For refurbishment and replacement the capital expenditure is based on detailed work plans supported by asset management strategies For system augmentations a number of future environmental scenarios are developed eg significant expansion in wind generation, high and low load growth. A probability is assigned to each scenario and augmentation projects under each scenario developed and costed. The final amount is the probability weight sum of each of the scenarios. Although capital expenditure is part of the revenue cap there is a review at the end of the regulatory period where the regulator reviews what has been spend and has the right to claw back any under spend or allow any prudent over spend of the capital expenditure allowance. This is termed an ex-post regime. Australia is moving to an ex-ante regime where capital expenditures are reviewed in more detail when setting the revenue cap and any under-spend is kept by the company and any revenue recovery on capital over-spend is lost for the period (although it may be included in the asset base for the next period). Significant increase in last few years to meet increased demand from air conditioners; large increases in new customer connection loads and improvement in reliability. For any transmission company that is under the ex-post regime the regulator has said they will review the capital expenditure at the end of the regulatory period and may claw back any non-prudent expenditure or any capital expenditure not spent however it is unclear how this will be done.
Belgium	Elia	The regulator reviews and approves capital expenditure. The capital expenditure is forecast by looking at The different investment projects which are needed in the examined period. Capital expenditures are treated as part of the price/revenue cap requirements and have stayed constant over the last five years. The regulator follows the realization of the

		development plan introduced by the TSO and can in case of doubt look in details into the different projects and how they are managed.
France	RTE	The regulator reviews and approves capital expenditure. RTE proposes an investment program that is reviewed an approved by the regulator on a yearly basis. As a supplement to this information, RTE provides the forecasted investment program 4 years ahead. Unbundling between development capital investment and investment dedicated to the network renewal. Recent updating of the criteria for decision making and of the discount rate. Capital expenditures are treated as a complete passthrough. There are two reportings intended for the regulator • A report on a semi annual basis : RTE updates the forecast of the capital investment program and if necessary solicits adjustments in the program approved by the regulator. • An ex-post checking in order to present what were the actual capital expenses and to justify what are the main differences between the expenditures and the program approved by the regulator.
Germany	Consentec & VDN	Until 2010, 850 km of new EHV transmission corridors will need to be built in order to accommodate the increase of wind power in the German network. Capital expenditure is currently treated as a complete pass-through. This may change once IBR is introduced. There were no substantial changes to capital expenditure requirements in the last five years.
Italy	GRTN	Capital expenditure is reviewed by the regulator but approved by the Ministry of productive activities. GRTN, by working out the Grid Development Plan, forecasts capital expenditure required by network reinforcement. Over the past five years the electricity sector has undergone major organizational changes, fuelled by the process of deverticalization and unbundling that Italy is experiencing including in

		accordance with EU directives. The tariff regulation system proposed by the Authority for the period 2004—2007, in keeping with the previous regulatory period, is based on a vertical organization of activities and is designed to foster competition at every stage of the process that is not conducted on a monopoly basis in accordance with current laws. Capital expenditure is currently treated as a complete pass-through. For the long term, investment-friendly regulations were needed to address the problem of the insecure supply. With the definition of measures for regulatory period 2004-2007 and approval of the new consolidated act on tariffs, investment incentives were introduced in the transmission and distribution sector by raising the rate of return on invested capital and offering a 2-point spread on the base rate for new investments in the national transmission network. To maintain a balance between investment needs in the sector and the electricity tariff, this move was offset, in terms of costs, by boosting productivity and efficiency and adjusting the useful life of infrastructures as recognized for tariff purposes. Above all, the Regulator grants remuneration for capital expenditure only after the facilities are in operation.
Korea	Korea Electric Power Corporation (KEPCO)	Capital expenditure is determined by accounting rules (e.g. tax law) and KEPCO's internal rules and only certain projects are treated as complete passthrough. Capital expenditure is forecast by the average Acquisition cost according to the transmission investment plan. The regulator does not check the capital expenditure of individual projects. They only control the level of transmission tariffs.
Qatar	Qatar General Electricity and Water Corporation	Kahramaa's Networks Development Plans are formulated for the short term, medium term and long term. An annual 5 year Business Plan, which covers both technical and financial network plans, gets approved by the Kahramaa Management Board and establishes the agreed programme for this period. The network plans are in line with demand forecasts for the period. Longer term Master Plans have tended to become outdated. At national level, the Master Plans currently being compiled by consultants for the Ras Laffan and Mesaieed Industrial Cities as well

		as the capital city, Doha, will be used in future as inputs to a consolidated Master Plan. Capital expenditure is in line with an agreed programme of work. Cash flow forecasting is normally based on expected turnkey contracts terms of payments. Generally we are not in much error if we assume an 80% capital expenditure in the financial year preceding the works commissioning year and 20% in the commissioning year itself. Since 2002, capital expenditure on *transmission* related projects has increased almost five-fold.
Romania	Institute for Studies and Power Engineering	The regulator reviews and approves capital expenditure which is treated as a passthrough. The Power Transmission Company has to fulfil The task of drawing up long term plans for Power Transmission Network, 10 years period, development planning, every 2 year updated, also containing the funding means and performance by stages of the necessary investments, taking into account the actual stage and future evolution of power consumption. The power transmission Company became more efficient, justifying the requirement for more investment. The Transmission Company (TC) must procure the licence for the projects, from the regulatory Authority. In this respect, the TC submits one FS to the Regulatory Authority, for each project requiring investments. The Regulatory Authority (RA) is also entitled, any time, to study any and all projects from the opportunity and efficiency point of view, before approval.
Russia	Federal Grid Company of Unified Energy System	The regulator reviews and approves capital expenditure which is treated as a passthrough. Capital expenditure is forecast according to 3 year investment plans. Capital expenditure has increased significantly over the last three years. The regulator aside from checking the annual reports also requires proof of any capital expenditure.
South Africa	Eskom	The regulator reviews and approves capital expenditure which is treated as a passthrough for certain projects only. The annual cash flows associated with each planned project are added together. A major increase in expansion related capital expenditure has occurred due to more rapid load growth and the commencement of construction of

		new power stations. The return paid on monies not spent is clawed back in the next control period, and interest is charged at prime plus 2%. The allowed return on allowed overexpenditure is paid with interest at prime.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	Capital remuneration rate fixed by Ministry for periods of 4 years at most. At present it is fixed at the rate of the 10 year Treasury Bonds + 1.5%. It is not necessary to forecast the capital expenditure because there is no regulatory period. For the period 1998-2004 the capital expenditure has been 900 M€.
Switzerland	Atel Transmission Ltd	Level of capital expenditure is open and determined a) by the necessary reliability and b) by the expected profitability.

Country	Respondent	Q2 g,h,m,I,j,k,l,n,o,p
Australia	Powerlink Queensland	Debt/equity ratio has increased. Current Transmission pricing mechanism does not ensure cost recovery and provide correct investment signals. The Regulator uses a weighted average cost of capital to determine the return on capital. This methodology uses the Capital Asset pricing model (CAPM) to determine the appropriate return on equity. Determining the appropriate inputs to the CAPM can be problematic given the regulated nature of transmission business and lack of suitable comparable companies. There is no distinction between stranded and non-stranded assets. Costs of stranded assets are not allowed to be recovered. The Transmission company is allowed to keep profit/efficiency gains, however the Regulator has indicated that they may claw back any capex under spend however they have not indicated how this would work. The Transmission company can easily raise capital provided that sufficient revenue has been allowed for within the reset.
	Transend Networks Pty Ltd	Debt/equity ratio has increased. The average increase in Transmission tariff has been 11% p.a. Current Transmission pricing mechanism does not ensure cost recovery and provide correct investment signals. The Regulator uses a weighted average cost of capital to determine the return on capital. This methodology uses the Capital Asset pricing model (CAPM) to determine the appropriate return on equity. Determining the appropriate inputs to the CAPM can be problematic given the regulated nature of transmission business and lack of suitable comparable companies. There is no distinction between stranded and non-stranded assets. Costs of stranded assets are not allowed to be recovered. The Transmission company is allowed to keep profit/efficiency gains, however the Regulator has indicated that they may claw back any capex under spend however they have not indicated how this would work. The Transmission company can easily raise capital provided that sufficient revenue has been allowed for within the reset.

	Vencorp	Current Transmission pricing mechanism provides full cost recovery. But in relation to transmission pricing signal: There are limited congestion pricing signals currently in Australia's National Electricity Market. Substantial investment in network assets may be required if new generation or load connects at congested locations on the network. However, the National Electricity Rules are largely silent on who should pay for new network investments where the investment is driven by a generator or load locating at a congested part of the network. For example, if the network is nearing its performance limit, a new connection will trigger the need for a network augmentation. Questions arise as to whether it is appropriate for a new connection applicant to bear all augmentation costs, especially if that connection is the "straw that breaks the camel's back". These issues are currently being considered by the Australian Energy Market Commission as part of a review of transmission revenue setting and pricing. There is no distinction between stranded and non-stranded assets. Regulator has clearly defined the future course of regulation.

