Total expenditure frameworks

A REPORT PREPARED FOR THE AUSTRALIAN ENERGY MARKET COMMISSION

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Scope of this report

The AEMC has engaged Frontier Economics to investigate:

- The key features of total expenditure (or 'totex') frameworks that have been adopted in other jurisdictions and industries and how they differ to the network regulatory provisions in the National Electricity Rules (NER);
- Whether there is any evidence that totex frameworks applied elsewhere have been successful in addressing any bias in favour of capital expenditure (capex) over operating expenditure (opex); and
- Whether it would be possible to adopt a totex framework in Australia and, if so, how the existing regulatory framework in the NER would need to be adapted to accommodate such a change.

The AEMC has not sought an assessment of whether the existing regulatory framework in Australia provides a bias in favour of capital expenditure.

Background

In Australia, economic regulators (including the AER) have almost universally set revenue allowances for regulated businesses using a 'building blocks' framework. This has involved regulators and regulated businesses treating opex and capex separately. Conversely, Ofgem and Ofwat in Great Britain no longer set separate allowances for opex and capex and now set maximum revenues by setting allowances for the expected efficient totex required by those businesses.

Drivers for adoption of a totex approach in the Great Britain

Three key considerations motivated Ofgem's and Ofwat's adoption of a totex approach over the last decade:

- The previous building blocks approach provided businesses with incentives to favour capex solutions (e.g., asset replacement) over opex (e.g., maintenance work to extend the technical life of existing assets) even when an opex solution was more efficient. This was because capex facilitated growth in the businesses' regulated asset bases (RABs) and a steady return on that capital investment over the assumed regulatory life of those assets;
- The asymmetric regulatory treatment of over- (and under-) spending as between opex and capex under the previous approach created a perception amongst regulated businesses that it was more profitable and/or less risky to pursue capex-focussed business models than opex-focussed business models; and
- A view that businesses should be given more freedom and flexibility to find the most efficient ways of delivering regulated services. Ofgem and Ofwat

considered that adopting a neutral view on whether businesses should incur opex or capex would encourage businesses to make opex-capex choices that would promote economic efficiency.

Great Britain – energy sector

The original approach to network price controls adopted by Ofgem (formerly Offer and Ofgas) utilised the well-known standard 'building blocks' approach, which involve setting separate allowances for opex and capex. There were also traditional incentive arrangements on each of opex and capex. However, owing the way these incentives operated, opex savings were retained in full by the company, whereas businesses captured only 40% of any capex savings. In addition, some companies preferred to grow their RAB, all other things equal, perhaps as their true cost of capital was somewhat lower than was allowed by the regulator. Further, there was greater regulatory scrutiny of opex than capex, with capex being regarded as more important to network reliability. Ofgem considered that, taken together, the former arrangements created an incentive for companies to engage in inefficient substitution between opex and capex via either accounting (reporting) allocation of expenditures or physical substitution.

In response to growing evidence of a capex bias, Ofgem proposed and implemented its totex regulatory arrangements to remove these perverse incentives. The key elements of these new arrangements incorporated:

- Common treatment of all costs including the application of the same incentive rate to essentially all cost allowances/expenditure;
- A capitalisation rate parameter and a single totex incentive mechanism to avoid incentives for businesses to inflate the RAB;
- Increased weight on totex benchmarking to avoid creating biased incentives for businesses to favour one cost head over another. Going forward, this is likely to become even more important due to the greater substitution possibilities (as between adding capacity and commercial arrangements for load interruption/shifting) that businesses are likely to face in the future; and
- Activity based accounting to provide Ofgem with the ability to compare companies in a granular and disaggregated manner.

It is generally accepted amongst the companies and commentators that the steps Ofgem has taken have been successful at eliminating any material incentive to capitalise opex (in both a physical and accounting sense) in the electricity networks sector.

England and Wales – water sector

Prior to the 2014 price control (PR14), the water regulator in England & Wales, Ofwat, applied a regulatory methodology that treated opex and capex separately. Ofwat determined an efficient allowance for opex that was funded through the annual revenue allowance. It also determined an allowance for efficient capex that

was added to the RAB and funded through the annual revenue allowance in the form of a return on the RAB and a depreciation allowance.

Based on the findings of its consultation process, Ofwat concluded that there was a 'capex bias" in the sector. This was partly due to the regulatory methodology (differences in regulatory incentives or 'aiming up' on the allowed cost of capital), and partly due to more general factors (company cultural in favour of capex projects, linked to a penalty only approach to environmental standards).

In response and reflecting the experience of Ofgem, Ofwat decided to apply a totex approach at PR14. The main features of the Ofwat approach were as follows.

- Use of totex benchmarking models to set an efficient totex allowance for each company for the five year period. Capex data was smoothed over five years to reflect the 'lumpy' nature of capex projects. This replaced the separate opex and capex benchmarking models used previously;
- Recovery of allowed expenditure through both:
  - An annual revenue allowance (the Pay-As-You-Go (PAYG) rate) proposed by the businesses; and
  - The remainder of totex was added to the RAB and earned a return and a depreciation allowance over an asset life proposed by the company; and
- Adjustment for variations between allowed and actual spending through the use of a totex 'menu'.

As in the energy sector, it is relatively early to assess the impact of the totex method on capex bias. Nevertheless, the totex method has addressed at least some of the factors identified by Ofwat as lying behind the bias. A company culture in favour of capex may take longer to change, although there are indications that the totex method has started to affect this.

Application of totex approaches outside the UK

Jurisdictions outside the UK have also adopted regulatory frameworks containing elements of the Ofgem and Ofwat totex approaches. These other jurisdictions include:

- The Netherlands: The Dutch regulatory office (now ACM) has advocated and sought to implement the use of total cost frameworks and, wherever possible, 'yardstick competition' in its price control reviews.
- Germany: The German federal regulatory office (Bundesnetzagentur) relies on total cost frameworks and, wherever possible, incentive regulation in its price control reviews. Future revenue allowances are set on the basis of benchmarked historical cost, with no role for business plans.

In both the Netherlands and Germany, the separate concepts of opex and capex are recognised but allowed revenues are determined on the basis of total costs.

- Victoria (historical): In its 2001-05 price control, the former Victorian Office of the Regulator-General (ORG) applied an efficiency carryover mechanism that provided regulated businesses with a share of the benefit from any savings in opex or capex achieved during the previous regulatory period.

Implementation of a totex approach in Australia

Rules

Applying a totex framework to the regulation of electricity and gas networks in the NEM would require making a number of changes to the NER. Under a totex framework, there would be no separate assessment of opex and capex forecasts. The NSP would need to propose a level of totex and the AER would assess that forecast based on whether that total level of expenditure was justifiable. Given the similarities between the existing opex and capex objectives, criteria and factors, it should be fairly straightforward to combine the NER provisions governing the assessment of NSPs' opex and capex forecasts in their regulatory proposals.

Application

The greater challenges in a move to a totex framework would likely arise for the AER needing to develop a new approach to assessing forecast costs. In particular, it is difficult to see how the AER could continue to apply different methods to assessing efficient capex and opex without defeating the purpose of the shift to totex.

Based on overseas experience, a move away from the separate assessment of capex and opex would likely necessitate a greater reliance on (totex) benchmarking. This would remove any incentive for businesses to favour one type of expenditure over another simply to secure a better regulatory outcome. For instance, if the regulator were to benchmark opex alone (or place greater weight on opex benchmarking), a regulated business may have an incentive to minimise repair and maintenance work (opex) and instead undertake more frequent asset replacement (capex) – even if this were not the most efficient asset management approach – as this strategy would optimise that business's performance in the regulator's opex benchmarking analysis. Under a totex benchmarking approach, the business would have no incentive to make such inefficient opex-capex substitution choices because it would receive no financial benefit from doing so. Undertaking totex benchmarking properly, and in a way that is truly informative for the purposes of setting expenditure allowances, is not a trivial task. However, it is not insurmountable.

Whilst it would be desirable for the AER to collect, analyse and benchmark disaggregated data on NSPs' costs and activities, in our view, any such disaggregated benchmarking should not be used directly to set expenditure

allowances for NSPs in the way Ofgem does. This is because it risks replicating the existing splits in capex and opex incentives. But disaggregated data could be used in less direct ways to influence the setting of allowances.

If the distinction between opex and capex is removed, the current obligations in the NER on the AER to develop and apply an efficiency benefit sharing scheme (EBSS) and a capex incentive guideline, as well as the option to develop a capital expenditure incentive scheme, would become redundant. The NER could instead oblige the AER to develop and apply a totex incentive guideline and incentive scheme, and set out appropriate principles for how the scheme should be designed and implemented. It may be appropriate for the AER to utilise a 'menu' approach to setting both totex allowances and incentive sharing rates.

Regarding the RAB, the AER would no longer approve a particular level of capex and the value of a business's RAB will not be increased by its actual capex – prudent or otherwise – over a regulatory control period. Rather, once the total efficient quantum of totex has been determined by the regulator, some process will be required to determine how much of that quantum will be recovered within the forthcoming regulatory period and how much would be capitalised within the RAB and recovered gradually over time. The existing depreciation allowance would need to be rewritten to delineate between depreciation on existing assets and depreciation on new capitalised totex.

Under a totex framework, it would be desirable to introduce a requirement for the AER to undertake financeability assessments, at least when determining the rate at which the totex allowance is to be capitalised within the RAB. We note that the existing regulatory framework does not include a 'financeability' concept.

Transition

The implementation of a totex framework would likely require the AER to undertake considerable development work. This would include:

- Making major changes to the structure of the PRTM and RFM;
- Reconsidering how it assesses the NSPs' forecasts;
- Designing a new totex incentive mechanism;
- Developing an approach for determining the proportion of the totex allowance to be expensed, and the proportion to be capitalised within the RAB, as well as an approach for setting depreciation allowances for both existing and new assets;
- Reviewing the appropriateness of its existing benchmarking models;
- Developing an approach to conducting financeability assessments; and
- Preparing and publishing guidelines setting out how it proposes to implement each of the measures above.

It is very difficult to predict with any precision the timeframes that would be necessary to implement a totex framework in Australia. However, we expect that a shift to a totex framework would likely take two to three years.

1 Introduction

1.1 Background

The Australian Energy Market Commission (AEMC) has asked Frontier to investigate total expenditure (totex) regulatory frameworks in light of stakeholder concerns about a network service provider (NSP) bias towards capital expenditure (capex) solutions over potentially more efficient operating expenditure (opex) solutions. One recent example of these concern is provided by a Rule Change request to the AEMC from the Australian Energy Council (AEC). This request raises a number of concerns about the current regulatory framework applying to energy networks in Australia. One of the AEC's concerns is that Distribution Network Services Providers (DNSPs) exhibit an inefficient capex bias.

The AEC's concern about a potential capex bias may be contextualised by a wider debate in recent years in Australia about whether past 'overinvestment' by regulated energy networks has led to inflated Regulatory Asset Base (RAB) values, and whether this, in turn, has contributed to high electricity prices faced by consumers. The AEC states in its submission to the AEMC the following:[1]

> Any regulatory form of control which guarantees revenue recovery up to a cap provides incentives to the DNSP to favour expenditure which increases the RAB.

However, a number of regulators overseas that operate price/revenue cap regimes have adopted totex frameworks precisely to address the sort of capex bias problem identified by the AEC. This raises a number of relevant questions:

- What are the key features of the totex frameworks that have been adopted in other jurisdictions and industries, and how do these regulatory arrangements differ from those codified within Australia's National Electricity Rules (NER)?
- Is there evidence that these totex frameworks been successful in addressing the capex bias problem?
- Is it possible to adopt a totex framework in Australia and, if so, how would the existing framework in the NER need to be adapted to accommodate such a change?

The AEMC has engaged Frontier Economics to investigate these questions.[2]

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1 AEC, *Consultation Paper National Electricity Amendment (Contestability of Energy Services Demand Response and Network Support)*, 9 February 2017, p.2.

2 We have not been asked by the AEMC to investigate whether in fact a capex bias problem exists in Australia, or how severe any such problem may be. We understand that the AEMC is undertaking its own analysis in this regard.

1.2 Structure of this report

This report is organised as follows:

- Section 2 provides examples of how a totex approach has been applied in various jurisdictions and markets
- Section 3 contains a detailed case study of why and how the Great Britain energy regulator, Ofgem, has applied a totex approach in the British electricity and gas distribution and transmission sectors.
- Section 4 contains another detailed case study of why and how the Great Britain water regulator, Ofwat, has applied a totex approach in the British water sector.
- Section 5 discusses some of the key issues that would need to be resolved or addressed in applying a totex approach to the regulation of distribution and transmission network businesses in the NEM.

2 Examples of totex approaches used in other jurisdictions

Box 1: Summary of this chapter

In Australia, economic regulators (including the AER) have almost universally set revenue allowances for regulated businesses using a 'building blocks' framework. This has involved regulators and regulated businesses treating opex and capex separately. Conversely, Ofgem and Ofwat no longer set separate allowances for opex and capex and now set maximum revenues by setting allowances for the expected efficient totex required by those businesses.

Three key considerations motivated Ofgem's and Ofwat's adoption of a totex approach over the last decade:

- The previous building blocks approach provided businesses with incentives to favour capex solutions over opex even when an opex solution was more efficient. This was because capex facilitated growth in the businesses' regulated asset bases (RABs), and a steady return on that capital investment over the assumed regulatory life of those assets.
- The asymmetric regulatory treatment of over- (and under-) spending as between opex and capex created a perception amongst regulated businesses that it was more profitable and/or less risky to pursue capex-focussed business models than opex-focussed business models.
- Businesses should be given more freedom and flexibility to find the most efficient ways of delivering regulated services.

Great Britain – energy sector

In response to growing evidence of a capex bias, Ofgem proposed and implemented its totex regulatory arrangements to remove these perverse incentives. The key elements of these new arrangements incorporated:

- Common treatment of all costs including the application of the same incentive rate to essentially all cost allowances/expenditure.
- A capitalisation rate parameter and a single totex incentive mechanism to avoid incentives for businesses to inflate the RAB.
- Increased weight on totex benchmarking to avoid creating biased incentives for businesses to favour one cost head over another. Going forward, this is likely to become even more important due to the greater substitution possibilities (as between adding capacity and commercial arrangements for load interruption/shifting) that businesses are likely to face in the future.
- Activity based accounting to provide Ofgem with the ability to compare companies in a granular and disaggregated manner.

It is generally accepted amongst the companies and commentators that the steps Ofgem has taken have been successful at eliminating any material incentive to capitalise opex.

England and Wales – water sector

Prior to the 2014 price control (PR14), the water regulator in England & Wales, Ofwat, applied a regulatory methodology that treated opex and capex separately. In response its research and reflecting the experience of Ofgem, Ofwat decided to apply a totex approach at PR14. The main features of the Ofwat approach were as follows:

- Use of totex benchmarking models to set an efficient totex allowance for each company for the five year period.
- Recovery of allowed expenditure through both an annual revenue allowance and a return on and of amounts added to the RAB.
- Adjustment for variations between allowed and actual spending through the use of a totex 'menu'.

The totex method has addressed at least some of the factors identified by Ofwat as lying behind the bias. A company culture in favour of capex may take longer to change, although there are indications that the totex method has started to affect this.

Netherlands

The Dutch regulatory office (now known as ACM) has advocated and sought to implement the use of total cost frameworks and, wherever possible, 'yardstick competition' in its price control reviews. The separate concepts of opex and capex are recognised and persist within the existing regulatory framework. However, all determinations of cost allowances are conducted on the basis of total cost.

A yardstick competition model has been imposed to provide incentives for efficient expenditure. Under this approach, expenditure allowances for individual business depend on how well that business has performed relative to the past industry average.

Concerns have been expressed that the strength of incentives to manage cost under the Dutch approach may encourage businesses to under-invest, and this could jeopardise the long-term reliability of the networks. The regulator seeks to mitigate this risk by a quality-of-service measure (Q-factor), which is calculated and also applied to adjust revenue allowances.

Germany

In Germany, the regulator relies on total cost frameworks and, wherever possible, incentive regulation in its price control reviews. Future revenue allowances are set on the basis of benchmarked historical cost, with no role for business plans. As in the Netherlands, the separate concepts of opex and capex are recognised but allowed revenues are determined on the basis of total costs.

Under the regulatory regime, costs are assumed to be controllable unless they are specifically identified to be either "non-controllable" or "volatile". Strong incentives are applied to controllable costs. The RAB is calculated annually in the traditional manner, based on the flows of capex spent by the companies and standardised regulatory accounting rules to derive depreciation. However, no individual company is guaranteed to earn a fair return on its RAB, unless it is able to match industry-wide and efficiency dependent performance. Unlike ACM, Bundesnetzagentur also undertakes an appraisal of company performance by a total costs benchmarking analysis.

As in the Netherlands, concerns have been expressed over the strength of incentives to manage cost, and the possibility that long-term reliability may be jeopardised. This risk is mitigated in Germany by the application of a bonus/malus style service quality incentive.

Victoria

The Office of the Regulator-General, Victoria (ORG) was formerly responsible for price-regulating electricity networks in Victoria. It used a standard building block framework for setting maximum allowed revenues, including separate opex and capex allowances.

In its 2001-05 price control, the ORG introduced an efficiency carryover mechanism that effectively equalised the incentive sharing rate that applied to opex and capex. There is no evidence that the ORG was seeking to address an identified capex bias. However, it is clear that the ORG was cognisant of the possibility for such a bias, and was explicit that the aim

Examples of totex approaches used in other jurisdictions

of combining opex and capex within a single carryover mechanism was to achieve neutrality between these two types of expenditure.

When it took over from the ORG, the Essential Services Commission (ESC) noted that the ability to defer capex meant that it was unclear that customers would be paying for sustained efficiencies via the efficiency carryover mechanism. In its final distribution decision for the 2006-10 period, the ESC decided to restrict the efficiency carryover mechanism to opex only.

2.1 Introduction to totex frameworks

In Australia, economic regulators (including the AER) have almost universally set revenue allowances for regulated businesses using a 'building blocks' framework. This approach involves regulated businesses proposing to the regulator forecasts of its expenditure requirements over the forthcoming regulatory period. The regulator will then assess the appropriateness of those forecasts and either accept those forecasts or, alternatively, substitute its own expenditure forecasts when determining the business's revenue allowances for the regulatory period.

Without exception, this approach has involved regulators and regulated businesses in Australia treating operating expenditure (opex) and capital expenditure (capex) separately. For instance, the National Electricity Rules (NER) specifies separate expenditure objectives and criteria for opex and capex (although, in practice, the formulation of the rules governing opex and capex are virtually identical), and opex and capex are treated separately within the post-tax revenue model used to determine the maximum allowed revenues that businesses may recover from consumers.

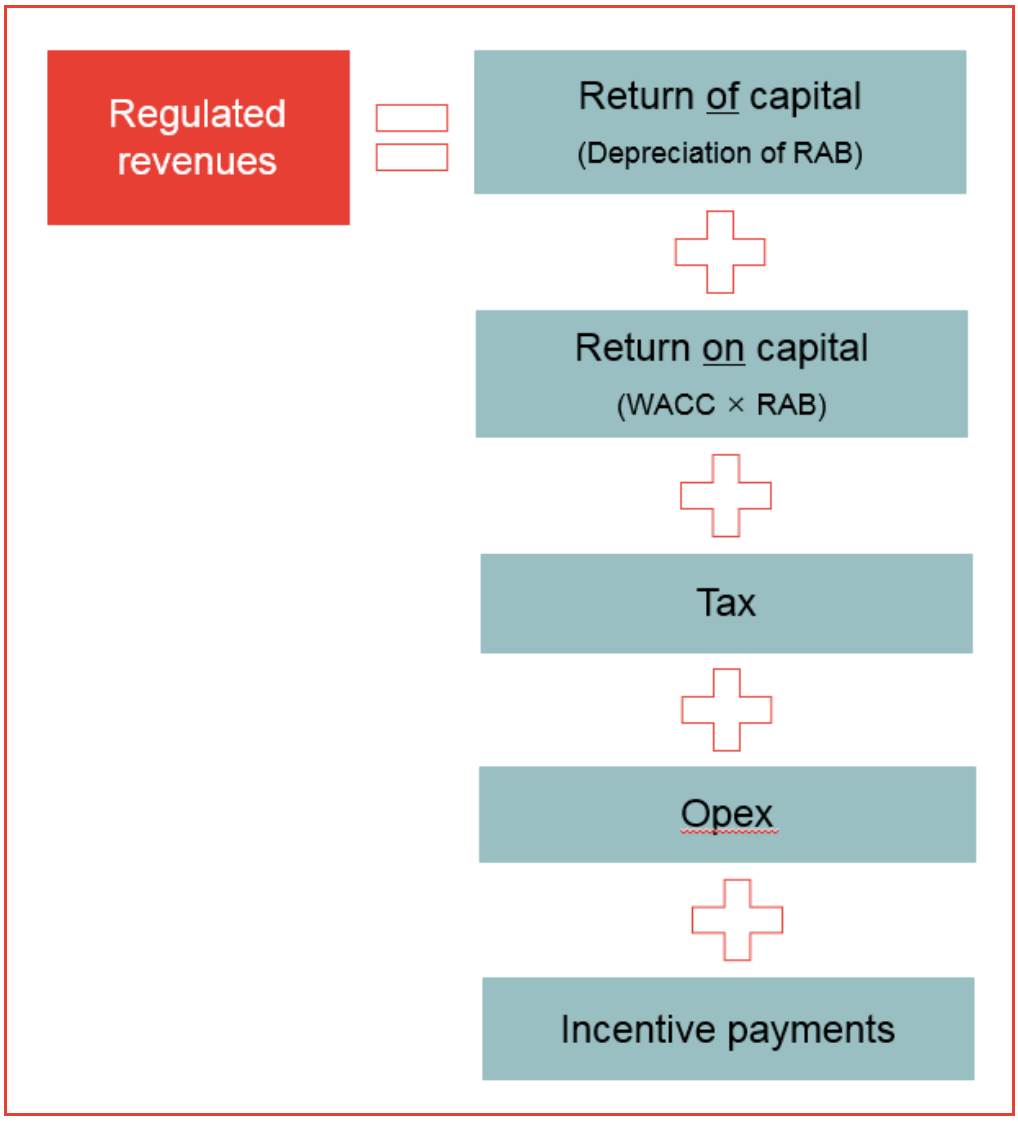
Opex and capex typically receive different treatments within a building blocks framework due to the differences in the characteristics of these two types of expenditure:

- Opex (e.g., maintenance, overheads) represents ongoing, recurrent expenditure that usually has a fairly smooth profile over time (for a firm in 'steady state'), and is recovered from consumers *within* a regulatory control period (RCP). Opex in turn can be broadly defined as either:
  - 'Controllable' opex (eg., network maintenance, asset works (minor upgrades), network operations, grid planning, head office and IT expenses, etc); and
  - 'Uncontrollable' opex (eg., debt-raising costs, insurance and network support costs); and
- Capex (e.g., asset replacement, network augmentation), on the other hand, tends to be relatively large and lumpy and may be more easily deferred than opex. Under a building blocks framework, capex is rolled into the regulatory asset base (RAB) and recovered from consumers *over an extended period of time*

(usually several RCPs) through a regulatory return on capital and depreciation allowance.

The way opex and capex feed into the setting of DNSPs' regulated revenues is represented in Figure 1 below.

Figure 1: Building block components of DNSP regulated revenues



Source: Frontier Economics

This was the approach that was adopted in many other countries with incentive-based systems of regulation, such as the UK and New Zealand. However, in its 2010-15 price controls for electricity distribution networks, the energy sector regulator in Great Britain, Ofgem, adopted changes to its regulatory framework that removed the distinction between opex and capex. Shortly thereafter, Ofwat, the water sector regulator for England and Wales, adopted similar changes to its framework when setting 2014-19 price controls for regulated water businesses.

Examples of totex approaches used in other jurisdictions

Ofgem and Ofwat now set maximum allowed revenues for the businesses they regulate by determining allowances for the expected efficient *total expenditure* (totex) required by those businesses. In doing so, Ofgem and Ofwat no longer set separate allowances for opex and capex. This new approach is commonly referred to as a totex approach.

Three key considerations motivated Ofgem's and Ofwat's adoption of a totex approach:

- Firstly, it was felt that the previous approach provided regulated businesses with incentives to favour capex solutions (e.g., asset replacement) over opex (e.g., maintenance work to extend the technical life of existing assets)—even in circumstances in which an opex solution was more efficient—because capex facilitates growth in the businesses' RABs, and a steady return on that capital investment over the assumed regulatory life of those assets. Similar sentiments have been expressed by some stakeholders in Australia.
- Secondly, Ofgem's and Ofwat's regulatory arrangements (e.g., more stringent benchmarking of opex than capex; stronger incentives to reduce spending on opex than on capex) were such that there was a perception amongst regulated businesses that it was more profitable and/or less risky to pursue capex-focussed business models than opex-focussed business models. The asymmetric regulatory treatment of the two forms of expenditure may also have created perverse incentives for businesses to report certain opex as capex, without any actual improvement in efficiency.
- Thirdly, Ofgem and Ofwat considered that businesses should be given more freedom and flexibility to find the most efficient ways of delivering regulated services.[3] Under the old building blocks approach, when Ofgem and Ofwat were determining expenditure allowances for a forthcoming RCP, allowed revenues would depend in part on how the businesses had performed against allowances in the previous RCP. Suppose a business had, during the course of the previous period, realised that replacement activity it had planned originally could be deferred efficiently by undertaking additional maintenance work that it had not forecast. This would result in *underspend* of capex (relative to what had been allowanced), and *overspend* of opex (relative to what had been allowed). As these two forms of expenditure were treated separately and differently, the capex underspend would have been rewarded (e.g., through a capex incentive mechanism), but the opex overspend would have incurred a financial penalty

[3] This view was consistent with Ofgem's and Ofwat's greater emphasis on regulated businesses consulting consumers more to identify and deliver the outcomes that consumers considered most valuable, and businesses becoming more adaptable and flexible within a RCP to respond efficiently to changing exogenous circumstances. This approach was also underpinned by Ofgem's and Ofwat's view that businesses, rather than the regulator, are best-placed to make efficient expenditure choices — provided that they are faced with the right incentives to do so.

