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Enhancement Framework in Regulated Utilities

A Report for Network Rail and ORR

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1. Introduction

This report, by NERA Economic Consulting for Network Rail and the Office of Rail Regulation, describes and analyses the arrangements for capital investment in infrastructure by other UK regulated network utilities (gas transportation, electricity transmission and distribution, water and sewerage, and airports). It focuses, in particular, on the way that the risks associated with capital investment are allocated between the network operators, their customers, their suppliers, their subcontractors and other parties. And it covers projects that fall both within and outside of the range of activities funded by each company's price cap. While we compare the risks faced in these industries with those arising in the rail industry, we were not asked to provide recommendations about how rail industry risks should be allocated.

Our analysis has been based on a combination of desk research, use of existing industry knowledge and discussions with a small number of individual companies in each of the industries studied. We would like to thank all those who have assisted with this study.

Our findings from each of the industries studied are set out in Sections 3 to 6 of this report. Before this, Section 2 contains a summary of the main risks associated with capital investment in each industry, how this situation compares with the rail industry, how these risks are allocated and some final concluding comments.

2. Synthesis and Comparison with Rail

2.1. Introduction

In this Section, we summarise the framework applying to enhancement investment in the gas, electricity, water and airports industries. First, in Section 2.2, we describe the main risks arising in relation to investment in each of these industries, and in Section 2.3 we assess the main similarities and differences between these industries and the rail industry (and rail infrastructure provision in particular). Then, in Section 2.4, we summarise the way in which these risks are allocated between the network operators, customers, suppliers, subcontractors and other parties. We also describe the mechanisms that are used to determine risk allocations, for example whether it is the methodology used to set the firm's price cap (especially the way in which the regulatory asset base (RAB) is rolled forward), other action by the regulator or a commercial decision by the network operator itself.

2.2. The Risks Faced in Each Industry

Capital investment in the electricity, gas and water industries is often carried out for one of four main reasons:

- to replace a part of the existing network, because it is either life-expired or damaged;
- to meet new service quality, environmental or safety requirements;
- to increase the capacity of part of the existing network, either because of general demand growth or because of specific changes (such as new industrial or residential developments leading to increased demand at certain locations, or the introduction of new sources of supply); or
- to connect new customers or suppliers to the existing network.

In many cases, the nature of the projects undertaken under each of these categories is relatively similar: a new main or pipeline is laid underground, and it is connected to the existing network at one or both ends. Capital investment at major airports is somewhat different, however, and can include either the construction of brand new infrastructure (runways, terminals, etc) or the extension or refurbishment of existing facilities.

Much of this investment will be funded through each company's price cap. This has important implications for the allocation of risks between companies and their customers, as discussed in Section 2.4 below, but it may also create some additional risks, at least in the short term. And some investment projects may fall outside of the price cap, for example some new connections (though the boundary between the costs that are or are not funded by the price cap varies between industries) or work carried out for third parties (such as a diversion of the network).

2.2.1. Cost overruns

As with many construction projects, investment expenditure in the electricity, gas, water and airports industries is subject to the risk of cost overruns. Projects can be more expensive than

originally expected, either because the initial cost estimate was an optimistic one or because of unforeseen events.

Although the fact that pipes and mains are often laid underground might create some uncertainty, for example because of the risk of encountering unexpected obstacles, there is also a very substantial body of experience in each industry of similar work that has been carried out in a wide range of terrains. Those carrying out the work (whether it is the network operator itself, a subcontractor or a third party) will usually have extensive prior experience of similar work. In addition, both Ofgem and Ofwat have carried out their own analysis of the likely unit cost for different types of work.

In theory, one other possible reason for a cost overrun might be because the condition of the existing network is worse than originally expected. But as we note in Section 2.2.3 below, many investment projects will be carried out on a freestanding basis, and only interconnect with the existing network at one or two points. This reduces very substantially the risk that unexpected problems with the existing network will cause difficulties for capital investment projects.

Although airport investments also have many similarities to "standard" construction projects in the rest of the economy, as we note below there may be an additional risk of delay or disruption. These events may also lead to cost overruns (for example because of increased security costs or an extended planning process).

2.2.2. Delays

Many construction projects across the economy as a whole take longer than expected, while some are completed sooner. This risk of capital investment being delayed will also affect projects carried out in the gas, electricity, water and airports industries. But there is no obvious reason why this risk should be any higher (or lower) in the gas, electricity and water industries, especially for straightforward projects to replace, strengthen or extend an existing network.

In the case of airports, however, the high profile of major investment schemes (such as new runways or terminals) introduces a significant risk that the project could be delayed. This might be because of difficulties in obtaining the necessarily planning and other approvals, which led to a very substantial delay indeed in the case of Heathrow's Terminal 5. Or it might reflect the impact of continuing protests against the investment, as occurred for example before the start of construction on Manchester Airport's second runway.

The impact of a delay on a firm's costs and revenues may then reflect a number of different factors, including:

- the mere fact that a project takes longer than expected will very often add to the cost of the project, simply because workmen, machinery etc need to be retained for a longer period than previously expected;
- a delay in a project may reduce the firm's revenues. This may be a direct effect, because the new investment is needed to provide additional capacity at a particular location where the firm cannot at present meet demand. Or else the impact on revenues may be indirect,

for example because the new investment is added to the firm's regulatory asset base at a later time than originally expected;

- the delay may result in the firm incurring additional costs (or lower revenues) because of service quality incentives introduced by the regulator. Some incentives (such as those applying to certain milestones in the delivery of Heathrow's Terminal 5) may be directly linked to the implementation of new investment projects, the provision of new connections and so on. Equally, a delay in particular projects may make it more difficult for the network operator to meet other targets (such as overall network reliability);
- the network operator may also incur additional costs if it needs to make alternative arrangements to meet demand (or satisfy service quality requirements) because the new investment will now come on stream later than expected;
- finally, a delay in particular types of investment, particularly new connections, may have serious implications for individual customers, perhaps even preventing some businesses from operating at all. Contracts for new connections often include liquidated damages that are payable by the network operator in the event of a delay, though in some cases these are small or are not payable if the delay is due, for example, to delays in obtaining the necessary planning consents.

2.2.3. Operational disruption

A great many investment projects will require part of the existing network to be shut down at some stage. A further possible risk, therefore, is that capital investment could disrupt the operation of the existing network, resulting in unexpected (or longer than expected) interruptions of supply. As with delays to the investment programme, interruptions of supply (or other degradations in quality) could result in a direct reduction in network operators' profits because of the impact of regulatory service quality incentives, or else because of compensation that must be paid to particular customers affected by disruption.

In general, however, the risk of disruption to existing services is relatively low for most investment projects. This is because the vast majority of work is carried out away from the existing network. In the case of a new connection, there may be only one or two locations where the new infrastructure meets the existing network. And even where the existing network is being replaced, this will often be achieved by laying new mains or pipes alongside the existing network or even along a different route. The main risk of operational disruption in such cases arises only when the new infrastructure is being connected to the existing network. The consequences of such disruption are likely to be limited, as the work can be planned (and customers notified of possible interruptions) in advance, and supply will generally only be interrupted for a short period of time.

A further important feature of electricity, gas and water networks is that supplies can usually take several different routes to reach the same destination. If part of the main transmission (rather than local distribution) network is disabled, then it is very possible that there may be no supply interruptions at all. And where work is being carried out on a local distribution network, there will usually be only a small number of customers who will not be able to continue receiving supplies via another route. So the impact of supply interruptions will generally be confined to a small number of customers in a very specific location.

The risk of operational disruption is slightly higher at airports. Occasionally, work is carried out close to runways, and there may be a small risk of disruption to services if the runway needs to be closed at any time. But the more likely event is a more general deterioration in service quality, for example because refurbishment or expansion work being carried out in an existing terminal building affects the availability of check-in desks and airbridges, or the speed and reliability of baggage handling facilities.

2.2.4. Volume and funding risks

A further risk facing regulated utilities is that they are typically subject to price caps that are reviewed at fixed intervals, usually every five years. The price cap is set, at the beginning of each five year period, on the basis of the regulator's assumptions about how much investment the firm will need to carry out during the period until the next price cap review. But there may be no mechanism for adjusting the price cap between regulatory reviews if external factors (such as greater than expected demand growth or a shift in weather patterns) mean that the firm needs to carry out substantially more investment than the regulator allowed for in the price cap.

In many cases, regulated firms will have little or no choice about whether or not to carry out this investment. They are often required to meet minimum quality standards (for example, the gas transportation network should be able to cope with a level of demand that will be exceeded in only 1 out of 20 years) and will face fines or licence enforcement measures if they do not take measures to ensure that sufficient capacity is available.

In practice, a firm may face two different types of risk associated with unexpected investment that it needs to carry out between price cap reviews:

- first, there may be some doubt about how it will eventually be compensated for the additional investment that it has carried out. In extreme cases, the new investment might be ignored altogether when the regulator calculates future price caps. And even where the regulator makes a full allowance at the next scheduled price review for the unexpected investment, the firm may lose out on the financing costs incurred during the current price control period;
- second, because any adjustment to the firm's revenues may not occur until the next scheduled price cap review, the need to fund additional investment within the original price cap may place pressure on the firm's finances.

2.2.5. Other risks

In theory, investment in each of the four industries is potentially subject to risks associated with safety or environmental damage, relating to both the staff carrying out the investment and also customers and others in the immediate vicinity of the new facility (who might be affected by a gas leak, inadequately protected against high voltage electricity, flooding or sewerage spills, or affected by aviation accidents). In practice, however, the regulatory requirements placed on each industry by bodies such as the Heath & Safety Executive, the Environmental Agency and the Civil Aviation Authority mean that the safety and environmental risks are minimal, but where they do arise a clear enforcement process is

already mapped out. If a network operator were to be found in breach of these regulations, then in many cases it could find itself subject to criminal prosecution.

A more tangible and potentially problematic risk is that associated with the quality of any new infrastructure provided. If, for example, a new pipeline connecting a particular customer, or even a new part of the main transmission/distribution network itself, is poorly constructed, then this may lead to increased maintenance costs at some point in the future or even the need for an early replacement. But such problems may not become apparent until long after the original investment has been completed.

2.2.6. Assessment of risks faced

Most investment carried out in the gas, electricity, water and airports industries includes a major element of construction work. It is inevitable, therefore, that there is some risk of cost overruns associated with such projects, either because the cost of specific tasks is higher than expected or because the project as a whole takes longer than expected to complete. But with the exception of major airport expansions, which face a risk of delay due to factors such as the planning process or protests by environmental groups, there is no clear reason to suppose that the risks faced by other regulated utilities is any greater than those affecting construction projects in the economy as a whole. Indeed, much of the work is relatively straightforward and the risk of cost overruns could be smaller than for construction projects in other sectors of the economy.

The risk of operational disruption appears to be small in all of the industries we have looked at. This reflects the fact that most work is carried out away from the existing network, and when supply interruptions do occur they are generally short and very localised. Similarly, the risks associated with safety or environmental factors appear to be low.

In general, similar risks apply across each industry, regardless of the type of enhancement project that is being carried out (for example, whether it is enhancing the reliability of the existing network or meeting the specific needs of particular customers or suppliers). One exception, however, is the volume and funding risk discussed in Section 2.2.4 above. As this reflects the largely fixed nature of a firm's revenue stream between price cap reviews, it clearly applies only to projects that are funded from a company's price capped revenues (rather than separate charges that fall outside of the price cap).

2.3. Comparison with the Rail Industry

There are a number of superficial similarities between the industries examined in this report and rail infrastructure provision. All are capital-intensive network industries, operating to a greater or lesser degree as natural monopolies and subject to economic regulation. Investment expenditure in all of these industries is subject to at least the same risk of cost overruns and time delays that affects capital investment projects in almost any sector of the economy.

One immediate difference, however, between rail infrastructure provision and the other industries featured in this report is that railways are confined to very specific route alignments. Most enhancement projects in the rail industry will be carried out along these existing routes, whereas much of the work in the gas, electricity and water industries can be

carried out without interfering with the existing network at all (and even at airports, much enhancement work will take place a sufficient distance away from operational facilities). Among other things, this means that in the rail industry:

- there are significant additional complexities associated with working on or alongside an operating network. Work may need to be carried out at certain restricted times (such as evenings or weekends), and this can mean that even minor perturbations in the work programme can have a significant impact on timescales and costs;
- because work is often carried out directly on the existing network, there is a significant risk that unanticipated features of the existing network (including the general asset condition or the interface with sophisticated signalling and communications equipment) could disrupt the work programme and lead to cost overruns or delays in completing the project; and
- there is also a much greater risk that investment projects will lead to operational disruption. Work that overruns may lead to additional cancellations or delays (either because part of the network needs to be shut down or, for example, because temporary speed restrictions need to imposed on a route). And any problems that occur during the work may also disrupt services.[1]

In addition to "standard" construction risks that affect all sectors of the economy, therefore, rail industry investment projects are likely to face significant additional risks that can lead to cost overruns or delays in completing the work. And the fact that work is very often carried out on existing routes increases the risk of operational disruption associated with enhancement projects.

A further very important difference is that, from each individual customer or supplier's point of view, the main function of electricity, gas and water networks is either to deliver a standard commodity to the customer's premises, or else to accept the supplier's input at an appropriate point of connection. Rail infrastructure is different, as:

- the route that a train takes across the network between its origin and destination is an important part of the service. For many services, the route is dictated by intermediate stops or the ability to run particular types of rolling stock over certain lines, and ride quality;
- the journey from origin to destination is an intrinsic part of the service. Factors such as journey time, service frequency, interchanges, ride quality and the quality of rolling stock can have a significant impact on passenger demand.

These factors mean that where operational disruption occurs on the rail network (and we have already argued that there is a greater risk of such disruption than in the electricity, gas, water and airports industries), the consequences of that disruption may be more widespread. In contrast, supply interruptions in the electricity, gas and water industries will usually be confined to a very small locality.

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[1] One recent example occurred when a crane fell over during work at Clapham Junction, causing major disruption to South West Trains services.

Finally, we note that the impact of this disruption will be magnified further by the performance regimes and incentives operating in the rail industry. Unlike in other regulated industries (where, for example, compensation may only become payable if supply is interrupted for 18 hours or more), there is almost no "dead band" in rail industry performance regimes. And compensation payments in other regulated industries are often arbitrary and relatively small sums of money, whereas rail industry performance payments are intended to provide full compensation to train operators for revenue losses (and, until recently, also included an additional "societal" top up).

2.4. How Risks Are Allocated in Each Industry

In this Section, we summarise the way in which risks associated with capital investment projects in the electricity, gas, water and airports industries are allocated. In some cases, work is carried out by subcontractors and at least some of the risk associated with the project is borne those subcontractors. But where the network operator itself carries out the work, or where it bears some of the risk even though the work is being undertaken by subcontractors, then some of this risk might be shared or even passed on entirely to customers. On occasion, this might be the result of a specific contract with the customer, for example which is based on the emerging cost of an investment. More usually, however, customers often bear some, and in some cases a very high proportion, of the long term risk associated with investment projects through the operation of the price cap and, in particular, the methodology used by the regulator to roll forward the RAB when the price cap is reset.

2.4.1. Cost overruns

2.4.1.1. Relationship with subcontractors

While many network operators use subcontractors to some extent during the course of major and minor investment projects, their role is often quite limited. They are usually charged with carrying out a specific piece of work, rather than managing a particular capital project in its entirety. The risks that are generally allocated to the subcontractors are correspondingly restricted, usually to variations in the unit costs of particular types of work.

Network operators typically retain responsibility for the design of capital works programmes. While subcontractors may carry out much of the work, they will generally be paid on the basis of agreed unit rates for standard tasks (such as laying a certain length/diameter of pipe, or providing a new connection of a certain length). Subcontractors therefore bear the risk of cost overruns that are caused by higher than expected unit costs for well-defined tasks, but not more general risks associated with project design and management.[2]

Other factors that might cause cost overruns, for example the project being more complex or requiring a greater length/diameter of pipes than originally expected, will remain with the network operator rather than the subcontractor. Equally, since subcontractors are paid on the

[2] In some cases, network operators are now establishing "partnership" or similar arrangements with certain subcontractors. These arrangements may result in a small degree of risk-sharing, though generally they aim to allocate risks to those parties best able to control those risks. And risks of large-scale supply interruptions or uncontrollable risks (such as bad weather, or unexpected obstacles) generally remain with the network operator.

basis of work actually carried out, the network operator will retain the general risk that more investment work is required than was forecast at the most recent price cap review.[3]

2.4.1.2. Risk sharing with customers

As most risk (other than that associated with the unit cost for standard tasks) is retained by network operators rather than their subcontractors, this risk must be borne eventually either by the network operator itself or by its customers. A high proportion of the capital projects carried out by network operators in the electricity, gas, water and airports industries are remunerated through the operator's price cap, rather than through contracts or other arrangements with individual customers. The regulatory framework therefore plays an important role in determining the allocation of risk between the network operators and their customers.

Historically, the regulatory approaches to remunerating capital expenditure in the electricity, gas and airports industries have been relatively informal and, in practice, have provided the network operators with a high degree of long term protection from the risk of cost overruns. In broad terms, the RAB in each of these industries has been rolled forward on the basis of *actual* capital expenditure, and therefore customers rather than the companies themselves have borne the risk of cost overruns. While there has generally been no retrospective adjustment (for example, when adding unexpected investment costs to the RAB) for the change in financing costs during the initial price control period, and therefore the companies have borne some risk from cost overruns, we note that in practice companies in the electricity and gas industries have generally underspent relative to the regulator's projections, and therefore benefited from the lack of any adjustment for financing costs.