	Western Power Corporation	Debt/equity ratio has increased. Average revenue has increased by 2% over the past five years. The current transmission pricing mechanism does ensure full cost recovery and is designed to provide efficient signals to transmission users. However the methodology produces approximate and imperfect signals that assume future investments will mirror past investments. The Regulator uses a weighted average cost of capital to determine the return on capital. This methodology uses the Capital Asset pricing model (CAPM) to determine the appropriate return on equity. Determining the appropriate inputs to the CAPM can be problematic given the regulated nature of transmission business and lack of suitable comparable companies. There is a distinction between stranded and non-stranded assets. Costs of stranded assets are not allowed to be recovered. The Transmission company is allowed to keep profit/efficiency gains, however the Regulator has indicated that they may claw back any capex under spend however they have not indicated how this would work. The Transmission company can easily raise capital provided that sufficient revenue has been allowed for within the reset. Regulator has not spelt out the future course of regulation.
Belgium	Elia	The debt/equity ratio is in Belgium fixed by the regulator: namely 1/3 equity – 2/3 debts. We are only regulated since two complete years: therefore there have been large decreases in the transmission tariffs but they are not a true image of the impact of regulation. The transmission tariffs are still new but they induce some responses of the market actors which could at the end induce troubles. The repartition of the tariffs between the different voltage levels induce the industrial customers to connect to the highest voltage level even for limited power. This means that the tariff at the lower voltage level increases: the costs stay constant but the volume of electricity decreases. The regulator fixes the WACC on basis of the equity/debt ratio and normal return for the equity and for the debts. This WACC is adapted each year according to the evolution of the basis parameters as OLO.

		We had an IPO in 2005 that was a great success. There is no distinction between stranded and non-stranded assets. The Transmission company is allowed to keep profits/efficiency gains only in a limited way and according to the will of the regulator. The rules are not defined exactly over what can be kept by the TSO and what has to be given back through the tariffs. In the framework of the new law, this mechanism has to be reviewed.
France	RTE	The debt/equity ratio has not changed. The tariffs are set for a 2 to 3 year period in current currency. It results in a decrease of the tariffs expressed in constant currency. The inflation effect is compensated by RTE's efficiency improvements. There is no distinction between stranded and non-stranded assets. The Transmission company is allowed to keep profits/efficiency. Regulator has not defined the future course of regulation.
Germany	Consentec & VDN	Debt/equity ratio has increased. The transmission tariffs have generally increased over the last 5 years, but the increases vary widely between the 4 TSOs and from year to year. The single most important reason for the increases and also for the variations lies in systematically increasing costs of system services, especially for frequency control and balancing energy. These costs increase substantially from year to year because of the large amount of wind energy converters installed in Germany: End of 2004 about 16000 MW, increasing by 1500 to 2000 MW each year. The large variations in wind energy generation lead to increasing costs of system services. System services costs being part of the transmission tariff, this leads to tariff increases. In the past, this could be in the order of magnitude of 10 % per year. A fixed return on the share of assets covered by equity capital (with a maximum share of 40%) and the actual cost of interest for the remaining share of the assets (generally debt) are allowed to be taken into account in the network tariffs. The real return on equity is set for the time being at 6.5 %. There is no distinction between the stranded and

		non-stranded assets. Transmission company does not keep any efficiency gains currently, may change once IBR is implemented. Currently it is easy to raise capital for new projects. Law and government regulations give a good amount of detail on regulation. But there is no experience yet with the actual behaviour of the regulator.
Italy	GRTN	For 2004 the tariff exercise envisages a reduction of about 3.4% in the tariff component for transmission, distribution, metering and sales. This equates to about 6% in real terms, if inflation over the last year is taken into account. The effect on the total tariff, including the components for fuel costs, fixed distribution costs and other charges, equates to a reduction of about 1% for 2004. Over the period 2004-2007 as a whole the exercise will produce a reduction of about 13% in real terms (assuming fuel costs and other charges to be stable) in the tariff component for transmission, distribution, metering and sales. A WACC is used. This rate is determined by considering risk indices of electric sector companies. For the long term, investment-friendly regulations were needed to address the problem of the insecure supply. With the definition of measures for regulatory period 2004—2007 and approval of the new consolidated act on tariffs, investment incentives were introduced in the transmission and distribution sector by raising the rate of return on invested capital and offering a 2-point spread on the base rate for new investments in the national transmission network. To maintain a balance between investment needs in the sector and the electricity tariff, this move was offset, in terms of costs, by boosting productivity and efficiency and adjusting the useful life of infrastructures as recognized for tariff purposes. The costs of stranded assets are allowed to be recovered. Efficiency gains are allowed to be retained and it is easy to raise capital for new projects. No direction on future regulation.
Korea	Korea Electric Power Corporation (KEPCO)	Transmission Tariffs are not yet charged, so there is no increase/decrease Currently transmission Tariffs cover the invested

		costs on transmission facilities. But owing to the underground cable and 765kV lines, the generation location/site signal is not given properly. Thus transmission congestion cost must be reflected in order to give proper location/site signal to generators. The return on capital/assets is determined using WACC. But when applied to actual Tariffs, RPI and economic environment are also considered integrally to determine the return on capital/assets. Regulator does not allow for adequate return on investment. The Transmission company is allowed to retain any efficiency gains although it is not easy to raise new capital. No future course of regulation has been spelled out.
Qatar	Qatar General Electricity and Water Corporation	Capital expenditure is financed by the State in line with Kahramaa's needs based on the Business Plan and Budget as approved by Kahramaa's Board and the Council of Ministers.
Romania	Institute for Studies and Power Engineering	Debt/equity ratio has increased. The tariff has increased by average of 21% p.a. The revenue cap during a regulatory period, takes into account the reference return (for the previous tariffing period) and a series of corrections of the revenue, considering the efficiency of the assets regulated basis for each tariffing period, by applying RRR (regulated rate of return). There is a distinction between stranded and non-stranded assets. The Transmission company is not allowed to retain any efficiency gains whilst also finding it difficult to raise capital for new projects. There is no future course of regulation planned.
Russia	Federal Grid Company of Unified Energy System	Debt/equity ratio has increased. The tariff has increased by average of 25% p.a. Pricing mechanism does not provide for cost recovery or correct investment signals. WACC is used and regulator allows adequate returns. Although there is a distinction between stranded and non-stranded assets, there is no recovery of costs for stranded assets. The Transmission company is allowed to retain any efficiency gains whilst also finding it difficult to raise capital for new projects. There is no future course of regulation planned.
South	Eskom	Debt/equity ratio has increased.

Africa		Regulation started in 2002, prior to that Eskom was allowed a price increase based on requirements. Pricing mechanism does not allow full cost recovery or send the correct investment signals. WACC is used. Regulator does not allow adequate returns. Although there is a distinction between stranded and non-stranded assets, there is no recovery of costs for stranded assets. For the first control period (2006 – 2009) there is no efficiency carry over mechanism in place. However, retention of legitimate efficiency gains will be allowed based on the motivation submitted by the utility. The Transmission company can easily raise capital for new projects. Regulator has defined the future course of regulation.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	Debt/equity ratio has not changed. On average, transmission tariffs have not varied. The current transmission pricing mechanism does not provide any signal to transmission users. Regarding new generation, locational signals would be needed. Capital remuneration rate fixed by Ministry for periods of 4 years at most. At present it is fixed at the rate of the 10 year Treasury Bonds + 1.5%. Although there is a distinction between stranded and non-stranded assets, there is a recovery of costs for stranded assets. The Transmission company is allowed to keep any efficiency gains and can easily raise capital for new projects. The regulator has defined the future course of regulation.
Switzerland	Atel Transmission Ltd	Debt/equity ratio has not changed. On average, transmission tariffs have not varied. The current transmission pricing mechanism ensures cost recovery but does not provide any signal to transmission users. The company is allowed to earn adequate returns. Stranded assets are distinct.