Examples of totex approaches used in other jurisdictions

(e.g., through an opex incentive mechanism).[4] In combination with the above considerations, this may have deterred businesses from making efficient expenditure choices that would be in the long-term interests of consumers. Ofgem and Ofwat considered that adopting a neutral view on whether businesses should incur opex or capex would encourage businesses to make opex-capex choices that would promote economic efficiency.

Table 1 provides a fuller outline of potential sources of capex bias identified by Ofgem and Ofwat. We draw on these drivers in our summary assessments of totex approaches used in other jurisdictions.

Table 1: Potential sources of capex bias

Capex bias driver	Assessment
Regulatory incentives for outperformance	The separate treatment of opex and capex in the regulatory method could provide differential incentives to outperform (ie underspend) the relevant (opex or capex) regulatory allowance.
Allowed return on RAB	The tendency of some regulators to 'aim up' and set the allowed return on RAB towards the top of the estimated range provides an incentive to grow the RAB and therefore focus on capex solutions.
Approach to cost assessment	The methods used by some regulators to set the separate allowances for opex and capex may encourage a company focus on capex. This is especially where the regulator applies more robust benchmarking to opex. Further, the greater information asymmetry applicable to capex can make it easier for companies to get capex projects accepted in their business plans.
Financing and ownership	Some investors may have a preference for RAB growth over short-term financial outperformance, which may be linked to, but wider than, any 'aiming up' in the allowed return.
Company culture and skillset	Some businesses' cultures may be based on an engineering mindset that favours capex solutions. Opex and capex may also have separate management structures that could introduce biases.
Risk of failure and penalties	Industry operations may be built around minimum standards and penalties (generally set by the quality regulators), which could lead to risk-averse behaviours on the part of the businesses, and a focus on capex solutions to minimise the likelihood of breaches of standards.
Control of assets	A preference amongst companies to control assets rather than contract with third parties for the provision of services.

Source: Frontier Economics

In more recent times, the ability for the regulator under a totex approach to vary the 'speed of money' (see below) – hence allowing the regulator more influence over the financeability of a regulated business in the context of anticipated large capital expenditures – may be considered as an additional ancillary benefit.

4 Indeed, if an opex incentive scheme were in operation, the business may, in these circumstances, face a financial penalty for overspending its opex allowances.

Examples of totex approaches used in other jurisdictions

The totex frameworks that Ofgem and Ofwat developed included a wide range of measures designed to remove the previous distinction between opex and capex. These changes included, for instance:

- The replacement of the concepts of opex and capex within the building blocks framework with the concept of 'fast money' (i.e., the proportion of allowed totex to be recovered within the RCP) and 'slow money' (i.e., the proportion of allowed totex to be capitalised within the RAB and recovered over a number of RCPs);
- Greater emphasis on the benchmarking of totex rather than the benchmarking of opex and capex separately; and
- The equalisation of incentive rates for opex and capex, by replacing the separate opex and capex incentive mechanisms with a single totex incentive mechanism.

Whilst Ofgem and Ofwat have, as far as we are aware, implemented the most comprehensive set of reforms towards a totex framework, there are examples of other jurisdictions in which regulators have adopted approaches that have a totex flavour. In the subsections below we provide short case studies on the regulatory arrangements in the Netherlands, Germany and Victoria (before 2010) and discuss the totex measures that were adopted in each of those jurisdictions. We also summarise the totex reforms adopted by Ofgem and Ofwat (with more detailed case studies of these two regulators' regimes provided in sections 3 and 4). This section concludes by providing a summary of the types of regulatory arrangements that could constitute a totex framework.

2.2 The Netherlands – energy sector

2.2.1 Introduction

From the initial introduction of economic regulation to the energy networks, the Dutch regulatory office (known variously over time as DTe, EK and now ACM) has advocated and sought to implement the use of total cost frameworks and, wherever possible, yardstick competition in its price control reviews. This process began with the publication of a first consultation paper (on electricity network regulation) in 1999. The first price control for electricity networks was then set in 2000, with the first gas price control set in 2001.

For practical reasons the introduction of this regulatory approach was phased in over a number of price controls while:

- better and more data were collected on operating costs and outputs[5];
- data on asset values were collected, cleansed and standardised; and
- in respect of yardstick competition, transitional periods were established to ensure all parties were on a 'level playing field' before the introduction was made.

Unlike in the energy and water sectors in the UK (see sections 2.5 and 2.6 below) there has not been a time when a traditional 'building blocks' style of regulation was once applied, and a decision was taken subsequently to move towards a total cost regime. The decision to use yardstick competition, and to focus on totex, was not an accident but a conscious design choice, taken as a result of in depth discussion of the options between Frontier Economics staff and the staff of DTe. These discussions were informed by Frontier Economics' knowledge of the emerging capex bias problem in Ofgem's arrangements (as we discuss in section 3 below). However, they were also ideas that were intellectually attractive in their own right to policymakers and regulators in the Netherlands.

The sections that follow provide an overview of the arrangements in place for energy networks.[6] We focus primarily on how this is applied to distribution companies, both electricity and gas, as the arrangements for these sectors are highly similar and most clearly show the philosophy of regulatory policy makers in the Netherlands.

We conclude with some remarks in respect of the regulation of TenneT, the electricity transmission company, and Gasunie Transport Services (GTS), the gas transmission company.

2.2.2 The regulator's approach to determining annual cost

In the Netherlands the separate concepts of opex and capex are recognised and persist within the existing regulatory framework. However, all determinations of cost allowances are conducted on the basis of total cost, which is defined as:

$$Annualised\ total\ cost = Opex + Depreciation + WACC \times RAB$$

5 Record keeping and data availability was a significant problem during the early stages of regulation in the Netherlands. The regulator had not established data collection procedures and the companies were not set up to routinely capture and report data. These difficulties were exacerbated by very rapid consolidation of companies, through merger between municipally companies. Often the new merged entity struggled to find and collate data from all predecessor entities.

6 A good overview of the Dutch arrangements is provided (in English) here: https://www.acm.nl/en/publications/publication/17231/Incentive-regulation-of-the-gas-and-electricity-networks/

where the sum of the return of capital (i.e., depreciation) and the return on capital (i.e., WACC × RAB) is taken to reflect the consumption of capital and, therefore, represent a smoothed measure of capex over time.

RAB and depreciation are determined according to common regulatory accounting rules prescribed by the regulator. These specify that straight-line depreciation must be applied, using specified assumed asset lives for different asset categories. The companies are required to measure and report actual capex against each asset category, such that a granular RAB can be calculated based on the actual assets installed. The WACC allowance is determined according to the regulator's prevailing view of WACC.

The key cost measure that populates the Dutch regulatory framework is based on a capital consumption concept, based on the stock of assets installed, rather than by a capital expenditure concept (as in the Ofgem framework). This process so far would be entirely familiar to observers familiar with the traditional building blocks approach to regulation.

Standardising opening asset values

At the inception of these arrangements, DTe undertook an extensive exercise to estimate standardised RAB values for the regulated networks.

An initial round of data collection revealed very material discrepancies in reported capital values. Companies provided values based on their statutory accounts. These values reflected a very wide range of capitalisation and depreciation policies that rendered comparison of gross and net (of depreciation) asset values virtually meaningless. DTe surmised quickly that any attempt to implement its preferred measure of annual cost, and to benchmark that cost, would result in efficiency measures and cost allowances that would be confounded by arbitrary differences in asset valuation, and which were likely to bear little relation to efficient allowances or to the long run cost of service provision.

To overcome this, DTe launched an exercise to collect data on past investment profiles going back over many years, by asset class. This exercise was only made feasible because the Dutch tax authority had requested similar information to support various investigations into the sector, meaning that the collection of these data was already required of the industry and underway. Once collected and cleansed, these data were then processed using standard accounting rules. The result was opening asset values that were related much more closely to actual installed assets and the fair cost of their use. In practice, the companies benefited from this standardisation process, as in almost all cases shorter depreciation lifetimes had been used prior to the initiation of economic regulation.

2.2.3 Incentives framework for costs

For the distribution companies a yardstick competition model has been imposed to provide incentives for efficient expenditure. At a high level (excluding points of detail that are unnecessary for understanding the general principle), under the yardstick approach, expenditure allowances for individual business depend on how well that business has performed relative to the past industry average. If enough businesses respond to these incentives for efficiency and surpass the historical industry average, the 'benchmark' will be set at a more challenging level for the next period. This 'competition' for efficiency will, in theory, drive industry-wide performance (see Box 1 below).

Box 2: Explanation of the Dutch 'yardstick' approach

The concept behind the Dutch regime can be explained simply using a stylised example.

Assume that under a standard CPI-X regulatory approach, the regulator adopts a simple rule to update allowed revenues: a price control is set for 5 years and any saving made accrues to the company during that period. After that, the firm's allowances are updated to reflect revealed cost. This means that if the firm permanently reduces annual operating expenditure by, say, €1m per annum at the beginning of the price control, the present value of that cost saving is €14.3m assuming a discount rate of 7%. If the company retains all the benefit of the opex saving for 5 years and then is required to pass-on all future savings to customers, the present value of the benefit retained by the company is €4.1m. This is equal to 29% of the present value. Therefore, the company faces an incentive strength of 29%. The greater the proportion of the present value of cost savings retained by the firm, the more powerful the incentive regime.

If the company retains 50% of the annual saving (i.e. €0.5m per annum) for 10 years before the full benefit is passed through to consumers, the value retained by the company has a present value of €3.5m, which implies an incentive strength of 25%.

More generally, the two parameters that determine the incentive strength of the regime are:

- the period for which a saving is retained; and
- the proportion of the saving retained by the business in each year.

A yardstick regime operates somewhat differently. It can be illustrated by assuming the regulator regulates two companies rather than one, and the regulatory 'update' rule adopted is to cut each firm's allowance by the *average cost reduction* in the sector, not by the reduction achieved by each company itself. This regime would allow the firms to keep any cost savings against the allowance for the five years of the regime (as before), but would also expose each firm to only

Examples of totex approaches used in other jurisdictions

a portion of any individual cost saving at the next review. Using the same assumptions as above, companies would then retain:

- 29 per cent of the present value of the saving, as a result of retaining the value of any savings for five years; but also
- half of the remaining 71 per cent present value of savings, because a firm's own cost reduction is weighted by 0.5 when calculating the industry cost reduction.

Overall, the incentive power of the regime is therefore 64% (being 29% + 71%*1/2), rather than the 29% under a standard CPI - X regime. As the number of firms is increased, the strength of the incentive power also increases. For example, with 14 firms, such a regime would have an incentive power equal to 29% + 71%*13/14 = 95 %.

The Dutch regime, although complicated by the existence of both opex and capital, by reliability incentives, by multiple firms of different sizes and by the desire to conduct ex post true ups such that the sector as a whole earns the allowed rate of return, nevertheless relies on this 'yardstick' principle.

Source: Frontier Economics

The rollout of the Dutch yardstick approach has involved:

- An initial period (or two) where efficiency was determined on a total cost basis, and company specific X-factors set to eliminate performance differences between companies by the end of the period. (We note that this stage was contentious and subject to court appeals.)
- A steady-state phase, where there was a presumption that companies began with no particular advantage/disadvantage over one another, and hence all firms received a common X-factor efficiency challenge.

In the current steady-state phase, the following calculations are performed to determine the common X-factor (again, abstracting away from unnecessary detail).

- The regulator determines industry aggregate total cost, using the definition provided above, for historical years for which data are presently available. This is simply the sum of total cost across all companies in the sector.
- The regulator also calculates a "Composite Output" metric for each company and in total in each year. This is a monetary measure of the valued outputs supplied by each company to customers, valued at the average level of network

charges. In essence, this measure can be understood to be a weighted sum of customer numbers (by type), peak capacity/demand and units distributed.[7]

- The regulator then determines the ratio of Composite Output per unit of Total Cost at the industry level. In essence this is a very simple measure of cost per output.
- Companies allowed revenues are calculated in the base year using this simple ratio, i.e. all companies are allowed the same amount of cost per output, subject to their measured volume of output. Companies with individual cost to output ratios higher than this (i.e. excess cost) receive less allowed revenue than their cost share. Companies with individual cost to output ratios lower than this (i.e. low cost) receive more allowed revenue than their cost share.
- Companies are thus incentivised to try to beat this industry average level.
- Lastly, the regulator calculates the rate of change of the ratio of Composite Output to Cost. It is this which is used to estimate the industry X-factor applied to all firms and which rolls forward the base year. The model works on a rolling true-up basis. The X-factor for the period ahead is estimated based on recent historical outturn performance, but is trued-up at the end of the period to reflect actual outturn observed X. The industry is then always racing against itself, not against the expectation of the regulator and in the fullness of time is guaranteed to earn its allowed rate of return.

The above is a highly simplified account of how the Dutch regime functions. In practice there are a range of other adjustments, for verified regional differences and for differences in reliability.

The further effects of and incentives arising from this regime are as follows:

- At an industry level, all costs are recovered and allowed. The industry in aggregate therefore always earns the regulator's estimate of the cost of capital.
- However, each company's share of total industry cost is based on its outputs. If a firm incurs more cost than is efficient when delivering its outputs, it will not receive a greater share of cost.
  - Thus, less efficient firms spend more than they receive, and will earn returns below the regulated level until they are able to match industry average performance.
  - More efficient firms will receive more than they spend, and will earn returns above the regulated level.

7 There is a separate (off-model) adjustment for recognised regional factors not captured by the above. Various other detailed/legacy adjustments are also made to ensure the fairness of the system, but a deep understanding of these is not necessary for present purposes.

Examples of totex approaches used in other jurisdictions

- This framework matches closely the textbook version of yardstick competition.
- Very strong incentives are provided to control costs, whether opex or capex, because unless a business can keep up with the 'average' company in the industry, it will earn returns that are lower than its efficient cost of capital. This makes the yardstick approach more high-powered than the building blocks approach used in Australia or in the UK.
- No separate assessment of opex and/or capex is ever made, and it is for companies to decide the quantum and nature of the expenditure necessary to meet demands placed on them, now and in the future. As noted above, this was a very conscious design choice made by the creators of the regime.
- In principle, based on the knowledge that this arrangement will persist in the future it follows that each company maximises its own position by delivering the services required by customers in whatever way minimises the total expected lifetime cost.

We note that for this regime to be credible, all stakeholders must have a high degree of confidence that the initial calibration of the yardstick is/was fair (i.e., that a level playing field was achieved at the outset). If one company enters the yardstick model with a legacy of inefficiency that can be eliminated easily, then the yardstick model will perceive that this company has moved ahead of the others in the sample, and will allow it to earn eternal excess terms at the expense of peers. All firms must be broadly equal, such that the distribution of excess and insufficient returns that results is considered a fair reflection of actual network performance. In the Netherlands, this was achieved through one or two rounds of benchmarking, to make every effort to ensure that the starting point was fair and reasonable.

2.2.4 RAB

As described above, RAB is calculated annually in the traditional manner, based on the flows of capex spent by the companies and standardised regulatory accounting rules to derive depreciation. However, as outlined above, no individual company is guaranteed to earn a fair return on its RAB, unless it is able to match average industry efficiency performance.

2.2.5 Benchmarking

The Dutch regulator now undertakes no additional appraisal of company performance other than that embodied in the yardstick mechanism outlined above. However, during the early price controls, when the level playing field was being created, a conceptually similar framework was adopted. Efficiency was measured using the same total cost/Composite Output framework, and differential X-factors applied for a transitional period.

2.2.6 Concerns over investment levels

Concerns have been expressed that the strength of incentives to manage cost under the Dutch approach may encourage businesses to under-invest, and that this in turn could jeopardise the long-term reliability of the networks.

The regulator seeks to mitigate this risk by a quality-of-service measure (Q-factor), which is calculated and also applied to adjust revenue allowances. The Q-factor is calculated on a yardstick basis, based on the volume and duration of interruptions and estimates of the societal cost of those interruptions. If this mechanism is calibrated appropriately, it ought to encourage companies to deliver an efficient level of investment. Past studies by the Dutch regulatory office have found no evidence of under-investment by the regulated businesses.

For completeness, we note that in the gas distribution sector provision is made for a Q-factor, but it is presently not calculated and therefore set to zero for all parties. This reflects the lack of a robust set of quality parameters for the gas sector.

It is also worth noting that, in addition to the incentive mechanism, the companies are required to maintain a safe and reliable network by other licence conditions, technical regulations and legislation (e.g. around health and safety). The Q factor is therefore not the only relevant provision.

2.2.7 Arrangements for TenneT and GTS

A similar total cost approach is also applied to the transmission electricity and gas operators (TenneT and GTS, respectively). ACM, as the Dutch regulatory office is now called, participates in a pan-European benchmarking exercise and uses the resulting study to determine X-factors that are applied to its usual measure of total cost. However, as one might anticipate at the transmission level, there is also scope for more bespoke treatment. In particular, network operators may apply to ACM for strategic investments to be considered separately, and their costs taken outside normal processes.

For completeness, we also note that system operation costs are regulated separately and are not part of the overall totex system.

2.2.8 Summary

In Table 2, we provide our summary view of the extent to which the Dutch regime addresses certain potential drivers of capex bias.

Examples of totex approaches used in other jurisdictions

Table 2: Frontier Economics' assessment of ACM's prevailing yardstick method

Capex bias driver	Assessment
Regulatory incentives for outperformance	There are no separate cost allowances for opex and capex, only one common incentive arising from a fixed revenue allowance that companies try to outperform. The yardstick regime therefore in principle provides equivalence in the treatment of cost savings. In the case of potentially substitutable savings on either opex or capex, companies would have full knowledge that each would pass in full through the relevant calculations and would hence lead to similar advantage versus the yardstick level, albeit with different time profiles. In principle companies should be confident that their interests are best served by minimising total life time costs in respect of any decision and should strive to do so.
Allowed return on RAB	Capex and RAB still exist in the traditional way under the Dutch regime. In principle, then, if the allowed rate of return is set above the cost of capital, companies may face an incentive to capitalise in order to earn this margin on a larger asset base. However, the yardstick regime mitigates this incentive. While any increase in Regulatory Asset Value (RAV) created by a single firm capitalising opex would increase RAV at the industry level, and this would generate some excess returns at the industry level, the company in question would earn only a small share of this benefit itself. In principle, this may leave some incentive for accounting substitution at the margin. Physical substitution, where capitalisation may involve some overall inefficiency, is unlikely to arise.
Approach to cost assessment	Now that the yardstick regime is in steady state, there is no ongoing cost assessment process that may bias incentives, only the operation of the general yardstick regime. See instead comments on equalised incentive rates above.
Financing and ownership	RAB growth is addressed above. It is not obvious that there are other relevant considerations in respect of financing and ownership.
Company culture and skillset	The Dutch companies have been exposed to the strong incentive arrangements imposed by ACM for many years and have never been exposed to any alternative arrangements. They are therefore familiar with the form of competition that this creates. Any shift in culture and/or skillset required by the arrangements will have been made by the companies while adjusting to incentive regulation generally.
Risk of failure and penalties	There are stringent technical standards imposed on all energy networks to ensure the safe conveyance of energy. All Dutch energy companies continue to be bound by these and face serious consequences should they be breached. Within the context of this high standard, companies are free to compete on the basis of their overall efficiency. Where there is a question as to the appropriate balance between cost saving and the provision of reliability, explicit incentive schemes are in place to devolve this decision to the companies.

Source: Frontier Economics

2.3 Germany – energy sector

As in the Netherlands, in Germany the economic regulation of energy networks, overseen by the federal regulatory office (Bundesnetzagentur), has relied on the use of total cost frameworks and, wherever possible, incentive regulation in its

price control reviews. Future revenue allowances are set on the basis of benchmarked historical cost, with no role for business plans[8], where historical cost is, as we describe below, measured on a capital consumption basis.

In the sections that follow, we provide an overview of the arrangements in place for energy networks. We focus primarily on how this is applied to distribution companies, both electricity and gas, as the arrangements for these sectors are highly similar. We also describe the recent changes resulting from an evaluation process on incentive regulation ending September 2016 with the amendment of the incentive-regulation ordinance. We also comment on arrangements for the electricity and gas transmission companies.

2.3.1 The regulators approach to determining annual cost

In Germany, as in the Netherlands, the separate concepts of opex and capex are recognised. However, the allowed revenues are determined on the basis of total costs, defined as follows:

$$\begin{aligned} Annualised\ total\ cost = {} & Opex + Depreciation \\ & + Return\ on\ equity \times Equity\ share\ of\ RAB \\ & + Return\ on\ debt \end{aligned}$$

Total cost is calculated for each individual company subject to regulation. Standard accounting rules are used to determine whether costs are opex or capex. Capex enters into the RAB. Return on and of RAB are then appraised as follows:

- Depreciation is determined according to common accounting rules prescribed by the law. The relevant legislation specifies that straight-line depreciation must be applied, and the ranges for the lifetimes that must be used by asset category.
- The companies are required to measure and report sums spent against each asset category, allowing a granular RAB to be calculated based on the actual assets installed.
- In Germany the return on capital is not calculated according to the usual WACC approach.
  - The regulator estimates a benchmark return on equity rate (using the Capital Asset Pricing Model), and then this is applied to the equity portion of the RAB to calculate the allowed return on equity capital.
  - The actual cost of debt is passed through. The return on debt rate is taken directly from the companies' P&L accounts and reflects each company's own debt book.

8 This reliance on benchmarking rather than company specific plans is necessary due to the large number of electricity/gas distribution networks operating in Germany (more than 100 networks each).

The total costs, on which incentives apply during the regulatory period, are based on a "photo year". The photo year is determined by the t-3 costs with t as the first year of the regulatory period (e.g. if regulatory period starts in 2019, the relevant photo year is 2016). This is similar in concept to the 'base year' used currently by the AER in its 'base-step-trend' approach to determine NSPs' opex allowances (i.e. typically, the penultimate year of the current regulatory period is used to assess the forecasts of expenditures for the forthcoming regulatory period).

As in the Netherlands then, the key cost measure that populates the German regulatory framework is based on a capital consumption concept, rather than by a capital expenditure concept as in the Ofgem framework.

2.3.2 Incentives framework for costs

Under Bundesnetzagentur's regime, costs are assumed to be controllable unless they are specifically identified to be either "non-controllable" or "volatile". Strong incentives are applied to controllable costs. However, in addition to the core arrangements we describe here, there exists a new arrangement that will allow companies to apply for a "capital-cost-adjustment", we describe below.

For controllable costs, a revenue cap model is adopted. Allowed revenue is determined by:

- Benchmarking total cost (described in more detail below), as defined above, to determine a set of company specific efficiency targets;
- Adding an industry wide general productivity assumption; and
- Inflating annually for CPI inflation.

We note specifically that depreciation and remuneration of capital falls under "controllable" costs and productivity factors also apply on these cost items. "Non-controllable" and "volatile" costs are pass-through items.

Companies then face a 100% exposure to this revenue cap on all controllable costs. The effects of and incentives arising from this regime are as follows:

- Very strong incentives are provided to control costs, whether opex or capex (depreciation and remuneration for capital).
- At an industry level, costs recovery, including a reasonable cost of capital, is not guaranteed. Full cost recovery would only arise if all companies reach the industry-specific productivity factor and their efficiency-dependent factor.
- No separate appraisal of opex and/or capex is ever undertaken, and it is for companies to decide the quantum and nature of the expenditure necessary to meet demands placed on them, now and in the future.

These arrangements have in the past been supplemented by a system that allowed regulated businesses to request the application of an "expansion factor" (based on specific changes to specified exogenous factors such as peak load, number of

connection points, service area) to provide additional allowances to cover the cost of further network investments.

This system has recently (September 2016) been replaced by the so-called "capital-cost-adjustment". The "capital-cost-adjustment" allows the annual update of the capital costs (depreciation, return on capital) during the regulatory period and the ability to pass through additional capital costs.

We return to this again below when we discuss investment incentives, but at this stage note that no similar arrangement exists to request additional opex. This appears, in principle at least, to create an incentive to use more capital-intensive solutions, e.g. building lines, instead of opex-based solutions, when dealing with issues of integration decentralised generation into the network. Bundesnetzagentur appears to recognise this already, noting that the "capital-cost adjustment" may be a barrier for fostering innovation in the network.

2.3.3 RAB

As described above, RAB is calculated annually in the traditional manner, based on the flows of capex spent by the companies and standardised regulatory accounting rules to derive depreciation. However, as outlined above, no individual company is guaranteed to earn a fair return on its RAB, unless it is able to match industry-wide and efficiency dependent performance. And full recovery of the allowed rate of return is not guaranteed even at the industry level.

2.3.4 Benchmarking

Bundesnetzagentur undertakes an appraisal of company performance by a total costs benchmarking analysis. This is implemented by undertaking a cross-sectional benchmark of company performance as at a 'photo year'. The photo year is determined by the t-3 costs with t as the first year of the regulatory period (e.g. if regulatory period starts in 2019, the relevant photo year is 2016).

The incentive-regulation ordinance sets the framework for the benchmarking analysis:

- **Benchmarking methodology**: two benchmarking techniques — Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) — shall be used.
- **Benchmarked costs**: two cost definitions shall be used ("controllable" costs with standardised capital costs and "controllable" costs without standardised capital costs).
- **Output parameters**: the parameter shall reflect the supply task of the companies. The ordinance lists some parameter which may be used (e.g. peak load, number of connection points, metering points, network length).

Examples of totex approaches used in other jurisdictions

- **Outlier analysis**: the ordinance provides for an outlier analysis to avoid that the efficiency scores of the companies are not distorted by exceptional companies.
- **Best-of-four**: the ordinance states that the efficiency scores used for the efficiency dependent productivity factor shall be calculated based on the best results from four different model specifications (DEA/standardised costs, DEA/non-standardised costs, SFA/standardised costs, SFA/non-standardised costs).

2.3.5 Concerns over investment levels

Concerns have been expressed over the strength of incentives to manage cost, and the possibility that long-term reliability may be jeopardised.

In Germany this risk is mitigated by the application of a bonus/malus style service quality incentive. A performance based adjustment to allowed revenues is calculated for each company versus the reference values determined by Bundesnetzagentur. Hence the German quality incentive also has a yardstick nature, as does the Dutch system. Assuming this mechanism is calibrated appropriately, this should encourage companies to deliver an efficient level of investment.