A rather different approach has been adopted in the water industry, where Ofwat has generally examined companies' capital expenditure projections in considerable detail (covering both the volume and the cost of proposed investments). Having satisfied itself that the proposed level of expenditure is necessary and efficient, this projection is then used (rather than actual expenditure) to roll forward the RAB at the next price cap review. The companies therefore bear the risk of capital overspends in long term as well as the short term.[4] But this is mitigated, in part at least, by two additional features of the regulatory framework:

- Ofwat has defined a range of circumstances (including specific events, such as a major change in construction prices, or a substantial adverse event with an impact equivalent to 20 per cent of annual turnover) in which a price cap might be re-opened before the next scheduled price review; and

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[3] As described below, however, some of this risk may be passed on, in the long term at least, to customers.

[4] Note, however, that Ofwat treats capital underspends differently, as companies are allowed to retain the benefits for a period of five years only (and do not benefit at all if the underspend is due to a failure to deliver an agreed investment).

- there is a "logging up" process whereby unexpected increases (or decreases) in capital expenditure, for example due to increased demand or an enhancement approved by customer representatives, can be added to the RAB at the next price cap review.[5]

Significantly, it appears that Ofgem is likely to move somewhat in this direction. It has now proposed a system whereby capital expenditure overspends will not be added to the RAB if the expenditure is believed to be wasteful and unnecessary, and in most other cases (except perhaps where the expenditure can be shown to have delivered significant benefits to consumers) the company will bear the financing costs associated with the additional expenditure for a full five years, even if the extra expenditure occurs at the end of price control period. This new policy is important, moreover, since it appears far more likely now (as compared with previous price control periods) that some companies will need to spend more than allowed by Ofgem in its latest price cap reviews.

In the case of investment that falls outside of the price cap framework (and except for unit cost risks that are passed on to subcontractors, as discussed above), the network operators often retain much of the risk of cost overruns. An important reason for this is that some items of expenditure (such as gas connection charges) are subject to a standard tariff approved by the regulator. But some cost risk is passed on to customers in certain situations, including:

- complex schemes which are taken forward in a number of different stages. While the network operator may bear the risk of a cost overrun in each single stage, the customer faces the risk that, having embarked on the project, the costs estimated for later stages will be higher than it originally expected;
- in some cases, third parties have the option of carrying out or taking control of the work themselves. This applies mainly to the provision of new connections in the gas, electricity and water industries, where the network operator will be responsible for the physical connection to the existing network, but the new infrastructure required beyond this point (which might comprise a mini-network, for example if the connection is to a newly-constructed wind farm) can be, and often is, provided by third parties; and
- some projects (such as a diversion of the existing network to meet the needs of a new developer) may be charged on an emerging cost basis.

2.4.2. Delays

As noted above, one of the most likely impacts of a delay to the completion of an investment project may be simply an increase in the cost of the project. In such cases, the allocation of risks is as described above.

Where there are other possible impacts of delays, such as a direct revenue loss or an increase in operating costs, these risks will usually remain with the network operator. This reflects that fact that many of the possible causes of delay are either controlled by the network

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[5] Even in such cases, the company will not be compensated for the financing costs incurred before the next price cap review (again, however, Ofwat has adopted an asymmetric approach – when investments are not delivered at all, the "logging down" adjustment reflects both the value of the investment and the financing costs allowed for it during the previous price control period).

operator (such as the detailed planning of the project, or the appointment of subcontractors) or else beyond the control of either party (such as bad weather).

In the case of airports, we note that BAA also faces specific regulatory incentives to complete certain milestones in relation to Heathrow's Terminal 5. This increases the risk to BAA associated with possible delays to T5.

2.4.3. Operational disruption

For the reasons described in Section 2.2.3, we believe that the risk of operational disruption associated with new investment in the gas, electricity, water and airport industries is generally small. This risk will generally remain with the network operators, rather than subcontractors or customers. This reflects the fact that the operators are generally responsible for the planning of investment projects and, even where subcontractors are used for part of the project, the network operator itself will generally be responsible for making the connection(s) between the new infrastructure and the existing network.

A further reason for network operators bearing the risk associated with operational disruption is that this may manifest itself in a deterioration in certain service quality measures, rather than a readily-identifiable interruption of supply. In such cases, it might be difficult to isolate the change in service quality that is attributable to the impact of new investment, rather than changes that are caused by the more general behaviour of the network operator.

A possible exception to this general approach occurs when a third party (such as a subcontractor or even a customer) provides new infrastructure that is passed over to the network operator. The key difficulty for the network operator is ensuring that the work carried out by third parties is of sufficient quality, especially as it might be several years before any faults (and the costs associated with rectifying those faults) become apparent.

However, while a few subcontractors offer long term guarantees in relation to new infrastructure, the most common approach is for the network operator simply to inspect new infrastructure before adopting it (and either require the third party to rectify any faults or else charge the developer for any work necessary to bring it up to standard).[6] In any case, the risks associated with such cases are generally small, as much of the work carried out by subcontractors or third parties covers relatively straightforward tasks, for which the general risk of failure is low.

2.4.4. Volume and funding risks

As with cost overruns, the allocation of risks associated with unexpected investment between price cap reviews will be determined by the methodology that the regulator uses to set future price caps. In some cases, the same framework will apply to any unexpected increase in capital expenditure, whether it is due to cost overruns on agreed projects or the cost of additional projects that the firm has delivered. But in other cases the costs associated with additional investment are treated more favourably than other cost overruns.

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[6] In the electricity industry, distribution companies have the right to inspect work under "Construction & Adoption" agreements that follow guidelines set out by Ofgem.

As described in Section 2.4.1.2, therefore, Ofwat's "logging up" process will generally allow the value of justifiable extra investment projects to be added to a firm's RAB at the next price review (whereas pure cost overruns will not be added to the RAB at all).[7] But the company will not generally be compensated for the additional financing costs incurred before the next scheduled price cap review because of the unexpected investment.

Ofgem and the Competition Commission (for airports) have generally rolled forward each firm's RAB on the basis of actual capital expenditure, with the result that each company's exposure is limited to the financing costs incurred before the next scheduled price review. But Ofgem is now moving to a more interventionist approach, with the result that companies might even be able to recover the financing costs if additional investment is carried out efficiently and provides significant benefits to consumers. Equally, however, they may not be remunerated at all for investment that Ofgem judges to be wasteful and unnecessary. In addition, Ofgem has set price caps for gas transportation and electricity transmission companies that include automatic adjustments in the price cap formula itself for the volume of certain types of investments that are difficult to predict (ie replacement of gas mains, and new connections by generators to the National Grid).

2.4.5. Assessment of risk allocations

For a great many enhancement projects, the main risk faced by regulated utilities is that associated with cost overruns. Although some of this risk may be borne by subcontractors, especially where they are paid on the basis of agreed unit costs for straightforward types of work, most of it must be borne by either the companies themselves or their customers. A high proportion of investment projects are funded within the companies' price caps, and therefore the main factor determining the allocation of risk is the regulator's approach in situations where capital expenditure is higher or lower than expected.

For some (though not all) cost overruns, the additional costs will eventually be passed on to consumers. But even in these cases, the companies will generally have to bear the financing costs associated with any cost overrun for a period of up to five years. And cost overruns that are not due to increased investment requirements or other exogenous factors (ie the company simply delivers the agreed investment programme at a higher cost than originally expected) are now being treated less favourably by regulators than other cost overruns.

In cases where an investment project is outside of the price cap, the allocation of risk is often determined by commercial negotiation. For relatively simple cases, the company will often bear the risk of cost overruns (either because it agrees to take on this risk, or because the work is charged at a standard tariff). But for more complex cases, the customer will often bear a larger proportion of the risk, as a result of either:

- a phased approach, where the company's exposure to risk is limited only to cost overruns within each phase, and the customer bears the risk that the cost of later phases (assuming the project goes ahead) will be more than expected; or

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[7] In theory, if the need for additional investment arises from a "Relevant Change in Circumstances" or a "Notified Item" then this could trigger an interim price cap review. But it is unlikely that additional investment (which is remunerated through increased depreciation and return on capital) would satisfy the materiality threshold for such a review, which states that the impact must be equivalent to at least 10 per cent of a company's turnover.

- an agreement that the customer should pay for the project on an emerging cost basis, which is usually the case when work is carried out for the benefit of third parties. But even in these cases, the risks taken on by the customer are generally comparable with those applying to construction projects generally, and probably significantly less than those associated with enhancement investment in the rail industry.

2.5. Concluding Comments

The main risk faced by network operators undertaking capital investment in the gas, electricity, water and airports industries is that associated cost overruns. Network operators may be partially protected from these risks by a number of factors, including:

- the use of subcontractors for some relatively straightforward jobs, with fixed prices per unit (so that the subcontractor bears the risk of unit cost increases);
- the likelihood that unexpected capital expenditure will eventually be added to the companies' RAB, though this may depend on being able to convince the regulator (especially in the water industry) that the additional expenditure was necessary and implemented efficiently;
- the inclusion of specific terms that adjust price cap formulae in specific circumstances, for example if the volume of gas mains replacements or the number of new connections to the National Grid are greater than originally expected
- for more complex jobs, the ability to carry out the work in stages, with a revised specification agreed at each stage and fixed prices only applying within each stage (rather than for the project as a whole); and
- in exceptional circumstances, the possibility of initiating an interim price cap review.

This leaves the companies retaining two main types of risk:

- cost overruns that are caused by higher than expected unit costs and where the work is carried out by the network operator itself (rather than subcontractors).[8] In some industries, the cost overrun might be passed on eventually to customers. But this is less likely to be allowed in the water industry, and increasingly also in the gas and electricity industries;
- at least the short term financing costs (within a price control period, and perhaps for a full five years) in cases where companies have had to carry out more investment than expected, or where the costs of particular projects have increased because of changes to the design or specification of the project (or other factors not related to unit costs). In many cases, the companies would expect to pass these additional costs on to customers eventually, though this may now depend on being able to convince the regulator that these additional costs were (a) necessary and (b) efficiently incurred. But the companies are unlikely to be able to recover the short term financing costs, except in exceptional cases.

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[8] This also applies in cases where, unusually, the subcontractor does not bear the risk that unit costs will be higher than expected.

In general, moreover, there is no particular reason to believe that these risks are more onerous than those faced by firms undertaking capital investment in other sectors of the economy. And while the network operators will often bear other risks, for example the possible impact of a project of service quality or the continuity of supply, these risks are likely to be relatively minor.

This situation is rather different from that facing Network Rail, where capital investment projects may be affected by the significant difficulties of working on an operational railway. The restrictions that this places on when and how work can be carried out, and the possible uncertainties associated with the condition of existing assets, are both likely to increase the risk of cost overruns. And the risks associated with operational disruption in the rail industry are very much greater than in the other industries considered in this report, as a result of (a) the fact that most work is carried out on or directly alongside the existing network; (b) the fact that, for very good reasons, disruption on the rail network may be more widespread than a fault at one particular location on the gas, electricity or water networks; and (c) the impact of rail industry performance and possessions regimes.

3. Gas Transportation

3.1. Industry Structure

Under the 1995 Gas Act, the following subjects need a licence in order to operate in the gas industry:

- gas transporters (ie providers of a gas transportation service);
- gas shippers (ie users of the gas transportation system – which may be bulk buyers or sellers of natural gas); and
- gas suppliers (ie retail sellers of gas to customers).

Transco, a wholly owned subsidiary of National Grid Transco (NGT), is the principal gas transporter in Great Britain. Transco operates the high pressure National Transmission System (NTS) and the lower pressure regional gas Distribution Networks (DNs). The NTS is a network of high-pressure pipelines with a length of 6,400 km and over 140 off-take points, from which gas is supplied to 40 power stations, several large industrial customers and the eight regional DNs.[9] The DNs comprise pipelines operating at a lower pressure than the NTS and eventually provide final customers with gas.

Although Transco owns and maintains the majority of pipelines in Great Britain, other companies (eg Kinetica, which is owned by PowerGen) have built and operate a small number of transmission pipelines. At the distribution level, a number of new entrants have built and are operating low-pressure gas distribution pipelines where none previously existed.

An important recent development is NGT's decision to sell some of its regional gas distribution networks. In August 2004 NGT announced it had reached an agreement on the sale of four regional distribution networks, although the sale process is likely to be finalised in early 2005.[10] The outcome of the sale process was the following:

- a consortium including Scottish and Southern Energy (50 per cent), Borealis Infrastructure (25 per cent) and the Ontario Teachers' Pension Plan (25 per cent) agreed to buy the **Scotland** and **South of England** networks for £3.2 billion;
- a second consortium made up of Cheung Kong Infrastructure Holdings and related charity the Li Ka Shing Foundation (together 85 per cent) and United Utilities (15 per cent) agreed to buy the **North of England** network for £1.4 billion; and

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[9] For management purposes, in April 2002 Transco re-organised its 12 Local Distribution Zones (LDZs) into the eight DNs.

[10] The completion of the deals remains dependent on amendments to the regulatory framework (such as modifying licence conditions and establishing arrangements for the interface between the transmission and distribution networks) and also regulatory approval. Regulatory approval is required from the economic regulator (Ofgem), the safety regulator (Health and Safety Executive, HSE) and the Secretary of State for Trade and Industry.

- a consortium led by the Macquarie European Infrastructure Fund (a wholesale fund managed by the Macquarie Bank Group) agreed to buy the **Wales and the West** network for £1.2 billion.[11]

NGT, however, remains the dominant player in gas distribution, since it keeps the contiguous London, East of England, West Midlands and North-West networks.

3.2. Regulatory Framework

Ofgem is the economic regulator of Transco's activities. Ofgem currently undertakes separate price controls for each of the following Transco activities:

- Transco in its role as transmission asset owner (TO);
- Transco in its role as the transmission system operator (SO);
- gas distribution;[12] and
- metering and meter reading.

Price controls for the NTS TO and the regional distribution networks take the form of an RPI-X mechanism and have a duration of five years. Through an RPI-X price control mechanism, transmission and distribution charges are allowed to grow by a percentage set equal to the inflation rate (ie the RPI) *minus* an efficiency factor, known as the X factor. Ofgem expects this mechanism to encourage efficiency gains within regulated businesses.

When setting price controls, Ofgem first estimates the revenue level that would be sufficient to finance a reasonably efficient business by using projections of the following categories of costs:

1. operating expenditure (opex);
2. replacement expenditure (repex);
3. allowances for depreciation; and
4. the appropriate level of return for capital already invested in the business.

Ofgem uses historic data on cost items such as replacement expenditure and operating expenses to forecast costs for the whole period of the price control, ie five years. Ofgem also uses benchmarking and engineering judgements to assess the efficiency of Transco's operations and the potential for cost cutting. On the basis of these, Ofgem makes statements about future operating expenditure, capital expenditure (capex), replacement expenditure and depreciation. In addition, Ofgem estimates future consumer demand in order to convert revenue allowances into price caps.

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[11] In total, NGT has agreed to sell four distribution networks for a total of £5.8 billion in cash plus £130 million of assumed liabilities. This represents a premium of 20 per cent on the assessment of NGT's Regulatory Asset Value (RAV) in March 2004, and 14 per cent on NGT's estimate of the RAV for March 2005, when NGT initially expected the deals to be closed.

[12] In June 2003 Ofgem introduced separate price controls for each regional gas distribution network.

Ofgem assumes a profile of revenues over the duration of the price control such that the Net Present Value (NPV) of revenue equals the NPV of projected costs for the time period under consideration, although revenues in any one year may not match costs in that year. Ofgem's profiling of allowed revenues is characterised by two parameters:

- "P_0" is the reduction in revenues in the first year of the price control compared to the previous year; and
- the "X factor" is the real reduction in revenues in the subsequent years of the price control.

The choice of X factor does not affect the NPV of allowed revenues over the regulatory period, as regardless of the level of X, Ofgem set this equal to the NPV of costs. However, the choice of X factor does affect the level of revenues in each year of the regulatory period. For example, the larger the value of X, the greater revenues are in the first year(s).

3.2.1. Regulatory treatment of capex underspends and overspends

3.2.1.1. Previous regime

During previous regulatory periods, Transco has typically outperformed its capital expenditure allowances set by the regulator. Under the then regulatory regime, Transco was allowed to keep both the depreciation of and return on the saving for the remaining duration of the price control.

More recently, Ofgem has stated it intends to allow Transco to retain any capex savings for a fixed period of five years[13] and has recently implemented this policy in its final proposals for the price controls of electricity distribution companies. In the event that Transco had overspent its capital allowances, it would have had to bear the financing costs until the next review.

3.2.1.2. New regime

Ofgem has stated its intention to change the treatment of under and overspends for gas (and electricity) companies.[14] In the case of Transco, Ofgem has proposed applying "rolling retention periods" for both opex and capex efficiency savings from April 2003. The intention of these mechanisms is to provide DNOs with the same incentives to make cost savings regardless of which year of the regulatory period the savings are made. Companies will be allowed to retain cost savings for a fixed period of five years, regardless of when the savings are made.

Because Transco has not previously spent more on capital than its regulatory allowances set by Ofgem, Ofgem had not, until recently, considered how it would treat capital overspends.

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[13] Open Letter on Gas Distribution Price Controls, Ofgem, March 2004.