Reasons for any shortfall between the capital expenditure requested and that allowed

Country	Respondent	Q3, a-g
Australia	Powerlink Queensland	The regulator's decision has typically resulted in a delay in investments. The Regulator engages an independent engineering expert to review the transmission company's proposed capital expenditure. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers, support services. There is no particular bias towards any particular category however it is most likely that the regulator will decrease the overall capital expenditure budget. In the current regulatory environment, additional capital expenditure in excess of the allowed budget will be reviewed at the next regulatory review and if deemed prudent it will rolled into the next revenue cap. Under the proposed ex-ante revenue cap, the TNO will earn a reduced return on investment until the additional spend is rolled into the asset base at the next reset. The level of detail required to justify projects that could be up to seven years into the future can create difficulties for transmission companies .This is particularly difficult where there is high load growth. The regulator looks at four aspects when deciding whether an investment is prudent: 1. Is there a justifiable need? 2. Have all the feasible options been identified? 3. Has the best option been selected? 4. Has the project been implemented efficiently When answering these questions the regulator tries to place themselves in the shoes of the transmission company at the time the decisions are being made.

	Transend Networks Pty Ltd	The regulator's decision has typically resulted in a delay in investments. The Regulator engages an independent engineering expert to review the transmission company's proposed capital expenditure. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers. There is no particular bias towards any particular category however it is most likely that the regulator will decrease the overall capital expenditure budget. In the current regulatory environment, additional capital expenditure in excess of the allowed budget will be reviewed at the next regulatory review and if deemed prudent it will rolled into the next revenue cap. Under the proposed ex-ante revenue cap, the TNO will earn a reduced return on investment until the additional spend is rolled into the asset base at the next reset. The level of detail required to justify projects that could be up to seven years into the future can create difficulties for transmission companies .This is particularly difficult where there is high load growth. The regulator looks at four aspects when deciding whether an investment is prudent: 5. Is there a justifiable need? 6. Have all the feasible options been identified? 7. Has the best option been selected? 8. Has the project been implemented efficiently When answering these questions the regulator tries to place themselves in the shoes of the transmission company at the time the decisions are being made.

	Vencorp	The regulator's decision has typically had no effect on the timing of investments. The Regulator engages an independent engineering expert to review the transmission company's proposed capital expenditure. The Transmission company requests capital for the following categories of projects; system reinforcement. VENCorp seeks a pass through from the regulator for unforeseen capital expenditure requirements. The level of detail required to justify projects that could be up to seven years into the future can create difficulties for transmission companies .This is particularly difficult where there is high load growth. The regulator looks at four aspects when deciding whether an investment is prudent: 9. Is there a justifiable need? 10. Have all the feasible options been identified? 11. Has the best option been selected? 12. Has the project been implemented efficiently When answering these questions the regulator tries to place themselves in the shoes of the transmission company at the time the decisions are being made.

	Western Power Corporation	The regulator's decision has typically resulted in a delay in investments. The Regulator engages an independent engineering expert to review the transmission company's proposed capital expenditure. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers. There is no particular bias towards any particular category however it is most likely that the regulator will decrease the overall capital expenditure budget. In the current regulatory environment, additional capital expenditure in excess of the allowed budget will be reviewed at the next regulatory review and if deemed prudent it will rolled into the next revenue cap. Under the proposed ex-ante revenue cap, the TNO will earn a reduced return on investment until the additional spend is rolled into the asset base at the next reset. The level of detail required to justify projects that could be up to seven years into the future can create difficulties for transmission companies .This is particularly difficult where there is high load growth. The regulator looks at four aspects when deciding whether an investment is prudent: 13. Is there a justifiable need? 14. Have all the feasible options been identified? 15. Has the best option been selected? 16. Has the project been implemented efficiently When answering these questions the regulator tries to place themselves in the shoes of the transmission company at the time the decisions are being made.
Belgium	Elia	The regulator's decision has had no effect on the timing of investments. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers, replacement of ageing equipments; opening of the electricity market by increasing the interconnections with neighbouring countries and by investing into grid to be more independent of the local generation company. For the moment, the regulator does not look into

		the different categories of investment; he is only interested by the total amount. Any unplanned investment requirement will be met by postponing other investments. The main barriers are surely the financing problems but also the difficulties to get the necessary permits for the needed investments. The regulator looks very carefully into the justifications of the development plan and the different projects it includes.
France	RTE	The regulator's decision has had no effect on the timing of investments. On regulator's request, RTE has carried out long term studies in order to provide an assessment of what could be the investment program required for developing and renewing the network ("Development Scheme", "Master Plan"). The approval of the yearly capital investment program by the regulator is made in accordance with his knowledge of the development strategies presented by RTE. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers and information systems As explained above, there is a half-yearly checkpoint. If a need for unplanned investment is detected during the regulatory period, it is outlined to the regulator with justification during the checking at mid-year. Generally, the regulator modifies his former approval accordingly. The environmental issues (NIMBY) are presently the main barriers to transmission investment. RTE uses a long term profitability criteria to determine prudent capital expenditure. The project are expected to be "profitable" with certain hypotheses in less than 10 years.
Germany	Consentec & VDN	The approval process for new lines is much too cumbersome and takes – at EHV level – up to 10 years or even longer until a line is built. (other questions not applicable)
Italy	GRTN	The regulator's decision has improved the timing of investments. The Transmission company requests capital for the following categories of projects; system reinforcement. Authorization difficulties and environmental constraints are the main barriers to Transmission investment.
Korea	Korea Electric	KEPCO don't need any allowance from regulator

	Power Corporation (KEPCO)	for the capital expenditure in the transmission network investments that already have gotten the approval of execution from regulator. There is no procedure to determine optimal capital expenditure. The Transmission company requests capital for the following categories of projects; system reinforcement. Refurbishment is likely to be cut , because it is possible to delay without interruption. Unplanned capital expenditure is executed by extra budget in reserve. The main barriers are civil petition and environmental protection. The regulator performs an audit(propriety of projects) to check for prudent capital expenditure.
Qatar	Qatar General Electricity and Water Corporation	The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers and ancillary services.
Romania	Institute for Studies and Power Engineering	The regulator's decision has had no effect on the timing of investments. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers, and ancillary services. Expenditure must be increased for refurbishment. The existent transmission network was calculated for a much more consumption value (In 1989 the consumption was much higher but the installations are old). The main barriers are the lack of necessary funds for paying the investor, as a result of the lower revenues than the proposed one.
Russia	Federal Grid Company of Unified Energy System	The regulator's decision has typically resulted in a delay in investments. Growth of the tariff and its containment within the limits of inflation is considered when determining the optimal amount of capital expenditure. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers. In the current regulatory environment, for additional capital expenditure in excess of the allowed budget, the company takes external loans within the limits of the credit authorized by Regulator. The main barriers to Transmission investment is

		the increase in the tariff. The regulator looks all projects when deciding whether an investment is prudent.
South Africa	Eskom	The regulator's decision has typically resulted in an improvement in the timing of investments. The only assessment done is based on past spending patterns and the future system growth requirements. However, for the next control period a hybrid model might be applicable. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers and ancillary services. The regulator deems the ancillary services to be within control of a Transmission company and is therefore likely to cap the allowed expenditure on these costs All unplanned investments are scrutinised and prioritised based on the impact that they have on the reliability and quality of supply. The investments are then undertaken and where possible planned projects are delayed to avoid a major impact on funding requirements. Funding of the investments which is made possible through revenue allowed by Regulator. Therefore if the revenue allowed is not sufficient to cover cost of capital and allow a return for the Transmission company, the company will be reluctant to invest in the Transmission system. An investigation document must exist that complies with the South African Grid Code, which proves that the investment has been thoroughly investigated to ensure that the best solution is implemented. A valid business case must exist based on one or more of the three regulator-approved financial justification methods.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	The regulator's decision has had no effect on the timing of investments. The regulatory body, the National Energy Commission, reviews the annual planning containing new transmission facilities and determines whether they are appropriate for the system for optimal capital expenditure. The Transmission company requests capital for the following categories of projects; system reinforcement, refurbishment, new/existing customers. Increase or decrease in capital is dependent on the merit of each case.

		Any unplanned investment requirement will be treated just like the rest of planned investment provided that the facility necessity can be adequately justified to the Regulator. The main barriers are social opposition, environmental requirements and administrative authorization process delay. The regulatory body, the National Energy Commission, reviews the annual planning containing new transmission facilities and determines whether there are appropriate for the system.
Switzerland	Atel Transmission Ltd	Not applicable

Q4 Changes in system investment planning guidelines to respond to changes in the regulatory environment.

Country	Respondent	
Australia	Powerlink Queensland	The regulatory environment has driven more transparent processes in relation to justifications and approvals. Transmission companies are aware of the need to demonstrate prudency of investments and all supporting decisions. The push by regulators to only allow the least cost technically acceptable solutions has prevented some more environmentally friendly solutions to be used. All transmission augmentation proposals are required to consider generation alternatives. Saving losses can be included as a cost benefit within the option assessment framework. Cost reductions from production resulting from freeing up of congestion is also an allowable benefit within the option assessment framework. A five year regulatory reset period would appear a reasonable balance between business certainty and business risk. For large augmentations a regulatory test must by carried out. This is an economic test that looks at the costs and costs savings to the electricity market (the market benefit). The project that maximizes the market benefit is the one the passes the regulatory test. It can be time consuming to carry out the consultation required for the regulatory test and the outcome can be disputed by interested parties, this can delay needed transmission augmentations. Within the interconnected networks of eastern Australia, a single market and regulatory framework exists. Opportunities exist to consider and review the above under the current regulatory framework.