For completeness, we note that in the gas distribution sector provision is made for a Q-factor, but it is presently not calculated and therefore set to zero for all parties.

As noted above, Bundesnetzagentur has recently introduced an additional mechanism to its arrangements, the "capital-cost-adjustment" system.

During evaluation processes for incentive regulation concerns were raised by companies that the system does not provide the right incentives for investments in particular for companies facing substantial decentralised generation (including decentralised generation at the household level, "behind the meter"). The companies argued that regulatory instruments should be introduced to allow Bundesnetzagentur to include increased capital costs in revenues during the regulatory period.

Bundesnetzagentur was of the opinion that the then existing instrument of the "expansion factor" (after some small adjustments) was sufficient to provide enough incentives to invest. However, during the law making process the Ministry of Economic Affairs decided to amend the incentive-regulation ordinance more in line with the request from the companies by allowing a pass-through of actual capital costs during the regulatory period using the "capital-cost-adjustment". This can be interpreted as a first deviation of Bundesnetzagentur from a "total cost" approach with may result to a drift to potential suboptimal capital intensity.

The new regulatory instrument works as follows:

- **Calculation of "capital cost adjustment"**. The adjustment is calculated as follows:
  - Investments undertaken since the photo year until the year for which the "capital cost adjustment" is applied for (e.g. if the photo year is based on 2016 costs and the "capital cost adjustment" is applied for the year 2020)0, then investments from the years 2017, 2018, 2019 and 2020 are relevant).
  - Investments are based on planned figures with an ex post adjustment using actual investments. The efficiency of the investments is assessed in the benchmarking analysis in preparation of the next regulatory period.
  - Based on the new investments Bundesnetzagentur calculates only for these investments
    - Depreciation;
    - Return on Equity x Equity;
    - Cost of Debt.
  - The incremental capital costs from these new investments can be added to the revenues during the regulatory period.
- **Offsetting effect from "capital cost reduction"**. In order to avoid an overcompensation of the companies there is an offsetting effect from the "capital costs reduction" during the regulatory period. This is calculated as the difference between the:
  - Capital costs from photo year; and
  - Capital costs (based on investments until the photo year) in the year t.

  This means that the decline of the capital costs due to the shrinking of the RAB is rolled forward during the regulatory period. For example, if the photo year is based on 2016 costs the "capital cost reduction" for the year 2020 will be calculated by the difference between:
  - Capital costs 2016; and
  - Capital costs (based on investments until 2016) in 2020.

In particular, companies criticised the second offsetting "capital cost reduction" in the design of this new regulatory instrument. Despite the criticism of the companies the new instrument finally replaced the "expansion factor" in the September 2016 amendment of the incentive-regulation ordinance.

2.3.6 Arrangements for electricity and gas TSOs

A similar total cost approach is also applied to the transmission operators. Bundesnetzagentur also applies a benchmarking analysis to TSOs. While for the

electricity TSOs Bundesnetzagentur participates in a pan-European benchmarking exercise and uses the resulting study to determine the efficiency dependent productivity factors, for gas TSOs a national benchmarking analysis is used. There is one deviation from the DSO with regards to large expansion and restructuring investments. The TSO can apply for so-called investment measures which allow including the costs from these investments in the revenues already during the regulatory period. On the other hand, for TSO the "capital-cost-adjustment" does not apply.

2.3.7 Summary

Table 3 below provides our assessment of the extent to which Bundesnetzagentur's regulatory method addresses some potential drivers of capex bias.

Table 3: Frontier Economics' assessment of BNetzA's prevailing regulatory method

Capex bias driver	Assessment
Regulatory incentives for outperformance	As with the Dutch regime, there is no separate appraisal of a firm's performance on opex and capex, only an allowed level of revenue that the company may try to outperform. In this context, companies are incentivised to minimise cost where they can.
Allowed return on RAB	Capex and RAB still exist in the traditional way, as under the Dutch regime. This means that, in principle, if the allowed rate of return is set above the cost of capital, companies may face an incentive to capitalise in order to earn this margin on a larger asset base. However, the German system includes a benchmark of total cost (see below), which may mitigate incentives to 'grow the RAB'.
Approach to cost assessment	The German system includes a benchmark of total cost, where total cost is determined as return of and on RAB. Hence, if a company chooses to inflate its RAB, there is no guarantee that it this will be recoverable. This risk may mitigate incentives to increase RAB by capitalising expenditure. However, it is also true that a company that chooses to capitalise some quantum of opex will reduce its benchmarked measure of costs, since if recorded as opex the full quantum would appear in the 'photo-year', whereas the same quantum recorded as capex would only be included in line with one year of depreciation and return. Thus a company may choose to capitalise in order to look more efficient in the benchmark now, but only at the expense of worsening its performance in some future benchmark. On balance, it is not clear that the approach to benchmarking creates any strong incentive to capitalise.
Financing and ownership	Apart from the RAB growth incentive issue, it is not obvious that there are other relevant considerations in respect of financing and ownership.
Company culture and skillset	The German companies have been exposed to the strong incentive arrangements imposed by BNetzA for many years and have never been exposed to any alternative arrangements. Any shift in culture and/or skillset required by the arrangements will have been made by the companies while adjusting to incentive regulation generally.
Risk of failure and penalties	There are stringent technical standards imposed on all energy networks, to ensure the safe conveyance of energy. All German energy companies continue to be bound by these and face serious consequences should they be

	breached. Within the context of this high standard, companies are free to compete on the basis of their overall efficiency. Where there is a question as to the appropriate balance between cost saving and the provision of reliability, explicit incentive schemes are in place to devolve this decision to the companies.

Source: Frontier Economics

2.4 Victoria – energy sector

2.4.1 The Office of the Regulator-General, Victoria

The Office of the Regulator-General, Victoria (ORG) was responsible for price-regulating electricity networks in Victoria until the ORG was subsumed by the Essential Services Commission of Victoria (ESC) in January 2002. The ORG used a standard building block framework for setting maximum allowed revenues (which would then be used to determine price limits) that the businesses would be permitted to earn. In particular:

- the ORG determined a value for each business's RAB for each year of the regulatory period. The RAB value would be allowed to change each year to take account of any allowed capex, regulatory depreciation and disposals;
- the business was allowed to earn each year a return on the RAB, and to recover (through an annual depreciation allowance) a return of capital; and
- the business was permitted an allowance for opex and for its expected tax obligations.

In addition to these building block elements, in its 2001-05 price control, the ORG introduced an efficiency carryover mechanism that provided regulated businesses with an additional share of the benefit from any efficiency gains achieved during the previous regulatory period, and was designed to:[9]

- to encourage distributors to pursue efficiency gains throughout the regulatory period, which in turn reduces prices to customers (in present value terms); and
- to reduce the incentive to defer the pursuit of efficiency gains that might otherwise exist immediately before a regulatory review.

[9] ORG, Electricity distribution price determination 2001-05, Vol 1: Statement of purpose and reasons, September 2000, p.83.

The ORG's efficiency carryover mechanism shared a number of key features with the Australian Energy Regulator's Efficiency Benefit Sharing Scheme (EBSS). In particular:

- Businesses were allowed to keep any efficiency gains/losses made for a period of five years after the year in which those gains/losses were achieved.[10] The savings would then passed through to consumers.
- This, like the EBSS, implied a sharing of benefits between businesses and consumers of around 30:70 in net present value terms (assuming a given discount rate).
- As with the EBSS, the intention of the ORG's efficiency carryover mechanism was to incentivise businesses to make efficiency savings in any year in which opportunities for savings arose (rather than deferring those savings inefficiently until the start of the next regulatory period).

However, unlike the EBSS, which applies only to opex, the ORG's efficiency carryover mechanism applied to opex *and* capex together.[11] Specifically, under the ORG's scheme, the efficiency carryover amount in any given year was computed as the combined gain/loss from opex and capex, where:[12]

- The carryover amount in relation to opex is the reduction (or increase) in the level of recurrent operating and maintenance expenditure, compared to opex allowance provided by the ORG for that year; and
- The carryover amount in relation to capex is the regulatory WACC, multiplied by the difference in that year's capital expenditure against capex allowance provided by the ORG.

This effectively equalised the sharing rate that applied to opex and capex, thereby removing the incentive for regulated businesses to favour capex over opex simply to secure a higher incentive mechanism payoff.

There is no evidence that the ORG was seeking to address a particular capex bias that it had identified, when it designed the efficiency carryover mechanism.

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10 An efficiency gain/loss was calculated by comparing the actual expenditure achieved by the business in a particular year to the expenditure allowed by the ORG in that year.

11 The AER utilises a separate incentive mechanism that relates to capex: the Capital Expenditure Sharing Scheme (CESS). The AER has calibrated the CESS so that the share of benefits retained by businesses (i.e., 30%) is aligned with the share of benefits that may be retained via the EBSS.

12 The ORG set a floor of zero for the carryover amount in any one year (i.e., negative carryover amounts were not permitted). Where the combined carryover amount from opex plus capex would be negative, the efficiency carryover was set to zero for that year, and the implied negative value was used to offset any positive carryover amount in the following year. The ORG argued that defining negative carryover amounts in terms of the sum of the carryover applicable to both opex and capex ensured that the gain to a business from the efficient substitution of opex for capex is the overall net 'gain' achieved, and that this would support the principle of neutrality between opex and capex.

However, it is clear that the ORG was cognisant of the possibility for such a bias, and the ORG was explicit that the aim of combining within a single carryover mechanism the efficiencies achieved in relation to opex and capex was to achieve neutrality between these two types of expenditure:[13]

> The Office noted in its Draft Decision that the long-run carryover mechanism should, as far as possible, treat the savings made in relation to either operating and maintenance or capital expenditure in the same way. Under such equal treatment, distributors will have equal incentives to pursue both operating and maintenance or capital expenditure savings.

It is important to note that whilst the efficiency carryover mechanism did not distinguish between opex and capex savings, the ORG did (like most other regulators) set separate opex and capex allowances.

Some businesses argued that the carryover mechanism was biased in favour of opex because it did not include avoided regulatory depreciation as a source of capital-related efficiency. These businesses argued that:

- Any capex savings achieved meant that consumers would, in future years, avoid paying both the return on *and* the return of that saved capital;
- The efficiency carryover mechanism recognised the saved return *on* capital because the capex carryover amount in any year was calculated by multiplying the capex saving by the regulatory WACC. However, the saved return *of* capital was not accounted for because the capex carryover amount excluded the future regulatory depreciation that had been saved by realising the capex efficiency; and, therefore
- The true benefit of capex savings were understated by the computation of the capex carryover amount.

The ORG chose to not account for avoided regulatory depreciation in the efficiency carryover mechanism on the grounds that doing so would add unwarranted complexity to the scheme:[14]

> As noted in the Draft Decision, the Office would need to make assumptions about the average life of capital assets and the timing of replacement capital expenditure in order to incorporate depreciation within the carryover calculation. It would also need to make assumptions on the appropriate depreciation profile. On balance, the Office considers that including an allowance for changes in depreciation would increase the complexity of the carryover mechanism, for little overall gain, given that any bias against capital savings is not expected to be significant. Therefore the Office does not propose to

13 ORG, Electricity distribution price determination 2001-05, Vol 1: Statement of purpose and reasons, September 2000, p.97.

14 ORG, Electricity distribution price determination 2001-05, Vol 1: Statement of purpose and reasons, September 2000, pp.97-98.

Examples of totex approaches used in other jurisdictions

include an allowance for changes in depreciation in assessing capital under- (or over-) spend as part of the carryover mechanism.

2.4.2 The Essential Services Commission of Victoria

As noted above, in 2002 the ESC replaced the ORG and was therefore responsible for determining price controls for the Victorian electricity distribution businesses for the 2006-10 period. When making this determination, the ESC considered the extent to which the ORG's efficiency carryover mechanism may have had incentivised efficient expenditures over the 2001-05 period and, on that basis, whether the ESC should continue to apply the carryover mechanism for the 2006-10 period. The ESC noted that:

- Over the 2001-05 period, reported opex had been 15% lower than forecast at an industry level, suggesting that the regulatory framework had provided incentives for opex efficiencies. However, the ESC acknowledged that it was not possible to be conclusive about the extent to which the carryover mechanism had driven these changes, compared to exogenous factors beyond the businesses' control, or whether the reduction was simply due to forecasting error.
- Over the 2001-05 period, reported capex had been 22% lower than forecast at an industry level. However, the ESC noted that the businesses submitted 2006-10 capex forecasts for the 2006-10 regulatory period that were 54% *higher* than reported capex during the 2001-05 period. The ESC considered that the savings realised over the 2001-05 period may simply be due to deferred capex.

The ESC argued that if capex underspend arises from unsustainable investment deferral, customers would be at risk of funding efficiency carryover rewards on savings that are not sustainable or genuine efficiencies.

The ESC went on to say that:[15]

> Where efficiencies are not sustainable (or have not occurred in the first place) customers will not benefit from lower prices arising from the sharing of efficiency benefits through the efficiency carryover mechanism and regulatory review. This differs from operating and maintenance expenditure where the incremental calculation of the efficiency carryover amounts and the clear translation of revealed costs into the next period forecasts ensure that customers only reward sustained efficiencies and that customers share in efficiency benefits via lower prices.

In this statement the ESC distinguished between the recurrent nature of opex and the lumpy nature of capex, and noted that the ability to defer capex meant that it was unclear that customers would be paying for sustained efficiencies via the efficiency carryover mechanism. In its final distribution decision for the 2006-10

15 ESC, Electricity Distribution Price Review 2006-10, October 2005 Price Determination as amended in accordance with a decision of the Appeal Panel dated 17 February 2006, Final Decision Vol. 1, Statement of Purpose and Reasons, October 2006, p.432.

period, the ESC decided to restrict the efficiency carryover mechanism to opex only, and to not extend the mechanism (as the ORG had done) to capex.

The ESC acknowledged that this approach could distort incentives in a way that encourages businesses to favour capex over opex:[16]

> The Commission recognises that applying the efficiency carryover mechanism to operating and maintenance expenditure and not to capital expenditure may create bias between distributors' operating and capital expenditure decisions. In particular, distributors may have an increased incentive to capitalise operating costs to secure greater efficiency carryover rewards in the 2011-15 period.

The ESC argued that it could mitigate this problem by scrutinising the capitalisation policies of the businesses against efficient 'benchmark' capitalisation policies. This, of course, assumes that the regulator has information on efficient capitalisation rates against which it can compare the capitalisation policies of the businesses. Such information may not be readily available to the regulator.

The ESC also recognised that, by not applying the efficiency carryover mechanism to capex, the businesses may have a greater incentive to inflate their capex in order to grow the RAB and to earn an ongoing return on this expenditure. However, the ESC argued that:[17]

> …this incentive is mitigated by the fact that distributors have to bear any financing costs for capital expenditure where this is greater than forecast. Therefore additional capital expenditure is most likely to occur where this will improve service performance. The short term cash position incentives facing these commercial businesses are also likely to maintain incentives for distributors to pursue efficient capital investment programs.

Following changes to the NER in 2012, the AER was permitted (but not obliged) to introduce a benefit-sharing scheme for capex savings. In spite of some concerns regarding incentives for inefficient capex deferral, the AER recognised the merits of rewarding capex reductions to a similar extent as opex reductions. Accordingly, the AER proceeded to introduce its Capital Expenditure Sharing Scheme (CESS) in its 2013 Capital Expenditure Incentive Guideline (see section 5.1.2 below).

2.4.3 Summary

Table 4 provides a summary of our assessment of the extent to which ORG's method described above addressed certain possible drivers of a capex bias.

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16 ESC, Electricity Distribution Price Review 2006-10, October 2005 Price Determination as amended in accordance with a decision of the Appeal Panel dated 17 February 2006, Final Decision Vol. 1, Statement of Purpose and Reasons, October 2006, p.432.

17 ESC, Electricity Distribution Price Review 2006-10, October 2005 Price Determination as amended in accordance with a decision of the Appeal Panel dated 17 February 2006, Final Decision Vol. 1, Statement of Purpose and Reasons, October 2006, p.433.

Examples of totex approaches used in other jurisdictions

Table 4: Frontier Economics' assessment of ORG's regulatory method

Capex bias driver	Assessment
Regulatory incentives for outperformance	ORG's carryover mechanism equalised the sharing rate that applied to opex and capex, thereby removing the incentive to favour capex over opex in order to secure a higher expenditure outperformance payoff.
Allowed return on RAB	There is no evidence that ORG determined an allowed rate of return that was deliberately 'generous' in a way that might make a strategy of RAB growth particularly attractive. However, the rate of return that ORG allowed in its decisions (9.6% nominal, vanilla in 2000) was considerably higher than is presently allowed by the AER for the businesses it regulates (5.8% nominal, vanilla in an April 2017 decision issued by the AER). This is partly explained by the fact that ORG allowed a higher equity beta (1.0) than does the AER (0.7), assuming a gearing of 60%, and partly by the fact that interest rates today much lower than they were when ORG made its determinations. The high rates of return allowed by ORG would have provided reasonably strong incentives for businesses to increase the value of RAB in order to maximise the return on capital.
Approach to cost assessment	ORG undertook separate benchmarking of opex and capex using simple techniques (e.g., it did not use econometric benchmarking due to concerns about the availability of reliable data) and bottom-up cost assessments. ORG did not undertake any totex benchmarking.
Financing and ownership	Under ORG's approach, there remained an incentive to favour capex as a means of inflating the RAB (thereby securing a higher return on and return of capital), because capex was rolled into the RAB.
Company culture and skillset	No information is available on whether the totex carryover mechanism introduced by ORG altered the company culture and skillsets within the businesses that ORG regulated.
Risk of failure and penalties	It is not clear that the totex carryover mechanism introduced by ORG had any impact on service quality or reliability. ORG's regulatory framework had clear reliability targets in place, as well as minimum service quality and safety standards. In addition, ORG applied a service quality incentive scheme that provided financial rewards (through a 'S-factor' adjustment) to businesses for achieving their reliability targets.
Control of assets	It is not clear that the businesses regulated by ORG had a particular bias in favour of controlling its own assets (as opposed to greater use of third party services). If such a bias did exist, it is not clear that the introduction of the totex carryover mechanism had any impact on these preferences.

Source: Frontier Economics

2.5 Great Britain – energy sector

The regulatory arrangements that prevailed in the energy sector prior to the fifth electricity distribution price controls (DPCR5) were similar in many respects to the arrangements that currently operate in the NEM:

- Maximum allowed revenues were determined using a standard building blocks approach in which separate allowances were set for opex and capex;

- The regulator, Ofgem, undertook top-down economic benchmarking to assess the efficiency of regulated businesses' expenditures. The regulator had a particular focus on opex benchmarking, whereas benchmarking played no role in setting capex allowances;
- Separate incentive mechanisms existed for opex and capex.

Since the third electricity distribution price controls (DPCR3), the economic regulator, Ofgem, became increasingly aware of a capex bias created by the differential treatment of opex and capex within the regulatory framework. In particular, there was mounting evidence that:

- A number of regulated businesses were simply recording opex as capex (particularly in areas where the boundary between these two forms of expenditure were somewhat blurred), to perform better on the regulator's economic benchmarking, and because the incentive mechanism for opex had been calibrated to apply a much harsher penalty for overspend than was the capex allowance; and
- A 'grow-the-RAB' strategy (through high levels of capex) appeared to be attractive to the investors in some of the businesses because it would provide a long stream of reliable income (via the return on and return of capital), as compared to opex allowances which could be reduced at any reset.

These behaviours were viewed as counter to the interests of consumers because:

- In the case of opex misreporting, businesses were awarded financial rewards for no real improvement in efficiency; and
- In instances of businesses pursuing a RAB inflation strategy, there was a real risk of network gold-plating (which Ofgem may fail to detect, due to deep asymmetries of information between the regulator and the businesses about the true need for capex investments), which would leave consumers paying for unnecessary expenditure for several price controls.

Whilst the evidence for a capex bias became increasingly clear over time, it was not until DPCR5 that Ofgem tackled the capex bias head-on with concrete regulatory reforms. (In doing so, Ofgem became the first economic regulator in the UK to address the capex bias problem.) At the next set of price controls, RIIO-ED1, Ofgem built on its initiatives at DPCR5 to cement in place the current totex framework.

Examples of totex approaches used in other jurisdictions

The core elements of Ofgem's totex framework, as it currently applies, are the following:[18]

- **Common treatment of all costs.** Ofgem now sets a singly totex allowance, without specifying the maximum allowances (or forecasts) of opex and capex separately. In doing so, all costs are now treated identically by Ofgem.
- **Capitalisation rate**. With opex and capex no longer existing as meaningful concepts, Ofgem sets a capitalisation rate parameter to determine the proportion of totex that may be recovered within each RCP (so-called 'fast money'), and the proportion of totex to be rolled into the RAB and recovered over multiple RCPs (so-called 'slow money'). The capitalisation rate may vary between companies if that is justifiable, including for reasons of financeability (see section 5.1.7).
- **Single incentive mechanism**. The separate opex and capex incentive mechanisms were replaced by a single totex incentive mechanism, with a common incentive rate for all types of expenditure. This reduced the incentive to report opex as capex because of the opex overspend attracted a harsher financial penalty. More importantly, it eliminated the incentive to pursue a 'grow-the-RAB' strategy (through inefficient substitution of opex and capex), because inflating the RAB would now require spending more in aggregate than has been allowed, and such overspending would be penalised by the totex incentive mechanism.
- **Greater weight on totex benchmarking**. Ofgem now gives prominent weight to totex benchmarking that is blind to the distinction between opex and capex. Once again, the intention behind this is to promote neutrality between opex and capex (in terms of eliminating incentives to misreport opex as capex, and to remove incentives to favour capital investments over operating and maintenance spend).
- **Activity based accounting**: Whilst Ofgem now sets totex allowances for regulated businesses, it still wishes to understand (*ex post*) how the businesses are spending those allowances. It has therefore introduced a set of highly detailed accounting guidelines to govern disaggregated cost reporting by the companies it regulates. Ofgem uses these disaggregated data to ensure ring fences between monopoly and competitive activities are being treated appropriately, and to understand issues such as allocations between licences under common ownership, treatment of corporate overheads, and so on. Ofgem also uses these data to undertake disaggregated economic benchmarking, which is given 50% weight (with the remaining weight given to

[18] These arrangements apply equally to all businesses regulated by Ofgem, including electricity distribution and transmission businesses, and gas distribution and transmission businesses.

the results from totex benchmarking models), when setting companies' totex allowances.

There is no clear empirical evidence that the adoption of a totex framework by Ofgem over the last two price controls has eliminated the capex bias problem. This is partly because the past misreporting of costs by some businesses makes it difficult to conduct a reliable analysis of how true capitalisation rates (and actual expenditure) have changed over time, and partly because the scope of activities conducted by the businesses have changed over successive price controls. However, it is clear that there is now no rational reason for regulated energy businesses to favour capex over opex. Further, our discussions with key industry participants suggest that there has been a genuine cultural change, whereby businesses now seek out the most efficient ways to spend their totex allowances, rather than seeking to game the allowances set by the regulator, or to pursue a strategy of potentially inefficient RAB growth.

A detailed case study of Ofgem's implementation of its totex framework is provided in section 3 below.

2.6 England and Wales – water sector

Prior to the last price control for water businesses in England and Wales (PR14), the economic regulator, Ofwat, used a building blocks framework that treated opex and capex separately. In the lead-up to PR14, the UK and Welsh governments commissioned an independent review by David Gray (now chairman of Ofgem) to consider whether Ofwat (and its regulatory approach) was fit to meet the various challenges facing the sector. The Gray review concluded, amongst other things, that there was convincing evidence of a capex bias in the sector. The review report also noted that Ofgem had recently adopted a totex framework to address precisely this issue, and the new arrangements that Ofgem had adopted had "considerable attractions."

When Ofwat began its consultations on its regulatory framework for PR14, it referred to the Gray review and also acknowledged that there was evidence that pointed to a capex bias in the industry, but it was not able to quantify the extent of the bias. Ofwat identified a number of possible drivers of capex bias, including: a differential treatment between opex and capex within the regulatory arrangements; a grow-the-RAB strategy preferred by some investors in the industry; a mindset within the industry that favoured engineering solutions; risk aversion over the breaches of standards; and a preference within the industry to have control over assets rather than contracting with third parties for the provision of services.

Ofwat introduced at PR14 a totex framework that shared many common features with Ofgem's approach:

- **Totex benchmarking.** Ofwat replaced its previous approach of statistical benchmarking of opex, qualitative assessments of maintenance plans and engineering assessments with three differently-specified statistical totex benchmarking models that removed any distinctions between different categories of costs.
- **Recovery of totex.** Ofwat now sets a Pay-as-you-go (PAYG) rate, which determines the proportion of totex to be expensed and recovered as fast money within the RCP. The remainder of totex is rolled into the RAB and then recovered via regulatory depreciation (using standard asset lives) over a number of RCPs.
- **Incentive mechanism.** Ofwat replaced the separate opex and capex incentive mechanisms it operated with a single totex incentive mechanism that applied the same sharing ratio to all costs. The new incentive mechanism had an added feature of creating incentives for the businesses to forecast expenditures accurately and reveal those forecasts truthfully to Ofwat. But this added property was not essential to the implementation of Ofwat's totex framework.

As these arrangements only began to operate in 2014, it is too early to assess quantitatively whether they have induced a change behaviour by the businesses regulated by Ofwat. However, it is clear that under these new arrangements, the businesses no longer face economic incentives to favour capex over opex.

A detailed case study of Ofwat's implementation of its totex framework is provided in section 4 below.

2.7 Summary: Features of totex frameworks

In the sections above we have provided examples of five jurisdictions around the world that have, to varying degrees, adopted totex arrangements. Distilling down these case studies, we identify below a number of elements that one would expect to find within a totex framework and explain how these differ from the arrangements that prevail in Australia:

- **The regulator determines a single totex allowance, rather than separate opex and capex allowances.** The regulated businesses can then decide over the RCP the most efficient way to spend those allowances.
  - This approach is adopted by Ofgem, Ofwat, Bundesnetzagentur and ACM.
  - In Australia, the NER requires the AER to approve separate opex and capex allowances for NSPs.
- **Capitalisation rate.** Under an approach where a single totex allowance is set, the regulator may wish to decide what proportion of that total allowance

should be recovered within a single RCP, and what proportion should be recovered over a longer horizon.