[14] In March 2004, Ofgem stated "*At this stage Ofgem expect similar principles to those described in the December 2003 consultation paper* [on electricity distribution price controls] *to apply to regional gas distribution networks from 1 April 2003*." Source: *Gas Distribution Price Controls*, Ofgem open letter, posted on Ofgem website 16th March 2004.

However, Ofgem has now stated how it would treat such overspends. Earlier this year, Ofgem stated that it will classify and treat capital *overspends* as follows:[15]

- *Category 1*: if Ofgem believes there is clear evidence of "*wasteful and unnecessary*" expenditure then this will not be included in the RAV;
- *Category 2*: if costs are higher than allowed at the last price control review but Ofgem believes they are consistent with "*efficient spending in general*" then Ofgem will treat this expenditure the same as a capital under spend by including it within the rolling retention mechanism. In the case of an overspend, the licensee could expect to have to meet the financing costs of the overspend for a full five year period, after which, Ofgem will add the amount of the overspend to the company's RAV; and
- *Category 3*: if costs are higher than allowed at the last price control review but Ofgem believes they are "*consistent with efficient spending and can be clearly shown as providing significant benefits to consumers*", Ofgem will *consider* allowing the company to recover depreciation charges and return from the year the expenditure is incurred (although does not say whether this recovery will be allowed immediately, or retrospectively either in the following year or at the next price control review).

3.3. Common Features of Capital Expenditure in the Gas Industry

In this section we provide a description of the main types of capital expenditure undertaken by the network operator in the gas industry and highlight the principal risks attached to different types of capital investments, with a broad indication of the likelihood of the risks being realised and their potential impact.

3.3.1. Transco's capital expenditure

In its *2003 Transportation Ten Year Statement*, Transco groups capital expenditure into two broad categories:

- investment in the National Transmission System (NTS); and
- investment in distribution.

Investment in the NTS includes the following categories (although a specific project could fall in more than one category):

- "Statutory", ie growth investment consistent with the obligations placed on Transco under its Gas Transporters licence to meet the "1 in 20" peak day security criterion (see below). This category would include investments in high-pressure pipelines[16] and in compressors;
- "Flexibility", which refers to the investment required for bringing the capacity of the NTS in the summer period closer to the one experienced in the winter;

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[15] Open Letter on Gas Distribution Price Controls, Ofgem, March 2004.

[16] For example, the two projects listed in the 2003 Ten Year Statement Transco due for completion in late 2004, ie the Aberdeen to Lochside pipeline, with a cost of £50m, and the Wooler to Bishop Auckland uprating, for £8.6m.

- "Power Station", accounting for large one-off connections to the NTS;
- "Emissions", ie investment necessary to comply with new environmental legislation to reduce pollutants; and
- "Other", including asset enhancement and replacement of assets that have reached the end of their economic life.

Investment in distribution includes the following two broad areas:

- development of the Local Transmission Systems (LTS). Projects in this area tend to be numerous and of lower value than NTS projects; and
- investments in the "below 7 barg" distribution system. These include: investments in mains, services and associated plant and machinery; investments for reinforcement of the system and new connections; and new and replacement meters. This area also includes expenditure for the de-commissioning of all the iron gas mains within 30 metres of buildings in a 30-year time period prompted by the HSE (see below).

As proposed by Ofgem in September 2001, Transco is expected to spend £2.3 billion (in 2000 prices) in capital expenditure over the period 2002 – 2007. The £2.3 billion comprises £804 million for the NTS, £996 million for Transco's DNs, and £532 million for Transco's metering and meter reading.

3.3.2. Risk profile of Transco's capital expenditure

The general security obligations placed on Transco drive its capital expenditure programmes. Below, we describe these security obligations and then briefly describe the risk profile of Transco's investments.

3.3.2.1. Security standards in the gas industry

The Standard Conditions of the Gas Transporters (GT) Licence[17] require that the licensee's pipeline system be able to meet the so-called "1-in-20" security criterion. Under this criterion, Transco's system must be able to cope with the peak aggregate daily demand likely to be exceeded (whether on one or more days) only in 1 year out of 20 years, after taking into account historical weather data derived at least from the previous 50 years and other relevant factors.

In order to meet this criterion, the GT licence specifies that Transco take into account any interruption or reduction in gas supplies resulting from contractual arrangements and availability of storage facilities.

The Gas Shippers and Gas Suppliers Licences also contain conditions referring to the "1-in-20" security criterion for transporters.

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[17] See Standard Condition 16 of the GT Licence.

3.3.2.2. Principal risks attached to capital expenditure in the gas industry

The first risk for Transco attached to its capital expenditure is that the expenditure it conducts fails to comply with the 1-in-20 security criterion and, therefore, Transco breaches its licence conditions.

In addition to the specific risk of not complying with the "1-in-20" security criterion, there are a number of other risks attached to capital expenditure undertaken by Transco.

Two risks – namely, the risks of cost and time overruns – are of commercial nature. As explained in further detail in the case studies, Transco usually transfers these risks to contractors in the case of small replacement works, but shares them when a partnership is formed.

The risk of interrupting existing services tends to be low in the gas industry; works are carefully planned – often in consultation with local authorities – and customers notified in advance of a planned disruption. Compensation schemes are in place when an unplanned disruption occurs, but payments are small and not frequent. Transco typically bears the risk of paying out under compensation schemes in the event of an unplanned interruption.

In the case of new connections, Transco may have to pay liquidated damages in the case of a late delivery of connection assets. But as gas entry connection assets are generally of low materiality, the associated liquidated damages are generally small. And in the case of new entry terminals, if Transco is late delivering contracted capacity (to an entity that has purchased gas entry capacity rights to the network infrastructure in an auction), Transco enter a capacity buy-back arrangement at a price agreed with the holder of the capacity rights.

Risks of property and environmental damage are low as well; works in the gas industry are undertaken by complying with safety regulations and gas pipelines are usually isolated during works.

Lastly, it should be noted that Transco may be subject to criminal prosecution if an incident occurred in which Transco was found to be in breach of regulations, eg Health and Safety Executive (HSE) safety regulations.

3.4. Case Study 1: Mains Replacement Programme

3.4.1. Background

In September 2001 the HSE published an enforcement policy[18] for the replacement of the iron gas mains operated by Transco. In particular, the HSE required Transco to undertake a national program to replace all the iron mains located within 30 metres of the premises (ie the "at risk" mains) within 30 years.

Transco estimated that there are about 91,000 km of remaining iron mains within 30m of buildings. The principal risk associated with the integrity of the gas mains supply is the risk

[18] The program, developed in conjunction with both Transco and Ofgem, is available at: http://www.hse.gov.uk/gas/gasmain.pdf.

of injuries, fatalities and damage to property caused by gas releases and subsequent explosions, with each gas release incident having the potential to cause multiple fatalities.[19] Without replacement, it is likely that parts of networks will reach the end of their reliable life within the next 20 to 30 years and, hence, the rate of failure and the number of incidents might increase rapidly. In such circumstances, it might be necessary to shut down the particular network and cut off the gas supply to both commercial and domestic customers in order to prevent incidents involving multiple facilities.

As a result of the HSE's enforcement policy, in September 2001 Ofgem agreed to adjust Transco's price control to allow for the enhanced mains replacement program. The schedule and the projected costs of the Mains Replacement Programme for the current regulatory period are described in Table 3.1.

Table 3.1
Mains Replacement Programme – 2002/3 to 2006/7

	2002/3	2003/4	2004/5	2005/6	2006/7	Total
Cost (£m, 2000 prices)	342	263	285	304	314	1,509
Length of replacement main (km)	2,258	2,696	2,991	3,298	3,512	14,755

Source: Ofgem, Review of Transco's Price Control from 2002: Final Proposals, September 2001.

3.4.2. Summary of the mains replacement mechanism

Ofgem also devised an incentive mechanism intended to encourage Transco to carry out the mains replacement activity efficiently and also to address the uncertainty over the volume of replacement work that existed at the time Ofgem was required to make a decision over Transco's price control.

The mechanism works as follows. For each year of the price control and each diameter band of mains to be replaced, Ofgem made a projection of the expected expenditure on mains replacement (PCP_{it}). Ofgem calculated this projection as:

- the *estimated* length in km of each type of mains (by diameter) to be replaced;

multiplied by

- an *estimated* unit cost per km of replaced mains (by diameter).

At the end of each year, Transco reports the length of mains abandoned by diameter band. These are multiplied by the unit costs of abandonment (contained in a "diameter matrix") to give a matrix cost total for the year. This matrix cost total is then be compared to the price control projection and the total outturn costs for mains replacement.[20]

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[19] For example, Putney (8 fatalities), and Rutherglen (5 fatalities) in 1985, and Larkhall (4 fatalities) in 1999.

[20] Transco calculates the total outturn cost after "amalgamating" the costs for replacing iron mains incurred both when the work is carried out by contractors and when it is done jointly by Transco and contractors within a partnership (see section 3.4.3).

An outturn price control allowance is then determined as follows:

- if the outturn total is equal or less than the matrix total then the price control allowance will be the outturn total + 0.33 * (matrix total – outturn total); and
- if the outturn total is greater than the matrix total then the price control allowance will be the matrix total + 0.5 * (outturn total – matrix total).

Transco's allowed revenues are then adjusted each year by the outturn price control allowance.

Ofgem's repex mechanism protects Transco from volume risks. That is if the HSE requires Transco to replace more length of pipe than Ofgem allowed for in the price control, Transco will receive the estimated unit cost per km of replaced mains multiplied by the additional length. Conversely, if Transco conducts less volume of work, it receives less revenue.

However, under Ofgem's repex mechanism, Transco faces unit cost risks. For example, if Transco's actual unit cost of mains replacement costs is higher than Ofgem's estimated unit cost, Transco must bear 50% of the excess and can pass through 50% of the extra cost immediately. If Transco's actual unit cost of mains replacement is lower than Ofgem's estimated unit cost, then the company can keep 33% of the saving and pass through 67% immediately.

For regulatory purposes, only 50% of the replacement expenditure is treated as capital expenditure and is added to the regulatory asset value (RAV), whereas the remaining 50% is treated as operating costs. In a section of Ofgem's final proposals document discussing the supplementary incentive mechanism for mains repex Ofgem states "*There will be no adjustment to regulatory asset values at the next price control review to take account of differences between Ofgem's projections and final outturns*".[21] This phrase is ambiguous, since Ofgem does not say what figure would or would not be adjusted – the RAV based on "*Ofgem's projections*" or the RAV based on "*final outturns*". However, we believe from the context that Ofgem is anticipating that the repex projection used to project the RAV, which in turn was used to set revenues from 2002, will also be used in defining the RAV in 2007.

The selection and scheduling of mains for replacement is made through the Mains Risk Prioritisation System (MRPS), a risk model developed by Transco and assessed by the HSE and Ofgem.[22] Transco outsources some of its mains replacement work to independent contractors and has recently renegotiated the cost of its contracts.

At the time of Transco's last price control review, Transco feared that the potential charges for lane rentals under the New Roads and Streetworks Act 1991[23] might have a negative impact on its financial stability. In recognition of this, Ofgem has shown its availability to re-

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[21] Para 4.87, *Review of Transco's Price Control from 2002: Final Proposals*, Ofgem, September 2001.

[22] This model is regularly updated and Transco has recently introduced a revised version.

[23] The New Roads and Streetworks Act 1991 allows the possibility for local authorities to charge utilities that over-run on agreed timescales for their works (Section 74 on overstay) and to introduce a daily charge for every day the utility companies occupy the street (Section 74A on lane rentals). The latter has been implemented as a pilot scheme in the London Borough of Camden and in Middlesbrough in March 2002.

open the Price Control in order to ensure that Transco's revenues are increased to recover the additional costs represented by efficiently incurred Lane Rental Charges.[24]

3.4.3. Development of the mains replacement mechanism

In 2002/3 and 2003/4 Ofgem applied the mains replacement mechanism to Transco at a national level. That is, Ofgem made no distinction between different mains replacement costs in Transco's eight regional DNs. However, in June 2003, Ofgem decided to split Transco's single gas distribution price control into eight separate price controls, one for each of Transco's regional DNs.[25] Ofgem undertook this separation to facilitate Transco's proposed sale of one or more of its DNs. As part of the price control separation, Ofgem allocated lengths of mains replacement across Transco's DNs and set unit costs of mains replacement for each of Transco's DNs. Ofgem's final proposals document contains few details as to how it made these allocations across regions.

3.4.4. Risk profile of the mains replacement programme

In order to carry out the replacement of iron mains under the 2001 HSE's enforcement order, Transco adopts one of the following two approaches:

- awarding the works to external contractors; or
- forming an alliance with contractors to jointly carry out the work.

We now proceed to describe each option in turn.

3.4.4.1. Simple contracts

Transco usually chooses to out-source main replacement works to external contractors when it is necessary to replace mains of very short length (ie below 100m) where only a couple of workers are estimated necessary to carry out the job. Contracts for this type of mains replacement work are signed for a period of 3 to 5 years, where contractors commit to undertake works on behalf of Transco on an exclusive (or nearly exclusive) basis. Contracts follow a framework agreement and contractors are bound to comply with Transco's standards and procedures for external works. Transco is in charge of the design part of the projects, which – given the limited size of the works – is usually straightforward.

Contract rates – expressed in terms of pounds per km of replaced mains - tend not only to reflect current costs for labour and materials, but also to incorporate operational risks that contractors are asked to bear. For example, the risk of cost and time overruns is bundled in the contract rates together with other components. Therefore, in the event that there is a cost overrun, this is borne by the contractor and not by Transco.

Transco is not bound to provide compensation to customers if it has given sufficient advance notice to customers of the planned interruption. Although in some cases (eg where customers

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[24] See Ofgem's Summary of Letter of Comfort, released in February 2002, at www.Ofgem.gov.uk/temp/Ofgem/cache/cmsattach/431_7feb02.pdf.

[25] Ofgem, *Separation of Transco's distribution price control: Final Proposals*, June 2003.

are chronically sick or disabled), Transco is obliged to provide customers with alternatives for heating and cooking.

In the case of a service disruption Transco has not notified in advance and which is not solved within 24 hours of occurring, customers are entitled to compensation payments. Transco bears the risk of paying out compensation for unplanned interruptions lasting more than 24 hours. However, since these are small payments, and tend to occur with low frequency, Transco does not consider it appropriate to insure against such risks.

Damage to properties is usually not caused by contractors (since mains are switched off during works) and indeed there is reportedly no record of explosions caused during replacement works. On the other hand, if an incident occurs because of defective work, in principle Transco might be charged for having some supervisory responsibility, but contractors would bear most of the risk if negligent.

3.4.4.2. Alliances with contractors

Recently, for replacement works in major conurbations,[26] Transco has sought to enter into alliances – or partnerships – with contractors. These schemes have durations of eight years, with the option of an extension for a further five years. The intention of these partnership contacts is that the replacement work is conducted in a more effective and collaborative way that results in the sharing of experience and best practice among partners. The basic principles of these partnership agreements are the same as in the suite of National Engineering and Construction (NEC) contracts, which have been used in the UK construction industry in the last 8-10 years. After their introduction in the construction industry, the use of these contracts has spread to other sectors as well, including offshore oil companies, water companies and now Transco.

For projects conducted under these partnerships, the proportion of Transco staff involved in the design stage is 50-60 per cent; but contractors conduct 90 per cent of the operational (ie on the ground) part of the project, with Transco's involvement usually being restricted to dealing with short-term emergencies.

As collaboration among partners is more frequent in these alliances, the process of risk mitigation is usually smoother and easier to deal with. For example, partners jointly design the contractual schemes (following the NEC contracts) and define the risks and resources. They also agree on an annual target cost and share penalties and gains in case of a cost over-run or under-run respectively. As a result, Transco and contractors have aligned incentives to meet or beat the cost targets. These cost targets are set on an annual basis and revised on the basis of the results achieved in the previous year.

In these partnerships, all "genuinely identifiable" risks are attached to the relevant party; on the other hand, partners share uncontrollable risks (eg bad weather conditions, unforeseen obstacles), and Transco bears broader, controllable risks (eg designing the pipeline system in order to meet the 1-in-20 security criterion). Since contractors are often part of big

[26] Three alliances are currently established for works in the Manchester, Birmingham and London (outside the M1 corridor) conurbations. The amount of work for these projects is worth around £40-50m per year.

companies, there is also the possibility of receiving operational assistance from other sister companies in case of problems.

As an example of shared risk, the partnership jointly bears the risk of interrupting gas supply up to 2,500 customers; above this threshold, Transco bears the risk and usually decides to insure against it. However, the likelihood of this risk is considered low and in any single year very few unplanned cut-offs to more than 2,500 customers for all causes happen. The probability of the risk is measured on the basis of the historical evidence and at the design stage by identifying how many customers are located in the area where replacement works take place.

When an incident occurs on a pipeline scheduled to be replaced according the annual plan submitted by Transco to the HSE, Transco might be considered in breach of the HSE order and, in case of fatalities, charged of corporate manslaughter. If an incident occurs on a pipeline not scheduled for replacement, Transco might be potentially liable, although with some mitigating defence.

3.5. Case Study 2: Connections to the NTS

3.5.1. Overview of connection expenditure

Transco typically provides exit connections to the NTS only for loads consuming in excess of 2m therms per annum. As a result of this, only power plants, combined heat and power (CHP) stations and very large industrial customers are entitled to ask for a connection to the NTS, but not domestic customers.

Transco offers three types of connections to the NTS:

- minimum connection;
- minimum connection and connecting pipeline; and
- taking ownership.