	Transend Networks Pty Ltd	The regulatory environment has driven more transparent processes in relation to justifications and approvals. Transmission companies are aware of the need to demonstrate prudency of investments and all supporting decisions. The push by regulators to only allow the least cost technically acceptable solutions has prevented some more environmentally friendly solutions to be used. All transmission augmentation proposals are required to consider generation alternatives. For large augmentations a regulatory test must by carried out. This is an economic test that looks at the costs and costs savings to the electricity market (the market benefit). The project that maximizes the market benefit is the one the passes the regulatory test. It can be time consuming to carry out the consultation required for the regulatory test and the outcome can be disputed by interested parties, this can delay needed transmission augmentations. Within the interconnected networks of eastern Australia, a single market and regulatory framework exists.

	Vencorp	There have been no changes to planning guidelines. The acquisition of easements in the longer term will become an issue that VENCorp will need to confront. Recent augmentations have been undertaken within existing transmission terminal stations or on existing easements. Existing transmission line easements are sufficient in some cases for the construction of new transmission lines. This is likely to make projects which use existing easements cheaper than Greenfield projects. To the extent that a small network investment, such as a wind monitoring scheme, the raising of transmission towers and the application of control schemes, have benefits to the market which outweigh the costs VENCorp will proceed with the network investment. VENCorp's annual planning report documents a number of larger projects which have been delayed by the introduction of small, more innovative, network solutions. Generator investment decisions are made by entrepreneurial investors. There is no formal co-ordination between transmission investments and generation investments. However, at the time that a transmission business considers a network augmentation it will consider generation alternatives which includes either the construction of a new generator or entering into a grid support arrangement with other generators. Reduction in transmission congestion and losses are considered as part of the benefits in the assessment of network options. A five year regulatory period is an appropriate balance. In Victoria there are no examples of transmission investments that are required that have not been constructed. There is no conflict between national and cross border needs. Having said this, transmission expansion across borders requires good faith on behalf of the transmission planning bodies. There is no formal role for transmission businesses to build inter-regional transmission investments. To date this has not been an issue, but it may be an issue in the future. An independent national transmission planner would have significant benefits for the Australian electricity market. This would ensure that needed investment is constructed in a timely and efficient manner. Real time capacity information improves the utilisation of existing transmission infrastructure. A move to some form of nodal/regional pricing will encourage generation solutions to locate in more appropriate areas.

	Western Power Corporation	The regulatory environment has driven more transparent processes in relation to justifications and approvals. Transmission companies are aware of the need to demonstrate prudency of investments and all supporting decisions. The push by regulators to only allow the least cost technically acceptable solutions has prevented some more environmentally friendly solutions to be used. All transmission augmentation proposals are required to consider generation alternatives. For large augmentations a regulatory test must by carried out. This is an economic test that looks at the costs and costs savings to the electricity market (the market benefit). The project that maximizes the market benefit is the one the passes the regulatory test. It can be time consuming to carry out the consultation required for the regulatory test and the outcome can be disputed by interested parties, this can delay needed transmission augmentations.
Belgium	Elia	Up to now, there have been no changes to planning guidelines. Nevertheless we are starting in our company a whole process to collect all necessary investment projects and to have a transparent and explicit arbitration procedure over which projects are executed and which are delayed or canceled. The ultimate goal is to decide on a reliability base over the investment projects and include so also all projects to replace aging assets. At this moment, this goal is still too ambitious and we try to use some pragmatic indexes to decide how to implement the different policies: development, replacement. The siting of new generation has a tremendous impact on the development of the grid. But for the moment there are not many projects of new generation and therefore the impact is limited. In Belgium, we try to have both evolving in parallel. Nevertheless there will be choices to be made and for the moment we defer in first place large scale investment. In Belgium, there is only a limited coordination. The regulator establishes a indicative program of generation means. This program determines only the needs for the coming years but is not mandatory and gives an indication to the market about the coming needs. The TSO has to establish a grid development plan that is mandatory.

		These two plans are coordinated through the hypotheses that are used: load growth, imports,… The TSO has no precise siting of new generation and has to make hypothesis about it. The TSO tries to forecast the needs of the market for the coming years and on that base determines the necessary investments to limit the congestions. That means an increase of the interconnection capacity but also investments to make the operation of the electrical system more independent of the generation companies (limiting the must run units for congestion or voltage problems). At this moment the regulatory lag is too short. The investment horizon is longer than one year. But due to the new law, it will change and then we will see if the situation improves. Inability to obtain rights of way is surely an key factor. But another important factor is the inability to forecast the needs of the electrical market. There is a big challenge to avoid investing in assets that could be stranded the day they are realized. Finally we have also the problem of financing new investments and as long as there are no new means found we could be obliged to cancel some investments. The regulatory and business structure should be changed to assist with financing. The TSO should have more power to induce the siting of new generation at for the grid favorable locations. By having market mechanisms as auctioning at the crossborder interconnections, there could be a clear indication about the necessity to reinforce some interconnections. The results of the auctioning should then be used to invest into these reinforcements.
France	RTE	The regulation as such has not involved change in planning guidelines or the definition of the technical policies. Small scale transmission investment such as Phase Shifter has been made instead of larger scale investment. It has to be considered as a consequence of the inability to obtain right of way rather than a consequence of the regulatory framework.

		There is no longer generation planning. The generation investments are made according to the opportunity of the market and the location of generation plant mainly depends on the location of the primary energy sources (gas terminals, wind, ..) Explanatory studies carried out at the request of generation companies make it possible to increase the awareness of these latter to the possible limitations of generation connection induced by the lack of transmission capacities in certain areas. Savings on congestion costs and of losses are included in the profitability analysis. Inability to obtain rights of way is surely a key factor preventing transmission projects from being built. It must be pointed out that the concentration of generation projects (CCG) in certain area due to the proximity of Gas terminals (and also owing to the structure of Gas transmission tariffs) becomes critical. Crossborder interconnection needs do not suffer. As long as the structure of the transmission tariffs of gas is not revised and remain significantly different from the electricity transmission one, the generation investors' interest will be locating their plants as close as possible of the large gas feeders. It will result in strong requests for developing the electric transmission network in these areas.
Germany	Consentec & VDN	Regulator is so new, no experience yet. Germany's generous Renewable Energy Law has led to the installation of over 16000 MW of wind power, most of it on the (Northern) coast and in the Northern half of the country. This leads to the need for additional 850 km of transmission corridors until 2010, and many more additional km in the years after that. To a moderate extent, especially related to certain congested interfaces with other countries. Through the connection negotiations between the power plant developer and the TSO, the TSO knows generation projects fairly early, and takes them into account in its network planning. But there is no overall planning authority that has responsibility for both generation and

		transmission planning – generation is an open market. Congestion and losses are considered as part of the economic analyses for system reinforcement options. Most of the above mentioned 850 km of new EHV line corridors are in danger of significant delay, and in addition hundreds of km of HV line corridors, all needed for the transport of wind energy. Public opposition to new facilities and (perhaps, to a lesser extent) upgrades of existing facilities, delays in gaining economic and environmental regulatory approvals and Uncertainty about the regulatory process all could prevent the company from building new facilities. Regulation has negatively affected national and cross border investments. The following additional solutions could help: • streamlining of the approval process for new lines. • Less preferred solution to getting the new lines approved quickly that are determined necessary. • Congestion management is necessary. Needs to be done in market-based ways, i.e. auctions. Needs to be co-ordinated. • Transmission construction does not normally compete with generation construction.
Italy	GRTN	The main targets of the planning activity are: - Security and continuity of supply - Congestion relief - Efficiency and cheapness of service - Interconnection capacity - Service reliability and quality - Environmental compliance The network reinforcement activity "chases" the generation location activity, trying to reduce congestions and accommodate the power produced by new generating units. The construction of new transforming substation (380/130 kV) can largely reduce the need to reinforce the 130 kV transmission network. There is no co-ordination between generation (completely liberalised) and transmission planning (activity performed by GRTN). In the GRTN Development Plan some general

		information are given on the best location from the electricity transmission point of view of new generation. From the network planning point of view, major efforts are focused on congestion reduction, both between market macro-areas and also at local level, so as to reduce - wherever possible - constraints risking to negatively affect the operation of sellers and buyers in the market. Congestion relief and losses reduction represent two of the main benefits attached to development works The regulatory lag is consistent with short-medium investment policies. Many needed transmission facilities are not being built, mainly because of: - public opposition - environmental constraints - authorization complexity National and cross border investment needs do suffer and changes in the regulatory and business structure, mitigation and market analysis would help.
Korea	Korea Electric Power Corporation (KEPCO)	We don't have any big changes in the transmission system investment planning guidelines. The restructuring of the electric power industry in KOREA isn't completed yet. But We have a priority list of investment types and a policy on replacing aging assets. The priority is determined according to reliability and contingency. kEPCO establish and execute the mid term facilities reinforcement plan. Small scale transmission investment did not reduce or defer the need for large scale investment. When government establish "Basic Scheme for Power Supply and Demand of KOREA" every two years. The coordination between transmission network planning and generation planning is performed. There is no planning guideline yet. However we are studying about the planning method to include the impact of congestion. There are transmission facilities not being built because of civil petition, environmental effect assessment. Inability to obtain right of way: • Public opposition to new facilities and