- Under Ofgem's and Ofwat's frameworks (which are most similar to the regime that applies in Australia), these regulators determine the rate at which totex is to be capitalised into the RAB and recouped gradually. The remainder is expensed and recovered within the current RCP.
- Under the NER, the opex allowance may be recovered within the RCP, whereas capex is rolled into the RAB and recovered over a number of RCPs via the depreciation allowance.

- **A single totex incentive mechanism applies rather than separate opex and capex incentive mechanisms.** This ensures that the same incentive rate (efficiency sharing ratio) applies equally to opex and capex.
  - This approach is adopted by Ofgem and Ofwat.
  - A variant of this approach was used by the ORG, whereby the efficiency carryover amount in any given year was computed as the combined over/underspend from opex and capex.
  - In Australia, separate incentive mechanisms apply for opex and capex, although the AER has attempted to harmonise the efficiency sharing ratios between these two mechanisms.
- **Prominence is given to the results of totex benchmarking when setting the totex allowance.** This eliminates (or reduces significantly) the incentive for regulated businesses to favour opex or capex simply to enhance their benchmarking performance and thereby maximise their allowances. Any opex-capex substitution (or misreporting of opex as capex, or vice versa) will (in principle) have no impact on the benchmarking results.
  - This approach is used by Ofgem, Ofwat, Bundesnetzagentur and ACM.
  - The NER requires the AER to produce an annual benchmarking report, and to have regard to the latest annual benchmarking report when assessing the forecast opex and capex forecasts put forward by NSPs when setting revenue allowances. The NER does not specify what form of benchmarking is to be used. In practice, the AER has undertaken some limited totex benchmarking of DNSPs and transmission network service providers (TNSPs), but has not *relied* on the results from this benchmarking analysis (as would be the case under a totex framework) to when determining revenue allowances.[19]

[19] Given that the AER is *required* by to determine separate opex and capex allowances under the current NER, it would be difficult to *rely* on totex benchmarking, when determining revenue allowances.

Examples of totex approaches used in other jurisdictions

3 Case study 1: Ofgem

Box 3: Summary of this chapter

The original approach to network price controls adopted by Ofgem (formerly Offer and Ofgas) utilised the well-known standard "building blocks" approach. Separate allowances were set for opex and for capex. Opex was reflected in allowed revenues in the year in which it was expected to be incurred. Capex was capitalised into the RAV, and revenues set to allow the return of RAV in line with prescribed regulatory depreciation rules, and return on RAV based on Ofgem's assessment of WACC.

There were also traditional incentive arrangements on each of opex and capex, where should a company be able to beat its allowance, it was able to retain the benefit for a time. Owing the way in which these incentives operated, any opex saving was retained in full by the company, whereas any capex saving resulted in only around 40% of the benefit flowing to the company.

These arrangements created a strong incentive for companies to favour reducing opex rather than capex, even in cases where the overall cost to deliver services may be increased as a consequence. These incentives arose because of:

- the difference in incentive rate between opex and capex savings;
- the possibility that some companies preferred to grow their RAB, all other things equal, perhaps as their true cost of capital was somewhat lower than was allowed by the regulator; and
- potentially, by the perception that the regulator may regard evidence of underspent capex as a signal that network reliability may be being diminished, and that this may result in increased regulatory scrutiny.

Ofgem considered that taken together there was an incentive for companies to engage in substitution between opex and capex and that this might be effected in one of two broad ways:

- accounting substitution: the company may choose to make changes to its accounting policies so as to report more of its expenditure as capex rather than opex. This would result in regulatory outperformance simply as a result of reporting procedures, which would be funded by customers; and
- physical substitution: the company may choose to adopt capex heavy solutions to its network planning even when solutions involving more opex are most efficient. Again the costs of this, in terms of higher actual cost and the funding of unjustified outperformance were borne by customers.

Over the course of several price controls, evidence continued to emerge to show that companies were, to varying degrees, responding to these incentives to the detriment of customers.

In response to this evidence, Ofgem proposed and implemented important changes to its regulatory arrangements. These were intended to achieve an entirely common treatment of costs irrespective of whether they would be classified as opex or capex in a traditional regulatory regime, so as to remove the perverse incentives described above.

The key elements of these new arrangements were:

- Common treatment of all costs. Ofgem now treats essentially all costs identically. It therefore applies exactly the same incentive rate to essentially all cost allowances/expenditure.
- Capitalisation rate and single totex incentive mechanism. With opex and capex no longer existing as meaningful concepts, Ofgem needs a way of deciding what costs should

be rolled into the RAB. It does this by using a simple, capitalisation parameter that is permitted to vary by company where good reasons are presented, including in respect of financeability. It is then not possible to inflate the RAB by substituting capex for opex, only by overspending in general, a strategy that would be very expensive to follow given the incentive rate applied to totex.

- Increased weight on totex benchmarking. Ofgem is, to a degree at least, alive to the fact that different benchmarking treatments can create biased incentives to favour one cost head over another. It has therefore made use of totex benchmarking at its most recent round of price controls to ensure more common treatment of different cost types in its efficiency analysis. However it has also made use of other benchmarking techniques, which may leave some residual bias. Going forward, totex benchmarking is likely to become even more important due to the greater substitution possibilities DNOs are likely to have – from demand side response, storage and other emerging technologies – which may result in these businesses facing a choice between investing in physical assets to add capacity or taking up commercial arrangements to interrupt/load-shift customers. As policymakers cannot and should not pre-empt which of these approaches should be used, neutral incentives between different types of expenditure should apply.

- Activity based accounting. Whilst Ofgem needs only totex to populate the calculations described above, it also wishes to assure itself that companies are adopting appropriate stewardship policies and undertaking expenditures necessary to sustain the network in all relevant regards. It considers having the ability to compare companies in a granular, disaggregated manner an important element of this. Ofgem has therefore introduced a highly detailed set of accounting guidelines to govern cost reporting by the companies it regulates. Strictly speaking, it is moot whether this disaggregated approach to data collection is necessary in order to address the capitalisation bias or to implement a totex approach.

It is generally accepted amongst the companies and commentators that the steps Ofgem has taken have been successful at eliminating any material incentive to capitalise opex.

3.1 Introduction

In this section we provide a detailed review of Ofgem's totex arrangements. We present:

- a review of Ofgem's analysis and commentary in previous price controls, that show the emerging evidence of a capitalisation bias;[20]
- some further empirical evidence that appears to corroborate Ofgem's view;
- the main elements of Ofgem's regulatory framework that together comprise the "totex framework" (we also include a brief review of other elements of Ofgem's arrangements that might be regarded as optional, rather than necessary elements of a totex framework); and

[20] In this section we refer to 'capitalisation bias' rather than 'capex bias' because, as we explain below, the problem that Ofgem sought to address with its totex framework was not simply the favouring of actual capex over opex by companies, but also the tendency to report opex as capex by increasing accounting capitalisation rates.

- the evidence that exists today to determine whether Ofgem's measures have been successful in addressing the capex bias.

3.2 The history that led up to Ofgem's totex approach

The existence of a capitalisation bias was understood and widely discussed in the energy sector in Great Britain (GB) long before totex arrangements were introduced. The existence of such a bias was plainly obvious to any regulatory economist who examined Ofgem's then-existing arrangements for opex and capex, which for many price controls were built on the very well-known standard "building blocks" approach, with:

- 100% exposure to over/under spend on opex; and
- significantly lower exposure to over/under spend on capex, due to the truing-up of the RAB for actual capex at the next price control, meaning that the company retained deprecation and return on any savings for a few years only, with the balance of any saving then passing to customers.[21]

As we set out below, these basic arrangements persisted more-or-less unchanged until the fifth distribution price control, DPCR5. Ofgem, as appointed independent regulator arm's length from policy makers, had freedom to decide to act to address these concerns – such as by equalising businesses' exposures to over- and under-spending across both opex and capex. There was no legislative or administrative barrier preventing action. However, for a variety of reasons, definitive steps to remove the capitalisation bias were not taken until circa 2010.

As far back as the third price control for electricity distribution companies (DPCR3, Final Proposals published in December 1999) Ofgem was reporting material differences in accounting policies and finding it necessary to make adjustments to reported data for opex and capex in order to ensure comparability for benchmarking. Frontier Economics was also working directly on this issue, noting that certain firms were responding to the incentives created by Ofgem's markedly different approaches to opex and capex (see below).

As a matter of principle, the differential in incentive rates between opex and capex were likely to have two effects:

- **Misreporting.** The bias may have encouraged firms to begin reporting opex as capex. This would not have changed the actual cost of service delivery, but would have led to unjustified regulatory outperformance that would have increased customer bills.

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21 Depending on depreciation lifetimes, the level of allowed return and the number of years for which the saving was retained by the company before it was handed to customers, this resulted in the company retaining somewhere between 20% and 40% of any saving made.

- **Physical substitution.** It is also possible that some firms may have chosen capex-heavy business models when a more opex-focussed approach may have been overall cost-reducing, creating genuine inefficiency in the sector.

In the subsections that follow, we summarise Ofgem's key findings and developments at each of DPCR3, DPCR4, DPCR5 and the first RIIO price control for electricity distribution, RIIO-ED1. This review reveals that Ofgem tolerated these issues – we believe as it considered that it was possible to address them by other means – for at least two price controls, before addressing them very comprehensively at DPCR5. While a variety of further elements of the regime evolved at RIIO-ED1, the totex arrangements were very largely established in their final form prior to this.

It is worth noting that our focus on electricity distribution is chosen in the interests of clarity of exposition. The exact same arrangements as we describe for electricity distribution were also in place for the electricity transmission companies, as well as gas distribution and transmission companies, and similar issues arose in relation to all of those businesses. However, there is, in our view, less clarity in Ofgem's published work on capex bias in those sectors. This is because, throughout much of the period of interest, there were far fewer licence holders active in those other sectors (in many cases only one) and direct benchmarking played a much weaker role as a result. Consequently, it was much tougher for Ofgem to diagnose similar problems with divergence in accounting policies. Furthermore, the totex arrangements were first introduced to the electricity distribution sector, and it is therefore natural to focus on the sector where they were first implemented.

3.2.1 DPCR3

The DPCR3 price control review ran over the period 1998 to late 1999. It resulted in a determination that ran from 1 April 2000, for five years. The price control determined allowed revenues for the 14 licenced operators (a number of whom were already under common ownership).

The price control documents make numerous mention of the existence of a capex bias. Our assertion above, that the existence of this bias was common knowledge, should not therefore be regarded as controversial. As was usual with Ofgem[22] then, most of the discussion is contained in the draft determination[23] rather than the final determination[24], where Ofgem's typical approach is to present only a brief

22 For completeness, we note that the price control was initiated by Offer, the body initially responsible solely for electricity regulation, but concluded by Ofgem, the combined regulator of gas and electricity.

23 Review of Public Electricity Suppliers 1998 to 2000, Distribution Price Control Review, Draft Proposals, Ofgem, August 1999.

24 Review of Public Electricity Suppliers 1998 to 2000, Distribution Price Control Review, Final Proposals, Ofgem, December 1999.

summary of its final position rather than a full discussion of its reasoning. Accordingly, the passages reproduced below demonstrating Ofgem's awareness of a capex bias have been taken from its draft determination.

For example, Ofgem stated[25]:

> There is a further asymmetry between the incentives to reduce operating and capital expenditure. Operating and capital costs have tended to be considered separately in setting price controls to date. At present companies appear more certain of their incentive to improve operating efficiency than of their incentive to improve capital efficiency.

Ofgem also noted[26] the problems that were likely to arise as a result of any imbalance in incentive strength.

> When setting a price control it is important to give PESs [Public Electricity Suppliers] properly balanced incentives between capital and operating spending. If incentives are unbalanced, PESs may either reclassify one type of expenditure as another or, faced with alternative capital and operating spending choices, make decisions which have higher overall cost to customers in the long run.

The issue was also flagged to Ofgem by a number of the companies.[27]

> A number of PESs believe that there is an imbalance in the incentives between capital and operational expenditure which means that companies are inclined to increase the asset base while saving operational; one example of this is the changes in capitalisation policy, where companies are more inclined to capitalise than in the past. Most companies highlighted a need for greater consistency in reporting, generally in relation to output or service levels. Greater consistency would also be desirable in relation to the allocation of expenditure.

The reference to capitalisation policy changes is particular germane, as it relates to a programme of work that Ofgem undertook with a firm of accountants (PKF) to try to impose a consistent set of capitalisation policies on data the companies had reported, in order to facilitate proper benchmarking. Ofgem had decided to undertake a relatively simple regression analysis (amongst other approaches) to inform future opex allowances. To support this it collected data for the most recently available year from all companies (at this time Ofgem did not routinely collect much data from the companies, making a specific data request necessary to support price control analysis). Once the data were returned, it quickly became apparent that differences in apparent performance were far too great to be explained by managerial efficiency alone. Rather, the analysis was strongly driven by emerging differences in accounting policy.

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25 DD para 1.12.

26 DD para 2.3.

27 DD para 3.5.

Again in its draft determination, Ofgem noted:

> In preparing its distribution regulatory accounts each PES has exercised a degree of flexibility with respect to the classification of expenditure as between operating cost, non-operational capital expenditure and network capital expenditure.

The benign explanation of this is that the companies were simply making best efforts to report faithfully their activity, in the face of very limited guidance from Ofgem and a substantial grey area as to what appropriate practice may be. While Ofgem was careful not to suggest companies had been in any way dishonest, it did note that:[28]

> These changes [in capitalisation policy] have generally had the effect of reducing the amount of operating cost, and increasing capital expenditure.

It seems clear then that at least some companies were responding to skewed incentives by changing their policy when it came to reporting expenditure as opex or capex. Clearly, if cost allowances set at DPCR2 were based on some given set of accounting policies that are then modified as per above, this would result in regulatory outperformance simply from changing reporting approaches, not due to any actual improvement in performance.

In order to address these issues, Ofgem took two steps.

- Working with PKF, it made adjustments to the companies' reported opex (for the single year analysed, 1997-98), in order to facilitate more robust benchmarking. To give a sense of scale:
  - in aggregate Ofgem reallocated £79.7m from capex back to opex on total sector opex of £1,244.6m (6.5%).
  - some of these adjustments were large, e.g. £15.9m adjustment to adjusted annual opex of £98.3m for Yorkshire (16.2%).
  - two companies received small negative adjustments to opex (i.e., had adopted capitalisation policies that Ofgem considered did not capitalise enough cost).
- Ofgem signalled that it would undertake a study to consider whether the incentives the regulatory regime was offering were appropriately balanced. This would cover not only capitalisation bias, but also issues such as the incentive for companies to hold back savings in the run up to a price control in order to maximise the benefit those companies could enjoy from making those savings in the next regulatory period.

At this stage there was no mention of more material changes to arrangements.

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28 DD para 2.14.

3.2.2 DPCR4

Developing Monopoly Price Controls

Ofgem followed up on its commitment to consider and consult on whether it needed to do more to balance incentives. In August 2002 Ofgem launched a consultation entitled Developing Monopoly Price Controls. The consultation was intended to consider a wide range of open questions and to map out the possible evolutions to its regulatory arrangements that Ofgem could consider. Amongst these was the question of capitalisation bias.

To support its consultation process Ofgem commissioned an expert report from Frontier Economics.[29] The wide-ranging report investigated capitalisation bias and developed a framework for quantifying the in-principle magnitude of the differential incentive strengths. It also discussed the role that benchmarking played in creating differential incentives between cost types. If opex is subject to aggressive benchmarking, whereas capex is subject to much lighter scrutiny, this further reinforces any capitalisation bias that exists owing purely to incentive rates.

The Frontier Economics report offered a wide range of conclusions, but those relevant to this present study were the following:

- there was undoubtedly a much stronger incentive to reduce opex rather than capex;
- Ofgem should take steps to balance incentives in order to avoid harmful effects for customers; and
- the preferred approach to doing this might be to adopt a yardstick approach to benchmarking centred on a totex cost measure. Although significant detail was not included in the Frontier Economics report, we can confirm that discussions with Ofgem focused on the potential to move to a Dutch-style yardstick competition regime (see section 2.2).

In practice, Ofgem was more cautious in respect of its next steps. In its Initial Conclusions document, Ofgem made a number of observations, but few concrete proposals emerged:[30]

- Ofgem noted that it would be complex to try to balance incentives by fine tuning existing arrangements (e.g. by altering retention periods for opex and capex) and was therefore not minded to try. Ofgem did not consider a more

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29 Frontier Economics, *Developing Network Monopoly Price Controls: Workstream B, Balancing Incentives*, March 2003.

30 Ofgem, *Developing network monopoly price controls, Initial Conclusions*, June 2003. Note that this was the final document issued under this work programme, with further deliberations subsumed into the main consultation process for DCPR4.

radical move to adopt a fully common treatment of opex and capex, i.e. there was no foreshadowing of the approach it eventually adopted.

- Ofgem noted the role of its approach to benchmarking in reinforcing capitalisation bias, and indicated that it would undertake further work to appraise the merits of moving to a totex-centred regime.
- Ofgem indicated that it would do more work to issue clearer guidance on accounting policies.

Ofgem then moved on to conduct its main price control review.

Main DPCR4 price control documents

At DPCR4 Ofgem again found itself struggling to undertake opex benchmarking owing to manifest differences in accounting policies. At the draft stage, Ofgem noted, amongst other things:

- differences in the proportion of corporate overheads that were capitalised across companies and evidence that companies had changed rates of overhead capitalisation during DPCR3 in order to outperform;
- differences in the extent to which companies allocated so-called indirect costs to fault costs;[31] and
- marked differences in the companies' policies to capitalising fault costs.

Ofgem commented again on these differences in approach in its final determination. It noted:

- the substantial amount of work that had been necessary to unpick (probably imperfectly) different accounting policies in order to support benchmarking;
- that it had been unable to pursue its preferred approach to benchmarking (i.e. to benchmark opex) and had instead been forced to benchmark opex plus total fault costs; and
- that it felt it necessary to retrospectively adjust reported data for previous years so as to ensure RABs were rolled forward on a consistent basis.

[31] Fault costs were the cost of repairing network failures and restoring service. This would involve at least the labour, materials and any subcontracting cost involved in undertaking the remedial action. But with a definition of this kind, there is clearly a question of judgement as to which members of an organisation should be understood to be involved in addressing faults, for example whether those involved at depots/head office supporting the repair should have their time allocated or not.

The following provides a good summary of Ofgem's concerns, and also provides a sense of Ofgem's growing frustration:[32]

> In this review, the normalisation process has revealed significant divergences of accounting policies and practices which have required extensive adjustment, not just to the 2002/03 base year data but also to other years in order to allow the roll-forward of the Regulatory Asset Values on a basis consistent with the last price control review. Ofgem considers that, in future, it will be important to collect cost data on a more comparable basis from DNOs each year. The proposed timetable for this work is set out in Chapter 2. Each of the DNOs has committed to support and contribute to this project.

In our view, the experience of DPCR4 was very much the 'final straw' in persuading Ofgem that there was a need to address far more completely the capitalisation bias, for which there was now overwhelming evidence.

3.2.3 DPCR5

At DPCR5, Ofgem addressed comprehensively what was then the long standing problem of capitalisation bias. DPCR5 was the final price control for the electricity distribution companies before the introduction of the RIIO framework. However, one should realise that DPCR5 was being executed at the same time as Ofgem was progressing with its RPI-X@20 review (the process through which the existing RIIO framework was designed). Hence DPCR5 already took account of the general direction coming out of this consultation and in many respects, might be interpreted unofficially as a very RIIO-like price control.

Initial consultation paper

The signs that changes should be expected in this area were apparent from Ofgem's very first consultation paper, in which a specific subsection entitled 'Removing distortions' was included.[33]

First, the problem was, again, acknowledged explicitly.[34]

> Different categories of costs are entered into the RAV in different proportions. There is an incentive on DNOs [Distribution Network Operators] to report costs in a way that maximises the amount of costs that can be entered into the RAV (increasing one measure of the business value) and to minimise the value of opex (thereby appearing relatively more efficient). For example, DNOs may seek to maximise RAV by reporting faults costs as asset replacement or indirect costs as direct costs. This may be partially offset by incentives to obtain a sustainable opex allowance going forwards as reporting rules are clarified.

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32 FD para 7.9.

33 Electricity Distribution Price Control Review, Initial consultation document, Ofgem March 2008.

34 Ibid, para 4.26,

Ofgem also specifically identified the potential harm to customers, and signalled that it would 'remove' this problem, rather than seek incomplete remedies as it had before.[35]

> The incentive to capitalise costs may also create a perverse incentive on DNOs to undertake activities that have a higher proportion of capex (such as outsourced activities) where opex might have been more efficient. In DPCR5, we will aim to remove these distortions particularly by reconsidering how costs are categorised and the consequent incentives.

Ofgem also reported on the steps it had taken to ensure that better data was available to it at the price control. Hitherto, Ofgem had not collected data from companies annually, only at price controls. This was addressed during DPCR4, putting Ofgem in a much better position for DPCR5.[36]

> As a direct result of difficulties experienced during DPCR4 in obtaining consistently reported historical levels of expenditure we required DNOs under SLC 52 to report their costs on an annual basis instead of providing these data every five years through the price control review. The cost data is captured now via a regulatory report pack (RRP) which includes both spreadsheet data and a written narrative.

Ofgem was seeking to achieve a range of outcomes through this exercise, but the first in its list of seven was to "develop consistent costs reported at an appropriate level of detail to allow for comparative efficiency analysis at DPCR5."

Ofgem also signalled that it would no longer tolerate any company adopting a 'flexible' approach to its cost reporting. From now on, the guidance would need to be adhered to.[37]

> We have made significant progress to date in terms of identifying and resolving inconsistencies in the cost reporting data. A number of DNOs have raised concerns that in some cases costs have not been reported in accordance with the RRP rules. Ofgem takes compliance with SLC 52 very seriously. The time for "bedding in" of RRP has passed and we will now look to recommend enforcement action to the Authority where we believe costs have not been reported in accordance with the RRP rules.

Ofgem did not reveal in any detail at this stage how it intended to 'remove' the capitalisation bias, but details followed in subsequent consultation papers.

Policy paper

Ofgem published a range of options that could be adopted to address the capitalisation bias in its next consultation paper.[38]

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35 Ibid, para 4.27.

36 Ibid, para 4.28.

37 Ibid, para 4.30.

38 Electricity Distribution Price Control Review, Policy paper, Ofgem December 2008.

Ofgem's thinking was guided by the following logic.

- Certain activities are, to some degree at least, potential substitutes for each other.
- Where there are differential rewards for over/under performing in cost areas that are potential substitutes, there will be an incentive to behave in a less-than-efficient manner.
- Such an incentive should be removed for well understood reasons.
- However, some activities are not substitutes for one another (e.g. head office overhead costs and load related expenditure). For these cost heads, different incentive arrangements could persist without giving rise to perverse incentives to substitute across cost boundaries.

Reflecting on this, Ofgem set out the following three options for consultation:[39]

> We are considering a number of potential options for moving towards more equal incentives:
>
> - We could treat the costs for all activities the same way and capitalise the same percentage of all costs into the RAV. This would remove the costs boundaries and reduce any distortions to the economic trade-offs we are encouraging DNOs to make. It may be appropriate to apply the IQI mechanism to all costs.
> - We could treat all direct costs, engineering indirect costs, networks investment support costs and any constraint payments (e.g. DSM or payments to DG) in the same way. A fixed proportion of all such costs would be allocated to RAV but business support costs would be fully expensed. This may capture the key economic trade-offs and significantly reduce boundaries but there may be some distortions remaining under such an approach.
> - We could identify where the key trade-offs are between activities such as faults and asset replacement and ensure that such costs are included in the RAV using the same fixed percentage. This would reduce but not remove all boundary issues.

Initial Proposals

At the initial proposals[40] stage Ofgem presented an almost final version of its proposals. We set this out in full below, under our coverage of the final proposals.

In respect of the initial proposals, we present only an analysis of capitalisation bias. Ofgem presented a very clear exposition of the problems it had faced (and created) as a result of capitalisation bias at the DPCR4 review.[41]

> The incentives to manage different types of costs under the DPCR4 price control are not equal. These imbalances may distort the decisions that DNOs need to make

39 Ibid, para 4.60.

40 Electricity Distribution Price Control Review, Initial Proposals – Incentives and Obligations, Ofgem August 2009.

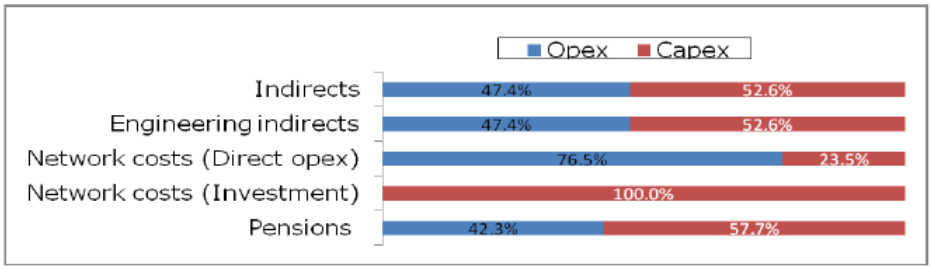
41 Ibid, para 19.1.

> between capex and opex solutions and create boundary issues. DNOs currently bear the full cost of each additional £1 classified as opex but only 29p to 40p for each additional £1 that is capitalised. The diagram below sets out the proportion of costs that are capitalised to RAV for each of the groups of activities under the current cost reporting rules.

We also reproduce below Figure 19.1 from Ofgem's paper, illustrating the tangle of different capitalisation rates, and hence incentive rates, that resulted from the unusual cost categories it was required to use in its DPCR4 benchmarking, and hence in its cost allowances.

Figure 2: Capitalisation rates during DPCR4

Figure 19.1 - Capitalisation of costs for different activities at DPCR4



Source: Ofgem

There was a consensus in the sector that these arrangements could not persist.