In the first case – minimum connection[27] – the works will be undertaken by Transco and funded by the party requesting provision of the connection. In the second case – minimum connection and connecting pipeline – Transco undertakes the works for the minimum connection, but also offers to undertake construction of the pipeline connecting to the customer's downstream facilities. Both elements are funded by the party asking for the connection. In both cases the undertaking of new connections is subject to Transco's standard conditions of contract.

Under the last scheme – taking ownership – Transco and a third party called the Utility Infrastructure Provider (UIP) enter into a Taking Ownership Agreement, whereby the UIP

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[27] The minimum connection comprises the tie-in to the NTS, the Transco valve, the telemetry kiosk and associated apparatus supplied by Transco within the Transco compound, all of which are funded by the party requesting the connection. Particularly, the Transco compound – an area of land necessary to accommodate the plant and equipment provided by Transco – must be provided free of charge together with appropriate consents and suitable access and egress arrangements. Building a minimum connection requires 2-3 years from the initial stage to actual gas supply.

procures the construction of the connecting pipeline and subsequently, upon completion of the connecting pipeline, Transco takes ownership of it and responsibility for its subsequent operation.[28]

3.5.2. Charges for connection

Under Standard Licence Condition 4B, Transco is required to publish the connection charges and its pricing methodology.[29] Transco's commercial policy is to remain cost neutral with respect to its connections activities (ie, it aims to recover all of the costs it reasonably expects to incur when it provides connection services).

Charges for connection works are calculated by Transco using:

- current cost of materials and any special expenses required to carry out the connection *plus* overheads related to the management of materials and other bought in services; and,
- contract rates[30] *plus* overhead costs related to the management of contractors and the general costs of providing connections activities.

As noted in Section 3.3.2.2, liquidated damages are payable in the event that Transco is late delivering a connection. But these are generally small.

Large connection projects also require design work before construction works can commence. If they are routine projects, Transco applies standard design charges.

However, some more complex projects are considered to be *Sufficient Complexity Jobs*, ie Transco has to put in place a significant design effort prior to being able to produce a quotation. In these cases Transco produces a quotation, charges and carries out the design of apparatus prior to estimating the cost of constructing any equipment. In some cases it may be necessary for Transco to split the design works into stages (eg feasibility study, conceptual design study, etc) with each stage being quoted, charged and completed before commencing a subsequent phase. Transco charges Sufficient Complexity Jobs on the basis of anticipated cost plus applicable overheads.

Sufficient Complexity connections occur when the connection is to be made to a system with pressure above 7 barg, or where there are known obstacles on the proposed route of the new apparatus and the anticipated total cost of the construction works including applicable overheads is expected to exceed £10,000, or where the total construction costs including applicable overheads, based on past experience of projects of a similar nature, is expected to be more than £100,000.

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[28] All the projects submitted for participation in the taking ownership scheme go through an audit process. The scope of Transco's taking ownership programme is limited to equipment that forms part of the NTS (eg it does not include meters).

[29] Available at http://asset.transco.co.uk/publications.htm

[30] Contract rates are those of the principal incumbent contractor for the relevant geographical area, but connections to the NTS and other similar large projects are individually tendered.

3.5.3. Upstream reinforcement

When a request for a new exit connection to the network is made, Transco may carry out additional work on the NTS necessary to meet the customer's requirements; this is known as upstream reinforcement works for system exit connections. Two concepts are crucial with respect to these reinforcements:

- the Connection Charging Point; and
- the Economic Test.

The Connection Charging Point is the closest economically feasible[31] point on the Transco system that is considered to have enough capacity to supply the new load, disregarding existing loads. Reinforcement costs downstream of the Connection Charging Point are considered as connection costs and are therefore fully chargeable to customers. On the other hand, Transco may fund reinforcement upstream of the Connection Charging Point, subject to the Economic Test (see below). As a result, the Connection Charging Point provides a way to distinguish between connection and reinforcement costs.

The Economic Test is used to calculate the maximum economic investment for Specific Reinforcement, which Transco can make for any specific load. Where the incremental transportation income from the additional load exceeds the incremental cost of the load (ie the reinforcement costs), such load is considered economic and the Economic Test is passed.[32] In such a case, Transco funds Specific Reinforcement.

3.5.4. Risks in connection expenditure

Since connections to the NTS are quite large and capital-intensive projects, and also in order to comply with the European Union regulations on tenders, all works in this category are individually tendered and carried out by contractors. Most projects are fixed-price contracts, but for projects where the nature of the work is unique (eg Jobs of Sufficient Complexity) a *cost-plus* contract is chosen.

As a result, all provisions aimed at mitigating risks are contained in individual contracts; these contracts may also contain some specific allowable cost overruns and penalty/bonus clauses. Sometimes contractors take out insurance in order to mitigate risks; it may also be the case that contractors offer a 20-year maintenance warranty in order to mitigate risks.

As to charges for lane rentals, following Ofgem's *Letter of Comfort*, Ofgem may allow Transco to recover the efficiently incurred extra costs.

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[31] In some cases the designed exit point might be closer to a main that is on the "wrong" side of a significant obstacle (e.g. a river) than it is to another main. In such cases the Connection Charging Point would be on the alternative main, since the cost of laying a connection pipe across the obstacle is likely to be prohibitive.

[32] In order for a load to be economic, the Economic Test is applied over all the anticipated life of the load.

4. Electricity Transmission and Distribution

4.1. Industry Structure

4.1.1. Electricity transmission

Electricity transmission companies transport electricity on high voltage lines at 275kV or 400kV. The electricity transmission system is divided into three main systems, England & Wales plus one in each of the north and south of Scotland. The Scottish systems are connected to the grid in England and Wales via the Scotland-England interconnector.

Ofgem has granted electricity transmission licences as per Table 4.1.[33]

Table 4.1
UK Transmission Ownership Structure

DNO	Parent	Parent's Owner
England & Wales		
National Grid Company plc	National Grid Transco plc	Publicly quoted
Scotland		
Scottish Hydro-Electric Transmission Ltd	Scottish & Southern Energy plc	Publicly quoted
Southern Scotland		
SP Transmission Ltd	Scottish Power plc	Publicly quoted

Source: "Who owns whom in the UK electricity industry", Electricity Association, June 2003.

4.1.2. Electricity distribution

Electricity distribution companies transport electricity on low voltage lines (132 kV and lower). There are 14 Distribution Network Operators (DNOs) in the UK (excluding Northern Ireland), owned by eight companies as set out in Table 4.2.

[33] Electricity transmission in Northern Ireland is regulated by the Office for Regulation of Electricity and Gas (Ofreg) and licensed to Northern Ireland Electricity plc (a subsidiary of Viridian Group plc).

Table 4.2
UK DNO Ownership Structure

DNO	Parent	Parent's Owner
England & Wales		
EDF Energy Networks EPN plc	EDF Energy plc	EDF (state owned)
EDF Energy Networks LPN plc	EDF Energy plc	EDF (state owned)
EDF Energy Networks SPN plc	EDF Energy plc	EDF (state owned)
East Midlands Electricity Distribution plc	Powergen plc	E.ON (German, publicly quoted)
Midlands Electricity plc	Powergen plc	E.ON (German, publicly quoted)
Northern Electric Distribution Ltd	MidAmerican Energy Holdings Co	Berkshire Hathaway (private)
Yorkshire Electric Distribution Ltd	MidAmerican Energy Holdings Co	Berkshire Hathaway (private)
SP Manweb plc	Scottish Power plc	Publicly quoted
Southern Electric Power Distribution plc	Scottish & Southern Energy plc	Publicly quoted
Western Power Distribution (South Wales) plc	Western Power Distribution Holdings Ltd	PPL Corporation (US, publicly quoted)
Western Power Distribution (South West) plc	Western Power Distribution Holdings Ltd	PPL Corporation (US, publicly quoted)
United Utilities Electricity plc	United Utilities plc	Publicly quoted
Scotland		
Scottish Hydro-Electric Power Distribution Ltd	Scottish & Southern Energy plc	Publicly quoted
SP Distribution Ltd	Scottish Power plc	Publicly quoted

Source: "Who owns whom in the UK electricity industry", Electricity Association, June 2003, Bloomberg, company accounts.

4.2. Regulatory Framework

4.2.1. Overview

Electricity transmission and distribution activities are regulated under RPI-X price caps which allow the network owner to earn revenues equal to forecast costs, including operating expenses, depreciation, taxes, and a rate of return which covers the cost of debt and equity financing, over each five-yearly "price control review" period.

Capital expenditure (capex) is compensated via the revenue allowance for depreciation and rate of return on the Regulatory Asset Value (RAV). Revenues related to capex are therefore distributed over time, unlike operating expenditures which are compensated via a revenue allowance for the time period in which they occur.

At the end of the price control period the RAV has generally been updated based on actual capital expenditures. Items not allowed for in the previous review are generally excluded.[34] In practice, DNOs have historically always underspent their capex allowance, and Ofgem has therefore allowed all capex costs to be included in the RAV. However several DNOs, notably EDF in particular, are now claiming significant higher capital expenditures than Ofgem is proposing to allow, and the risk of capex overspends has become more likely.

[34] For instance, in the current (2004) review, Ofgem is proposing to adjust the RAV in order to exclude expenditures that relate purely to accounting changes (in particular, to the extent to which companies capitalise overheads). Ofgem, *Electricity Distribution Price Control Review, Initial Proposals*, June 2004, p. 79, paragraph 6.67.

Ofgem proposes to deal with the potential problem of capex overspends through two mechanisms:

- by implementing what it calls a "sliding-scale" mechanism. Under this scheme, DNOs will be able to choose between higher capex allowances with lower retention rates, or lower capex allowances with higher retention rates. This allows, for instance, companies that believe they have higher capex requirements than Ofgem's forecasts to choose a higher capex allowance, but with a higher penalty for any overspend above that allowance;[35] and
- by categorising capital overspends into one of three groups: (1) wasteful and unnecessary; (2) efficiently incurred; and (3) efficiently incurred and providing significant benefit to customers. These three categories are detailed in Section 3.2.1.2.

4.2.2. New connections to distribution networks

Connections to distribution networks are competitive and excluded from the price cap. New connections have historically been regulated under a system known as "tariff support". Customers are charged up to a certain point (ie some of the reinforcement costs are defrayed into general Use of System (UoS) charges for all customers), while tariff support offsets some of the ongoing UoS charges that are not incremental to the new development.

In future, Ofgem is likely to change to a system where the customer charge is shallower (ie the customer pays less of the reinforcement costs), but the customer loses the tariff support, which previously covered some of the ongoing UoS charges.

When the new connection is complete, the DNO takes ownership of the new connection, including responsibility for any ongoing maintenance and upgrading work. This arrangement creates some tension between the contractor and DNO in terms of the trade-off between the quality of the initial connection and the DNO's obligation to continue servicing the customer once ownership is transferred.

4.3. Distribution Capital Expenditure Projects

4.3.1. Types and amount of capital expenditure

For regulatory purposes capex expenditure in electricity distribution is segregated into three main areas:

- load related costs;
- non-load related costs:
  - replacement expenditure, which is split into several categories including lines, cables, transformers, switchgear, and service lines;
  - capitalised faults and non-operational expenditure (eg IT);

[35] Precise details of Ofgem's "sliding-scale" scheme can be found in Ofgem, *Electricity Distribution Price Control Review, Initial Proposals*, June 2004, p. 90, paragraph 6.95.

- costs for services such as connections which fall outside the regulatory revenue control ("excluded services"); and
- distributed generation.

Capex forecasts for the distribution industry (excluding distributed generation) are shown in Table 4.3.

Table 4.3
Total Industry Capex Forecasts (£m)

	2006	2007	2008	2009	2010	Total
Load-related	663	663	631	631	631	3,218
Non-load-related	677	677	684	684	684	3,406
Connections (competitive)	375	375	348	317	260	1,674
Other	300	297	286	283	280	1,445
Total	2,014	2,010	1,949	1,915	1,855	9,742

Source: Ofgem, "Electricity Distribution Price Control Review, Initial Proposals, June 2004", pp. 117-130.[36]

The forecasts in Table 4.3 constitute the "base case" allowed revenues (except for connections costs, which are outside the price control). The base case forecasts are designed to be the "minimum costs necessary to maintain current underlying performance and network resilience over the period to 2010 assuming there is no change from present operating, technical and regulatory conditions".[37]

In addition, distributed generation capex forecasts by the DNOs for the total 2005-2010 period range from £289m to £442m.[38]

4.4. Risk Profile of Capital Expenditure

4.4.1. Nature of risks

Distribution companies are subject to a number of risks in relation to capital expenditure projects.

First, DNOs are subject to the standard project risks of cost overruns. To some extent DNOs have historically been shielded from cost overruns on any given project since the full capital expenditure costs have been added to the RAV at the end of the review period. In future, the increased possibility of capex overspends and Ofgem's proposed treatment of overspends as described in section 4.2 may increase pressure on the total level of capital expenditures.

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[36] Prices are in 2002/3 values. The total capex numbers have undergone some marginal adjustments in the September update to Ofgem's consultation process, however we have chosen to show the June figures where a full breakdown was provided. Actual revenue allowances may deviate from the numbers shown given Ofgem's proposal to allow companies to choose higher levels of capex under the "sliding scale" mechanism described earlier.

[37] Ofgem, *Electricity Distribution Price Control Review, Policy Document*, March 2004, p. 70, paragraph 6.3

[38] Ofgem, *DG-BPQ Analysis, Summary of Findings,* March 2004, p. S-4.

DNOs are also subject to financial penalties for prolonged interruptions to services. DNOs are required to pay a £50 penalty to each consumer affected by any outage if supply is not restored within 18 hours, with further payments of £25 for successive period of 12 hours afterwards. These penalties apply to business consumers equally as to residential customers. Our overall assessment is that these risks are not in fact very significant. The penalties are quite low in comparison to the scale of the investments and, as we discuss in the case studies, the probability of major outages being caused by capital investment projects is not great.

However Ofgem is also proposing to introduce an "Interruptions Incentive Scheme" (IIS) for the 2005-2010 price control review, which will tie ±3% of total allowed revenues to the total number and length of interruptions. This will increase the risk faced by DNOs across their total capex and maintenance programmes, if not the specific risk to any one project.

The environmental risks associated with electricity networks appear to be relatively low. One potential concern is the possibility of oil leakage from larger transformers. However the primary risks for the DNO are reputational rather than financial. Nevertheless it is feasible, as with any prosecution for damage or causing injury, that a DNO's risk assessment process could be found to be generally deficient. Such a determination could feasibly necessitate a major and extremely costly review of all of the DNO's risk assessment policies. However such a major change is likely to provide cause for the price control to be reopened in order to cover the DNO's additional costs.

Occurrences of injury to persons and damage to property are relatively rare. However, management would be liable for civil and criminal prosecution if negligence was determined to be a cause of a major incident.

4.4.2. Extent of, and drivers for, contracting out

While the design and network-planning phases of capex projects are almost uniformly carried out in-house (although occasionally with some technical consulting support), there is wide variation across the DNOs in the extent to which the operational work is contracted out or also carried out in-house. Some of the DNOs retain a large in-house labour force,[39] while others, notably East Midlands Electricity, contracts out most of their capital expenditure projects. Other DNOs have set up their own contracting businesses, which in theory compete with others for work from the parent company (Scottish & Southern being a notable example).

Larger replacement projects form one area where DNOs generally do tend to contract out most of the work. Companies tend to have staff available for smaller projects, particularly in non-peak months when the amount of emergency work is reduced. Outsourcing larger projects appears to provide significant savings particularly in labour costs. Electricity companies tend to have historically high labour costs (including, for instance, generous ring-fenced pension plans). Labour costs tend to be lower in contracting and construction

[39] Western Power Distribution, for example, carries out the bulk of its work in-house, and outsources only tree-cutting, excavation and re-laying of cables, together with some of its larger project work such as replacing transformers and extensive line replacement projects.

businesses, which means that these business can provide savings on project costs and some downwards pressure can be brought to bear on the costs of in-house staff.

Contracting out may also make the allocation of overheads between the regulated and competitive parts of the business more transparent, since it provides a market test of costs. This may be beneficial for companies that may otherwise receive a determination from Ofgem on the allocation of overheads to the regulated parts of the business.

4.4.3. Contractual arrangements

There are no recommended or mandated contract templates in relation to contractor agreements for replacement expenditures. DNOs are generally responsible for their own contractual arrangements.

In the case of new connections, Ofgem has set out guidelines for the content of Construction and Adoption agreements, although these are not mandated. For example, these agreements provide the DNO with the right to inspect the work. The Agreement may also require the contractor to obtain planning permission before undertaking any work, since there have been cases where DNOs have had to remove cables that have been laid without planning permission.

One of the problems with contracting out network construction work is that the DNO takes ownership of the asset afterwards and carries the ongoing liability for maintenance. This applies to both replacement and load-related expenditure. Some DNOs have introduced longer-term performance criteria into their contracts in an attempt to mitigate the risk of poor quality work and the ongoing maintenance risk. However this not a common feature in the industry. DNOs tend to control for such risks via project supervision, rather than through longer-term penalty and incentive schemes.

Larger contracts are allocated via tender and are subject to EU procurement rules.

4.4.4. Allocation of risks

The risk of cost overruns is generally written into the contract. Under this approach, contractors are paid on a cost-per-unit basis, and therefore bear the risk associated with unit cost overruns. Contractors will usually be responsible for other aspects of their work, for example any risks arising from disturbance or nuisance caused by their work.