		(perhaps, to a lesser extent) upgrades of existing facilities • Delays in gaining economic and environmental regulatory approvals National and cross border needs do not suffer because of the local and state/provincial nature of the regulation of transmission expansion.
Qatar	Qatar General Electricity and Water Corporation	Kahramaa designs the reliability of power supply of its transmission networks in accordance with the (n-1) contingency criteria. The n-1 criteria means that an outage of one of the n components that make up the transmission sub-network should allow supply to be maintained to that area without loss of load, at any load level. This reliability criteria is qualified by a risk/benefit analysis and other considerations such as capital investment priorities, social needs, the environment and land use. The contingency criteria to which the transmission network has been designed is taken into account when assessing the impact of a Consumer's installation on other Consumers or the power system. The n-1 criterion is applied to all Transmission Networks in the State of Qatar. For these networks , the network must be capable of withstanding the loss of any single component at any load level and for any generation schedule. The n-1 contingency criterion applies to: 1. All aspects of steady-state criteria. 2. All aspects of stability criteria. 3. All aspects of power quality criteria. An analysis of the loading conditions under summer peak load showed that various primary substations were not fulfilling the n-1 criterion at peak load conditions. This will be addressed as part of the current 5 year Business Plan for the Electricity Networks to ensure that the transmission system fulfills the security criterion. A 5 year Business Plan for network rehabilitation measures also exists. Estimates of costs of rehabilitation are based on the average technical lifetime of the equipment. With regard to the average technical lifetime of electrical equipment, the following average lifetime periods based on Kahramaa's experience are

		considered for each type of equipment: For cost estimations of future rehabilitation of transmission system installations, it has thus been assumed that the average technical lifetime of the equipment is about 30 years. Whilst the life-time of auxiliary equipment is expected to be 25 years only, these costs are relatively low compared with the high-voltage equipment costs, and a lifetime of 30 years has at times been used in studies to simplify the calculation of future rehabilitation needs. However, actual replacement/refurbishment decisions are based on the condition of the plant, its maintenance cost, obsolescence, impact on supply security/personnel safety and availability of spare parts. Urban projects are more expensive than rural or out-of-city limits projects since due to environmental/aesthetical/public safety considerations urban projects must use much expensive underground cables and enclosed substations. Small scale transmission investment such as on upgrading existing facilities could reduce/defer the need for the large scale investment on establishing new facilities. Power generation in the state of Qatar is undertaken by Independent Power & Water Producers (IPWPs). An annual maximum demand forecast is prepared based on a bulk demand survey and customer needs for the 5 year Business Plan and beyond. This forms the basis of a supply/demand balance which determines the additional capacity requirements to be purchased from IWPPs. Network plans are then developed to evacuate the power from the new production facilities, with appropriate network studies being undertaken as necessary by consultants or through recently developed in-house facilities. These network studies are based on a busload forecast which is also done, using the global forecast mentioned above. Any needed transmission facility is identified in the network development plans. Examples of non built transmission facilities are those extra network branches or upgrading of existing branches to cope with the high rate of demand

		growth. The substation sites and corridor acquisition procedure are normally commenced as early as feasible after the expansion plans are confirmed. Substation sites allocation is finalized by the Ministry of Municipal Affairs and Agriculture (MMAA). Underground cables are normally laid within the reserve allocated for Transmission circuits. Permission is obtained from the concerned authorities via a Road Opening (RO) procedure to open roads for cable laying. Overhead Lines (OHL) corridors are normally beyond the Doha City Limits, where MAA is the State's authority concerned with the determination such City limits. The OHL corridor also has to be sanctioned by the Supreme Council for the Environment and Natural Reserves (SCENR). An Environmental Impact Assessment (EIA) may be required as deemed necessary by SCENR. The time taken for such approval processes can result in the delay of projects. *Lack of information and analytical tools:* • Lack of coordination between generation planning and transmission planning • Insufficient planning tools to determine what improvements are needed in the • new restructured environment • Inability to obtain data to justify project need • Inability to forecast accurately the location of new demands which leads in many cases to transmission facilities being added in the wrong areas. A Market Study Report of the Gulf Cooperation Council Interconnection Authority (GCCIA) has recommended that each of the GCC member countries should consider establishing independent regulation. The requirement for an independent regulator at the initial stages is not critical to developing the regional electricity market, but is often critical for developing national electricity markets. Independent regulation can be established in the short to medium-term depending on the pace of

		sector reform in each GCC member country. A Regional Market (e.g. GCC Grid) will enable: • Lower installed capacity (reserve sharing) • Larger/more efficient generating units • Enable operating (spinning) reserves sharing • Interchange of energy • Permit assistance from neighbouring systems Permit emergency assistance e.g. mitigate effects of unforeseen contingencies such as catastrophic multiple outages.
Romania	Institute for Studies and Power Engineering	The transmission company requests only the necessary investment and well justified for all the categories above mentioned. The impact of siting decisions on investment is reduced - for new substations and big for new OHL (to obtain land approvals and expropriations) The study team of the TC receive information from the production companies. They analyze the increase of power consumption and establish the necessary generated power, based on calculation softwares, used by AIEA and SEP – Holland, making the development analysis of the transmission networks. There is in this respect a norme to design the development of transmission network. NPS must comply with the criterion N-1 elements in operation. The value of losses represents one of the elements to be taken into consideration, in the technical-economic analysis in order to obtain the optimal solution. Naturally, lag must be shorter. Regulations have been made, according to those in EU and they determine the good operation of NPS and therefore, of the TC. We cannot agree to the absence of any regulation or to the use of ones that are in disagreement with NPS demands. The existent power transmission network was sized for a consumption value 1.7 times higher. The following are key in preventing new Transmission facilities from being built.

		• Delays in gaining economic and environmental regulatory approvals • Lack of coordination between generation planning and transmission planning • Insufficient planning tools to determine what improvements are needed in the • new restructured environment • Inadequate returns on transmission investment • Inappropriate transmission pricing structure National and cross border needs do not suffer, however the following could improve the situation; - re-organisation of regulations adapted to an ever open energy market; - new technologies that permit cancelling some projects (investments); - power system service stimulation (e.g. consumers); - settlement of steady-state stability problems (in Romania, generally the power sources are in the South, whereas the zones, in deficit of power, are in the North); - stimulation of customers to build up power plants in the zone, in deficit of power.
Russia	Federal Grid Company of Unified Energy System	Development Strategy, grounds for investment plans have been developed Funding gap in development and modernization of network assets has resulted in increase of capacities that have exceeded the designed lifetime Within frameworks of the Holding (RAO EES) that comprises generating and networks companies The regulatory lag is fine. Transmission facilities are built. National and cross border needs do not suffer.
South Africa	Eskom	Eskom Transmission's operating licence defines it as a transporter of energy and not a trader. As such, the company is no longer permitted to justify capital investments in terms of resulting increased energy sales. The three approved justification methods are Operational Cost Saving (efficiency gains, including reductions in

		network losses and O&M cost savings), Least Economic Cost (value to customers of improved reliability or quality of supply exceeds the cost to Eskom Transmission of providing it), and Statutory/Strategic (legal requirement (usually safety or environmental), or needed for long-term sustainability of the business). The first two methods must be applied first. Secondary plant (protection, telecomms, control, measurements, standby DC) may be classified as Statutory/Strategic since benefits are difficult to quantify but consequences of failure can be catastrophic. Expansion related investments require regulatory approval on a case by case basis before being allowed as Statutory/Strategic. New or modified customer connections dedicated to the customer concerned and associated backbone reinforcements that cannot be justified using the Operational Cost Saving or Least Economic Cost methods, as well as additional investments made at a customer's request to provide quality of supply in excess of Grid Code requirements, fall outside the regulatory framework and are recovered from the customer concerned via a connection charge. The location of the customer has an impact on the overall business case whether to invest or not. However, if there are strategic reasons to invest, then the Regulator is approached for approval before the investment is made. Shunt capacitors are an effective means of buying time for line reinforcements, particularly when delayed by the environmental approval process and appeals lodged by landowners and other stakeholders against the routing of the line. They can also be a viable alternative in areas with slow load growth. Initial transmission integration cost is included in the capital cost of each station under consideration for purposes of ranking opions. For base load and mid-merit stations, a transmission avoided cost study is done. The NPV of savings and premiums in capital investments and network losses relative to a reference station are calculated over a 25 year horizon, converted to a levelised cost per MWh delivered, and added to the levelised cost per MWh of building and operating the station. The Grid Code mandates the company to