Final proposals

In its Final Proposals[42], Ofgem confirmed its approach to removing the capitalisation bias. It decided to adopt the second of the three options detailed above, i.e. all costs apart from business support costs and non-operational capex would be treated identically, passing through its Information Quality Incentive (IQI) mechanism, receiving the exact same incentive rate (company specific, determined by the IQI), and being capitalised into RAV in equal proportion.[43] Business support costs and non-operational capex were to be expensed and subject to a 100% incentive rate.

Business support costs were defined as "CEO costs, finance and regulation, HR, network policy, property, information systems (IS), and insurance."[44] These

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42 Electricity Distribution Price Control Review, Initial Proposals – Incentives and Obligations, Ofgem December 2009.

43 The IQI is a menu-based incentive mechanism that rewards companies not only for outperforming cost allowances, but also for forecasting accurately (and revealing truthfully to the regulator in regulatory proposals) expenditure requirements for the forthcoming regulatory period.

44 Ibid, para 21.9.

costs (which were commonly referred to in the sector, although not in writing, as "evil overheads") were excluded from the equalisation policy as Ofgem:

- wished companies to continue to have the strongest possible incentive to reduce corporate overheads; and
- considered that there was no meaningful prospect of substitution between business support costs and other cost heads.

Non-operational capex in Ofgem's accounting policies is principally comprised of IT and property costs. Ofgem's reasoning for excluding this cost head from equalisation was similar.

For completeness, there were a range of other small cost items also excluded from IQI and given bespoke treatments. In the main these cost items were small, uncertain and targeted at addressing very specific network issues or activities (for example costs arising from a new Traffic Management Act, pensions, expenditure in relation to distributed generation and so forth).

We offer the following further observations on the DPCR5 outcome:

- Ofgem's solution to the problem of capitalisation bias – to treat (almost) all costs in an entirely identical way and to abandon the concepts of "opex" and "capex" – required it to develop a new approach to determining what quantum of cost it would capitalise into the RAB.
  - Its solution was to determine a fixed proportion of cost that would be capitalised and recovered over a number of regulatory periods via a depreciation allowance ("slow money"), with the balance expensed in the year incurred ("fast money").
  - Costs outside the IQI mechanism were all treated as "fast money".
  - The proportion of "slow money" was fixed at 85% for all companies at DPCR5. The logic behind this choice was that it resulted in an overall speed of money that broadly matched that under previous arrangements. This was regarded as the approach apt to create the least disruption to financing plans and the financeability of the companies. (In line with its formal duty to ensure the financeability of companies that it regulates, the effect of this parameter choice was tested explicitly by Ofgem, to ensure all network companies appeared financeable.)
  - One consequence of this approach is that there is that the RAB value in Ofgem's regulatory model is increasingly a financial construct, rather than being causally related to the cost constructing assets as would be understood by an accountant.
- While Ofgem equalised in the treatment of all costs, it persisted with very different treatments in respect of benchmarking, i.e. Ofgem did not rely on totex benchmarking at DPCR5. Instead it relied on a range of approaches to

quantify allowances for "network investment" (principally load and non-load related network investment), "operational activities" (network operating costs, indirect costs closely associated with network costs, business support costs, non-operational capex, work force renewal and traffic management costs). A wide range of methods were used, including regression analysis, survivor modelling, unit cost appraisal and expert review. While a review of the effect of the suite of Ofgem models is beyond the scope of this report, suffice it to note that any unequal appraisal reopens the possibility that companies may have incentives to prefer one type of spend over another.

- The removal of any meaningful concept of opex and capex prompted Ofgem to pursue its activity-based approach to accounting. However Ofgem still felt that it needed to have access to detailed cost reporting for a range of other purposes. These included:
  - to ensure costs were being correctly reported as between controllable and non-controllable costs;
  - being able to monitor how companies allocated overheads between licensees;
  - being able to monitor how the companies allocated costs between their competitive connections business and its other (regulated monopoly) network activities;
  - being able to monitor how companies accounted for customer contributions; and
  - to provide the potential for Ofgem to continue with a richer set of benchmarking possibilities to at price controls. Absent more detailed cost collection, Ofgem would have been left with few options when it came to benchmarking.

  Comprehensive guidance was issued to support this, and these guidance documents have continued to evolve in order to aid clarity and comparability since.
- While Ofgem chose to equalise incentives by passing (almost) all costs through the IQI mechanism, this is not an essential element of Ofgem's totex arrangements. Ofgem could, in principle, abandon the IQI (truth-revelation feature of its incentive scheme) and choose a common incentive rate by some other means without disrupting other aspects of its equalised incentives.

3.2.4 RIIO price controls

Ofgem made only one change to its arrangements relevant to this topic at its RIIO-ED1 price control. This was to expand the coverage of the IQI to include, essentially all costs (i.e. business support costs and non-operational capex were now also passed through the IQI mechanism and capitalised according to simple proportions). The only costs now excluded were certain kinds of pension deficit

repair payments, pass through (non-controllable) costs and some relatively small costs associated with specific work schemes, where Ofgem had a bespoke treatment.

In respect of benchmarking, Ofgem revised its approach from DPCR5, now making use of a multitude of different models, some "totex", some very detailed disaggregated, with widely varying properties. As we noted for DPCR5, while a review of the effect of the suite of Ofgem models is beyond scope, any unequal appraisal reopens the possibility that companies may have incentives to prefer one type of spend over another

For completeness, we also note that Ofgem allowed companies more flexibility around the proportion of totex to be capitalised, requiring companies to propose a ratio in their business plans. Provided sound reasons (including financeability analyses) were put forward to support the company's submission, Ofgem would allow a certain level of variation. The companies were eventually allowed to adopt capitalisation rates ranging between 62% and 80%.[45]

While there were a range of further changes to arrangements, in respect of depreciation lifetimes, the introduction of fast tracking, recalibration of the IQI, further refinement of asset condition monitoring arrangements and many more, none of these changes are related to the main topic of this paper. They should not be regarded as necessary elements of Ofgem's approach to removing capitalisation bias.

We also note that the same approach as described here for RIIO-ED1 was also put in place for gas distribution in RIIO-GD1 and electricity and gas transmission in RIIO-T1. All four energy network sectors then are exposed to the same arrangements.

3.3 Evidence of capex bias

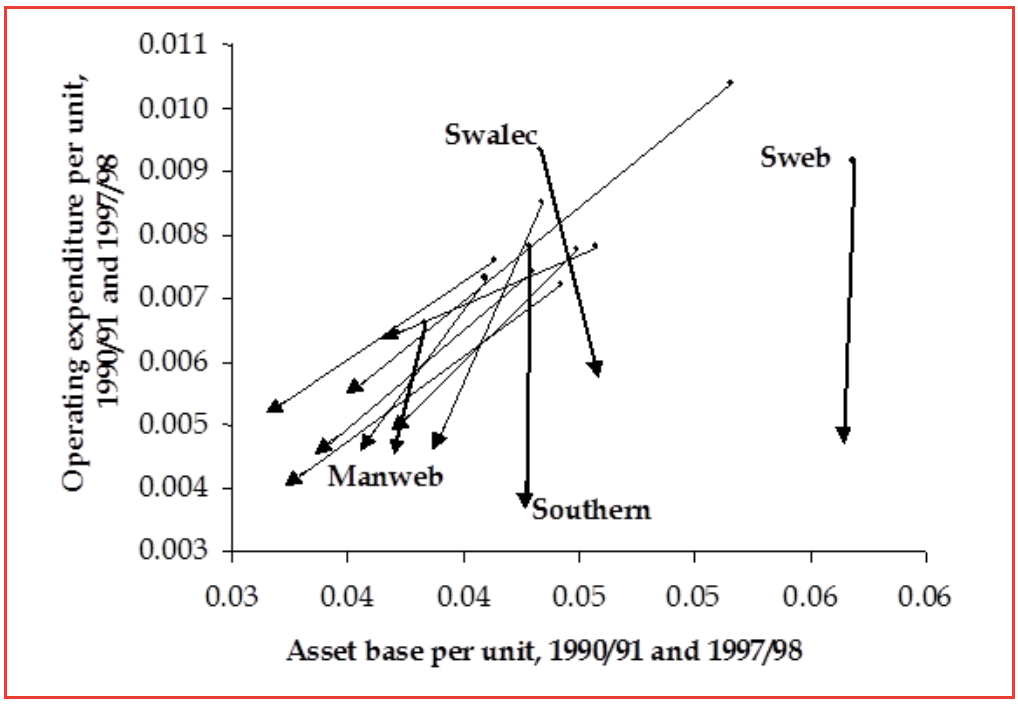
In the section above, where we have reviewed the historical development of Ofgem's present totex arrangements, we have set out numerous examples of the evidence found and presented by Ofgem and others to evidence the existence of a capitalisation bias. It is perhaps unnecessary to demonstrate this point further.

However it may be interesting to see a figure prepared by Frontier Economics circa 18 years ago, as part of work for a regulated electricity distribution network in the run up to DCPR3. The figure below shows a scatter plot of opex per unit and RAV per unit for each of the 12 of the 14 licenced networks (the necessary data

[45] All of these percentages were lower than the 85% level applied to all companies at DPCR5. In part this reflects the effect of brining Business support costs and non-operational capex into the IQI. Also, as we note below at RIIO-ED1 Ofgem changed its assumed depreciation lifetime for new investments from 20 years to 45 years. A lower parameter was therefore necessary to maintain the overall speed of money at historic levels and to ensure financeability.

for the two Scottish firms was unavailable). Points are shown for the 1990-91 year (the first financial year after the companies were vested) and for 1997-98, which was then the latest year for which data was available.

Figure 3: Early Frontier Economics analysis of capitalisation bias in GB



Source: Frontier Economics

Our hypothesis at the time was that:

- all new firms began their life with very material legacies of inefficiency;
- one would expect to see across the board improvements in all areas of performance once proper incentives were established (although it might be that certain types of saving would be achieved more easily or rapidly, one would not necessarily expect proportionally equal savings in all areas);
- Coupled with volume growth over time, one would then expect to see most companies' direction of travel being from the top right of the figure towards the bottom left of the figure.

For many of the companies, this was precisely what was seen. However, there were clearly a number of outliers, where apparently very large reductions in per unit opex were not accompanied by any reduction in per unit asset base. Frontier Economics considered, and argued on behalf of our client, that such companies were engaging in opex/capex substitution so as to maximise regulatory earnings and that Ofgem should take steps to address this. Ofgem did so approximately 10 years later, once it too became convinced of the need to protect customers from the effects of this bias.

Case study 1: Ofgem

3.4 Core elements of arrangements – summary

Ofgem's totex approach then can be considered to contain the following elements.

- **Common treatment of all costs.** Ofgem now treats essentially all costs identically. It therefore applies exactly the same incentive rate to essentially all cost allowances/expenditure. Ofgem monitors expenditure annually and trues up for over/under spend versus totex allowances at its so-called Annual Iteration Process.[46] Simply, there is one allowance for total cost, and while Ofgem collects a wealth of granular data to allow close monitoring, for this purpose it is simply necessary to compare outturn totex with the allowance in each year, and multiply any divergence by the retention (incentive) rate.
- **Capitalisation rate and single totex incentive mechanism**. With opex and capex no longer existing as meaningful concepts, Ofgem needs a way of deciding what costs should be rolled into the RAB. It does this by using a simple, capitalisation parameter that is permitted to vary by company where good reasons are presented, including in respect of financeability. The majority of cost is deemed slow money, and passes into the RAB. The remainder is deemed fast money and is expensed. Any over/underperformance is treated in the same way. It is then not possible to inflate the RAB by substituting capex for opex. Inflating the RAB would require spending more in aggregate than has been allowed, and such overspending would be penalised by the totex incentive mechanism. If there was a belief that the allowed rate of return was very materially above the true WACC, then this could (in principle at least) result in a continued concern in respect of incentives to capitalise in order to inflate RAB. But given the strong incentives applied on totex, and the capitalisation rates, in our view at present this risk is materially mitigated
- **Increased weight on totex benchmarking**. Ofgem is, to a degree at least, alive to the fact that different benchmarking treatments can create biased incentives to favour one cost head over another. In our view, it was the case that during DPCR3 (and perhaps DPCR4) Ofgem had a general view that opex was "bad" and should be benchmarked aggressively (and reductions strongly incentivised), whereas capex was "good" and should be given a lighter-touch scrutiny. This differential benchmarking treatment undoubtedly reinforced incentives to capitalise from different incentive rates. The weight placed on totex benchmarking (at least at ED1 and GD1) will have signalled to the sector that Ofgem wished to limit the extent of any such bias going forward. As a

46 With 8 year price controls, Ofgem's policy now is to calculate performance against incentives annually and to update allowed revenues comprehensively within period in order to avoid large step changes in allowed revenue between price controls. All of these calculations are performed at the Annual Iteration Process, using an agreed and published financial model. See for example: https://www.ofgem.gov.uk/publications-and-updates/riio-ed1-financial-model-following-annual-iteration-process-2016

matter of principle then, it seems appropriate to include increased weight on totex benchmarking as a core part of Ofgem's arrangements.

Going forward, totex benchmarking is, arguably, going to become more important rather than less, in particular in electricity distribution. It seems reasonable to suppose that in future DNOs will have even greater substitution possibilities, from demand side response, storage and other emerging technologies, which may result in these businesses facing a choice between investing in physical assets to add capacity or taking up commercial arrangements to be allowed to interrupt/load-shift customers. Since it will be very difficult for policymakers to pre-empt which of these approaches should best be used where and when, the in-principle ideal is to leave this decision to the companies, with neutral incentives between types of expenditure and a clean incentive to reduce total lifetime costs. Differential incentives on opex and capex would clearly be unhelpful in this context.

- **Activity based accounting**. Whilst Ofgem needs only totex to populate the calculations described above, it also wishes to assure itself that companies are adopting appropriate stewardship policies and undertaking expenditures necessary to sustain the network in all relevant regards. It considers having the ability to compare companies in a granular, disaggregated manner an important element of this. Ofgem has therefore introduced a highly detailed set of accounting guidelines to govern cost reporting by the companies it regulates. Companies report data annually to Ofgem, and following draft submissions Ofgem visits each company to explore any questions and apparent inconsistencies. This provides a wealth of information that could support further analysis.

  Strictly speaking, it is moot whether this disaggregated approach to data collection is necessary in order to address the capitalisation bias or to implement a totex approach. It is possible to conceive of arrangements where considerably less data are collected and where the regulator places little or no focus on disaggregated benchmarking, trusting incentives and totex benchmarking alone. However, Ofgem will need some detail, at least to ensure ring fences between monopoly and competitive activities are being treated appropriately, and to understand issues such as allocations between licences under common ownership, treatment of corporate overheads, and so on. Besides, a cautious regulator might consider that some deeper cost collection than just totex was necessary to ensure that customers were safeguarded sufficiently and that any latent (unforeseen) problems could be identified. While Ofgem's approach is certainly at the detailed (exhaustive) end of the spectrum, we would not criticise Ofgem for this, but raise this point for consideration by AEMC.

Case study 1: Ofgem

3.4.1 Other changes

At the RIIO price control, a wide range of other changes were made by Ofgem, and it persisted in the use of a range of other instruments developed previously, such as the IQI. It is worth noting that none of these changes are essential elements of the arrangements, although some might reasonably be classed as potentially helpful complements.

Potentially helpful complements include Ofgem's quality of service incentives and its approach to asset condition monitoring. One of the concerns often expressed when incentives are equalised is whether the typically resulting increase in incentives to reduce capex will lead to reliability problems that would ultimately be to the detriment of consumers. Countervailing measures such as strong service quality incentive schemes should alleviate these concerns. We note that the regulatory arrangements specified within the NER, like many regulatory regimes around the world, include a service quality incentive mechanism in the form of the Service Target Performance Incentive Scheme (STPIS).

Elements of Ofgem's RIIO regime that are entirely independent of capitalisation bias include Well Justified Business Plans and Fast Tracking, Innovation funding, Stakeholder engagement, Uncertainty Mechanisms, the eight-year duration of price controls, and many of the other incentive schemes introduced (e.g. guaranteed standards of performance). We do not wish to question the relevance or purpose of these wider instruments, and an appraisal is beyond scope here, but our key point is that the AEMC should not consider these elements a necessary part of the Ofgem package to address capitalisation bias.

3.5 Criticism of Ofgem's approach to removing capitalisation bias

Above we have set out a detailed review of every stage of the process that led ultimately to Ofgem's adoption of its present regulatory arrangements. These arrangements address comprehensively the two most critical aspects of more traditional regulatory arrangements that distort choices between opex and capex:

- Differential incentives rates; and
- A desire to grow RAB.

The arrangements are effective and practical and we therefore do not have substantive criticisms of them.

To date, there has been no other criticism of Ofgem's approach in this area. The problems that existed prior to the changes outlined above were clear for all to see, and the need for a remedy agreed upon. Companies, as far as we are aware, supported the move. Certainly no company appealed against these changes, as they are allowed to do under existing merits review arrangements in GB. We are

unaware of any criticism from customer representatives in respect of these changes. Similarly, we have seen no critique of these moves from the academic community.

Further, we also consider that the process of their introduction was well executed. Following the problems that emerged at the DPCR4 review, Ofgem signalled very early that steps would be taken to address comprehensively the capitalisation bias. Ideas on how this could be done we're gathered and tested early with the sector, and from the very outset of DPCR5 the direction of travel was clearly signalled. The supporting work (e.g. change in data reporting etc.) that was necessary to support this move was also identified at an early stage of DPCR5, providing companies time to adapt accordingly. We therefore see no issues with Ofgem's implementation.

If there is a criticism of Ofgem, it is that two price controls elapsed after initial strong evidence of a capitalisation bias emerged before they acted. In our view it is reasonable to assert that Ofgem was reasonably quick to diagnose the problem, but slow to act.

3.6 Evidence that the capex bias has been addressed

It is very hard, in our view, to point to empirical evidence that demonstrates clearly that past behaviours engaged in by companies in response to the capitalisation bias have now stopped. It is not possible, for example, to present a long run analysis of "opex" and "capex", as Ofgem's accounting policies have changed markedly over time (so making fair comparisons over time is not feasible), and now these concepts no longer exist distinctly within Ofgem's regulatory framework. Also, the scope of the businesses has changed over time, with separation from retail and metering leading to one-off changes.

Even if one took the substantial effort to attempt to construct "opex" and "capex" over time adjusting for all these factors, it is unlikely that one would be able to pick out the effect of removing the capitalisation bias from other, larger effects. DPCR5 was the first regulatory period in which the capitalisation bias was dealt with squarely by Ofgem. It was also the period in which, coincidentally, GB DNOs experienced the peak of their asset replacement cycle. Hence "capex" as it would have been understood 20 years previously, increased substantially during DPCR5, but this clearly does not signal any failure to address bias in Ofgem's policy.

Despite this, the theoretical arguments are very clear that the bias has been removed. All costs now demonstrably face the same incentive rate irrespective of their nature. If companies were, under the new arrangements, to continue favouring capex over opex inefficiently, they would be pursuing an irrational, value-destroying strategy (as such an approach would be identified as inefficient and penalised financially). Additionally, there has in the past been a hypothesis that the shareholders of some companies had a strong preference for RAB growth,

such that even under equalised incentive rates there would have been a preference for capex over opex. Under Ofgem's arrangements, there is no way one can inflate RAB by favouring one kind of spend. RAB can only be grown from some given level by spending more than would otherwise be the case, which is unlikely to be attractive given incentive rates are typically above 50%.

As we noted above, it is possible that Ofgem's approach to benchmarking, using detailed disaggregated models, may allow some biases to creep back in. However at its last set of reviews, Ofgem placed weight on totex approaches too, so this effect should not be overstated. Ofgem has also, so far, sent no signals as to how it will conduct benchmarking at the RIIO-2 controls, so it would be a bold decision for any company to capitalise inefficiently now in anticipation of some particular benchmarking model prevailing at RIIO-2.

3.7 Summary appraisal

In the table below, we provide a summary view of the extent to which the Ofgem regime addresses certain potential drivers of capex bias.

Table 5: Frontier Economics' assessment of Ofgem's prevailing regulatory method

Capex bias driver	Assessment
Regulatory incentives for outperformance	Ofgem's method provides for total equalisation of incentives to outperform across all cost heads.
Allowed return on RAB	Under Ofgem's regime there is no way to inflate RAB, other than simply spending inefficiently more in total. A proportion of this overspend would be capitalised and would be in receipt of the margin between allowed returns and the true cost of capital. Given capitalisation rates and incentive rates on totex, the risk of any party following this strategy is well mitigated.
Approach to cost assessment	While totex benchmarking did play a role at the most recent RIIO reviews (in particular ED1 and GD1), Ofgem has also relied on a range of other techniques, including disaggregated modelling. As noted above, it is possible that this gives rise to unintended incentives, but given the complexity of the modelling, careful study would be needed to understand these incentives in full. Also, given that Ofgem has yet to commit to any particular method of cost assessment for future reviews, it is not obvious that any company will act on incentives created by past benchmarking studies.
Financing and ownership	RAB growth is addressed above. In principle, Ofgem's approach of allowing company flexibility in respect of capitalisation rates may support financeability in the sector.
Company culture and skillset	It is not obvious that companies have failed to adapt to the new arrangements, or that they lack any relevant skillsets.
Risk of failure and penalties	There are stringent technical standards imposed on all energy networks, to ensure the safe conveyance of energy. All GB energy companies continue to be bound by these and face serious consequences should they be breached. Within the context of this high standard, companies are free to compete on the basis of their overall efficiency. Where there is a question as to the appropriate balance between cost saving and the provision of reliability, explicit incentive

	schemes are in place to devolve this decision to the companies.
Control of assets	There is a rich diversity of in-source/out-source business models adopted by energy companies in GB. All companies make use of sub-contractors for at least some proportion of their activity, and some place a heavy reliance on delivery partners. Some companies will let long running framework contracts covering the provision of large labour pools, while others will be for the delivery of specific pieces of infrastructure and/or programmes. Companies will also subcontract elements of their work, e.g. civils, excavation, reinstatement. This diversity of models pre-dated the introduction of totex arrangements, and has also survived their introduction.

Source: Frontier Economics

Case study 1: Ofgem

4 Case study 2: Ofwat

Box 4: Summary of this chapter

Prior to the 2014 price control (PR14) the water regulator in England & Wales, Ofwat, had applied a regulatory methodology that treated opex and capex separately. Using a similar methodology to that applied by Ofgem for the energy networks, Ofwat determined an efficient allowance for opex for each company that was funded through the annual revenue allowance. Ofwat also determined an allowance for efficient capex. This was added to the Regulatory Asset Base (RAB) and funded through the annual revenue allowance in the form of a return on the RAB and a depreciation allowance.

In the run-up to the 2014 price control there was a growing recognition within Ofwat and the government of the importance of a 'capex bias' in the sector. Following a consultation on the issue, Ofwat concluded that there was general support for the view that there was a 'capex bias' in the sector. Ofwat also concluded that there was a range of factors behind the bias. Some of these factors were linked to the regulatory methodology (differences in regulatory incentives or 'aiming up' on the allowed cost of capital), while other factors were more general (company cultural in favour of capex projects, linked to a penalty only approach to environmental standards).

Based on these findings, and reflecting the experience of Ofgem, Ofwat decided to apply totex approach at PR14. The main features of the Ofwat approach were as follows.

- Approach to setting totex allowance. Ofwat used a new set of totex benchmarking models to set an efficient totex allowance for each company for the five year period. Capex data was smoothed over five years to reflect the 'lumpy' nature of capex projects. This replaced the separate opex and capex benchmarking models used previously.
- Recovery of allowed expenditure. The totex allowance was recovered through allowed revenue in two routes. First, a proportion of the totex was included in the annual revenue allowance, this proportion was referred to as the Pay-As-You-Go (PAYG) rate and was proposed by the companies in their plans and submit to review by Ofwat. Second, the remainder of totex was added to the RAB and then earned a return and a depreciation allowance. Again the asset life to generate the depreciation charge was proposed by the company.
- Reconciliation of actual and allowed expenditure. The adjustment for variations between allowed and actual spending was through a totex 'menu'. This set a single incentive rate (in practice around 50%) for the share of any saving retained by the company.

As in the energy sector it is relatively early to assess the impact of the totex method on capex bias. Nevertheless, the totex method has addressed at least some of the factors identified by Ofwat as lying behind the bias. It has addressed the differential regulatory incentives between opex and capex. If there remains any 'aiming up' in the cost of capital then this should no longer affect capex and opex decisions (though it may still affect decisions around PAYG rates). A company culture in favour of capex may take longer to change, although there are indications that the totex method has started to affect this.

4.1 Introduction

In this section we provide a detailed review of Ofwat's totex arrangements. We address the following:

- the background to the introduction of a totex approach in the water sector and the extent to which Ofwat was influenced by Ofgem;

- evidence relating to the 'capex bias' in the water sector;
- a description of the core elements of Ofwat's totex framework;
- consideration of other, related, elements of the regulatory framework; and
- an assessment of the impact of Ofwat's move to a totex approach.

4.2 Background to the introduction of a totex framework

As outlined in more detail below the 2009 price control review in the England & Wales water sector (PR09) was conducted using a regulatory methodology that treated opex and capex separately.

Following the completion of the price control the government established an independent review, undertaken by David Gray. The Terms of Reference for the review were to "assess whether the existing arrangements are fit for purpose in the light of the future challenges the sector faces and to recommend changes where appropriate." The review report[47] made a wide range of recommendations relating to the Ofwat regulatory regime and customer representation in the sector.

One focus for the review was the perceived bias towards capital investment in the sector. The report stated as follows:[48]

> Many respondents argued that the companies have an incentive to pursue capital investment schemes, rather than potential alternatives, in order to enjoy the long-term return on the resulting addition to Regulatory Capital Value (RCV). The companies generally accept there is some truth to that view but also express a concern that they cannot rely on not being penalised for inefficiency if they choose solutions involving operating costs rather than investment – therefore they tend to prefer to invest.
>
> The review team considers that the evidence of a bias towards capital investment is convincing, (not least in that several companies clearly perceive there to be one and this is a self-fulfilling belief), that a wider behavioural issue plays a part and that such a bias is undesirable […].As discussed […] the companies seem very Ofwat-dependent and risk-averse. Ofwat, in turn, effectively controls their investment programmes down to quite a small level of materiality. The risk-averse approach is therefore always to go for an investment solution because it can be defined clearly and approved by Ofwat.