There is not usually a problem in terms of a cost overrun due to the state of assets being worse than expected, since, at least in the case of replacement expenditure, it is usually the case that whole assets are being replaced. Thus, for instance, if a project requires the replacement of a decayed pole, this would simply be added in as an additional unit cost the contractor could charge the DNO.

In the case of new connections, connection to the live system is carried out by the DNO (although Ofgem increasingly appears to perceive this as a barrier to entry and is taking steps to allow competition in this area as well) and the DNO therefore bears the primary risk for causing unplanned interruptions to other parts of the network, although as discussed this risk is very low in any case.

There are also some risks associated with gaining access to roads and private properties to carry out work, eg delays in access. Taking the example of Western Power Distribution, it retains these risks in the case of reinforcement or replacement work, but passes on to customers costs associated with gaining access or changes to work arising from access problems. Its contracts exclude any liability for delay due to access issues, and in the case of new connections excludes all liabilities for delays in providing a connection (except death or personal injury caused by negligence, and some limited liability for physical damage to customers' property resulting from its negligence).[40]

In the case of diversions, where, for example, a new highway requires a diversion that provides no incidental benefit to the network, the costs are likely to be passed on to the customer in full. For instance, Western Power Distribution charges the Highways Agency on an actual cost basis, so that the Highways Agency bears the full risk for the estimate.

4.5. Case Study 1: Distributed Generation

The term "distributed generation" refers is the transport of small-scale generation (wind farms and the like) connected directly to the distribution network. Historically the full costs of connection have been charged upfront, including full reinforcement costs and costs that might normally be spread over time as "use of system" charges. However Ofgem is requiring the industry to switch to a new pricing system which will allow 80% of the costs to be passed through on a 15-year annuity basis to the customer, with a further incentive scheme paid at a £/MW rate. This is intended to provide a degree of certainty while providing some incentive for efficiency.

The live connection to the network is always carried out by the DNO, but the wiring of the generation system to the point of connection may be carried out by the DNO or by the developers themselves. The risk is often around the planning process, since there is often a lot of opposition to wind farms, and people may try to oppose the DNO's work in preparation for the new connection.

The risk around reinforcement of the network is generally quite small in terms of the risk of to network reliability and the possibility of substantial interruptions. For DNOs with substantial distributed generation plans, notably United Utilities and Scottish & Southern, the greatest risk is in the design and planning stage, which is carried out in-house, rather than in the operational work.

4.6. Transmission Capital Expenditure Projects

4.6.1. Types and amount of capital expenditure

Capital expenditure in the electricity transmission business can be grouped into two broad categories:

- load-related expenditure (LRE); and

[40] Western Power Distribution's exclusions are implemented via their general terms for connection. These are ultimately determinable by Ofgem if a customer complains.

- non load-related expenditure (NLRE).

The load-related expenditure is driven by the connection of new generation and load, reinforcement of the existing transmission system to accommodate these new connections, reinforcement where generation is retired, and also by general load growth. On the other hand, the non load-related expenditure is associated with other factors such as asset replacement.

For the period from 2001/2 to 2005/6, Ofgem has allowed total capital expenditure of £1,320 million (in 1999/00 prices), of which £585 million is for LRE capex and £735 million is for NLRE capex.

4.6.2. Asset replacement

Most parts of the transmission network operated by National Grid Transco (NGT) were built in the late 1960s and are now reaching the end of their reliable life. As a result, NGT is currently undertaking the replacement of some network assets and is planning to increase its spending on the replacement program in the future.

For the purposes of planning replacement works, NGT uses a specific probabilistic model developed in-house. The model enables NGT not only to decide which parts of the network need to be replaced, but also to forecast the volume of works in the future (ie usually beyond the five year time horizon of price control reviews); this is particularly useful because some of the components have significant lead times.

The replacement works usually undergo three stages:

1. initial decision process;
2. scheme development; and
3. "on-ground" stage.

The initial decision process is made internally when it is decided which parts of the network have to be replaced, also using the risk model described above. The scheme development stage is also carried out internally most of the times; in some case engineering consultants may participate in this stage. External contractors often carry out the "on-ground" works, with some NGT staff overseeing and inspecting.

NGT tends to use standard contractual arrangements with contractors. These arrangements are set up by the procurement department at NGT and include quality standards and safety issues as well. Besides, NGT maintains a database of contractors, where each contractor is scored against a set or parameters related to its past performance. This mechanism helps NGT ensure a high quality of work is maintained over time, as contractors with a low score are penalised and there is a low probability of them of being awarded contracts in future. This may help to reduce NGT's risks, as works are more likely to be carried out by contractors who have proved to be reliable in the past. In general, contractors – who tend to be big companies – work for NGT on an ongoing and non-exclusive basis.

Another form of risk mitigation is that NGT sets up milestones and targets during the course of the replacement works, which have to be met by the contractors. In this way, the risk of time and cost overruns is closely monitored. Finally, NGT earmarks a contingency fund, which is used to meet extra costs whenever a project exceeds the budget.

In addition to strictly financial risks, NGT also identifies risks related to the following categories:

- security of supply;
- quality of supply; and
- additional operational costs.

Additional operational costs are incurred when NGT does not operate the system at its minimum dispatch cost, because of some outages or constraints. These costs can be quantified as the difference between the dispatch costs that are actually incurred and those that would be incurred in the absence of constraints or outages.

As an effort to reduce its exposure to such risks, although some resilience is built into the network, NGT adopts the following measures as much as possible:

- works are carried during weekends (when load is lower) or during a period which is convenient for customers;
- staff work on extended shifts;
- special operational arrangements are made; and
- substitutes (eg a power plant replacing another one that need to be disconnected) are found.

However, following a financial scheme proposed by Ofgem, NGT still faces the risk of financial penalties if the quality and continuity of supply fall below a certain threshold.

As to risks for personal injury and damage to properties and to the environment, NGT bears those risks. However, NGT requires that its contractors hold a recognised environmental accreditation (such as ISO 14001) or undergo a thorough assessment by NGT-nominated personnel. This ensures that all works are undertaken in such a way that risks are minimised.

4.6.3. Diversion of the network

NGT occasionally has to accommodate requests for diversion of lines (eg for the development of a new residential estate). For diversion of networks, NGT usually offers either a "fixed-price" agreement or an "indicative" price agreement, as described above. However, NGT seeks to be cost-neutral with respect to the diversion works, ie to pass all costs on to the party requesting the diversion. Among the costs passed on, NGT may include the addition operational costs incurred if the system cannot be managed efficiently because of the diversion.

4.7. Case Study 2: New Connections to the Transmission System

Under the current Standard Licence Conditions, NGT is obliged to offer commercial terms for a connection to the transmission system, upon receipt of a valid application. NGT must provide a response within three months of the receipt of the application.

NGT usually decides the design of the new connection and details of the system infrastructure, although for the actual building of the new connection, the customer may choose NGT or a different contractor.

If NGT is in charge of the new connection,[41] the schedule of the works and costs forms part of the legal agreement. NGT also requires financial guarantees, in the case that customers decide not to go ahead with the requested connection at a certain point.

4.7.1. Nature and allocation of risks

From 1993 to 2001 NGT operated under a fixed revenue cap (indexed only to RPI and an X factor). Therefore, any variation in the timing and level of new connections (or any other capex item) to the electricity transmission system has, in the past, led to significant differences in capital expenditure and (less significantly) in NGT's annual costs and profits. NGT, therefore, faced the risk of bearing the cost of depreciation and no return on any expenditure on connections over and above that forecast by Ofgem until, at least, the start of the next price control period.

In setting the NGT's revenue cap, NGT and Ofgem have consistently failed to agree an accurate forecast of future capital expenditure on reinforcing the network to accommodate new generators. Nevertheless, to reduce the problems caused by forecasting errors, the latest review of NGT's revenue control has instituted from 2001 an automatic adjustment to NGT's revenue cap of £23 million per GW of new connections by generators.[42]

This mechanism removes the volume risk that NGT faces from unexpected changes in the volume of new connections although leaves it facing a cost risk, as there is a fixed allowance per GW of new connection regardless of the costs that NGT actually incurs. This approach recognises the inherent uncertainty in relation to the volume of new connections, while retaining a revenue formula that gives NGT an incentive to minimise costs.

NGT may offer two types of contracts to customers seeking a connection:

- a "fixed-price" agreement; or
- an "indicative" price agreement.

In the first case NGT bears the entire risk of cost overruns. In the second case, some of the risk is transferred to the customer; although it is should be noted that NGT must carry out the

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[41] For the actual building of the new connection NGT usually chooses a single turnkey principal contractor.

[42] See para 3.8 and 3.9, *The transmission price control review of the National Grid Company from 2001: Transmission Asset Owner: Final Proposals*, September 2000.

works in an economic and efficient way and Ofgem might challenge NGT's spending on a new connection.

The schedule of works includes the date for completion of the works, which mostly depends on obtaining all of the planning permissions and consents on time. Since the relationship with landowners is usually long-term, NGT tends to be part of the discussions with them.

NGT enters connection agreements with an agreed completion date. It reserves the right to change the completion date if, after using reasonable endeavours to obtain the necessary planning consents, the required consents are delayed or withheld. Otherwise, NGT will pay liquidated damages (LDs) for delivering the connection later than the completion date. Usually, LD rates are based on standard industry terms of 1 per cent of the gross connection asset value per week for a maximum of 15 weeks (although other rates and an associated premium can be agreed). During such a period NGT will not levy network charges. Rights to use the network infrastructure cannot be used until the connection is completed. However, once the connection is completed, NGT must resolve any limitations in infrastructure capacity by congestion management actions, usually by accepting bids and offers within the balancing mechanism - effectively buying back the entry capacity for specific periods at rates determined by the holders of access rights.

5. Water and Sewerage

5.1. Industry Structure

In this section we present a brief overview of the structure of the water and sewerage industry in England and Wales and in Scotland.

5.1.1. England and Wales

The England and Wales water and sewerage industry comprises 10 regulated water and sewerage companies and 12 regulated water only companies. All 22 companies are vertically integrated. On the water side, the business includes abstraction, transportation, treatment, distribution and retail activities; on the sewerage side, activities include sewage collection, treatment, disposal and retail.

The conditions of appointment of water companies are set out in individual company licences. These set out the framework of economic regulation (discussed in Section 5.2) and the statutory responsibilities of the companies. The licence also defines the geographic area in which a company is to be the default service provider.

In terms of the competitive structure of the industry, much of the primary legislation enshrined within water companies' current licences was set out in the Water Industry Act 1991 (WIA91). This Act allowed for only limited competition within the industry, ie only for customers using over 100Ml/yr, and did not provide a statutory requirement for the licensed water companies to allow other companies access to their network of pipes. This position is currently in the process of changing. The recent Water Act 2003 (WA03), which comes into force in Autumn 2005, includes a common carriage provision requiring companies to allow competitors to use their distribution network to supply customers who use at least 50 Ml/yr. The aim of this requirement is to extend opportunities for competition among suppliers. WA03 also makes provision for property developers and others to lay water mains and service pipes, thus also creating competition in this activity.

5.1.2. Scotland

Scottish Water, a government owned company, is the sole provider of water and sewerage services in Scotland. Like its England and Wales counterparts, Scottish Water is a vertically integrated business responsible for all components of service provision. It was established on 1 April 2002 by the merger of the three former water authorities in Scotland.

The overall framework of competition law in Scotland is similar to that in England and Wales in that it is largely influenced by the Competition Act 1998, which came into force in March 2000.[43] The process of introducing competition into the water and sewerage industry in Scotland is, however, at a less advanced stage than in England and Wales. The legislation

[43] The Office of Fair Trading has sole responsibility for the enforcement of competition law in the Scottish water and sewerage industry. In England and Wales, both Ofwat and the Office of Fair Trading have powers, which are exercised concurrently.

required to introduce a licensing regime in Scotland that will allow for competition in the water and sewerage sector is currently in the process of parliamentary scrutiny.

The Water Services etc. (Scotland) Bill was first introduced to the Scottish Parliament in June 2004 and proposes to license retail competition for non-households. Unlike England and Wales, the proposed legislation does not specify a threshold volume of usage for non-households. Also the Bill prohibits common carriage on the public network because the Scottish Executive fears there are potential risks to health and the environment. Like England and Wales, however, it also prohibits competition for households.

5.2. Regulatory Framework

In this section we set out a broad overview of the type of regulation that UK water companies are subject to. We focus in particular on economic regulation including the process of price setting, how the scope of the capital programme is determined and the respective approaches to financial risks and incentives in England and Wales and in Scotland.

5.2.1. England and Wales

Water companies are subject to environmental, drinking water quality and economic regulation. Environmental regulation is the responsibility of the Environment Agency (EA), which oversees the management of water resources and licensing of abstraction, the control of pollution, land drainage and flood protection, and the protection of natural habitats. Drinking water quality regulation is the responsibility of the Drinking Water Inspectorate.

Economic regulation is the responsibility of Ofwat and covers matters relating to the interests of customers, namely price and quality of service. The main duty of Ofwat is to set limits on price increases at five-yearly periodic reviews. The 2004 price review is the third since privatisation and applies to prices over 2005/6 to 2009/10. Ofwat's Final Determination of price limits was published on 2 December 2004. Ofwat also has responsibility for handling disputes between water companies and between customers and water companies.

5.2.1.1. Ofwat's approach to setting prices

Ofwat sets price limits for residential water and sewerage customers and non-residential water and sewerage customers using less than 100ML/yr by estimating the revenue required by each water company to run its business efficiently and comparing this with the revenue currently received. The main elements of Ofwat's approach to estimating the revenue requirement are:

- estimate the operating and capital costs of maintaining base service provision, allowing for efficiency gains;
- decide which enhancement capital investment schemes the company should undertake over the next review period and estimate the costs of the enhancements; and
- estimate the cost of capital for the industry.

The revenue requirement is then set at the level that covers operating costs, depreciation and the rate of return on the regulatory asset base. This is translated into price limits by first

estimating the revenue that would be earned if prices were to remain at the same level. This estimate is derived by forecasting changes in household and non-household population, meter penetration and demand levels. Forecasts of large user (non-tariff basket) revenues are deducted from total revenues to obtain the revenue required from the regulated customer base.

Ofwat monitors water company performance across all service areas and combines the various measures, by means of a weighted sum of individual scores, into an Overall Performance Assessment (OPA) score. The factors measured by the OPA include water supply factors (pressure, service interruptions, hosepipe bans and drinking water quality); sewerage service factors (sewer flooding incidents and risks of flooding); customer service factors (complaints, compensation policies, and provision of information); and environmental factors (leakage, sewage treatment and sewage disposal compliance). Companies' scores are linked to prices directly. At the 2004 price review, the direct adjustments ranged from +0.4 per cent to -0.1 per cent for the first year of the new price control period.

Companies can appeal Ofwat's determination on price limits to the Competition Commission, in which case the Competition Commission formulates its own determination.

5.2.1.2. Specifying the capital programme

In deciding which capital schemes should be undertaken and funded within price limits, Ofwat takes account of guidance published by the Secretary of State, who is in turn guided by environmental legislation, companies' own strategic business plans, often including their research on customer priorities, and the government's own research into customer priorities.

The costs of capital schemes are estimated by companies and audited by company-appointed reporters approved by Ofwat. The costs are then submitted to Ofwat as part of companies' strategic business plans. Ofwat may adjust the costs of particular schemes if it chooses.

The main types of capital expenditure undertaken by companies in the water and sewerage industry are described in Section 5.3.

5.2.1.3. Incentives and standard cost risks

The regulatory framework allows companies to make a profit (ie in addition to earning their cost of capital) on their capital investment programmes, both maintenance and enhancement, if the actual costs incurred to achieve the specified outputs are lower than the costs allowed at the price review. Similarly, companies face the risk of making a loss on their investments if the actual unit costs are higher than allowed.

The mechanism for allowing this is through the regulatory capital value (RCV). Throughout the regulatory period, the RCV accumulates by allowed rather than actual capital expenditure. Companies will thus earn an excess return if they spend less than allowed and incur a loss if they spend more than allowed. The regulatory framework allows a company to earn an excess return on its capital programme for five full years regardless of in which year in the review period the company under-spends relative to its allowance. Thus, water companies are provided a consistent incentive to achieve capital cost savings throughout the price-cap period.

In the case of capital overspends, Ofwat's approach in previous reviews has been to permanently disallow any additional expenditure over and above the regulatory allowance. Companies therefore have borne the risk that excess expenditure across the whole capital programme will never be reimbursed. For the 2004 price review, Ofwat has introduced a new provision in the regulatory framework which caps the losses a company can incur. A new ceiling of 10 per cent of the total regulatory expectation of service turnover has been set, such that all expenditure in excess of this ceiling to achieve the same required outputs will be added to the RCV.[44]

At least for the larger companies, the risks around the capital programme are often well diversified because of the large number of independent schemes that water companies undertake. This mitigates to some extent the unit cost risks of individual schemes.

5.2.1.4. Dealing with uncertainties between reviews

In the case where additional obligations on a company arise during the regulatory period that were unforeseen at the time of the review, companies may either call for an interim determination or propose that the expenditures are "logged up", ie added, onto the RCV at the next review.

Interim price determinations take place between periodic reviews at the discretion of Ofwat but can be initiated by either the company or Ofwat. Such determinations allow for unforeseen increases in costs to be passed through to customers in specific circumstances. They also allow Ofwat to recover certain gains the company has made relative to the assumptions made at the periodic review and pass them onto customers.