		investigate means of relieving congestion, which could include purchase of ancillary services. Investments must however satisfy the Operational Cost Saving or Least Economic Cost justification methods before being allowed into the regulatory asset base as prudently incurred. Losses are explicitly taken into account in determining the least lifecycle cost option for implementation, as well as any savings in losses being allowed as a cost saving when using the Operational Cost Saving method to justify the investment. The rising real cost of losses as a result of excess generating capacity being taken up and new plant (including a contribution to capital) playing a growing role in determining the cost thereof, is expected to result in more investments being justified on the basis of a reduction in losses. It is even expected that opportunities will exist in future to invest with the sole objective of saving losses even if the investment is not required in terms of the planning criteria. The regulator has stated explicitly that such investments are not only allowed but encouraged since they drive efficiencies in the industry, so long as a valid Operational Cost Saving business case exists. IBR is only being implemented with effect from 1 April 2006, which marks the start of the first 3 year control period for the 2007-9 financial years. As a result, we can only express an opinion based on a theoretical evaluation. The regulator has however stated its intention to extend the second control period to 5 years. It is our belief that the dynamic nature of the business environment makes planning for a 5 year period in advance with sufficient accuracy is not possible. It will prevent us from responding to changes in the environment in time, and will make an application for a reopener a certainty. The development of economically depressed areas is being held back because sufficient load growth must already exist in an area to justify transmission infrastructure before it can be built, but poor quality and reliability of supply is constraining development. A specific example is the Tabor-Spencer 275kV line, which is intended to improve reliability of service in the far north of the country, stretching about 150km south of

		the Zimbabwe border. The customer load base is dominated by game and cattle farming and peasant farmers. Building a Least Economic Cost business case requires significantly more load to be at risk to justify the investment than usual, since the customer interrupion cost for domestic or rural load is less that 10% of that for industrial or mining load. Since the problem is starting to attract the attention of local politicians, it may be possible to get approval from the regulator for the line as a strategic investment motivated by a need to foster economic development and relieve poverty in one of the most economically depressed parts of the country. Obtaining rights of way is becoming increasingly problematic. The Environmental Protection Act requires all developers to conduct an EIA and get a Record of Decision (ROD) from the provincial Department of the Environment and Tourism (DEAT) in the province or provinces in which their developments are located. Anyone, not only affected landowners, may lodge an appeal against an ROD. The appeal process starts with DEAT, and aggrieved unsuccessful parties can appeal to the Supreme Court and onwards to the Supreme Court of Appeal and Constitutional Court, which could theoretically delay the process by as much as 5 years. In our case, this relates to substation construction or extension as well as line rights of way and construction. An exemption can usually be obtained without difficulty from DEAT for substation extensions that do not require the purchase of additional land on condition that an environmental impact management plan is submitted. The ROD is only valid for two years, but can be extended for up to five years, after which a new EIA and ROD must be obtained before construction can start. The appeal process may also delay this second ROD. One recent experience was with the Matimba-Witkop 2 400kV line which was delayed by more than a year by appeals lodged by landowners against the ROD for acquisition of the right of way and line construction. Because transmission plant generally has a high level of reliability, failure statistics on specific items of plant are generally too sparse to be statistically significant. In such cases, generic

		values are calculated using the performance of the entire population of such plant items. Secondary plant refurbishment has proved particularly problematic to justify in financial terms. Refurbishment of the control systems of the five AEG SVCs installed in the early 1980's was justified as a strategic investment since malfunction could have catastrophic consequences, but the risk cannot be quantified with sufficient accuracy for business case purposes. It was shared with the regulator as a test case to exclude the risk of it being disallowed from the regulatory asset base. The regulator supported our approach, and gave permission for secondary plant refurbishment in general to be justified in this manner so long as it can be proved that the existing equipment is problematic or can no longer be maintained due to lack of spares. Regulation takes place on a national level in South Africa. An association of regulators exists for the member states of the Southern African Power Pool (SAPP) to coordinate regulatory policy to foster the development of cross border interconnections for regional development. South Africa, Namibia, Botswana, Lesotho, Swaziland, Mozambique, Zimbabwe, Zambia, Democratic Republic of Congo, and Congo Republic are interconnected.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	There have not been significant changes in the regulatory environment regarding transmission during the last years. New Generation location decisions are having an important impact on investment in transmission network This is one of the present main problems of transmission planning in Spain. The location of generation is decided by the generation companies without much consideration about the transmission facilities that could be needed. Usually they assume that the transmission network will have the capacity they need, which has usually been the case. However, this could no longer be true. Coordination between transmission and generation location is now a problem and locational signals for generation sitting should be introduced shortly. Transmission planning must foresee in advance

		where more generation will be located depending on several factors like access to the grid requests from generators. One of the objectives of transmission planning is to provide more efficiency to the system. For doing this, congestion must be reduced or removed if possible and losses must be reduced. There is not a specific regulatory period in Spain The following transmission facilities are not being built; • Transmission line Lada-Velilla, which would links the north (a very important generation zone in Spain) with the centre-north of Spain • Soto-Penagos, links two regions of the north of Spain with several generation resources The following are key factors in preventing new transmission facilities from being built; • Public opposition to new facilities and (perhaps, to a lesser extent) upgrades of existing facilities • Delays in gaining economic and environmental regulatory approvals National and cross border needs suffer because of the local and state/provincial nature of the regulation of transmission expansion. Given the fact that in Spain what prevents the TSO to build the necessary lines is public local opposition, this is the point to be addressed. Local authorities need to be convinced of the public interest of the installation. Apart from the private owners of the land, the municipalities need to be adequately compensated. Actions to minimize the transmission lines impact in their territories are also needed. However, in some cases it will continue to be very difficult. It is a fact that society does not accept some transmission lines.
Switzerland	Atel Transmission Ltd	Not applicable

Q5 Impact of Regulatory Changes

Country	Respondent	Revenue available for developing/managing the network
Australia	Powerlink Queensland	The regulator has set up a couple of performance measures for the power system based on the number of loss of supply events and percentage of time that transmission elements are available for service. The revenue set by regulators does allow for the minimum to operationally manage the network. Regulation has increased the awareness of revenue orientated benchmarking.
	Transend Networks Pty Ltd	The regulator has set up a couple of performance measures for the power system based on the number of loss of supply events and percentage of time that transmission elements are available for service. The revenue set by regulators does allow for the minimum to operationally manage the network. Regulation has increased the awareness of revenue orientated benchmarking.
	Vencorp	The regulator has set up a couple of performance measures for the power system based on the number of loss of supply events and percentage of time that transmission elements are available for service. In Victoria, VENCorp has developed an availability incentive scheme. The scheme is a simplified alternative to a fully market based approach to measuring and incentivising network owner performance. The scheme is in place with the Victorian network owners and aims to provide economic signals to network owners which encourage network owners to seek plant outages at times when the expected cost to wholesale electricity market participants of an outage is minimal. The revenue set by regulators does allow for the minimum to operationally manage the network. Regulation has increased the awareness of revenue orientated benchmarking.
	Western Power Corporation	In WA the regulatory proposal is still being evaluated but we have proposed two reliability measures, network availability and system minutes.
Belgium	Elia	No performance measures are available. The revenue set by regulators does allow for the minimum to operationally manage the network.