47 Gray, 2011, Review of Ofwat and customer representation in the water sector.

48 Gray, 2011, Review of Ofwat and customer representation in the water sector, p.54

To address this issue, the review favoured the introduction of a totex approach, as had recently been introduced by Ofgem for the energy networks:[49]

> Other regulators have considered this issue and have in general also concluded that equalising the strength of separate incentives for operating and capital costs is too difficult to achieve in practice. Ofgem, in particular, considered this question in its recent review of network regulation in the energy sector (RIIO) and concluded that it should adopt an approach which combined the treatment of operating and capital costs, capitalising a fixed percentage of total costs and thereby equalising the incentive effects. This has the disadvantage of removing the direct link between actual capital expenditure and the RCV but Ofgem concluded that this was outweighed by the benefits of equalisation of incentive strength.
>
> This is a highly technical area in which it is clearly for Ofwat to decide on the appropriate approach. However, the review team's assessment is that this issue is both real and important and that the Ofgem approach as set out in RIIO appears to have considerable attractions.

Ofwat then considered the issue as part of its consultation into the methodology for PR14. This consultation was the Future Price Limits programme (undertaken between 2010 and 2012) and Ofwat proposed the introduction of a totex approach, again referencing the previous decisions by Ofgem:[50]

> We categorise expenditure in two ways.
>
> We define capital expenditure (or capex) as the renovation, renewal and enhancement of the above- and below-ground assets that each company uses to provide services to existing and future customers and the community. The costs for capex are usually recovered over the useful life of the capital through depreciation and through the companies earning a return on capital. […]
>
> Operating expenditure (or opex) covers all of the day-to-day activities that each company carries out to deliver services to its customers. Opex is recovered in the year in which it is spent.
>
> A total expenditure, or totex, approach considers expenditure in a more holistic way. This means looking at a total expenditure requirement rather than separate opex and capex allowances. We would look at total expenditure when considering cost assessment and efficiency challenges, and we would apply incentives to total expenditure. [...]
>
> We are also considering changing our approach to cost recovery by determining up front what proportion of total expenditure is recovered in the year it is spent and what proportion is recovered over a longer period. Ofgem has applied this approach in its RIIO framework.

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49 Gray, 2011, Review of Ofwat and customer representation in the water sector, p.56.

50 Ofwat, 2011, *Future price limits – a consultation on the framework*, p.48.

This proposal was then confirmed in the final methodology statement for PR14:[51]

> We have decided to confirm our consultation proposals, and will implement a **totex based approach** to assessing efficient expenditure for the next price review. We are making this change to move to a totex approach because assessing operating and capital expenditure separately can lead to different incentives for companies to deliver operating and capital efficiency savings, and might contribute to a bias towards capital intensive business solutions and expenditures.

The approach adopted by Ofwat was informed and influenced by the RIIO framework introduced by Ofgem. There is no indication that Ofwat considered the actual impact that the Ofgem approach had on the regulated energy networks. The main lessons that Ofwat would have taken from the Ofgem experience were practical insights around the implementation of a totex approach, rather than lessons relating to its impact and success.

In the sections below we describe the evidence for capex bias that prompted the shift to a totex methodology and outline the details of the totex method that Ofwat used at PR14.

4.3 Evidence for capex bias

As explained above, following the 2009 price control Ofwat undertook an assessment of the extent of capex bias in the sector. The main conclusions of the paper were as follows.

4.3.1 The evidence pointed to a capex bias but Ofwat was not able to quantify the impact

Ofwat considered a range of qualitative and quantitative evidence on the potential capex bias. The majority of stakeholders supported the existence of a capex bias, although many of the companies considered that their own decisions were not affected by capex bias.

Ofwat considered a range of data to test the existence of a bias but concluded that the evidence was inconclusive due to the difficulties in establishing an appropriate counter-factual. At the same time Ofwat identified the following relevant factors:

- The data illustrated that companies had achieved high rates of outperformance (i.e. delivered the enhancement projects for materially less than the allowed expenditure) on capex enhancement projects. This was consistent with a capex bias at the business planning stage, where the company has a preference for capex solutions over opex solutions because it is easier to out-perform the cost assumptions. Once the allowance was set, at the delivery stage, efficiency

[51] Ofwat, 2013, *Setting price controls for 2015-20 – final methodology and expectations for companies business plans*, p.18

incentives tended to outweigh the RAV return effect in relation to *enhancement capex* (new projects aimed at improving services). This is because these are bespoke schemes around which there is a greater information asymmetry, so companies would find it easier to pad the costings and then outperform. For *base capex* where there was better benchmarking, it was harder to pad forecasts and companies appeared to have a tendency to substitute from opex into base capex (ie efficiency incentives did not outweigh the RAV return effect);

- Opex outperformance rates varied across companies, which Ofwat considered could reflect differences in company culture (though recognising that there could be other explanations); and
- Evidence from the recent price control period of material transfers by Ofwat of companies' expenditure data from capex expenditure categories into opex expenditure categories. This means that Ofwat had assessed that companies had recorded expenditure as capex which it considered would be more accurately assessed as opex. Ofwat considered the extent of these transfers to be evidence of a capex bias in companies' capitalisation policies.

Overall, these factors were considered to be supportive of the qualitative evidence on the existence of the capex bias.

4.3.2 Regulatory methodology could drive capex bias

Ofwat identified a number of features of the regulatory methodology that could drive the capex bias.

- Regulatory incentives for outperformance (i.e. underspending the allowance) – the separate treatment of opex and capex in the regulatory method could provide differential incentives to outperform the regulatory allowance.
- Allowed return on Regulatory Asset Base – the tendency of regulators (including Ofwat) to 'aim up' and set the allowed return on RAB towards the top of the estimated range provides an incentive to grow the RAB and therefore focus on capex solutions[52].
- Approach to cost assessment – the methods used by Ofwat to set the separate allowances for opex and capex may encourage a company focus on capex. This

52 Historically one of the core justifications for 'aiming up' was a concern that the 'true' WACC is not estimated with certainty and if the true WACC was above the allowed WACC then companies would under-investment and that this would be more detrimental for customers than the risk of over-investment. This would be consistent with the existence of a capex bias but would imply that the capex bias was a preferred outcome. In practice the rationale for 'aiming up' was more nuanced and reflected factors such as the design of the regulatory appeals process in the UK and the desire of regulators' in the early days of privatisation to build credibility and confidence with investors. Once investors are confident around the regulatory regime they are more likely to respond to 'aiming up' with a bias towards capex. This is consistent with the emergence of capex bias as a concern over time, it was not identified as a concern in the first 10-15 years after privatisation.

is because Ofwat applied more robust benchmarking to opex and the greater information asymmetry for capex made it easier for companies to get capex projects accepted in their business plans.

4.3.3 Other features that could drive capex bias

At the same time Ofwat identified that there were factors other than the regulatory methodology that could drive a capex bias.

- Financing and ownership – there was a view that some investors had a preference for RAB growth over short-term financial outperformance, and that this preference was linked to, but wider than, any 'aiming up' in the allowed return.
- Company culture and skillset – it was noted that companies' cultures were generally based on an engineering mindset that favoured capex solutions. It was also observed that opex and capex tended to have separate management structures that could introduce biases. This was clearly a qualitative assessment by Ofwat, based on its knowledge of the industry.
- Risk of failure and penalties – the industry operations were built around minimum standards and penalties (generally set by the quality regulators). Ofwat felt that this led to risk-averse behaviours on the part of the businesses, and a focus on capex solutions to minimise the likelihood of breaches of standards.
- Control of assets – related to the above was a perceived preference for companies to control assets rather than contract with third parties for the provision of services.

Overall Ofwat concluded that the drivers for any bias were complex and not just focussed on regulatory incentives. As a result a range of different options to deal with the bias were identified – covering regulatory and company behaviours.

4.4 Core elements of the totex framework

In this part we describe the main elements of the totex framework that Ofwat introduced at PR14. We cover:

- the assessment of allowed expenditure;
- the method for the recovery of expenditure; and
- the method of adjusting based on differences between actual and allowed expenditures.

4.4.1 Assessment of allowed expenditure

Pre-PR14 price controls

The approach to determining the cost allowances had evolved since privatisation in 1989. However, the system employed in PR09, which is described below, was in the core elements the same as that used in earlier price controls.

Then, as now, the cost allowance was determined separately for water and wastewater services. At PR09 the cost allowance was divided into the following categories:

- operating costs;
- infrastructure[53] maintenance;
- non-infrastructure maintenance;
- infrastructure enhancement[54]; and
- non-infrastructure enhancement.

The allowance for each of these categories was calculated by Ofwat as follows:

- for operating costs and maintenance capital expenditure (to be recovered within each price control period) the allowance was based on the current level of expenditure by each company adjusted by an efficiency target estimated by Ofwat; and
- for enhancement capex (to be recovered over a number of price control periods) the allowance was based on the business plans submitted by each of the companies adjusted to remove specific projects that Ofwat did not approve, and then adjusted by an efficiency target.

Separate efficiency targets were set for each category and these were based on benchmarking analysis undertaken by Ofwat. The benchmarking methods were as follows.

- Operating costs. Separate regression benchmarking models were estimated for sub-service operating costs.[55] For example, for the water service there were separate models for resource & treatment opex, distribution opex, power expenditure and business services opex. Efficiency targets were set so that

53 Infrastructure refers to all of the below-ground assets (i.e. pipes and service reservoirs). Non-infrastructure refers to above ground assets (i.e. treatment works).

54 Enhancement expenditure related to improvements in service levels, divided into growth (meeting new demand), quality (improved drinking water or environmental quality) and security of supply (more resilient services).

55 Ofwat used cross-sectional Corrected Ordinary Least Squares (COLS) benchmarking analysis for this purpose.

each company would close 60% of the gap from their current level to the efficiency frontier by the end of the five year regulatory period.

- Maintenance costs. The maintenance expenditure allowance was based on qualitative benchmarking of the maintenance planning models used by the companies. An industry standard for maintenance planning had been established and companies were judged as to how well their processes and information met the standard. The score was used to determine how much of the difference between current expenditure levels and business plan proposals[56] would be included in the allowance. The allowance also reflected the cost efficiency of the company as measured by the cost base analysis (see below).
- Enhancement expenditure. The efficiency targets for enhancement expenditure were based on the cost base submission. Ofwat asked companies to submit cost estimates for around 50 standard capital projects. These estimates were reviewed by an engineering auditor (known as a 'reporter') on Ofwat's behalf. Efficiency targets were calculated so that companies would converge to upper-quartile levels of efficiency as calculated by the cost base.

This approach to setting expenditure allowances had been criticised for its complexity and resource requirements. The separate modelling of different cost categories also introduced the risk of biases between different expenditure types. Ofwat had included cross-checks in its approach. For example, it tested whether companies that were assessed at the efficient frontier in the opex models were not very inefficient in the capex benchmarking (and vice versa). This would be seen as evidence of substitution between opex and capex (either in choice of projects or classification of expenditure) and Ofwat would then ignore this company in terms of setting the benchmark.

PR14 price control

For PR14 Ofwat introduced a totex benchmarking approach as the basis for setting totex cost allowances. The main features of Ofwat's benchmarking were as follows.

- **Data.** Ofwat collected a dataset specifically for the cost assessment. Annual data were collected going back a number of years to enable assessment of efficiency over a number of years using a panel data approach. Ofwat considered different potential lengths for the panel but settled on a five year period for the water models. With 18 companies in total, this provided a sample size of 90.

[56] The business plan proposals were always above current levels of activity.

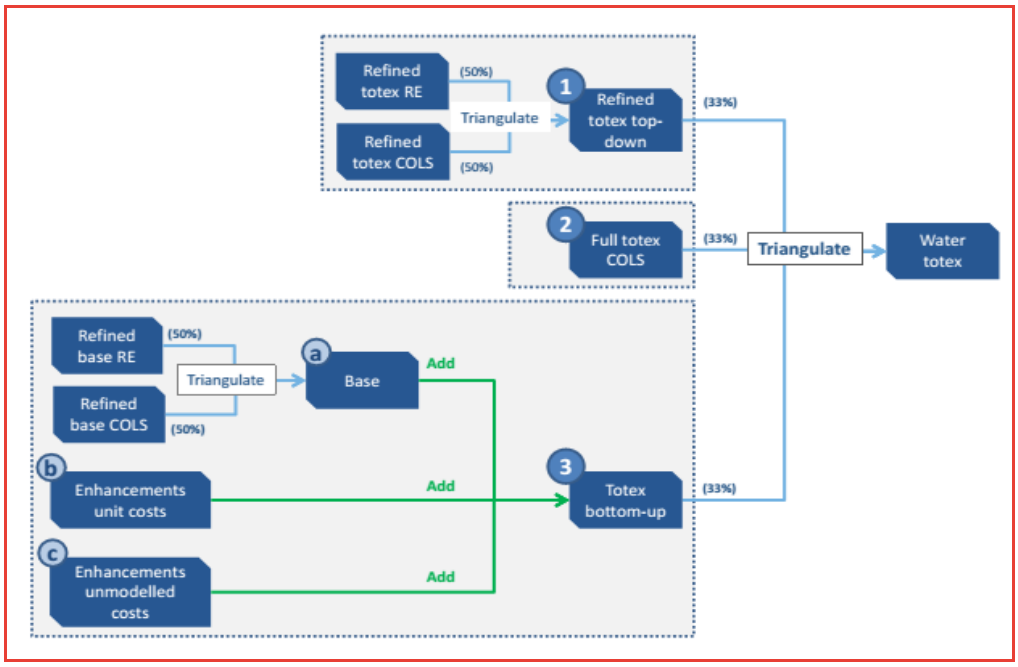
- **Costs definition.** Ofwat considered two definitions of total expenditure; one included enhancement expenditure (this was referred to as totex) and one excluding enhancement expenditure (this was referred to as base totex, or botex[57]). Ofwat did not consider an approach based on capital costs (i.e. using depreciation allowances to represent capex needs) but only used capital expenditure.[58] To address potential 'lumpiness' in capital expenditure the figure for each year was calculated as a five year rolling average. Finally, some expenditures, typically those associated with new policy requirements, were excluded from the modelling.
- **Explanatory variables.** Ofwat collected data on a range of explanatory variables (identified on engineering and operational considerations). Two approaches were adopted: a 'full model' was estimated that included all theoretical models (regardless of statistical significance) and 'refined models' which only included statistically significant results.
- **Functional forms and estimation methods.** Ofwat considered different functional forms (Cobb-Douglas and translog) and different estimation methods (Ordinary Least Squares, Generalised Least Squares, fixed and random effects).
- **Model selection.** A shortlist of ten possible models was selected for both water and wastewater. From these ten a set of five models were chosen to be used to set the expenditure allowance.

An example of this is shown in Figure 4 below. Ofwat referred to this as 'triangulation' as ultimately three different approaches were each given a one-third weight.

57 Therefore, base totex includes operating expenditure for existing levels of service and the capital expenditure on the maintenance of existing assets.

58 There are a number of ways to account for capital expenditure within a benchmarking analysis. One approach is the so-called 'user cost of capital' approach, where capital expenditure is proxied by the sum of the regulatory return on and return of capital. Another approach is to use a rolling average of capex. Both approaches seek to provide a smoothed measure of capex that can be combined with opex to construct an overall totex measure.

Figure 4: Ofwat cost assessment – water service



Source: Ofwat

One strand of the triangulation was refined totex models. This was based on the average of a refined COLS model and a refined random effects (RE) model. The second strand was a COLS model with all the variables included (the 'full' model). The third strand was based on base totex models (average of refined COLS and RE models) with separate modelling of enhancement expenditure (based on unit cost models)[59].

To use this modelling approach to generate totex allowances, the following additional steps were taken.

- The models were used to generate projected totex for each company for the PR14 period, using projections of explanatory variables generated by Ofwat's engineering advisers.
- Ofwat calculated the difference between average efficiency and upper quartile efficiency in the modelling, which was a gap of around 6.5%.
- This efficiency challenge was applied to all companies' projected totex for the PR14 period.
- Excluded expenditures and special factor adjustments (i.e. allowances for factors that affected companies' costs that were not accounted for in the

[59] Ofwat identified simple unit cost regression models for categories of enhancement expenditure where the enhancement costs were explained by single cost drivers. For example, enhancement expenditure on lead reduction was explained in terms of the number of lead communication pipes replacement. The unit costs were then projected forwards using a forecast of future activity to generate the enhancement spend in that category.

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benchmarking analyses) were then added to the totex allowance. Companies could claim special factor adjustments for legitimate cost drivers that were not captured, or not fully captured, in the Ofwat totex modelling. Ofwat applied a set of criteria that these claims needed to pass before an adjustment was made.

There was then a final adjustment to the totex allowance to reflect the company's choice from the 'totex menu' (see discussion below). In practice this was a minor adjustment and is explained in more detail in the next section.

Bristol Water was the only company that did not accept the PR14 determination and its appeal was referred by Ofwat to the Competition and Markets Authority (CMA) for determination.[60] In its submissions Bristol Water made a range of criticisms of the benchmarking. The CMA, in its report[61], made a number of findings in relation to Ofwat's totex benchmarking.

- **Totex definition.** The CMA was broadly supportive of totex benchmarking but considered that the Ofwat models did not include explanatory variables for enhancement expenditure and therefore the focus should be on base totex models.
- **Lack of disaggregated models.** Although the CMA was supportive of totex models it also concluded that it would be better to also consider evidence from disaggregated models (either separating opex from capex, or separating different business functions). The CMA recognised that this could introduce distortions between, say, opex and capex but considered that disaggregated models had offsetting benefits in terms of the range of cost drivers that could be included.
- **Timing of investment needs.** Despite the fact that Ofwat had used five year rolling averages for capex, the CMA considered that this did not account fully for the potential 'lumpiness' of capital expenditure needs.[62] The CMA's preference for base totex models (i.e. that excluded enhancement spend) was partly motivated by the fact that base totex should be less 'lumpy' than enhancement spend.
- **Other concerns.** The CMA raised other concerns including the use of the translog functional form, the inclusion of endogenous cost drivers and potential missing cost drivers.

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60 The CMA conducts merits based reviews of decisions made by a number of UK regulators.

61 CMA, 2015, *Bristol Water plc, A reference under Section 12(3)(a) of the Water Industry Act 1991*.

62 Unlike Ofwat, Ofgem did not (at RIIO ED1) seek to smooth capex (by computing a rolling average measure of capex) when implementing its totex benchmarking model. This is because it there was some evidence that the investment cycles of the DNOs it was benchmarking were roughly in synch, so the lumpiness of capex was unlikely to distort estimates of totex efficiency. See Frontier Economics, Total cost benchmarking at RIIO-ED1 – Phase 2 report – Volume 2, May 2013, section 3.

In spite of these material reservations around Ofwat's totex benchmarking, the CMA was at pains to point out that no benchmarking approach is perfect. It stated:

> The fact that we identified concerns with Ofwat's models does not, on its own, dictate whether or not these models should be used for cost assessment. No benchmarking analysis will be perfect and there will always be vulnerabilities and limitations in any approach.

The CMA developed its own totex models to use in the determination.[63] The timeframe of the appeal meant that it had to rely on the Ofwat dataset and was not able to consider disaggregated models or other alternatives. It developed a set of base totex models that each used a smaller number of explanatory variables (but all with statistically significant and intuitive results) and involved the simpler Cobb-Douglas rather than the translog functional form.

The key point is that Ofwat faced challenges in developing a totex benchmarking approach, and these were reflected in the findings of the CMA.

The concern around the timing of investment needs remained. Two options for addressing this could have been considered but the CMA did not have the timeframe to undertake the additional data collection.

- First, extend the time series further back in time. The Ofwat models were based on a five year dataset and the capex figure in each year was an average of the previous five years' capex. Therefore this required nine years of data on capital expenditure. A longer averaging period would reduce the impact of 'lumpy' capital projects but would undermine the efficiency assessment by relying on increasingly out of date information.
- Second, switch from total expenditure to total cost method, where the capex component is assessed through depreciation charges rather than actual spend. The use of charges rather than spend addresses the 'lumpiness' issue but it relies on accurate and comparable depreciation assumptions. In the case of the water sector the depreciation charge data would be sensitive to variations in asset life assumptions between the companies.

Ultimately there is a balancing exercise between the pros and cons of the different options for dealing with 'lumpy' capex projects. Part of the balancing exercise is through the method for setting the benchmark. In other words the choice of an upper quartile benchmark (rather than the frontier) may reflect a view that the companies at the frontier may have benefitted from below average capex needs in the sample period.

63 Unlike Australia's merits review body (the Australian Competition Tribunal), for water sector appeals the CMA conducts de novo reviews of regulatory decisions that involves the CMA undertaking its own analysis to inform its decision.

4.4.2 Recovery of expenditure

The next element of the totex framework that we consider is the method for recovering the totex allowance through the price setting process.

Pre-PR14 price control

Before PR14, the methodology for the recovery of allowed expenditure was as follows.

- Allowed operating costs were recovered from price limits in the year they were expected to be incurred, i.e. they were expensed.
- Allowed capital expenditure was recovered through a mix of depreciation allowances and a return on capital on the Regulatory Asset Base (RAB). The methodology aimed to set depreciation allowances in line with medium-term projections of maintenance capex. Enhancement capex was added to the RAB, earning a return and additional depreciation allowances in the future.

In terms of the depreciation allowances, infrastructure assets were not depreciated in the normal sense. Instead, they were subject to an infrastructure renewals accounting rule introduced in 1989. Under this method the infrastructure network was treated as a single asset system to be maintained in perpetuity rather than as a collection of individual assets each with its own life and maintenance requirements. Infrastructure Renewals Expenditure (IRE) was capitalised (i.e. added to the RAB) as it was incurred and attracted a return on capital. An annual charge, the Infrastructure Renewals Charge (IRC) was included in the assessment of allowed revenue for the annualised costs of maintaining the operating capability of the infrastructure asset. The IRC was equivalent to a depreciation charge and was subtracted from the RAB. On average IRE was expected to be equal to the IRC and therefore the RAB was not expected to increase as a result of infrastructure maintenance.

For non-infrastructure (above ground) assets, in PR09 Ofwat required companies to calculate the forecast Current Cost Depreciation (CCD) on those assets for the years from 2007-08 to 2019-20. It required calculation of CCD separately on:

- Assets existing at 31 March 2008 and the capital investment after that date to maintain serviceability at that date. This capital investment was referred to as Maintenance Non-Infrastructure (MNI). The CCD on these was referred to as CCD on base service provision.
- Capital investment after 31 March 2008 to enhance serviceability. The capital investment was called Enhancement Non-Infrastructure (ENI) and the CCD on it was referred to as CCD on enhancements.

CCD was calculated using the Modern Equivalent Asset Valuations (MEAVs) of assets rather than using the historical or book costs values. The CCD was interpreted as the annual charge that wrote the MEAV of the non-infrastructure

assets down to zero, to reflect the reduction in value due to usage, passage of time, wear and tear, technological obsolescence, depletion or other such factors.

The period over which an asset was written down to zero was referred to as the 'asset life'. Not all assets had the same asset life. Computer hardware and other IT assets have a short life and either lose value quickly by being superseded or are used beyond a repairable state within a short period. Buildings and other concrete structures, while still deteriorating assets, last longer and hence have a longer expected asset life. Electrical and mechanical plant and machinery were expected to have lives of medium-length.

The opening RAB (or Regulatory Capital Value (RCV) as it is referred to in the England & Wales water sector) was rolled forward by investment minus allowed depreciation, with the RCV indexed by RPI inflation.

Therefore, the evolution of the RCV in England & Wales followed the formula:

$$RCV_{t+1} = [RCV_t + \text{Maintenance-Investment}_t + \text{Enhancement-Investment}_t - \text{Allowed-Depreciation}_t[64] - \text{Grants \& contributions}_t - \text{Outperformance of regulatory assumptions}_t] \times [1 + \text{RPI-inflation}_t]$$

Therefore the RCV included the additional capital expenditure undertaken by the company in the period net of the depreciation allowances funded through price limits. Ofwat then set price limits so that the companies could, if operating efficiently, earn a reasonable rate of profit on the RCV. This reasonable rate of profit was set with reference to an estimate of the real Weighted Average Cost of Capital (WACC).

PR14 price control

At PR14, Ofwat changed its methodology and dropped the distinction between infrastructure and non-infrastructure assets. This was tied-in with the shift from an 'opex and capex' approach to price setting to a 'totex' approach. The main elements of the PR14 approach were the following:

- **Retention of building block approach.** Prior to PR14 the allowed revenue was calculated using a 'building block' revenue model. The main building blocks were the opex allowance, the depreciation allowance and the profit allowance (which was RAB multiplied by the allowed WACC). At PR14 Ofwat retained the logic of the building block model but adjusted the components to fit within a totex approach.
- **Pay-as-you-go (PAYG) rate**. This was the proportion of total expenditure that was 'expensed' in price limits and effectively replaced opex within Ofwat's building block framework. This is also referred to as 'fast money'. The PAYG rate was proposed by companies in their business plans. The remainder of

64 Including CCD and IRC.

totex (i.e. 1 – PAYG rate applied to the level of totex) was treated as if it was capex; it was added to the RCV and depreciated, and was therefore viewed as 'slow money'. The overall depreciation allowance in the building block was replaced by two components: the existing RCV run-off rate and the depreciation on new assets.

- **Existing RCV run-off**. The capital charge on the opening RCV was expressed as a % run-off rate. This replaced the CCD on existing assets in the old building block method. The RCV run-off rate was proposed by each company in its business plan.
- **Asset life for new assets**. The capital charge on RCV additions (i.e. totex multiplied by 1-PAYG rate) was based on a single composite asset life. This composite asset life was proposed by companies in their business plans.

Ofwat asked companies to justify the value of these parameters in their business plans. It expected companies to base the values on those that would have been derived from the PR09 methodology. In other words:

- The PAYG rate multiplied by totex would be equal to the expected level of opex[65];
- The RCV run-off rate multiplied by the RCV would be equal to the depreciation of existing assets (i.e. CCD on above ground assets plus IRC on below ground assets); and
- The asset life to be applied to new assets would be equal to a weighted average asset life based on different categories of asset types (i.e. short, medium, long, very long lived assets).