The individual factors forming the basis of a claim may be either a Relevant Change in Circumstance (RCC), a Notified Item (NI), or discretionary costs. An RCC arises when there is a new or changed legal requirement, where the proceeds from land disposal differ from those assumed at the price review, or where some output has not been achieved, funding for which was provided at the review. Three companies also have a fourth type of RCC in their licence: where the growth of the Construction Output Price Index (COPI) exceeds the growth of RPI.

Notified Items are specific items notified at the last periodic review as being eligible for pass through at an interim determination if they exceed a certain materiality threshold. In Ofwat's 2004 price determination, there were five NIs. These included changes up or down in the number of meter optants, increases in bad debt and the costs of managing bad debt, increases in the charges for abstractions and discharges, charges for lane rental and traffic management, and increases in the taxation of infrastructure expenditure arising from the introduction of International Financial Reporting Standards. The process for arriving at this set of NIs

[44] Ofwat introduced this provision in response to concerns that Thames Water had significantly overspent on its capital programme for 2000 to 2005 and that the unlimited risk facing companies in the absence of the provision means that investors require a higher rate of return on capital.

involved consultation with the industry over which factors were the key areas of cost uncertainty ahead of the review.[45]

When an interim determination is initiated, Ofwat performs a triviality test on each individual factor. The test requires that the Net Present Value (NPV) of the impact must be at least one per cent of the company's previous year's turnover. Ofwat then takes all the non-trivial factors and applies a combined materiality test. This test requires that the combined NPV of the impact of all factors must be at least 10 per cent of the company's turnover for RCCs and NIs, or 20 per cent of turnover for discretionary costs. Finally, if the materiality test is passed, Ofwat calculates revised price limits to allow the company to recover all extra costs incurred, including the full financing costs. A company may appeal to the Competition Commission if it disputes Ofwat's interim determination.

The interim determination process mitigates against substantial cost risks arising from new legislation and, where the provision is included in companies' licences, from construction price volatility.[46] Discretionary costs can also be passed-through via an interim determination in the event of an unavoidable substantial adverse financial effect on the company's cash flow, such as a substantially lower than expected revenue. The principal risk that companies still retain is the risk that Ofwat will decide not to allow certain expenditures because it judges them not to be efficient.

During the current price control period 2000-05, eight companies asked Ofwat for an interim price determination on the basis of Notified Items and RCCs. Of these, seven companies were granted revised price limits.

A second mechanism for pass-through of unforeseen costs is through logging up. The threshold impact for an individual item to pass the triviality test is one per cent of service turnover in year three. If aggregated with other small items, the combined threshold is three per cent of service turnover in year three. Ofwat also requires companies to prove that the items result from a Recognised Change. This may be due to an RCC, a Notified Item, a service enhancement approved by WaterVoice, the customer representative body, or an increase in the demand for water. Ofwat requires the water company to prove that its expenditure was necessary before considering the item to be relevant. For this purpose, it requires a Reporter's confirmation that the solution chosen and the submitted costs are reasonable.

In considering the amount to be logged up, Ofwat will challenge and, if necessary, adjust all capital costs to reflect its expectations of an efficient company's costs. The adjusted costs must then pass a second triviality test at the same threshold level before being logged up onto the RCV.

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[45] The Notified Items specified at the 1999 Periodic Review included costs associated with the number of households taking up the option of a free meter, the effects of the prohibition of disconnection of household supplies for non-payment of charges; and the cost of administering the statutory scheme for abatement of metered charges to domestic customers in vulnerable groups.

[46] There are currently only three companies containing the provision in their licence to pass through changes in construction prices (Anglian Water, United Utilities and Yorkshire Water). Ofwat has consulted on the issue of whether to grant all companies this licence condition. The condition has not been brought in as part of the 2004 periodic review but it may be revisited in the near future (see Ofwat, MD194, 5 August 2004).

The capital costs that are logged up onto the RCV earn a rate of return on a continuing basis only, ie the financing costs associated with delayed recovery are not included in the RCV adjustment. By contrast, when Ofwat logs down from the RCV capital expenditures that were assumed in price limits but which were not incurred by the company for any reason, the company's earnings from the RCV for these capital expenditures are also subtracted from the RCV.

Ofwat's rationale for excluding the financing costs when logging up is that it encourages companies to work to define all possible obligations as part of the periodic review.[47] Ofwat also notes that companies have an incentive to highlight unforeseen expenditures but to hide any instances where outputs are less onerous to achieve than were assumed. It is Ofwat's view that excluding the financing cost of intra-period investment compensates for this information asymmetry. This position has been strongly contested by water companies in the lead up to the 2004 price review but has remained Ofwat's position in its final determination.

The logging process mitigates risk to a certain extent by allowing a range of unforeseen costs to be passed through to customers at a lower materiality threshold than for interim determinations. However, the full costs are never passed through because the RCV adjustment does not include the financing costs associated with delayed cost recovery. Companies also face the risk that Ofwat will decide not to allow the full capital cost because it judges the company to have been inefficient.

5.2.1.5. Summary of financial risks of capital investment programme

Table 5.1 sets out a summary of Ofwat's approach to dealing with the financial risks in the capital investment programme.

[47] Ofwat, "Logging up and down – dealing with shortfalls in outputs and new requirements between periodic reviews", June 2002.

Table 5.1
Financial Risks of Capital Programmes in the England and Wales Water and Sewerage Industry

Risk / Scenario	Ofwat's Approach to Rewards / Penalties
Greater-than-expected costs to deliver specified outputs (including maintaining base service)	No addition to RCV for up to 10% of expected service turnover. Costs above this ceiling fully passed through to RCV.
Less-than-expected costs to deliver specified outputs (including maintaining base service)	Full earnings on outperformance allowed for five years.
Additional obligations placed on company requiring extra capital expenditure	If costs are material, an interim determination may be triggered, in which case all capital costs and financing costs are potentially recoverable. If non-trivial, costs may be logged up onto RCV at end of regulatory period to reflect extra investment where justified. Financing costs are excluded from adjustment.
Pre-specified outputs not delivered by the end of the regulatory period	RCV adjusted downwards at end of regulatory period to reflect shortfall. Extra earnings for company on this part of RCV are also subtracted as part of the adjustment.

Ofwat aims for the expected rate of return on capital investment to be consistent with the level of overall financial risk in order that companies are able to attract a continuing inflow of investor capital. Ofwat monitors a selection of key financial ratios, including regulatory gearing and FFO Interest Cover Ratios, adjusted for capital maintenance expenditure, to ensure that the overall revenue allowance is consistent with an investment grade credit rating. If the overall package is found in its financial model to be insufficient for this purpose then Ofwat adds a financeability adjustment to companies' allowed revenue.[48]

5.2.2. Scotland

Like the England and Wales water companies, Scottish Water is subject to environmental, drinking water quality and economic regulation. Environmental regulation is the responsibility of the Scottish Environment Protection Agency (SEPA), which has a similar role to that of the EA in England and Wales. Drinking water quality regulation is the responsibility of the Drinking Water Quality Regulator, whose primary purpose, like the DWI in England and Wales, is to protect public health. Economic regulation is the responsibility

[48] For the 2004 periodic review, Ofwat has used a financial model that does not explicitly take account of risk factors. On behalf of Water UK, the UK water industry body, NERA recently developed a financial risk modelling tool which allowed companies to input risk distributions around a large number of items including capital cost, operating cost and revenue items, and by multiple simulations, trace through their effects to their key financial ratios. This modelling tool allowed companies to understand the impact of the 2004 draft determination and 2004 final determination on their business taking full account of the asymmetric nature of many of the risks they face as a business. The model was externally audited and a number of companies used the results from this model, applied to their own situation, as part of their representations to Ofwat following the draft determination.

of the Water Industry Commissioner (WIC) for Scotland. The primary purpose of the WIC is to set prices for Scottish Water.

The regulatory framework in Scotland is evolving rapidly and so, correspondingly, are the risks facing Scottish Water. The next price review for Scottish Water will be in 2005 to apply to prices for the period 2006 to 2010. To date, a number of consultation papers have been published by the WIC relating to his proposed approach for this next review. The remainder of this section discusses the regulatory framework in light of the WIC's proposals as set out in these papers and how this differs from the current framework.

5.2.2.1. The WIC's approach to setting prices

Since the last review in 2002, Scottish Water has been subject to revenue cap regulation by the WIC. This means that when actual revenues are different from allowed revenues, prices in the next year adjust to compensate for the difference. This framework thus passes demand risk through to customers unlike the price cap mechanism in England and Wales.

The WIC's approach to setting the revenue cap for the 2002 to 2006 period involved estimating cash costs, including operating expenditure costs, capital expenditure costs and the costs of debt interest payments, and subtracting the amount that could "prudently and sustainably" be funded from public expenditure.[49] The approach is therefore currently fundamentally different from the England and Wales model in its treatment of capital expenditure in that it is not based on a regulatory capital value approach.

For the forthcoming price review in 2005, the WIC has indicated that he will introduce an RCV for Scottish Water and that the regulatory framework will move towards the England and Wales model in its treatment of capital expenditures. The WIC has also stated that he will replace the revenue cap with a price cap for the 2006 to 2010 period and thereby bring the regulatory framework even more closely into line with England and Wales. Under the proposed framework, Scottish Water, like the England and Wales water companies, will also be able to appeal against the WIC's determination on price limits to the Competition Commission.

5.2.2.2. Specifying the capital programme

The capital programme for the 2006 to 2014 period is currently under the process of consultation between all the relevant stakeholders as part of the Quality and Standards (Q&S) III process. The final Q&S III paper is due for publication in early 2005 and will set out the Scottish Executive's advice on the scope of Scottish Water's capital investment programme for 2006 to 2014. Using this guidance, Scottish Water is due to set out its second draft business plan in April 2005, which will constitute Scottish Water's principal submission for the price review. As in England and Wales, Scottish Water will estimate the costs of each proposed capital scheme and its estimates will then be audited by a reporter. The final decision on the costs that will be allowed is the WIC's.

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[49] Water Industry Commissioner for Scotland (2004c) "Our Work in Regulating the Scottish Water Industry: The Calculation of Prices", September, p. 59.

5.2.2.3. Incentives and standard cost risks

The WIC's proposed approach to the process of Scottish Water's RCV accumulation is broadly similar to Ofwat's approach for the England and Wales water companies in that Scottish Water will be able to make a profit on its capital investment programme if its costs are below target and it will make a loss if they are above. Unlike the England and Wales framework, however, underspends on specified outputs will be retained only until the next review rather than on a five-year rolling incentive framework.

5.2.2.4. Dealing with uncertainties between reviews

WIC (2004c) proposes to adopt Ofwat's approach in its entirety in respect of the process and scope of interim determinations and logging. [50]

5.2.2.5. Summary of financial risks of capital investment programme

Table 5.2 sets out the WIC's proposed approach to dealing with the financial risks in the capital investment programme in Scotland.

Table 5.2
Financial Risks of Capital Programmes in the Scottish Water and Sewerage Industry

Risk / Scenario	WIC's proposed approach to rewards/penalties
Greater-than-expected costs to deliver specified outputs (including maintaining base service)	No addition to RCV
Less-than-expected costs to deliver specified outputs (including maintaining base service)	Earnings on outperformance allowed until end of regulatory period.
Additional obligations placed on company requiring extra capital expenditure	Same as Ofwat's approach.
Pre-specified outputs not delivered by the end of the regulatory period	Same as Ofwat's approach.

5.3. Common Features of Capital Expenditure in the Water and Sewerage Industry

In this section, we summarise the main types of capital expenditure undertaken by water companies in the UK. We describe the main types of risks attached to different types of capital investments, with a broad indication of the likelihood of the risks being realised and their potential impact.

[50] Water Industry Commissioner for Scotland (2004c) "Our Work in Regulating the Scottish Water Industry: The Calculation of Prices", September, p.125

5.3.1. Types of capital expenditure

5.3.1.1. Regulated capital expenditure

Aggregate regulated capital expenditure in 2003/4 in the regulated England and Wales water and sewerage industry was £3.7 billion. This comprised £3.2 billion of additions to current cost fixed assets and £0.5 billion of expenditure on infrastructure renewals. Total turnover for the England and Wales industry, for comparison, was £6.9 billion in 2003/4. Scottish Water is currently investing around £450 million per year throughout the current investment programme, Quality and Standards II, which runs from April 2002 to March 2006. Scottish Water's turnover in 2003/4 was around £1.0 billion.

Table 5.3 sets out how Ofwat classifies capital expenditures in the England and Wales water and sewerage industry by purpose category. The table also shows the proportions of total gross capital expenditure within each category in 2003/4.

Table 5.3
Classes of Regulated Capital Expenditure in England and Wales Water and Sewerage Industry

Class of Capital Expenditure	Proportion of E&W total in 2003/4	Purpose
Maintenance		
Infrastructure Renewal Expenditure	13.4%	Maintenance of underground assets.
Maintenance Non-Infrastructure	31.8%	Maintenance of above-ground assets.
Enhancements		
Quality (Q)	39.6%	Enhancements to drinking water quality or environmental improvement.
Supply-Demand Balance (SDB)	12.6%	Increase supply to meet rising demand.
Enhanced Service Levels (ESL)	2.7%	Enhanced service to customers, eg alleviate water pressure or sewer flooding problems.

Source: Ofwat (2004) "Financial performance and expenditure of the water companies in England and Wales" 2003-04 report.

The principal drivers for capital expenditure in England and Wales are capital maintenance requirements, quality drivers and demand growth. We focus here purely on enhancement investment and thus leave aside discussion of the types of investment and accompanying issues of uncertainty in maintaining service levels.

The main drivers for Quality enhancement capital expenditure are environmental and drinking water quality regulations. Typical investments in this category include building or upgrading water and sewerage treatment works, renovating distribution systems and replacing pipes.

Capital expenditure to maintain the supply-demand balance includes asset and infrastructure enhancement expenditures such as reservoirs and trunk mains. It does not include local

distribution infrastructure development required to service new connections. These costs are recovered through an infrastructure charge levied to the new customers

A case study in Section 5.4 describes the risk profile of investment in developing a treatment works. This provides an overview of the general issues involved in the majority of capital investment schemes in the water and sewerage industry.

5.3.1.2. Non-regulated capital expenditure

In addition to investments that companies undertake but that Ofwat decides are unnecessary, there are two main types of capital expenditure that always fall outside of the scope of the regulatory price limits – ie that are not reimbursed through general customer tariffs. These are capital costs associated with large users (>100Ml/yr) and capital costs incurred by the company to save money on future costs.

Large users (>100Ml/yr) fall outside of the scope of regulation for England and Wales water companies. Ofwat requires that companies recover all costs associated with serving large users from the large users themselves. Thus all capital expenditures required to maintain or enhance the network for the purpose of supplying new or existing large users must be recovered through the large user tariff, which is not itself regulated.

The second type of capital expenditure that falls outside the regulatory scope is what Ofwat terms "spend to save". This includes, for example, expenditure on a new computer software system which lowers the costs of maintaining a given standard of customer service. This type of expenditure is recovered by the company through its effect on lowering operating expenditure. Companies are allowed to keep for five years any operating expenditure underspend relative to target levels.

5.3.2. Risk Profile of Capital Expenditure

Water company capital investment schemes are subject to the same common risks facing all large construction projects – namely the risks of cost overruns, delays, and poor quality outputs. In this section, we describe how these risk factors impact financially and otherwise on water companies, customers and third parties.

5.3.2.1. Cost overruns

The impact of cost overruns generally falls mainly on the water company itself. As discussed in Section 5.2 above, water companies make a profit if their capital programmes come in under budget and make a loss if they run over budget. Companies are allowed the expected costs of schemes by the regulator, ie they include a risk adjustment to the best-scenario costs, and so the riskiness of the capital programme is factored into the allowance they receive for the schemes. In general, therefore, customers do not bear the risk of cost overruns.

The exception to this rule is the case where the cause of the cost overrun is an increase in general construction costs in relation to RPI; this exception only applies to the three companies that have the relevant clause in their licence (see Section 5.2.1.4). For these three companies, the relevant costs can be reclaimed from customers through an interim determination of prices. In all other cases, the general risks of cost overruns are borne by the water company.

Water companies in England and Wales and in Scotland have the freedom within the regulatory framework to choose any contracting arrangements and insurance schemes to deliver the agreed outputs from capital enhancement schemes and so are free, within the constraints of the market, to mitigate against the risks of cost overruns. Companies have their own policies on contracting and insurance arrangements and arrangements vary within companies as well as between companies. Without having undertaken a full survey of all water companies, it is not possible to know for certain whether fixed price or variation-of-price construction contracts are more common. Both types of contract are used widely. Scottish Water, for example, has outsourced its entire capital enhancement programme to a company called Scottish Water Solutions, which is a joint venture between Scottish Water, United Utilities and a number of other contractors.

5.3.2.2. Delays

The risk associated with delayed completion of a capital enhancement scheme depends to a large extent on the type of scheme and its timing. In general, where schemes take longer to complete than was assumed in the regulatory contract, then Ofwat/WIC will seek to recover the revenues earned by the company on the part of its accumulated RCV it is deemed not to have built. This happens through the logging-down mechanism discussed in Section 5.2.1.4.

For Supply Demand Balance (SDB) schemes - abstraction and treatment schemes to raise the overall volume of water into supply in a resource zone - there are not any significant additional risks associated with delays. Water companies' resource plans are very long term in nature and the supply capacity incorporates headroom to allow for particularly dry weather. So delays to resource scheme deliveries do not generally impact upon overall supply risk, and customers are unaffected.