		Regulation has increased the awareness of revenue orientated benchmarking.
France	RTE	Regulation has not increased the number of revenue orientated performance indices. Regulation has increased the awareness of revenue orientated benchmarking.
Germany	Consentec & VDN	The revenue set by regulators does allow for the minimum to operationally manage the network. Regulation has increased the number of revenue orientated performance indices. Regulation has increased the awareness of revenue orientated benchmarking.
Italy	GRTN	A Cost/Benefit Analysis is carried out to evaluate the performance of the investment in the transmission system. This Analysis is based on Discounted Cash Flow methodology and it brings to the calculation of some performance indices. Regulation has increased the awareness of revenue orientated benchmarking.
Korea	Korea Electric Power Corporation (KEPCO)	No performance measures are available. The revenue set by regulators does allow for the minimum to operationally manage the network.
Qatar	Qatar General Electricity and Water Corporation	As part of the Corporate Performance Report (CPR) to Senior Management, key performance indicators are reported covering: • System Minutes Lost (for Generation & Transmission event separately); • Loss of Load (Minutes); • System Average Interruption Duration Index (SAIDI); and • System Average Interruption Frequency Index (SAIFI). A study is currently being undertaken using consultants to benchmark performance, including power system performance, against regional (Gulf Cooperation Council - GCC) and international utilities as part of an initiative to improve performance of Kahramaa as an entity.
Romania	Institute for Studies and Power Engineering	The following performance indicators are available; - performance indices of NTS; - economic and financial efficiency indices for optimizing the investment; - criterion of reliability based maintenance, not time based. The revenue set by regulators does allow for the minimum to operationally manage the network.

		Regulation has increased the number of revenue orientated performance indices. Regulation has increased the awareness of revenue orientated benchmarking.
Russia	Federal Grid Company of Unified Energy System	The following performance indicators are available; • *Bottleneck* • *Losses* • *Failures* • *Investments efficiency* The revenue set by regulators does allow for the minimum to operationally manage the network. Regulation has increased the number of revenue orientated performance indices. Regulation has increased the awareness of revenue orientated benchmarking.
South Africa	Eskom	A set of KPIs is used to measure power system performance, from which a Technical Sustainability Index is calculated. This index is used as a measure in performance appraisals of individuals as well as reporting to the business. The KPIs include total Cigre System Minutes lost in incidents of less than 1 minute each, total interruptions less than one minute, total interruptions of one minute or more, and quality of supply exceedances (voltage dips, harmonic distortion, voltage unbalance, under- or overvoltage). The revenue set by regulators does allow for the minimum to operationally manage the network. Regulation has increased the number of revenue orientated performance indices. Regulation has increased the awareness of revenue orientated benchmarking.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	There are some indices like ENS (Non Supplied Energy) and TMI (Average Interruption Time) that measures the quality of service. The revenue set by regulators does allow for the minimum to operationally manage the network. Regulation has not increased the number of revenue orientated performance indices. Regulation has not increased the awareness of revenue orientated benchmarking.
Switzerland	Atel Transmission Ltd	Not applicable
Country	**Respondent**	**System Investment Incentives**

Australia	Powerlink Queensland	The pricing policy prescribed by the regulator does allow for a realistic depreciation period. The operational life-expectancy does align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does accommodate the necessary transmission network investment.
	Transend Networks Pty Ltd	The pricing policy prescribed by the regulator does allow for a realistic depreciation period. The operational life-expectancy does align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does accommodate the necessary transmission network investment.
	Vencorp	Tariff increases prescribed by regulation does accommodate the necessary transmission network investment.
	Western Power Corporation	No regulatory decision as yet.
Belgium	Elia	The pricing policy prescribed by the regulator does not allow for a realistic depreciation period. The regulator has imposed depreciation periods that are far too long and that do not give enough money for the autofinancing. These periods are really too long for electronic equipments but even for the classical ones. The operational life-expectancy does not align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does not accommodate the necessary transmission network investment. There are no tariff increases. Regulation has not increased the number of system investment orientated performance indices. Regulation has increased the awareness of system investment orientated benchmarking
France	RTE	The pricing policy prescribed by the regulator does allow for a realistic depreciation period. The operational life-expectancy does not align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does accommodate the necessary transmission

		network investment. Regulation has increased the awareness of system investment orientated benchmarking
Germany	Consentec & VDN	The pricing policy prescribed by the regulator does allow for a realistic depreciation period. The operational life-expectancy does align with the financial life-expectancy of plant and equipment. Regulation has increased the number of system investment orientated performance indices. Regulation has not increased the awareness of system investment orientated benchmarking
Italy	GRTN	The pricing policy prescribed by the regulator does allow for a realistic depreciation period. The operational life-expectancy does not align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does accommodate the necessary transmission network investment. Regulation has increased the awareness of system investment orientated benchmarking
Korea	Korea Electric Power Corporation (KEPCO)	The pricing policy prescribed by the regulator does allow for a realistic depreciation period. The operational life-expectancy does not align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does not accommodate the necessary transmission network investment. Regulation has not increased the number of system investment orientated performance indices. Regulation has not increased the awareness of system investment orientated benchmarking.
Qatar	Qatar General Electricity and Water Corporation	No comment
Romania	Institute for Studies and Power Engineering	The operational life-expectancy does align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does accommodate the necessary transmission network investment. Regulation has increased the number of system investment orientated performance indices. Regulation has increased the awareness of system

		investment orientated benchmarking.
Russia	Federal Grid Company of Unified Energy System	The pricing policy prescribed by the regulator does allow for a realistic depreciation period. The operational life-expectancy does not align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does not accommodate the necessary transmission network investment. Regulation has increased the number of system investment orientated performance indices. Regulation has increased the awareness of system investment orientated benchmarking.
South Africa	Eskom	The pricing policy prescribed by the regulator does not allow for a realistic depreciation period. Currently all Transmission assets are written off over a period of 25 years. This period does not reflect the correct economic life of the assets. The operational life-expectancy does not align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does accommodate the necessary transmission network investment to some extent. Regulation has increased the awareness of system investment orientated benchmarking.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	The pricing policy prescribed by the regulator does allow for a realistic depreciation period. The operational life-expectancy does align with the financial life-expectancy of plant and equipment. Tariff increases prescribed by regulation does accommodate the necessary transmission network investment. Regulation has not increased the number of system investment orientated performance indices. Regulation has not increased the awareness of system investment orientated benchmarking.
Switzerland	Atel Transmission Ltd	Not applicable.

Country	Respondent	System Maintenance Incentives
Australia	Powerlink Queensland	Regulation may lead to cost cutting of maintenance practices. The aim is to achieve reduced costs through efficiency improvements. Regulation may lead to the enhancement of maintenance practices. The aim is to achieve reduced costs through efficiency improvements, however there is always the risk that the incentives may lead to reduction in costs by reducing services. Regulation has increased the number of maintenance orientated performance indices. Regulation has increased the awareness of system maintenance orientated benchmarking.
	Transend Networks Pty Ltd	Regulation may lead to cost cutting of maintenance practices. Regulation may not lead to the enhancement of maintenance practices. Regulation has increased the number of maintenance orientated performance indices. Regulation has increased the awareness of system maintenance orientated benchmarking.
	Vencorp	Not applicable.
	Western Power Corporation	Regulatory decision not yet made.
Belgium	Elia	Regulation may lead to cost cutting of maintenance practices. Regulation has increased the number of maintenance orientated performance indices. Regulation has increased the awareness of system maintenance orientated benchmarking.
France	RTE	Regulation has not increased the number of maintenance orientated performance indices. Regulation has not increased the awareness of system maintenance orientated benchmarking.
Germany	Consentec & VDN	Regulation has increased the number of maintenance orientated performance indices. Regulation has increased the awareness of system maintenance orientated benchmarking.
Italy	GRTN	No comment
Korea	Korea Electric	Regulation may not lead to cost cutting of

	Power Corporation (KEPCO)	maintenance practices. Regulation may lead to the enhancement of maintenance practices. Regulation has increased the number of maintenance orientated performance indices.
Qatar	Qatar General Electricity and Water Corporation	No comment.
Romania	Institute for Studies and Power Engineering	Regulation may lead to cost cutting of maintenance practices. Regulation may lead to the enhancement of maintenance practices. Regulation has increased the number of maintenance orientated performance indices. Regulation has increased the awareness of system maintenance orientated benchmarking.
Russia	Federal Grid Company of Unified Energy System	Regulation may not lead to cost cutting of maintenance practices. Regulation may lead to the enhancement of maintenance practices. Regulation has increased the number of maintenance orientated performance indices. Regulation has increased the awareness of system maintenance orientated benchmarking.
South Africa	Eskom	Regulation may lead to cost cutting of maintenance practices. Regulation may lead to the enhancement of maintenance practices. The efficiency initiatives might lead to optimisation of the maintenance activities. Regulation has increased the number of maintenance orientated performance indices. Regulation has increased the awareness of system maintenance orientated benchmarking.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	Regulation may lead to cost cutting of maintenance practices. Regulation may lead to the enhancement of maintenance practices. Regulation has not increased the number of maintenance orientated performance indices. Regulation has not increased the awareness of system maintenance orientated benchmarking.

Switzerland	Atel Transmission Ltd	Not applicable.