Ofwat permitted companies to propose values that differed from these 'natural levels', provided that the variation were justified in terms of financeability or affordability considerations. For example a company could argue for a higher PAYG rate if it would lead to an improved financeability position, provided that the impact on customer affordability was considered properly.[66] Ofwat provided guidance on how financeability should be assessed in terms of the credit metrics that should be considered (i.e. cash interest cover and gearing levels) and how they should be measured (i.e. using notional rather than actual gearing). Ofwat did not provide detailed guidance on how the results of the financeability assessment should feed into the determination of these values. The general position was that

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65 This could reflect projected levels of opex and capex to reflect any structural shifts in expenditure needs compared to previous levels.

66 The credit rating agencies indicated that the changes could enhance the flexibility of the companies to manager short-term financing pressures. At the same time Moody's decided that it would adjust the calculation of its core metric, adjusted interest cover ratio (AICR), to remove the impact of the company's choice of 'speed of money' (see Moody's, *2015 Industry Outlook, UK Water Sector: Stable outlook despite challenging price review*.)

if there was no financeability concern then the natural levels should be used and that if there was a financeability concern then it was better to adjust these values rather than propose other solutions that would involve customers paying more (in NPV terms).

Ofwat made adjustments to the values in the plans if it considered the justifications were insufficient. In practice Ofwat did not make significant adjustments. It focussed on the overall trend in the RCV, looking for companies where the RCV was growing materially in real terms (indicating that the company was keeping customer bills lower in the short-term at the expense of higher bills in the future) or the RCV was falling materially (indicating that the company was keeping bills higher in the short-term to support financeability). This approach gave companies scope to flex the individual components provided that the overall balance was reasonable. The Ofwat adjustments, where made, were focussed in the PAYG rate rather than the other two components.

As with the pre-PR14 methodology Ofwat then set price limits so that the companies could earn a rate of profit on the RCV that reflected the estimate of the WACC.

Overall the move from a more traditional depreciation approach to the new methodology did not raise material concerns from companies or stakeholders. In part this could be explained by the fact that the way it was implemented by the companies and Ofwat meant that the outcome did not differ significantly from the previous method.

4.4.3 Expenditure incentive mechanisms – adjusting for actual compared to allowed expenditure

The third element of the totex methodology was in relation to incentive mechanisms, which make adjustments to allowed revenues in future price controls to reflect differences between allowed and actual expenditures.

Pre-PR14 price control

At PR09 Ofwat had two expenditure incentive mechanisms: one for operating costs and one for capital expenditure.

The opex mechanism was designed to ensure that companies retained the benefit of any underspend for a period of five years. This was referred to as the 'opex rolling mechanism', and was very similar to the AER's Efficiency Benefit Sharing Scheme. At each price control Ofwat would calculate the scale of opex efficiency savings and also calculate how much of this had already been retained during the five year price control. Ofwat would then calculate the residual benefit that the

company should retain in order to have received the benefit for five years in total[67]. This residual was then applied as a revenue adjustment at the start of the next price control. This incentive mechanism was asymmetric with the company absorbing all of any net opex overspend.

For capital expenditure, Ofwat operated a menu methodology that had some similarities to the IQI menu used by Ofgem. This mechanism was called the capex incentive scheme or CIS[68]. It was not a pure menu as such since the companies were not given a choice about their menu position. Ofwat took the ratio of the company's proposed capex compared to Ofwat's assessment as the menu choice. This determined three components:

- An adjustment to the allowed level of capex, moving it slightly towards the company's view;
- A revenue penalty (if the ratio was above 100%) or reward (if the ratio was less than 100%); and
- A cost sharing factor that was 30% when the ratio was 100%, increasing with a lower ratio and decreasing with a higher ratio.

The cost sharing factor determined how any capex underspend or overspend would be shared between the company and the customer. So a factor of 30% meant that the company would retain 30% of any underspend and the customer would receive 70%. Unlike the opex mechanism the CIS sharing was applied symmetrically. The calculation of the adjustment was made at the next price control and the sharing rates referred to the NPV of the cost saving. Any adjustment was applied at the next price control mainly through a RCV adjustment.

The mechanisms were designed so that the incentives for making savings relative to the allowance in opex and capex would be broadly similar[69], so retaining opex savings for five years would be roughly equivalent to retaining 30% of the NPV of the benefit. However, the separate mechanisms meant that this could never be exact, because:

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67 So for example if a company achieved a saving at the start of the first year then it would have retained the benefit for the full five years by the time of the next price control, so no further adjustment would be needed. If the saving was achieved at the start of year four then only two years would have been retained and a further three years would be included in the residual. Note that this example ignores the exact timing of the price control, which takes place before year five data are known. In practice there is a 'blind year' adjustment at the following price control to allow for this.

68 Prior to PR09 the capex incentive regime was also asymmetric with the company absorbing 100% of any capex underspend. It is possible that the switch to a symmetrical capex approach for PR09 may have exacerbated any capex bias, although this was not addressed by Ofwat in its assessment of the issue.

69 Provided that the company was not at risk of over-spending its opex allowance. If this were the case then the asymmetry of the opex scheme would create much stronger incentives to cut-back on opex.

- Changes in discount rates changed the relationship between a NPV sharing and a five years retention method.
- Incentives for opex savings varied depending on whether it was a temporary or permanent reduction in opex.
- The capex incentives depended on the menu choice, in practice varying between 20% and 40%.
- There were complex interactions with the cost assessment benchmarking, with a prospect that savings would influence the allowance in future controls. For example, reducing opex in this period could affect the opex allowance in the next period (particularly if the company was at the efficiency frontier).

PR14 price control

At PR14 the two incentive mechanisms were replaced with a single totex menu. It operated in a similar way to the CIS menu at PR09, although companies were given an opportunity to influence their menu choice.

As with the CIS, the totex menu determined three factors.

- An adjustment to the allowed level of totex, moving it 25% of the way towards the company's view from the Ofwat assessment;
- A revenue penalty (if the ratio was above 100%) or reward (if the ratio was less than 100%); and
- A cost sharing factor that was 50% when the ratio was 100%, increasing with a lower ratio and decreasing with a higher ratio, in practice the sharing rate would range between 45% and 55%.

The single sharing rate meant that the final incentive for saving opex and capex were equalised. The company retained the same benefit from saving £1 whether that was £1 of opex or £1 of capex.

The CMA considered the merits of Ofwat's totex menu as part of the Bristol Water determination. It expressed a number of concerns regarding the menu, principally that it did not achieve the objective of encouraging the companies to reveal their true level of efficient costs. The CMA noted that the first two factors outlined above (the totex allowance adjustment and the revenue penalty or reward) almost exactly offset each other. The consequence was that a company effectively received the Ofwat totex assessment (once penalties and rewards were included) regardless of its menu choice. However the CMA did not express any concerns regarding the use of a single cost sharing rate.

Case study 2: Ofwat

4.5 Related elements of price control methodology

As outlined above Ofwat made a number of changes to the regulatory methodology linked to the switch from separate opex and capex to a totex approach. The relevance of these other changes are explored briefly in this section.

4.5.1 Totex menu

In the theoretical literature the purpose of a menu is to overcome the information asymmetry between the company and the regulator and encourage the company to reveal its true level of efficient costs. As the CMA noted the Ofwat version of the totex menu was not particularly successful in this regard and the CMA felt that the totex menu, as implemented by Ofwat, was not justified.

Hence, it is important to note that a totex approach can be implemented without requiring a totex menu. The relevant feature of the totex menu was the single cost sharing rate, and this can be applied directly without the other features and complexity of a totex menu. In other words, it would be possible to design a single totex incentive mechanism that does not rely on a menu approach.

4.5.2 Totex benchmarking

Another big change implemented by Ofwat was to switch from separate cost assessment models to totex cost benchmarking models. Totex benchmarking models have advantages and disadvantages over separate models.

- Separate models are sensitive to companies adopting different solutions (opex or capex), whether as a result of a bias or not. The risk is that combining an efficient opex frontier with an efficient capex frontier can create an unrealistic overall efficiency frontier that fails to recognise the realities of opex-capex trade-offs. This is less of a risk with totex models.
- Separate models however mean that more explanatory variables can be included, increasing the robustness of the modelling.

This is consistent with the CMA's conclusions that there is merit in undertaking both totex modelling and disaggregated modelling.

Totex benchmarking models are not necessary to implement a totex approach. It is possible to use separate models to determine the allowance for totex but then treat totex as a single item in the price setting process and the incentive mechanisms. Therefore it is important to see the three elements outlined in the previous section (setting the totex allowance, totex recovery and incentive adjustments) as different elements that can be separated.

4.5.3 Outcome incentives

A further element of Ofwat's PR14 methodology was the introduction of outcome incentives. This involved the following steps.

- The introduction of targets and financial incentives for the levels of service (e.g. quality, reliability, environmental protection) identified as priorities during the customer engagement process for the business plan.
- The removal of previous policies aimed at ensuring that companies maintained assets to a sufficient standard (serviceability indicators) and that specific projects were delivered (i.e. 'logging down').

At one level the introduction of customer related outcomes is separate from the introduction of a totex methodology. However, one of the objectives of the change was to provide companies with more flexibility around how service levels were delivered. The previous policies imposed penalties on companies if they did not deliver the agreed plan, including specific capital projects. The aim of the new approach was to make it easier for companies to re-optimise and switch between capex and opex solutions during a price control.

4.6 Impact of capex bias

This final section considers whether Ofwat's PR14 methodology has been successful in addressing the totex bias in the sector. As in the energy sector it is too early to assess the impact based on quantitative evidence of cost and expenditure trends, as we only have one year of data on totex expenditure[70].

Table 6 below sets out our qualitative assessment of the impact of the changes against the factors identified by Ofwat in its analysis of the capex bias. Overall it shows that the totex approach has, in principle, addressed a number of the identified drivers for a capex bias.

Table 6: Frontier Economics assessment of Ofwat's PR14 totex methodology

Capex bias driver identified by Ofwat	Assessment
Regulatory incentives for outperformance	The introduction of a single cost sharing rate greatly simplified the incentives for cost out-performance between opex and capex. The regulatory model may still introduce bias in decision making (see below) but is likely to be less biased towards capex.
Allowed return on RAB	This factor has been addressed successfully through PR14 changes. First, Ofwat has (arguably) reduced the degree of aiming-up in the WACC estimate, reducing the incentive to

70 The price control period covered by PR14 started in April 2015. Therefore the first year's data was for 2015/16. The data for the second year, 2016/17, will be available in summer 2017.

	grow the RAB in the future[71]. Second, and more importantly, even if an incentive to grow RAB remains this would no longer drive a capex bias as RAB growth depends on the overall totex allowance and PAYG parameters. Companies may have incentives to reduce the PAYG rate but this affects the timing of recovery, not the incentives to incur capex vs opex.
Approach to cost assessment	Previous benchmarking approaches were more focussed on opex than capex and therefore probably encouraged substitution away from opex (although less clearly than in energy). Ofwat's new totex models addressed this concern, although weaknesses in the modelling approach creates uncertainty around future cost assessment methods which could distort decisions now.
Financing and ownership	Investor preference for RAB growth has been addressed through approach to totex recovery. More highly geared companies are sensitive to credit metrics, which drive off accounting definitions of costs and can affect decisions between opex and capex solutions.
Company culture and skillset	Anecdotal evidence shows that companies are engaging with the changes and shifting their focus onto totex rather than separate opex and capex. However it takes time to adapt the culture of companies and this will take a number of years. In addition, some companies had entered into long-term outsourced contracts for their capex programmes, which makes it harder for the companies to take a totex based view.
Risk of failure and penalties	The totex approach itself has had no impact on the bias introduced by concern around the risk of failure and penalties. The introduction of outcome incentives with rewards and penalties may mitigate against this bias, although there remains a preponderance of minimum standards and penalty sanctions in the sector.
Control of assets	The totex approach itself has had no impact on the bias introduced by a company preference to control assets directly. Ofwat is currently proposing other changes and policies aimed at addressing this issue and encouraging greater use of third party services.

Source: Frontier Economics

The switch to a totex approach did not change the way in which costs are recovered from customers because, as explained above, the PAYG and RCV run-off rates were generally chosen to reflect the same levels as in the previous regulatory methodology. However the main aim to change the incentives for how companies chose between opex and capex solutions rather than how the solutions were recovered from customers.

There may be some reason to consider that the totex approach and introduction of outcome incentives creates an 'opex bias'. The potential reasons for this are as follows.

71 This is hard to demonstrate from the documents. The allowed WACC at PR14 was above the mid-point of the WACC range, as it had been in PR09. The difficulty with this evidence is that Ofwat has a lot of flexibility about how the range is estimated in the first place. The anecdotal evidence suggests that investors considered the PR14 WACC decision to be 'tougher' than the PR09 decision.

- First, it is, arguably, easier to outperform the allowed totex amount by opex rather than capex solutions, given that capex solutions involve a larger upfront totex commitment. If the opex solution is sub-optimal then the company will face higher totex costs in the future, but they may choose this route particularly if there is a chance that the deferred capex would be recovered through the future cost allowance as a special factor. If companies had greater confidence that the cost assessment approach would be applied consistently and rigorously in the future then this factor would be less important.
- Second, if companies are keen to avoid outcome incentive penalties then opex solutions are quicker to implement than capex solutions. There is anecdotal evidence that companies are strongly motivated to avoid any incentive penalties. Clearly there is a value to customers if services are improved more quickly. However, the concern is that additional expenditure (in NPV terms) incurred by companies would exceed the additional value placed by customers on 'early' delivery and therefore the decision would reflect an inefficient outcome.

There is no evidence to date of a switch to an opex bias in the industry. It is possible that the factors above are having an impact but not enough to offset the remaining drivers towards capex identified in the Table above.

Nevertheless, for PR19 Ofwat is intending to introduce additional asset health metrics as part of the regulatory control. This is to address a concern that the PR14 approach did not contain sufficient incentives for the companies to ensure long-term maintenance of the network assets is not neglected.

Case study 2: Ofwat

5 Implementation of a totex framework in Australia

Applying a totex framework to the regulation of electricity networks in the NEM would require making a number of changes to the NER. Some of these changes would involve imposing or revising obligations on the AER to prepare or review its 'Better Regulation' guidelines. The key areas in which changes are likely to be required is discussed in section 5.1.

In addition, the introduction of a totex framework is likely to involve broader changes to the way in which the AER conducts its economic regulatory functions. These broader changes are discussed in section 5.2.

The potential timeframes for implementation of a totex framework are considered in section 5.3, followed by an overview of changes to NSP's business operations and regulatory obligations in section 5.4. Finally, section 5.1.10 highlights some of the key differences in the treatment of DNSPs and TNSPs under a totex framework.

Box 5: Summary of this chapter

Applying a totex framework to the regulation of electricity and gas networks in the NEM would require making a number of changes to the NER. Some of these changes would involve imposing or revising obligations on the AER to prepare or review its 'Better Regulation' guidelines.

Under a totex framework, there would be no separate assessment of opex and capex forecasts. The NSP would need to propose a level a totex and the AER would assess that forecast based on whether that total level of expenditure was justifiable. Given the similarities between the existing opex and capex objectives, criteria and factors, it should be fairly straightforward to combine the NER provisions governing the assessment of NSPs' opex and capex forecasts in their regulatory proposals.

The greater challenges in a move to a totex framework would likely arise for the AER in amending its expenditure forecast assessment guideline and explanatory statement. In particular, it is difficult to see how the AER could continue to apply a revealed cost approach to assessing a particular component of a business's forecast costs (ie recurrent controllable opex) without defeating the purpose of the shift to totex.

A move away from a revealed cost starting point would – based on overseas experience – likely necessitate a greater reliance on (totex) benchmarking. This would remove any incentive for businesses to favour one type of expenditure over the other simply to secure a better regulatory outcome. For instance, if the regulator were to benchmark opex alone (or place greater weight on opex benchmarking), a regulated business may have an incentive to minimise repair and maintenance work (opex) and instead undertake more frequent asset replacement (capex) — even if this were not the most efficient asset management approach — as this strategy would optimise that business's performance in the regulator's opex benchmarking analysis. Under a totex benchmarking approach, the business would have no incentive to make such inefficient opex-capex substitution choices because it would receive no financial benefit from doing so. Undertaking totex benchmarking properly, and in a way that is truly informative for the purposes of setting expenditure allowances, is not a trivial task. However, it is not insurmountable.

Whilst it is desirable for the AER to collect, analyse and benchmark disaggregated data on NSPs' costs and activities, any such disaggregated benchmarking should not be used directly to set expenditure allowances for NSPs in the way Ofgem does. But disaggregated data could be used in less direct ways to influence the setting of allowances.

Under a totex framework, it would be desirable to introduce a requirement for the AER to undertake financeability assessments, at least when determining the rate at which the totex allowance is to be capitalised within the RAB. We note that the AER's previous consideration of 'insolvency' is a very different concept to 'financeability' as understood by and applied by regulators in the UK.

If the distinction between opex and capex is removed, the current obligations in the NER on the AER to develop and apply an efficiency benefit sharing scheme (EBSS) and a capex incentive guideline, as well as the option to develop a capital expenditure incentive scheme, would become redundant. The NER could instead oblige the AER to develop and apply a totex incentive guideline and incentive scheme, and set out appropriate principles for how the scheme should be designed and implemented. It may be appropriate for the AER to utilise a 'menu' approach to setting both totex allowances and incentive sharing rates.

Regarding the RAB, the AER would no longer approve a particular level of capex and the value of a business's RAB will not be increased by its actual capex – prudent or otherwise – over a regulatory control period. Rather, once the total efficient quantum of totex has been determined by the regulator, some process will be required to determine how much of that quantum will be recovered within the forthcoming regulatory period and how much would be capitalised within the RAB and recovered gradually over time. The existing depreciation allowance would need to be rewritten to delineate between depreciation on existing assets and depreciation on new capitalised totex.

The implementation of a totex framework would likely require the AER to undertake considerable development work. This would include:

- A major change to the structure of the PRTM and RFM.
- Reconsidering how it assesses the NSPs' forecasts
- Design of a new totex incentive mechanism
- An approach for determining the proportion of the totex allowance to be expensed, and the proportion to be capitalised within the RAB, as well as an approach for setting depreciation allowances for both existing and new assets
- The appropriateness of its existing benchmarking models
- An approach to conducting financeability assessments; and
- The preparation and publication of guidelines setting out how it proposes to implement each of the measures above.

It is very difficult to predict with any precision the timeframes that would be necessary to implement a totex framework in Australia. However, we expect that a shift to a totex framework would likely take two to three years.

We do not anticipate that a move to a totex framework would result in a material change in NSPs' regulatory obligations. It is unclear how NSPs' business operations are likely to change if a totex framework were adopted in Australia.

Implementation of a totex framework in Australia

5.1 Changes required to the NER

5.1.1 Setting expenditure allowances

With the removal of the extant distinction between opex and capex, some process must be established to allow the regulator to decide how it ought to determine the appropriateness of NSPs' totex forecasts. This can be challenging because expenditure relating to capital investments can be lumpy and cyclical, whereas expenditure relating to the operation of the network tends to be much smoother. Therefore, the overall totex forecast must be able to accommodate different types of cash flow with very different timing profiles. This would require a recrafting of the separate opex/capex objectives and criteria within the NER.

Existing expenditure forecast assessment

NER requirements

Presently, chapters 6[72] and 6A[73] of the NER provide that a Network Service Provider's (NSP's) regulatory proposal must include the total forecast opex and capex that the NSP considers is required to achieve the *operating*[74] and *capital*[75] *expenditure objectives*, respectively. These objectives broadly refer to meeting or managing demand for regulated network services, complying with any relevant regulatory obligations and maintaining the quality, reliability, security and safety of supply.

The AER is, in turn, obliged to accept the NSP's forecast of opex or capex if the AER is satisfied that the NSP's forecast 'reasonably reflects' the *operating*[76] and *capital*[77] *expenditure criteria*, respectively. These criteria are that the forecast reasonably reflects:

- The efficient costs of achieving the operating or capital expenditure criteria
- The costs that a prudent operator would require to achieve the operating or capital expenditure objectives and
- A realistic expectation of the demand forecast and cost inputs required to achieve the operating or capital expenditure objectives.

72 For DNSPs.

73 For TNSPs.

74 NER 6.5.6(a) and 6A.6.6(a).

75 NER 6.5.7(a) and 6A.6.7(a).

76 NER 6.5.6(c) and 6A.6.6(c).

77 NER 6.5.7(c) and 6A.6.7(c).

In deciding whether the NSP's proposed opex or capex reasonably reflects these criteria, the AER must have regard to a wide range of factors defined as the *operating*[78] and *capital*[79] *expenditure factors*, respectively. In brief, the factors refer to the AER's most recent annual benchmarking report, the actual and expected opex or capex in any preceding regulatory control period, the relative prices of and substitution possibilities between opex and capex, the consistency of forecasts with opex or capex incentive schemes and various other matters.

The NER requires the AER to develop and publish guidelines that specify the approach the AER proposes to use to assess NSPs' forecasts of opex and capex.[80] In response, the AER has published the following:

- *Expenditure Forecast Assessment Guideline for Electricity Distribution*, November 2013
- *Expenditure Forecast Assessment Guideline for Electricity Transmission*, November 2013
- *Expenditure Forecast Assessment Guideline Explanatory Statement*, November 2013.

The NER makes clear that the AER's guidelines are in general not binding on the AER or anyone else. However, if the AER makes a determination that is not in accordance with a guideline, it must state in its reasons for a determination why it departed from the guideline.[81]

AER guidelines

The AER's forecast assessment guidelines outline the AER's intended approach to assessing NSP's opex and capex forecasts. At a high level, the AER adopts the same approach across both types of spending. This involves comparing the NSP's forecast with an alternative estimate that the AER develops from various information sources and using a range of assessment techniques. If a NSP's capex or opex forecast is greater than the AER's estimates, and the AER considers there is no satisfactory explanation for this difference, it will take the view that the NSP's estimate does not reasonably reflect the expenditure criteria and the AER will substitute its own estimate.[82]

For recurrent expenditure, the AER has stated that it prefers to use revealed (past actual) costs as the starting point for assessing and determining efficient forecasts. The AER noted that if a NSP has been operating under, and responded to, an effective incentive framework, actual past expenditure should be a good indicator

78 NER 6.5.6(e) and 6A.6.6(e).

79 NER 6.5.7(e) and 6A.6.7(e).

80 NER 6.2.8 and 6A.2.3.

81 NER 6.2.8(c) and 6A.2.3(c).

82 AER, *Expenditure Forecast Assessment Guideline Explanatory Statement*, November 2013, p.41.

of the efficient expenditure the NSP requires in the future.[83] The AER has generally taken this assessment approach to controllable opex where an NSP has been subject to an efficiency-benefit sharing scheme (EBSS – see further below).

As noted above, the AER also develops an alternative estimate of opex to test the efficiency of an NSP's revealed opex. The AER has typically done this using benchmarking and other quantitative techniques (see below). If the AER finds that an NSP's revealed opex for a given 'base year' is inefficient, the AER will adjust it downwards as necessary. The AER then seeks to estimate future efficient opex by scaling actual or adjusted base year opex for expected growth in output, real input prices and productivity. The AER describes its approach as the 'base-step-trend' approach.

Given the discrete ('lumpy') and long-lived nature of capex, the AER has generally not used revealed actual costs as its starting point for estimating efficient future capex. Rather, the AER's guideline notes that it uses a combination of top-down and bottom-up approaches to assess forecast capex.[84]

Elements of the AER's capex forecast assessment approach could include:[85]

- reviewing the economic justification for expenditure
- reviewing the expenditure forecasting methodology and resulting expenditure forecasts
- top down economic benchmarking
- reviewing governance and policies
- trend analysis
- category benchmarking
- targeted review of high value or high risk projects and programs
- sample review of projects and programs and applying efficiency findings to other expenditure forecasts.

The approach taken varies according to the category of capex the AER is examining. The high level categories are replacement capex (repex), augmentation capex (augex), connection and customer driven works capex, and non-network capex. Where the AER's assessment finds the NSP's forecast is not adequately justified or inefficient, the AER will substitute capex estimated using its approach for the NSPs proposal.[86]

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83 *Ibid.*, p.42.

84 *Ibid.*, p.54.

85 *Ibid.*, pp.54-55.

86 *Ibid.*, pp.54, 57-58.

As discussed below, the AER has to date placed much greater weight on benchmarking in assessing NSPs' allowed opex than it has in assessing allowed capex.

Approach under a totex framework

Under a totex framework, there would be no separate assessment of opex and capex forecasts. The NSP would need to propose a level a totex and the AER would assess that forecast based on whether that total level of expenditure was justifiable.

Given the similarities between the existing opex and capex objectives, criteria and factors, it should be fairly straightforward to combine the NER provisions governing the assessment of NSPs' opex and capex forecasts in their regulatory proposals. The key difference between the treatment of opex and capex presently arises in relation to the scope for NSPs to propose forecast capex (but not opex) associated with 'contingent projects'.[87] However, if the opex and capex objectives, criteria and factors were consolidated, there would seem to be little barrier to generalising the provisions around contingent projects so that they refer to totex rather than capex.

The greater challenges in a move to a totex framework would likely arise for the AER in amending its expenditure forecast assessment guideline and explanatory statement. While there is a great deal of commonality in how the AER assesses opex and capex, there are important differences. As noted above, the AER's present approach to expenditure assessment places considerable weight on revealed costs for recurrent expenditure (generally, controllable opex), and also has made greater use of benchmarking when setting opex allowances. By contrast, Ofgem and Ofwat did not use revealed costs to set either opex or capex allowances in their respective pre-totex eras. Rather, as discussed in sections 3 and 4, both Ofgem and Ofwat primarily utilised benchmarking analysis to set opex (and to a lesser extent capex) allowances. This made the shift to a totex approach simpler in Britain than it would be in the NEM.