For Quality (Q) schemes triggered by environmental or drinking water quality directives and Enhanced Service Levels (ESL) schemes, companies may face additional risks from delays in cases where late delivery is liable to lead to non-compliance with required standards. Compliance with environmental obligations and incidences of environmental damage are monitored by the Environment Agency and reported to Ofwat via the annual June Returns. Likewise, the Drinking Water Inspectorate monitors the quality of drinking water and also reports any incidence of non-compliance to Ofwat. Water companies are penalised by Ofwat for non-compliance with a number of factors including drinking water quality, environmental damage and various customer service factors including supply interruptions, low pressure and customer contact. These factors are combined into an Overall Performance Assessment (OPA) for companies in England and Wales. Companies must meet targets as part of this OPA in order to satisfy their regulatory obligations and receive their full revenue allocation. Delays to Q and ESL capital enhancement schemes may impact on their ability to meet these targets.

Water companies in England and Wales are also subject to Guaranteed Standards Scheme (GSS) regulations, which set minimum compensation levels that they must pay to customers in the event of particularly poor standard service at any time. The GSS Regulations cover a

wide range of service factors but these are generally applicable to maintenance rather than enhancement expenditures.[51]

In the case of schemes involving laying new or replacement mains or sewers, delays may impact on customers and on traffic through the area. The impact on customers through supply interruptions is generally short. Each company must report any instances of supply interruptions and the scope and duration of the interruptions as part of its June Return and these data feed into the OPA. Although not required by Ofwat, companies will often pay compensation in the event of supply interruptions in order to maintain their reputation. Thus, the risk to customers of supply interruptions is not fully passed back to the water company or diversified across all customers.

At present, companies do not bear the cost of the delays arising from traffic congestion. However, this is soon to change with the introduction of lane rental charging, which is likely to be implemented within the next year or two. Pilot schemes have already been conducted in Camden and in Middlesbrough, and there is strong support in Government for the charges. Ofwat has allowed a Notified Item in the 2004 price determination for these charges, so the efficient costs of schemes requiring the use of road lanes will be passed through to customers while the additional costs of delays, if deemed to be due to inefficiency, will be borne by the water company. This will have the effect of reallocating the traffic congestion element of the risk of delays onto water companies.

For investment to provide new connections, delays which result in the new customer being unable to trade or households being unable to move in require the water company to pay compensation to the affected party. The issues surrounding the risks associated with investment in new connections are described in a case study in Section 5.4.

5.3.2.3. Quality

Due to the vertical integration of the industry and the regional monopoly industry structure, the majority of capital expenditures by water companies involve little interaction with third parties other than contractors and customers. The exceptions to this rule are cases where companies extend or divert the network and make connections to new property developments. In these cases, the water company will also interact with the developer. The issues over the quality of the developer's work are described in a case study in Section 5.4.

5.3.2.4. Summary of risks in capital enhancement programmes

It is useful to distinguish between unit cost risk, which is the risk around the cost of agreed outputs, and volume risk, which is the risk that more outputs are required between price reviews than agreed.

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[51] As an example, customers are entitled under the GSS to compensation if following an unforeseen interruption their supply is not restored within 12 hours (except in the case of a strategic mains burst, in which case the company has 48 hours to restore supply). The compensation payable is £20 for households and £50 for business customers. This does not affect customers' statutory rights to seek legal redress for damages. One notable exception from the GSS regulations is any requirement to pay compensation in the event of supplying water unfit for human consumption. Companies are penalised for non-compliance with quality standards on a company-wide scale through the Overall Performance Assessment, but individual customers are not covered by any enforced compensation scheme as part of the GSS.

The financial risks associated with additional obligations arising between reviews are mitigated to a degree by the logging-up mechanism and by the possibility of an interim determination of prices as described in Section 5.2.1.4. The risk around unit costs is largely controllable by water companies in that they have flexibility over contracting and insurance arrangements. The risks are also mitigated to a large extent at a company-wide level by the fact that the capital programme contains a large number of independent schemes and so the risks are diversified. The remaining financial risks are largely borne by the water companies themselves. Companies are able to earn a profit on their capital programmes when they deliver the agreed outputs at a lower cost than allowed by the regulator.

5.4. Case Studies

In this section, we focus on a selection of individual case-studies of typical capital investment projects to describe the risks involved and how they are allocated among the relevant parties. The case-studies we examine are:

1. Building a new treatment works.
2. New connections to the network.
3. Network diversion to meet the needs of a third party.
4. Inter-company network connections.

5.4.1. Building a new treatment works

The construction of new treatment works is a highly typical example of the type of capital expenditure a water company will undertake. The need for a new treatment works may be driven by demand growth, by new quality requirements or simply to replace an aging asset. As with all construction, this type of project is subject to the risks of cost overruns, delays, and poor quality outputs.

The cost of an enhancement project, such as building a new treatment works, is estimated by the company using its own methodology. The enhancement costs of a large scheme are generally built up using unit costs for sub-components of the projects which are estimated using data from past schemes. The estimate is then audited by an appointed Reporter before submission to Ofwat for approval. Ofwat will generally challenge the assumptions upon which the costs submitted by the company are based, and allow a reduced amount where it feels they are excessive. Ofwat also applies an efficiency adjustment based on comparative econometric analysis of unit costs against other companies.

There are no regulatory rules governing the contracting arrangements for building a new treatment works and so companies are free to negotiate their own agreements with construction firms to undertake the work. Companies' approaches to sharing risks between themselves and their contractors vary, often within the company as well as between companies. From the water company's perspective, the most important factor is that project risks are adequately funded within the regulatory allowance. On this matter, there is often disagreement between companies and Ofwat. The main area of disagreement is the fact that the penalty for under-performance is not symmetrical with the reward for over-performance. As discussed in Section 5.2.1.3, companies earn a profit on under-spends for a maximum of

five years, while the extra cost overspends are never reimbursed, other than in exceptional circumstances.

When there are delays in the building of a treatment works there will generally be a deleterious impact on direct enhancement costs. In addition, significant delays to the building of a treatment works may impact on a company's ability to meet its performance targets in terms of drinking water quality or environmental compliance. This will magnify the financial effects of the delay.

Once the treatment works has been built, the RCV increases in line with the regulatory allowance for the enhancement cost of the asset and the company begins to earn the return on this. As discussed in the sections above, the company will earn a return on the investment greater than the WACC if the project comes in under budget but the return will be less in the opposite case.

The regulatory framework provides companies with the incentive to achieve a high level of quality on the capital output since higher quality will generally imply a lower maintenance cost and/or a longer asset life and possibly also a lower operating cost. Concomitantly, the approach also exposes companies to financial risks associated with poor quality outputs in exactly the opposite direction.

The mechanism for this incentive arrangement for maintenance expenditure is the same as for enhancement expenditure. Where a company's (non-infrastructure) maintenance/ replacement expenditure is less than the allowable amount then the company earns a return higher than the allowed WACC. The company is allowed to earn the excess returns for five years in the same way as with enhancement capital expenditure. In the case of capital overspends, Ofwat disallows any additional expenditure over and above the regulatory allowance, except where the total overspend is greater than 10 per cent of service turnover. The risks around the quality of the delivered treatment works thus impact on companies through their impact on future maintenance expenditure.

5.4.2. New Connections to the Network

When new customers connect to the water and sewerage network, there are potentially four activities requiring the company to undertake capital expenditure. These include:

1. Laying a service pipe or drain and making the connection to the property;
2. Laying a new water main or sewer if there is none nearby;
3. Upgrading the local distribution network or sewerage network including local service reservoirs or local pumping stations; and
4. Developing resources, if water resources are already fully committed (including bulk mains and treatment plants) or increasing the capacity of the sewage treatment works.

Companies in England and Wales are expected to recover the costs of investments in new connections for activities 1 to 3 from developers wherever possible. In practice, Ofwat recognises that the full costs associated with new developments across the whole company area cannot be recovered in full from developers and so allows companies a revenue item to make up the shortfall. Companies submit estimates of the costs associated with new

development and the amounts they expect to recover from developers. Ofwat applies an adjustment to these developer contributions in cases where it deems them to be unduly pessimistic. Companies have the incentive to charge developers as much as they can for any work they undertake but face the risk that they will under-recover these costs relative to the regulatory allowance.

Companies submit charges and terms and conditions to developers for work associated with new connections. These are not directly regulated but the developer can appeal to Ofwat if it considers them to be too high. In such cases, companies must justify the charges on grounds of their costs and Ofwat will judge whether they are appropriate. The company can require the developer asking for the new water or sewerage infrastructure to pay a security before commencing work in order to mitigate against the risk of non-payment.

In the case of domestic connections, developers, or their third party contractors, are entitled under the Water Industry Act 1991 to enter into an agreement with the water company for the company to adopt a self-laid main or sewer. In this case, the company is entitled to recover the expected 12-year NPV of the costs associated with connecting and adopting the self-laid main or sewer minus the 12-year NPV of expected revenue from the customers serviced by the new connection discounted by the WACC. The effect of this calculation is to fully compensate companies for their expected costs. Companies face the risk that they will under-recover their costs but this risk should be symmetrical with the upside that they over-recover costs.

In the case of non-domestic connections, there is no specific provision in the legislative or regulatory framework covering the installation of self-laid pipes. The company is not prohibited from adopting a self-laid pipe for non-domestic purposes. Ofwat has powers in the absence of an agreement between a water undertaker and a person requesting a supply of water for non-domestic purposes to determine the conditions on which such a supply should be provided. The company would normally be expected to recover its expenses for any work undertaken, including a return on capital employed, but does not have to subtract an income allowance.

The work required to make new connections is generally straightforward and is not subject to a significant degree of cost risk or risk of delays. When connecting to a self-laid pipe, the developer has an incentive to achieve a satisfactory quality level for the job and it is our understanding that there are rarely any significant problems in this area. There is no regulatory minimum compensation payment for delayed completion of a connection; companies have their own compensation policies.

5.4.3. Network diversion

In the case that water companies are asked to divert a water main or sewer to meet the needs of a third party developer, the activity is straightforward. Either the developer or the water company will lay the new main or sewer. In either case, the developer is expected to pay the full costs of the work. If the developer lays the pipe then the water company will inspect the work before making the connection and switching the flow to the new pipe. It is our understanding that there are rarely any significant risks to the company in this area since all cost risks are passed through to the developer.

5.4.4. Inter-company network connections

From Autumn 2005, with the introduction of the new competitive framework, water companies in England and Wales will be able to connect to other water companies' networks to supply large customers outside their licence area. Likewise, water companies must allow other companies access to their own network on reasonable terms in order to compete for service agreements with their own large customers. The extension of competition sanctioned by the Water Act 2003 is unchartered territory for the industry and it is not clear yet how the legislation will impact on the sector. During the consultation process to date leading up to the implementation of the Act, water companies have voiced concerns that it may give rise to severe financial, water quality and service quality risks.

There are a number of potential risks associated with these new arrangements, including the risks of under recovery of sunk costs and risks associated with ensuring adequate water quality. At this stage, it is not clear exactly how the interconnection and common carriage arrangements will work in practice.[52]

[52] Ofwat has recently issued four consultation papers on the subject, the latest two of which were published as this report was being finalised. The arrangements for the introduction of competition in Scotland are at an earlier stage. A bill containing the proposed amendments to the competitive framework is currently in the process of parliamentary scrutiny by the Scottish Parliament.

6. Airports

6.1. Industry Structure

Four airports in the UK are designated by the UK Government for *ex ante* economic regulation (through a price cap on aeronautical charges). They are BAA's London airports, Heathrow, Gatwick and Stansted, and Manchester Airport.

These are the largest airports in the UK. Heathrow, Gatwick, Manchester and Stansted had a throughput of 63.2 million, 29.9 million, 19.5 million and 18.7 million passengers respectively in 2003. Together, these account for more than 65 per cent of passenger throughput for all airports in the UK. The fifth largest airport, Birmingham, served only 8.9 million passengers in 2003.[53]

Heathrow is the world's busiest international airport. It is the airport hub for British Airways (BA), and BA undertakes approximately 40 per cent of all timetabled flights (slots) at Heathrow.[54] It is also an important centre for the Star Alliance group of airlines, whose members include Lufthansa and bmi. Overall, it is used by around 90 airlines, including many serving long haul destinations. BA is also the largest user of Gatwick, though it has substantially reduced its presence there in recent years. Gatwick serves 80 airlines, including many charter carriers. Stansted is an important centre for low cost airlines, notably Ryanair and easyJet, and serves 35 airlines in total.[55] Manchester Airport serves around 95 airlines.

BAA is a public limited company, listed on the London Stock Exchange. Manchester Airport is owned by Manchester Airports Group, also a public limited company, which is wholly owned by ten local authorities in Greater Manchester.

Revenue for the designated airports is shown in Table 6.1.

Table 6.1
Airport Revenue, 2003/04 (£ millions)

	Aeronautical	Retail	Other*	Total
Heathrow	421	215	207	843
Gatwick	131	98	60	289
Stansted	54	60	27	141
Manchester				248

Source: BAA Annual Report 2003/04, p63; Manchester Airports Group Annual Report 2003/04 p4.
**Includes revenue from property and operational facilities.*

[53] These data are taken from CAA published statistics for 2003, Table 1, http://www.caa.co.uk/erg/erg_stats/default.asp

[54] Figure 3.15 of NERA, *Study to Assess the Effects of Different Slot Allocation Schemes*, Final Report to the European Commission, January 2004.

[55] Statistics taken from BAA *Airport Statistics – Issue brief*, November 2004.

6.2. Regulatory Framework

Airports can be regional or (in the case of Heathrow) national monopolies. Planning restrictions prevent direct competition from emerging. In addition, Heathrow and, to a lesser extent, Gatwick are highly congested airports which are capable of accruing considerable economic rent.

Designated airports are subject to economic regulation according to the Airports Act 1986. Prices are ordinarily set for five years periods (quinquennia), and the current quinquennium (Q4) covers the period 1 April 2003 to 31 March 2008.

The Civil Aviation Authority (CAA) is the economic regulator of airports in the UK. It initiates price reviews, undertakes consultations and develops proposals. It is then required to refer its proposals to the Competition Commission (CC). The CC recommends the price cap for each airport and also decides whether the airports have been acting against the public interest over the previous five years. The CAA then implements a price cap, taking account of the CC's recommendations. It also imposes conditions on an airport if the CC finds that it has been acting against the public interest.

This approach differs from other regulated industries, where the industry regulatory body determines the price caps and the CC only becomes involved if the regulated company refers the decision to it for review. Another important difference is that the CAA is unable to initiate an interim review of prices, though airports can ask for such a review. For a number of years, the government's policy position has been that airport regulation should be brought into line with the framework applying to other regulated utilities, but it is far from clear when (or indeed if) this is likely to be implemented.

The four airports are subject to their own RPI-X price cap. The cap applies to the change in revenue yield from one year to the next, where revenue yield is defined as the total revenue from aeronautical charges divided by the total number of airport passengers.

The price cap is calculated according to a single till. This means that the revenue requirement from aeronautical charges is calculated taking into account cost and revenue projections from commercial activities connected to the airport, in particular airport retail. The implication of this approach is that any excess returns expected from commercial activities will be used to reduce the amount that must be raised from regulated aeronautical charges, so that the overall expected return is equivalent to the airport's cost of capital.

The price caps are subject to a number of adjustments. The adjustments that are most relevant to this study are:

- the price caps at Heathrow and Gatwick airports are reduced if certain construction milestones ("triggers") are not met; and
- Heathrow and Gatwick airports are required to pay airlines compensation if the service quality provided falls below certain specified levels.

We discuss the treatment of triggers in detail in the Heathrow Terminal 5 case study (section 6.4).

Schedules of rebates for poor service quality were introduced in July 2003. The maximum possible rebate is currently 1.5 per cent of aeronautical charges; in April 2005 a further service quality criterion will be introduced, peak time aerodrome congestion, amounting to up to 1 per cent of prices (so that, together, possible rebates are capped at 2.5 per cent of charges).

In addition to peak time aerodrome congestion, other service quality terms consist of availability and serviceability of certain equipment (aircraft standards, jetties, people movers, arrivals reclaim carousels, jetties, fixed electrical ground power and the two track transit systems at Gatwick); there are also service level standards for piers and security queues.

There are dead bands in the calculation of rebates for certain facilities to permit periodic maintenance at off peak times. BAA is also exempt from paying for failures necessitated by safety or security concerns, which result from damage sustained by airlines, or where the rebate would act against the CAA's statutory objective of encouraging investment. The standards apply to terminals individually.

The CAA framed its decision regarding service quality so as to encourage and facilitate airports and users agreeing improvements to the details of the scheme at any point, and will review the service quality regime in the run-up to the introduction of the aerodrome congestion rebate, in April 2005.[56]

6.3. Common Features of Capital Expenditure at Airports

6.3.1. Types of capital expenditure

Table 6.2 shows how BAA capital expenditure projects are classified. It shows expenditure on each category with respect to each airport for 2001/02. The Terminal 5 project at Heathrow accounts for a large proportion of expenditure, and is classified as a capacity project for Heathrow Airport Limited (HAL).

[56] See CAA, *Economic Regulation of Heathrow and Gatwick London Airports – Service Quality – Statement of Standards and Rebates*, May 2003.