Country	Respondent	Customer Satisfaction
Australia	Powerlink Queensland	Regulation has negatively affected customer's satisfaction regarding the price paid for electricity. Regulation has negatively affected customer's satisfaction regarding the *quality* of electricity. Regulation negatively affected customer's satisfaction regarding the *reliability* of electricity. Regulation has increased the number of customer orientated performance indices. Regulation has not increased the awareness of customer orientated benchmarking.
	Transend Networks Pty Ltd	Regulation has negatively affected customer's satisfaction regarding the price paid for electricity. Regulation has negatively affected customer's satisfaction regarding the *quality* of electricity. Regulation has not increased the awareness of customer orientated benchmarking.
	Vencorp	Not applicable.
	Western Power Corporation	No comment.
Belgium	Elia	Regulation has negatively affected customer's satisfaction regarding the price paid for electricity. Due to different mechanisms, the government has used the transmission tariffs to collect taxes. Therefore the price of electricity in whole has not decreased and the expectation of the customers has been deceived. Regulation has not affected customer's satisfaction regarding the *quality* of electricity. Regulation has not affected customer's satisfaction regarding the *reliability* of electricity. Regulation has increased the number of customer orientated performance indices. Regulation has increased the awareness of customer orientated benchmarking.
France	RTE	Regulation has increased the number of customer orientated performance indices. Regulation has increased the awareness of customer orientated benchmarking.
Germany	Consentec & VDN	Regulation has increased the number of customer orientated performance indices. Regulation has increased the awareness of

		customer orientated benchmarking.
Italy	GRTN	Regulation has negatively affected customer's satisfaction regarding the price paid for electricity. Regulation has increased the number of customer orientated performance indices. Regulation has increased the awareness of customer orientated benchmarking.
Korea	Korea Electric Power Corporation (KEPCO)	Regulation has negatively affected customer's satisfaction regarding the price paid for electricity. Regulation has positively affected customer's satisfaction regarding the *quality* of electricity. Regulation positively affected customer's satisfaction regarding the *reliability* of electricity. Regulation has increased the number of customer orientated performance indices.
Qatar	Qatar General Electricity and Water Corporation	No comment.
Romania	Institute for Studies and Power Engineering	Regulation has positively affected customer's satisfaction regarding the *quality* of electricity. Regulation positively affected customer's satisfaction regarding the *reliability* of electricity. Regulation has increased the number of customer orientated performance indices. Regulation has increased the awareness of customer orientated benchmarking.
Russia	Federal Grid Company of Unified Energy System	Regulation has positively affected customer's satisfaction regarding the price paid for electricity. Regulation has positively affected customer's satisfaction regarding the *quality* of electricity. Regulation positively affected customer's satisfaction regarding the *reliability* of electricity.
South Africa	Eskom	Regulation has positively affected customer's satisfaction regarding the price paid for electricity. Regulation has not increased the number of customer orientated performance indices. Regulation has not increased the awareness of customer orientated benchmarking.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	Regulation has increased the number of customer orientated performance indices. Regulation has not increased the awareness of customer orientated benchmarking.
Switzerland	Atel Transmission Ltd	Not applicable.

Country	Respondent	Level of System Security
Australia	Powerlink Queensland	It is not believed that regulation may lead to the future *improvement* in level of system security. System operation is not subject to economic regulation.
	Transend Networks Pty Ltd	It is not believed that regulation may lead to the future *improvement* in level of system security.
	Vencorp	It is believed that regulation may lead to the future *improvement* in level of system security. Regulation has increased the number of system security orientated performance indices. Regulation has increased the awareness of system security orientated benchmarking.
	Western Power Corporation	No comment.
Belgium	Elia	It is believed that regulation may not lead to the future *improvement* in level of system security. Regulation has increased the number of system security orientated performance indices. Regulation has increased the awareness of system security orientated benchmarking.
France	RTE	Regulation has not increased the number of system security orientated performance indices. Regulation has not increased the awareness of system security orientated benchmarking.
Germany	Consentec & VDN	Regulation has increased the number of system security orientated performance indices. Regulation has increased the awareness of system security orientated benchmarking.
Italy	GRTN	Regulation has increased the number of system security orientated performance indices. Regulation has increased the awareness of system security orientated benchmarking.
Korea	Korea Electric Power Corporation (KEPCO)	It is believed that regulation may lead to the future *improvement* in level of system security. Regulation has increased the number of system security orientated performance indices. Regulation has increased the awareness of system security orientated benchmarking.
Qatar	Qatar General Electricity and Water Corporation	No comment.
Romania	Institute for Studies and Power Engineering	It is believed that regulation may lead to the future *improvement* in level of system security. Regulation has increased the number of system security orientated performance indices. Regulation has increased the awareness of system security orientated benchmarking.
Russia	Federal Grid	It is believed that regulation may lead to the

	Company of Unified Energy System	future *improvement* in level of system security. Regulation has increased the number of system security orientated performance indices. Regulation has increased the awareness of system security orientated benchmarking.
South Africa	Eskom	It is believed that regulation may lead to the future *improvement* in level of system security. Regulation has not increased the number of system security orientated performance indices. Regulation has increased the awareness of system security orientated benchmarking.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	It is believed that regulation may lead to the future *improvement* in level of system security. System security includes short-term and long-term system security. In the first one, the regulator can improve the security by giving the TSO more tools, for example, to be able to purchase reserves directly with generators, to centrally manage the water resources, to require wind generation more technical requirements to help the TSO with system security. Regarding the long-term system security, the regulator can encourage more investments in generation by introducing locational signals. Regulation has not increased the number of system security orientated performance indices. Regulation has not increased the awareness of system security orientated benchmarking.
Switzerland	Atel Transmission Ltd	Not applicable.

Country	**Respondent**	**Transmission Design**
Australia	Powerlink Queensland	Regulation has influenced utilities to produce more cost effective transmission network designs. Cost driven designs have not affected safety issues. Cost driven designs have affected reliability and system security issues.
	Transend Networks Pty Ltd	Regulation has not influenced utilities to produce more cost effective transmission network designs. Cost driven designs have not affected safety issues. Cost driven designs have affected reliability and system security issues.

	Vencorp	Regulation has not influenced utilities to produce more cost effective transmission network designs. Cost driven designs have not affected safety issues. Cost driven designs have not affected reliability and system security issues.
	Western Power Corporation	Cost driven designs have not affected safety issues. Cost driven designs have affected reliability and system security issues.
Belgium	Elia	Cost driven designs have not affected safety issues. Cost driven designs have not affected reliability and system security issues.
France	RTE	Regulation has not influenced utilities to produce more cost effective transmission network designs. In the past, network development strategies were designed in France according to a least cost criterion. Regulation has not lead to change this design criterion. Regulation has increased the number of design orientated performance indices. Regulation has not increased the awareness of transmission design orientated benchmarking.
Germany	Consentec & VDN	Cost driven designs have not affected safety issues. Cost driven designs have affected reliability and system security issues. Regulation has not increased the number of design orientated performance indices.
Italy	GRTN	Regulation has influenced utilities to produce more cost effective transmission network designs. Cost driven designs have not affected safety issues.
Korea	Korea Electric Power Corporation (KEPCO)	Regulation has not influenced utilities to produce more cost effective transmission network designs. Cost driven designs have affected safety issues. Cost driven designs have affected reliability and system security issues. Regulation has not increased the number of design orientated performance indices. Regulation has not increased the awareness of transmission design orientated benchmarking.
Qatar	Qatar General Electricity and	Cost driven designs have not affected safety issues.

	Water Corporation	Cost driven designs have not affected reliability and system security issues.
Romania	Institute for Studies and Power Engineering	Regulation has influenced utilities to produce more cost effective transmission network designs. Cost driven designs have not affected safety issues. Cost driven designs have not affected reliability and system security issues. Regulation has increased the number of design orientated performance indices. Regulation has increased the awareness of transmission design orientated benchmarking.
Russia	Federal Grid Company of Unified Energy System	Regulation has influenced utilities to produce more cost effective transmission network designs. Cost driven designs have affected safety issues. Cost driven designs have affected reliability and system security issues. Regulation has increased the number of design orientated performance indices. Regulation has increased the awareness of transmission design orientated benchmarking.
South Africa	Eskom	Regulation has influenced utilities to produce more cost effective transmission network designs. Cost driven designs have affected safety issues. Cost driven designs have affected reliability and system security issues. Regulation has not increased the number of design orientated performance indices. Regulation has not increased the awareness of transmission design orientated benchmarking.
Spain	RED ELÉCTRICA DE ESPAÑA, S.A. (REE)	Regulation has influenced utilities to produce more cost effective transmission network designs. Cost driven designs have not affected safety issues. Cost driven designs have not affected reliability and system security issues. Regulation has not increased the number of design orientated performance indices. Regulation has not increased the awareness of transmission design orientated benchmarking.
Switzerland	Atel Transmission Ltd	Not applicable.