Table 6.2
BAA London Airports: Classification of Capital Expenditure 2001/02
(£ million, 2001/02 prices)

Classification of projects	HAL	GAL	STAL	Total
Safety, security and environmental	8.5	8.3	3.0	19.8
Capacity	244.8	17.9	49.3	312.0
Service quality	10.6	24.9	28.9	64.4
Revenue generating	53.3	14.0	1.0	68.4
Replacement / refurbishment of existing assets	42.9	13.2	3.7	59.8
Process / productivity improvement	0.0	0.0	0.0	0.0
Other, eg community projects, staff facilities	0.0	0.0	0.0	0.0
Total	**360.1**	**78.3**	**85.9**	**524.3**

Source: Table 9.4, Competition Commission (November 2002) BAA plc: a report on the economic regulation of the London airports companies (Heathrow Airport Ltd, Gatwick Airport Ltd and Stansted Airport Ltd).

6.3.2. Risks associated with capital enhancement projects

BAA may bear the following categories of risk from capital enhancement projects:

- cost overruns;
- time overruns;
- service quality;
- volume;
- safety and security.

As with all industries, airports face risk associated with capital costs exceeding those forecast. We discuss allocation of such risk through regulatory mechanisms in section 6.3.3 and between the airport and other parties in section 6.3.4.

Similarly, projects can overrun. In this industry in particular, proposals for development can be delayed by the public planning process, as occurred notoriously with respect to Heathrow Terminal 5. Developments can also be delayed by direct action, for example by environmental protestors opposed to the construction of Manchester Airport's second runway. In Q4, the regulator has introduced a system of financial penalties which will be levied if BAA fails to meet certain project milestones; these are discussed in the context of Terminal 5 in the next section. Project delays can also undermine service quality and/or capacity.

Construction projects can often undermine service quality by reducing capacity temporarily, for example by closing part of a terminal. Such impacts can be forecast, and therefore planned for. But risks to service quality might emanate from projects taking longer than expected, or being worse than expected because of increases in traffic volumes; and they might result in more disruption than anticipated.

Heathrow and Gatwick are highly congested airports, so failures in service quality have little impact on traffic volumes, and therefore direct revenue risk. (In contrast, service quality at Stansted may be more likely to influence demand and therefore revenue directly, though this impact may be limited by the fact that this airport is used predominantly by low cost carriers.) In the past BAA has shared some of the costs of service quality failures with airlines on an *ad hoc* basis, however. For example during Q3 bmi experienced disruption as a result of improvements in transfer baggage facilities at Heathrow Terminal 1. BAA agreed a financial settlement with bmi to compensate for these problems.[57]

As discussed in section 6.2, in Q4 the CAA has developed service quality regimes for Heathrow and Gatwick so that BAA now experiences the financial effects of service quality failings directly in the form of compensation to airlines. Up to 2.5 per cent of airport revenues could be returned through rebates, though the payments are apportioned across terminals.

BAA bears substantial traffic volume risk because its price cap applies to revenue per passenger. Passenger numbers are volatile and to a large extent beyond operators' control. The volume risk associated with enhancement projects is not that substantial, however. It tends to be limited to revenue expected to be recovered within the quinquennium that the project is completed - the regulator will revise demand projections at the time of each price review.

BAA is currently considering a major investment proposal which it considers to contain substantial volume risk. The government has suggested construction of a second runway at Stansted Airport. BAA is concerned that the traffic volumes at Stansted may be insufficient to finance the runway, and would like regulatory assurances that it could fund the investment, in part, through revenue receipts at its other London airports. The CAA issued a consultation document earlier this year on the regulatory treatment of this expenditure, suggesting that Stansted's price cap could be adjusted during current quinquennium, thus allowing a degree of pre-funding for the new runway. But it maintained its stance that users of Heathrow and Gatwick airports should not contribute to the cost of the new runway at Stansted.[58]

Safety of workers is a central concern for all construction projects, irrespective of sector. At airports, construction can take place in proximity to passengers, airport employees, or even aircraft movements. Operators tend to mitigate such risk by carrying out as much work as is practical off-site, or by restricting access to areas in the vicinity, but difficult situations do arise. For example, the operator at Gatwick Airport is planning the renovation of an office block adjacent to the runway. In addition, airside construction projects, in particular, risk undermining airport security procedures.

BAA is liable for its own failures with regard to safety and security through its statutory obligations and normal legal mechanisms. This was demonstrated with the tunnel collapse that occurred during the construction of the Heathrow Express during the mid 1990s.

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[57] CC, op.cit paragraph 2.397.

[58] See CAA, *Regulatory Treatment of Initial Expenditure on New Runway Capacity*, July 2004.

6.3.3. Regulatory treatment of cost risk

The CAA does not examine airports' capital programmes to the same level of detail as certain other economic regulators. It does not, for example, sample individual projects, review how the programme and projects are developed, or examine operators' decision-making processes. Nor does it formally monitor capital expenditure between reviews. The CC's assumptions concerning capital expenditure were largely based on BAA's own projections, though BAA's cost forecasts were subject to some broader scrutiny. Given its size, costs for Terminal 5 were subject to specific studies. The CAA explored the use of cost benchmarking techniques in the Q4 review, but they were not found to provide sufficiently robust results.

Instead of detailed examination and benchmarking of capital costs, the regulators are placing greater emphasis on consultation with users (airlines). BAA has published its capital investment programme annually since 1996 following a MMC[59] conclusion that "consultation with the airlines on the capital programme is essential to enable the costs and benefits both of overall strategy and individual projects to be evaluated adequately".[60] At the time of the next review, BAA will need to demonstrate that it has consulted effectively with regards to its capital programme and that service quality or capacity projects are, to a large extent, dictated by balancing different users' requirements.

BAA's cost estimates in its capital investment plan include contingencies for cost and volume risk. It appraises projects on the basis of a discounted cashflow, using the cost of capital. It adds or subtracts other risk premia according to the degree of protection or exposure to construction cost, price risk, volume risk and business experience. At the time of the last periodic review (2002), BAA used the basic hurdle rate of 12 per cent average (post-tax nominal); BAA would increase the rate by 3 per cent for business cases with a high risk on cost or a high dependence on traffic forecasts; and reduce by 3 per cent in low-risk areas.[61] Larger projects, notably T5, have project-specific contingency provision.

Past practice and the starting presumption for the next periodic review are that any capital costs incurred by BAA will be incorporated in the regulatory asset base and financed accordingly (with an allowance for cost of capital). Airlines might dispute this approach if they consider such investment unnecessary, but this is not normally an issue for the congested London airports – where airlines are keen to fund expansion of capacity - and BAA will be careful to document its rationale for project investment.

If BAA were to incur more, or less, capital expenditure in the current quinquennium than was allowed for during the periodic review, the presumption is that the financing costs associated with this discrepancy during the current quinquennium would not be funded or clawed back. If there were a major discrepancy between forecast and actual expenditure, it is possible that some adjustment might be made, as occurred in Q3 as a result of the planning delay of Terminal 5, but such a situation is regarded as extreme.

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[59] The Monopolies and Mergers Commission was the precursor to the Competition Commission.

[60] MMC, BAA Plc, A report on the economic regulation of the London airports companies, June 1996, para 2.64.

[61] Described in CC, op. cit, paragraphs 9.10 to 9.15.

Therefore BAA does not face cost risks to the same extent as other, more closely monitored, regulated industries.

6.3.4. Contractual allocation of risk

6.3.4.1. Customers

There is currently no mechanism for allocating risk between the airport and any particular airlines, or other individual customers, which the capital project is intended to benefit. Customers bear risk associated with capital projects only to the general extent that a project may influence service quality, capacity or cost (and therefore airport charges). The regulator seeks to reallocate some such risks to the airport operator through use of rebates for poor service quality and mechanisms associated with the timing of delivery of capital investment milestones.

The CAA did explore the option of greater customer involvement in investment projects as part of the Q4 review. In its consultation on capital expenditure, the CAA stated:

> "*Greater user involvement could be formalised through a contractual approach, in which users negotiate directly with the airport over capital projects. This could allow additional outputs related to future capex to be handled outside the price cap and be replaced by contracts between airports and users. This would be consistent with the default price cap approach to setting charges. However, the resulting incentive structure of this approach raises a number of issues, including the robustness of the price cap.*"[62]

Although there has been a move towards greater airline involvement, the contractual approach initially suggested by the CAA has not been tested (and the CAA's more recent documents focus on consultation only rather than formal contracting).

6.3.4.2. Subcontractors

BAA's relationship with its contractors typically takes the form of partnering. Under partnering arrangements, the rewards of any cost reduction are usually shared with contractors, and both BAA's and contractors' profit margin are reduced if costs are greater than expected. (In Terminal 5, however, all risk is borne by BAA, as discussed in section 6.4.) Partnering exposes BAA to greater risk of increased cost (though the regulatory mechanism serves to reduce these risks to some extent). BAA favours such an approach because it argues that it produces greater cooperation with contractors, whose experience of working on airport projects would enable them to do so again at lower costs by introducing innovative methodologies.[63]

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[62] CAA (January 2001) *Economic Regulation and Capital Expenditure – Consultation Paper*, Executive Summary (page iv)

[63] From Competition Commission (November 2002) , Conclusions, paragraph 2.338.

6.3.4.3. Third parties

There are few examples of capital projects being carried out at the request of third parties (there is no equivalent, for example, to utilities being required to carry out diversionary work for developers).

Surface access projects on airport land have tended to be promoted by the airport operator, who also manages their development and bears the associated risk. For example, BAA considered it necessary to extend the London Underground service (as well as Heathrow Express) to Terminal 5, and is financing this extension without contributions from third parties. BAA financed the entire construction of Heathrow Express.

If construction of a second runway at Stansted is agreed, BAA may well resist bearing the full cost of the necessary upgrade to rail access because, as with the runway itself, it would be concerned that the investment could not be adequately financed through increased returns.

Airports do not generally receive subsidies. An exception to this was a one-off payment by the European Union to the Ground Transport Interchange at Manchester Airport (though the contribution amounted to a small fraction of total cost; the remainder was financed by the airport – see Section 6.5). Some airlines outside the UK are subsidised by national or regional authorities, though often the subsidy is restricted to domestic flights.

6.4. Case Study: Heathrow Terminal 5

6.4.1. The project

Heathrow Terminal 5 (T5) is designed to cater for 30 million passengers a year (a little over 60 million passengers a year currently use Heathrow), and is predicted to cost £4.2 billion. Construction started in summer 2002 and the first stage is due to open in March 2008. It was subject to the UK's longest ever planning inquiry, lasting three years and 10 months.[64] British Airways is the expected occupier of T5.[65]

6.4.2. Regulatory involvement

The size of T5 has meant that it has been subject to unique regulatory treatment.

The regulators concluded that if T5 were only funded through aeronautical charges after its completion, the resulting increase in charges would be unacceptable. Hence it was necessary for some of the funding to take place during the Terminal's construction. Allowances for T5 were made in both Q3 and Q4, even though T5 is now not scheduled for completion until Q5.

In the price review for Q3 it was assumed that the T5 planning inquiry would finish in 1997, and work would start on T5 shortly afterwards. As the Government's permission to allow T5 to be built did not occur until November 2001, substantially less work was undertaken in Q3

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[64] Information taken from BAA (November 2004) *Issues brief – Terminal 5*.

[65] BAA has allocated the new facilities to BA on the basis that it would minimise the number of passengers required to transfer between terminals, the number of airlines using more than one terminal, and would make best use of terminal and apron capacity (Source: CC, op cit, paragraphs 9.58 to 9.60).

than that which was allowed for in the price cap.[66] Under the Airport Act 1986, the CAA was unable to initiate an interim review of prices. As a result, part of the determination for Q4 included a claw-back of funding. The CAA has said that its general policy is that claw-backs are highly undesirable and that the claw-backs in Q3 should be viewed as a "one-off" resulting from extreme circumstances.[67]

6.4.2.1. Project Triggers

Given this unusual system of advanced funding, the price cap for Heathrow Airport in Q4 has been set to vary in accordance with achievement of milestones. These are referred to as "capital expenditure triggers".

The Competition Commission specified trigger points in broad terms as part of its recommendations on the periodic review in 2002. There are five triggers at Heathrow, each relating to T5 milestones, and each worth 2 per cent of prices. (The Gatwick Airport price cap is subject to a single separate trigger.) The price cap is reduced for the duration of the delay in achieving a milestone; when the milestone is achieved, the price cap is returned to its previous trajectory. The CAA published its decision on the detailed specification of each trigger in September 2004. The CAA adopted definitions agreed between BAA and stakeholders (principally airlines), following a consultation.

6.4.3. Contractual Allocation of Risk

BAA has developed a unique and bespoke commercial partnering agreement with contractors and suppliers called "the T5 Agreement". BAA explains that through this agreement it "retains all of the risk associated with the project and, having removed this accountability from the supply chain, it has enabled everyone involved in the project to focus their intellectual property on the delivery of solutions."[68]

Under the T5 Agreement, BAA has set aside funds which will be distributed to all suppliers if the project finishes on time and on budget. Allocation of risk to contractors was judged to be inappropriate, because the contractors were too small to be able to bear the risk.

We understand that Swiss Re has insured the T5 project, but have been unable to establish the details of these arrangements.

Although BA is the main beneficiary of T5, it is not involved contractually in T5's construction.

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[66] £1.5 billion was forecast to be associated with T5, whereas only around £0.5 billion was incurred. However, BAA incurred greater expenditure than anticipated elsewhere, in part to compensate for the delay, so that the discrepancy between total forecast and actual expenditure in Q3 was around £300 million. Of course, the expenditure on T5 was put back rather than foregone. Taken from CAA (January 2001), op cit, paragraphs 2.7 to 2.10.

[67] CAA (February 2003) *CAA Decision – Economic Regulation of BAA London Airports 2003 – 2008*, paragraph 6.10.

[68] BAA (November 2004) *Issues brief – Terminal 5*.

6.4.4. T5 Risk

The size of Terminal 5 means that BAA faces significant risk associated with cost overruns, including increases in costs resulting from catastrophic events. It presumes that any costs incurred will be included in the regulatory asset base going forward, but additional financing costs within the current control period would not be recovered.

It also faces risk directly from project delays, as a result of the triggers in the Heathrow price cap. It does not yet bear volume risk associated with T5, though will do following the next quinquennial review, after which the terminal is expected to open.

BAA has prepared its cost estimates of T5 in consultation with BA. BA employed its own cost consultants and stated publicly that it believed the costs to be reasonable (though CC noted that BA would only bear a proportion of the associated costs and gain a larger proportion of the benefits).[69]

In 2001 PricewaterhouseCoopers examined risk associated with T5 on BAA's behalf and found it faced material risks through the key areas of commencement, scope change, construction, integration, significant disruption and commissioning. At the request of CC, consultants reviewed BAA's cost projections, but were unable to discover the amount of contingency that had been built into the baseline figures within the cost plan.

Significantly, the CC decided to recommend BAA a cost of capital some 0.25 per cent higher than the figure it originally judged appropriate (which itself was somewhat above the mid-point of the range of possible values it identified) in order to allow for the scale of the T5 project and the consequential increase in BAA's gearing. It justified this decision as follows.

> "*We also, however, believe in the current circumstances of BAA, a further increase in the cost of capital would be appropriate. First, we believe that the scale of the T5 project and consequential increase in borrowings and gearing will increase BAA's risks: it represents a considerable investment, with very long-term returns, subject not only to construction risks, but also risks of uncertain demand. Although passenger demand to use Heathrow should be strong, growth in the number of passengers per ATM is necessary if the additional capacity of T5 is to be fully utilized, but passengers per ATM have recently declined, adding to project risks. An increase in the cost of capital would also allow for the foreclosure of the options for BAA to postpone or cancel the project in the light of more data on air travel demand following 11 September, and for the effect of higher gearing and cost of new equity in the event of any major shocks.*"[70]

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[69] CC, op cit. paragraphs 9.52 to 9.57.

[70] CC, op cit. paragraph 2.327.

6.5. Case Study: The Station, Manchester Airport

The Ground Transport Interchange at Manchester Airport, now called "The Station", was officially opened in January 2004. It took two years to build and cost around £60 million, including future provision for further phases of ground transport, in particular Metrolink, Manchester's light rail system.

The station was constructed at the initiative of Manchester Airport to improve accessibility to the airport. The aim is to encourage 25 per cent of those travelling to and from the airport to use public transport by 2005.

Of the £60 million cost, €3.877 million was funded by a European Union grant under the Trans-European Network Schemes programme. The remainder was funded by Manchester Airport. In addition, the Association of Greater Manchester Authorities provided £3.45 million funding for an interactive passenger information system.

The main project partners were Manchester Airport, Greater Manchester Passenger Transport Executive (GMPTE), the Strategic Rail Authority, Network Rail and First North Western (representing the train operators).

Network Rail originally owned the existing rail station. This was purchased by Manchester Airport, so that it had overall control of the development, with the airport then leasing back the rail regulated element (rail station element at platform level) to Network Rail. This enabled the airport to undertake further development and upgrade the existing station at concourse level by integrating it with the new development to provide a single terminal for multi–modal transport. This development also included future provision for air passenger check–in, as well as future development of both light and heavy rail by the appropriate partners.

A product brief was agreed at the outset with the partners, which was utilised to incorporate all requirements throughout the design stages through to implementation. This included the incorporation of a new bus and coach station introducing a new passenger information system

The overall cost risk was borne entirely by Manchester Airport. This embraced all the elements of the project from inception through to implementation, including the responsibility for all regulatory approvals within the ground transport industries. The Airport mitigated some of the risk through its control and own industry regulatory treatment of cost. Contracts for the construction were awarded through competitive tender based upon two stages as a consequence of the heightened aviation security risks associated with 9/11.

Manchester Airport now owns and operates the Station, with its partners operating the ground transport elements.

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