Under a totex framework, it is difficult to see how the AER could continue to apply a revealed cost approach to assessing a particular component of an NSP's forecast costs (ie recurrent controllable opex) without defeating the purpose of the shift to totex. A move away by the AER from a revealed cost starting point for assessing an NSP's proposed opex would accordingly likely necessitate a greater reliance on (totex) benchmarking. The implications of this are discussed in section 5.1.5 below.

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87 Contingent projects are specific projects not provided for in an NSP's regulatory proposal because the projects are large and only necessary upon the occurrence of a pre-specified trigger event – see NER 6.6A and 6A.8.

Implementation of a totex framework in Australia

As the setting of expenditure allowances moves away from NSPs' revealed costs, it may be appropriate to expand the list of factors to which the AER must have regard when assessing an NSP's allowed expenditure in at least two ways.

First, it could be appropriate to provide scope for the AER to utilise a 'menu' approach to setting both totex allowances and incentive sharing rates (see below). A menu approach involves allowing the regulated business to choose its preferred combination of expenditure allowance and incentive rate out of a specified menu of options, with a higher allowance typically paired with a lower incentive rate. The most well-known example of a menu regulation approach is the Information-Quality-Incentive (IQI) developed by Ofgem.[88] As discussed in section 3, the IQI was first applied by Ofgem in its fourth price control review for electricity distribution networks (DPCR4), which was prior to its implementation of a totex approach to setting expenditure allowances in DPCR5.

The purpose of a well-designed menu approach to economic regulation is to utilise the regulated business's (presumed) superior information about its potential to make cost savings to provide it with incentives to truthfully reveal its view of its potential efficient costs and then to strive to make savings in order to achieve those potential efficient costs. In the context of a move away from using an NSP's revealed costs as the starting point for setting its opex allowance, a menu approach could help mitigate the impact of errors arising from too great an emphasis on (as-yet) imperfect benchmarking to set expenditure allowances.

For example, if a DNO initially forecast expenditure of 1.2 times Ofgem's original estimate but actually spent 110 (ie 1.1 times Ofgem's estimate), it would face a 'payoff' of -4.3 relative to its actual expenditure (ie it would effectively receive a final allowance of 105.7). This payoff would be derived as follows:

$$Payoff = (105 - 110) \times 0.5 - 1.8 = -4.3$$

Figure 5 reproduces the IQI matrix used for electricity distribution businesses in Ofgem's recent RIIO-ED1 determination. A distribution business's (DNO's) position in the matrix depends on both its column position and its row position. The DNO's:

- Column position: depends on the ratio of the DNO's proposed expenditure to Ofgem's estimate of its efficient expenditure. For this matrix, the applicable column can vary from 90 (a ratio of 0.9) to 130 (1.3).
- Row position: depends on the DNO's outturn expenditure as a ratio of Ofgem's *ex ante* estimate. For this matrix, the applicable row can vary from 90 (a ratio of 0.9) to 150 (1.5).

88 As noted in section 4, a menu approach is also used by Ofwat and is referred to as the Capital Incentive Scheme (CIS).

A DNO's column position determines its allowed expenditure and the efficiency incentive ratio to which it is exposed. As flagged above, higher allowances are coupled with lower incentive ratio. For example, if a DNO initially forecast expenditure of 1.2 times Ofgem's estimate, it would receive an up-front allowed expenditure of 105 – a ratio of 1.05 times Ofgem's estimate – and face a sharing incentive ratio of 50%.

A DNO's row position determines its final position or 'payoff' relative to its actual expenditure.

The formula for a DNO's payoff is:

$$Payoff = (Allowed\ expenditure - Actual\ expenditure) \times Incentive\ strength + Additional\ income$$

For example, if a DNO initially forecast expenditure of 1.2 times Ofgem's original estimate but actually spent 110 (ie 1.1 times Ofgem's estimate), it would face a 'payoff' of -4.3 relative to its actual expenditure (ie it would effectively receive a final allowance of 105.7). This payoff would be derived as follows:

$$Payoff = (105 - 110) \times 0.5 - 1.8 = -4.3$$

Figure 5: Ofgem RIIO-ED1 'slow track' IQI matrix

Table 2.8: IQI matrix

DNO:Ofgem Ratio	90	95	100	105	110	115	120	125	130
Efficiency Incentive	65%	63%	60%	58%	55%	53%	50%	48%	45%
Additional income (£/100m)	3.1	2.4	1.7	0.9	0.1	-0.8	-1.8	-2.8	-3.9
Rewards & Penalties									
Allowed expenditure	97.50	98.75	100.00	101.25	102.50	103.75	105.00	106.25	107.50
Actual Exp									
90	7.95	7.9	7.7	7.4	7.0	6.4	5.7	4.9	4.0
95	4.7	4.76	4.7	4.5	4.2	3.8	3.2	2.5	1.7
100	1.5	1.6	1.7	1.6	1.5	1.1	0.7	0.1	-0.6
105	-1.8	-1.5	-1.3	-1.2	-1.3	-1.5	-1.8	-2.2	-2.8
110	-5.1	-4.6	-4.3	-4.1	-4.1	-4.1	-4.3	-4.6	-5.1
115	-8.3	-7.7	-7.3	-7.0	-6.8	-6.7	-6.8	-7.0	-7.3
120	-11.6	-10.9	-10.3	-9.9	-9.6	-9.4	-9.3	-9.4	-9.6
125	-14.8	-14.0	-13.3	-12.7	-12.3	-12.0	-11.8	-11.7	-11.8
130	-18.1	-17.1	-16.3	-15.6	-15.1	-14.6	-14.3	-14.1	-14.1
135	-21.3	-20.2	-19.3	-18.5	-17.8	-17.2	-16.8	-16.5	-16.3
140	-24.6	-23.4	-22.3	-21.4	-20.6	-19.9	-19.3	-18.9	-18.6
145	-27.8	-26.5	-25.3	-24.2	-23.3	-22.5	-21.8	-21.2	-20.8
150	-31.1	-29.6	-28.3	-27.1	-26.1	-25.1	-24.3	-23.6	-23.1

Source: Ofgem, RIIO-ED1: Final determinations for the slow-track electricity distribution companies, 28 November 2014, Table 2.8, p.17.

The IQI matrix is designed such that it is always in a DNO's interests to both:

- *Ex ante*, forecast its lowest achievable costs prior to the determination of the allowance, and
- *Ex post*, minimise its actual outturn costs for any allowance provided.

This can be seen in the above matrix by observing that it is in the DNO's interest in every situation to accurately forecast its outturn expenditures as well as to minimise those outturn expenditures regardless of the up-front allowance it receives. For example, if a DNO believes it can achieve expenditure of 110 (and does achieve 110), it is better off forecasting 110 *ex ante* than any other value. A forecast and outcome of 110 results in a payoff of -4.1 (ie an effective allowance

of 105.9). This is a better payoff (and effective allowance) than if the DNO forecast 130 to try to 'game' the regulator, because then despite receiving an up-front allowance of 107.5, the DNO would receive an outturn payoff of -5.1 (ie an effective allowance of 104.9).

$$Payoff = (107.5 - 110) \times 0.45 - 3.9 = -5.1$$

While a menu approach is not a necessary accompaniment to a move to totex, it may be beneficial given the greater reliance a totex approach necessarily places on benchmarking methods to assess forecast efficient costs.

Second, it may be appropriate to require the AER to have regard to a NSP's 'financeability' when assessing its allowed totex. Financeability refers to the sufficiency of a business's cash flows today to meet its operational needs and is discussed further in section 5.1.8 below.

Required changes to the NER

The relevant NER provisions highlighted above that set out opex and capex objectives, criteria and factors would need to be changed to effect the consolidation of the arrangements for assessing forecast opex and capex. In particular, Rules 6.5.6, 6.5.7, 6A.6.6 and 6A.5.7 would need to be brought together. In addition, the list of totex factors should be expanded to include:

- The scope for NSP to choose amongst combinations of allowed expenditure and incentive sharing rates and
- The financeability of the NSP going forward.

5.1.2 Incentive mechanisms

Existing incentive arrangements

NER requirements

The NER *requires* the AER to develop and publish an efficiency benefit sharing scheme (EBSS) for opex[89] and to develop a Capital Expenditure Incentive Guideline.[90] The NER also *allows* the AER to develop an incentive sharing scheme for capex.[91]

With respect to the EBSS, the NER requires that the scheme provides a 'fair sharing' of efficiency gains and losses around an NSP's allowed opex as between the NSP and network users.

89 NER 6.2.8, 6.5.8, 6A.2.3 and 6A.6.5.

90 NER 6.2.8, 6.4A, 6A.2.3 and 6A.5A.

91 NER 6.2.8, 6.5.8A and 6A.6.5A.

In developing an EBSS, the AER is obliged to have regard to:[92]

- the need to ensure that likely benefits to consumers warrant rewards and penalties to NSPs
- the need to provide NSPs with a continuous incentive to reduce opex, in so far as this is consistent with economic efficiency
- the desirability of both rewarding NSPs for efficiency gains and penalising them for efficiency losses
- any incentives that NSPs may have to capitalise expenditure and
- the possible effects of the scheme on incentives for the implementation of non-network alternatives.

The NER requirements regarding the Capital Expenditure Incentive Guideline primarily focus on ensuring that:[93]

- Any capex sharing scheme that is developed by the AER complies with the relevant principles. These include that rewards and penalties under the scheme need not be symmetric with respect to capex savings and overspends. The AER is also required to consider interactions with other incentive schemes.
- The AER explains whether depreciation for establishing the opening RAB at the next regulatory control period is based on actual or forecast capex.
- The AER explains how it intends to exclude any of an NSP's incurred capex from the RAB due to inefficient overspending, inappropriate capitalisation of opex or inappropriate payment of margins to related parties.

The latter obligation is reinforced by the obligation on the AER to state in its draft and final determinations the extent to which the roll forward of the RAB from the regulatory control period just ending meets the capital expenditure incentive objective.[94]

Further, NER S6.2.2A and S6A.2.2A provide that the AER may exclude certain amounts of an NSP's capex from the roll forward of the RAB where:

- The NSP has spent more than its capex allowance, and the excess does not reasonably reflect the capital expenditure criteria.
- The NSP has incurred capex that represents a margin paid by the NSP that does not reflect arm's length terms.

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92 NER 6.5.8(c) and 6A.6.5(c). The first of these considerations does not apply to TNSPs, although in practice this does not appear to have had any material influence on the design of the relevant EBSS.

93 NER 6.4A, 6.5A, 6A.5A and 6A.6.5A.

94 NER 6.12.2(b) and 6A.14.2(b).

- The NSP's capex includes expenditure that should have been classified as opex as part of a NSP's capitalisation policy.

AER guidelines

The AER's EBSS and its accompanying explanatory statement were published in November 2013.[95] The EBSS was virtually identical to the AER's former efficiency-benefit sharing schemes for TNSPs (2007[96]) and DNSPs (2008[97]). All these schemes provide a 5-year carryover benefit (or loss) of any incremental savings (or overruns) made by an NSP, such that the NSP enjoys six years of any savings (and bears six years of any overruns), with the remaining value of savings (or overruns) accruing to its customers. The result is that the NSP receives or incurs approximately 30% of the present value of any savings or overruns, with customers receiving or incurring the remaining 70% (assuming a 6% real discount rate).

The EBSS is designed to work in combination with a revealed cost approach to setting a NSP's opex allowance. Together, they are intended to provide a continuous incentive for NSPs to make opex savings throughout a regulatory control period, instead of NSPs having incentives (as they could in the absence of an EBSS) to defer making any potential savings until after their opex allowance for the next regulatory control period has been established.

The AER has opted to develop an incentive scheme for capex and it published its capital expenditure sharing scheme (CESS) in section 2 of its *Capital Expenditure Incentive Guideline*.[98] The CESS exposes NSPs to approximately 30% of the net present value of benefits or costs associated with under-spending or over-spending, respectively, their allowed capex over a regulatory control period. The CESS is in part intended to equalise NSP's incentives to reduce capex with its incentives to reduce opex.

The AER's guideline also provides for *ex post* measures for capex, giving the AER the scope to exclude capex from being rolled into the RAB under the conditions outlined above. The AER has said that it would apply a two stage process for the *ex post* review.

The first stage will consider a number of factors including:

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95 AER, *Efficiency Benefit Sharing Scheme for Electricity Network Service Providers*, November 2013 and AER, *Efficiency Benefit Sharing Scheme for Electricity Network Service Providers, Explanatory Statement*, November 2013.

96 AER, *Electricity transmission network service providers, Efficiency benefit sharing scheme, Final decision*, September 2007.

97 AER, *Electricity distribution network service providers, Efficiency benefit sharing scheme, Final decision*, June 2008.

98 AER, *Capital Expenditure Incentive Guideline for Electricity Network Service Providers*, November 2013 and AER, *Capital Expenditure Incentive Guideline for Electricity Network Service Providers, Explanatory Statement*, November 2013.

- Whether the NSP has overspent
- Whether the overspend is significant
- The NSP's history of capex
- How the NSP's capex compares with similar NSPs.

If the AER has concerns after stage one, it will progress to stage 2, which is a more detailed assessment of the NSP's capex. This will include an assessment of the NSP's planning and management processes and the efficiency and prudency of its capex. To the extent that inefficient or imprudent overspends are identified in stage 2, the capex will not be rolled into the NSP's RAB. Given the recentness of the guideline, the AER has not exercised this power to date.

Approach under a totex framework

If the distinction between opex and capex is removed, the current obligations in the NER on the AER to develop and apply an EBSS and capex incentive guideline, as well as the option to develop a capital expenditure incentive scheme, would become redundant. This is because separate allowances would no longer be set for opex and capex, and the existing EBSS and CESS would have no effect. Similarly, the AER's versions of these instruments would need to be revoked.

The NER could instead oblige the AER to develop and apply a totex incentive guideline and incentive scheme, and set out appropriate principles for how the scheme should be designed and implemented. These principles could be drawn from the existing NER principles for the EBSS and capex incentive scheme, but could be rationalised and consolidated. For example, it would no longer be necessary or appropriate to include principles dealing with incentives for NSPs to inappropriately capitalise opex or to make reference to an independent capex incentive objective. Whether any incentive scheme should be symmetric (*contra* the existing capex incentive guideline) could be left to the AER, although any asymmetry between the rewards for underspending and penalties for overspending could distort the incentives of an NSP to make savings as and when possible.

Along with removing the capex incentive objective, the NER would likely need be changed to remove the scope for the AER to exclude any of an NSP's capex from the roll forward of the RAB. Instead, the AER would need a broad power to disallow or 'claw back' any expenditures attributable to inappropriate related party margins and the NER could be amended to stipulate – or more likely, oblige the AER to determine or approve – two variables:

- A suitable incentive sharing rate such that the payoff from excessive totex spending is sufficiently negative to deter overspending;[99] and
- A suitable split between the value of totex to be expensed in the current year or regulatory control period and the value of totex to be capitalised (ie added to the NSP's RAB) and recovered more gradually.

The incentive sharing rate could be left to the AER, as it is now for the EBSS and CESS. This would enable the AER to adopt a menu regulation approach for jointly determining an NSP's totex allowance and its incentive sharing rate, such as under Ofgem's IQI – subject to the totex incentive principles set out in the NER.

The split between expensed and capitalised totex is discussed in the next sub-section.

Required changes to the NER

The NER provisions that oblige the AER to develop an EBSS and capex incentive guideline and provide the AER with the option to develop a capex incentive scheme would need to be replaced by an obligation to develop a totex incentive guideline and incentive scheme. This would need to be accompanied by appropriate principles.

The scope for the AER to exclude any of an NSP's capex from the roll forward of the RAB would need to be removed. Instead, the NER could be amended to oblige the AER to determine or approve a suitable incentive sharing rate and a suitable split between the value of totex to be expensed and capitalised.

5.1.3 Additions to the RAB

Existing arrangements

NER 6.4A and 6A.5A set out the capital expenditure incentive objective, which is to ensure that only capex that reasonably reflects the capital expenditure criteria increases the value of the RAB.

Under Schedules 6.2 and 6A.2 of the NER, an NSP's actual capex on regulated services[100] is rolled into its RAB at the end of a regulatory control period, subject to the ability of the AER to exclude certain amounts discussed above.

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99 If the allowed WACC for the business reflects its true cost of capital and there is no other reason for an NSP to favour capex, the NSP's exposure to loss via the sharing rate would need to be less than if these conditions are not met.

100 Standard control services for DNSPs and prescribed transmission services for TNSPs.

Approach under a totex framework

Under a totex framework, the AER would no longer approve a particular level of capex and the value of an NSP's RAB will not be increased by its actual capex – prudent or otherwise – over a regulatory control period.

Rather, once the total efficient quantum of totex has been determined by the regulator, some process will be required to determine how much of that quantum will be required within the forthcoming regulatory period (i.e., as an expensed cash flow in place of an opex allowances) and how much would be capitalised within the RAB (in place of a capex allowance) and recovered gradually over time. In other words, a process will be required to determine the NSP's *capitalisation rate*. In the UK, this consideration gave rise to the concept of 'fast money' and 'slow money'. Some relevant considerations are whether:

- the regulator should mandate the split between fast money and slow money; or
- NSPs should propose the split to suit their particular circumstances.

If the latter, the regulator will need to develop a framework to assess the reasonableness and appropriateness of the proposed split between fast money and slow money. If NSPs have too much freedom to adopt their own splits, they may choose splits that reflect any 'capex' bias they retain – say, due to the relative attractiveness of the regulated rate of return.

Ofgem's approach to determining the split has been pragmatic. As noted in section 3, in DPCR5, Ofgem chose an intermediate approach to expensing versus capitalising expenditure. For all companies, the proportion of slow money was fixed at 85% for all direct costs, engineering indirect costs, network investment support costs and any constraint payment (eg network support payments to distributed generators). All remaining expenditure in these areas was expensed, as was all business support costs. This was to produce a 'speed of money' that was broadly equivalent to that under the previous arrangements. We note that DPCR5 was the regulatory period in which British DNOs experienced the peak of their asset replacement cycle, which suggests that an 85-15 split may have resulted in less capitalisation than may have occurred under the previous arrangements. In RIIO-ED1, Ofgem allowed companies the flexibility to propose their own splits based on sound reasons and companies were eventually allowed to adopt capitalisation rates of 62% to 80%.

If a totex approach were implemented in the NEM, the AER should be obliged to develop a guideline dealing with its intended approach to the fast money slow money split. This could include the conditions – if any – under which it could or would allow NSPs to diverge from a default split and what that default split would be. Part of the AER's approach could depend on the uniformity of historical splits of opex and capex across NSPs. Any split should be set subject to a financeability criterion, as discussed in section 5.1.8.

Implementation of a totex framework in Australia

Required changes to the NER

NER 6.4A and 6A.5A, as well as Schedules 6.2 and 6A.2 would need to be largely removed. As noted above, the NER would need to be amended to oblige the AER to determine or approve a suitable split between the value of totex to be expensed and capitalised. That proportion of totex that was capitalised would be added to the RAB.

5.1.4 Depreciation

Existing arrangements

Depreciation – representing the return *of* an NSP's RAB – is a key part of the building block model used to determine NSPs' annual regulated revenues under the NER.[101] The NER also requires the AER's capital expenditure incentive guidelines to specify whether depreciation is to be based on forecast or actual capex.[102]

The key NER provisions around depreciation are contained in 6.5.5 and 6A.6.3 for DNSPs and TNSPs, respectively. These provisions require depreciation to be calculated on the basis of schedules conforming to particular requirements that reflect the nature and economic life of the relevant assets. The approval of an NSP's depreciation schedules is a key part of the AER's network determinations.[103]

In rolling forward the RAB to a new regulatory control period, the NER gives the AER the option of choosing between depreciation based on actual or forecast capex.[104] In making this choice, the AER must have regard to a range of factors including the capex incentive objective, the capex incentive guideline, the capex factors and the following:

- the incentives of NSPs to make efficient capex, including as a result of an incentive scheme;
- substitution possibilities between assets with different lengths of economic lives;
- the extent to which an NSP's capex has exceeded allowed capex.

101 NER 6.4.3, 6A.4.2 and 6A.5.4.

102 NER 6.4A, 6A.4.2 and 6A.5A.

103 NER 6.12.1 and 6A.14.1.

104 NER S6.2.2B and S6A.2.2B.

During a regulatory control period, the RAB must be reduced annually by depreciation,[105] and at the start of a new regulatory control period, an NSP's RAB must be reduced by the value of depreciation during the previous period.[106]

In its capex incentive guideline, the AER stated that its default approach to depreciation will be to use depreciation on forecast capex to roll forward the RAB, except where an NSP is not subject to a CESS or an NSP has persistently overspent on capex or persistently incurred inefficient capex.[107] This is because where a CESS is in place, it will provide a sharing incentive rate of 30%. The use of depreciation on actual capex would increase the sharing rate beyond 30% because:

- If there is a capex overspend, actual depreciation will be higher than forecast depreciation – this means that the RAB will be reduced by more than if forecast depreciation were used, increasing the penalty borne by the NSP for the overspend; and
- If there is a capex underspend, actual depreciation will be lower than forecast depreciation– this means that the RAB will be reduced by less than if forecast depreciation were used, increasing the reward earned by the NSP for the underspend.

Further, using actual depreciation provides a stronger incentive for investing in shorter-lived assets compared to longer-lived assets. Conversely, forecast depreciation leads to the same incentive regardless of asset life.

Approach under a totex framework

Under a totex framework, an NSP's RAB value would increasingly become a financial construct, rather than being causally related to the cost of constructing assets. As discussed in the Ofwat case study in section 4, the existing depreciation allowance would be replaced by two components:

- Depreciation on existing assets (ie assets developed before the move to totex), which could be calculated as it is now based on particular asset lives; and
- Depreciation on new 'assets' (ie that proportion of totex that is capitalised), which could be equal to a weighted average asset life based on different categories of asset types (i.e. short, medium, long, very long lived assets).

Similar issues would arise as do presently regarding the question of whether the RAB should be rolled forward on the basis of depreciation on forecast or 'actual' capitalised totex. The AER would need to be obliged to prepare a guideline on this and other aspects of its intended approach.

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105 NER S6.2.3(c) and S6A.2.4(c).

106 NER S6.2.1(e) and S6A.2.1(f).

107 Capital Expenditure Incentive Guideline, section 3, pp.43-45.

Required changes to the NER

A number of provisions in the NER would need to be rewritten to delineate between depreciation on existing assets and depreciation on new capitalised totex. The NER would also need to be oblige the AER to prepare a new guideline on its intended approach to depreciation.

5.1.5 Totex benchmarking

Rationale for adoption in Australia

The current NER requires the AER to publish annual benchmarking reports[108] and to have regard to the latest benchmarking report when assessing the NSPs' expenditure forecasts when determining opex and capex allowances.[109]

Based on the overseas experience canvassed in the earlier sections of this report, it is very likely that totex benchmarking analysis would need to play a significant role within any totex framework adopted in Australia. This is because the form of benchmarking adopted can affect significantly the incentives that companies face when planning how they deliver regulated services. For example, as discussed in section 2, the energy regulator in Germany, the energy regulator in Great Britain and the water sector regulator in England and Wales benchmark totex rather than opex and capex separately when setting expenditure allowances.

The rationale for this approach is to remove any incentive for businesses to favour one type of expenditure over another simply to secure a better regulatory outcome. For instance, if the regulator were to benchmark opex alone (or place greater weight on opex benchmarking), a regulated business may have an incentive to minimise repair and maintenance work (opex) and instead undertake more frequent asset replacement (capex) — even if this were not the most efficient asset management approach — as this strategy would optimise that business's performance in the regulator's opex benchmarking analysis. Under a totex benchmarking approach, the business would have no incentive to make such inefficient opex-capex substitution choices because it would receive no financial benefit from doing so.

In addition, if the regulator were to only conduct opex benchmarking, or give opex greater weight when setting allowances, businesses may face perverse incentives to report certain costs as capex rather than opex—once again to appear more efficient than they really are in the regulator's benchmarking analysis.

The regulator could seek to mitigate such behaviour by:

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108 NER 6 Part O and 6A Part L.

109 NER 6.5.6(e)(4), 6.5.7(e)(4), 6A.6.6(e)(4) and 6A.5.7(e)(4).

- Setting strict rules for recording opex and capex according to prescriptive definitions of these costs, and then monitoring and enforcing information reporting by the businesses. However, strong information asymmetries between the regulator and the businesses may make such an approach challenging to implement successfully.
- Comparing the business's expenditure capitalisation policies to a benchmark (e.g., the average capitalisation rates for the industry, or the business's historical capitalisation policy). However, such an analysis may be uninformative if all businesses in the industry face the same incentives to allocate spending to capex works rather than opex-related activities. Further, in the absence of complete information, it may be difficult for regulators to judge what efficient capitalisation rates ought to be for particular businesses facing different operating environments and network characteristics.[110]
- Undertaking totex benchmarking that is blind to the distinction between different categories of costs. Under such an approach, a business would have no incentive to inefficiently favour capex over opex because there would be no advantage in doing so: the benchmarking analysis (if undertaken properly) would detect that the business was systematically spending more (or reporting more) capex in place of opex, and would therefore provide no financial reward to the business for pursuing such a strategy. Totex benchmarking has the potential to provide the regulator with a more complete picture of the true efficiency of businesses as it takes account of opex-capex substitution choices.

One argument against the need for a totex benchmarking approach in Australia is that the AER already undertakes separate benchmarking analyses of opex *and* of capex, so if NSPs were to be biased in favour of capex, the AER's capex benchmarking analysis would expose this. Whilst this argument has some merit, it is also important to consider what weight benchmarking plays in the determination of opex and capex allowances. In the last round of revenue reset determinations, benchmarking played a central role in determining the opex allowances of DNSPs. In particular, the AER used its benchmarking analysis to make significant downward adjustments to the revealed base year opex of a number of DNSPs, and this had a significant downward impact on those networks' opex allowances for the current RCP. The impact of the AER's opex benchmarking analysis on allowances is evidenced by the fact that several DNSPs sought limited merits reviews of the AER's opex benchmarking analysis.

110 For example, some businesses in the industry may simply need to replace assets more frequently because their networks are exposed to harsher environmental conditions (e.g., storms, termite damage, erosion, etc.), and other networks may require less frequent capex (e.g., because more of their assets are located underground) or proportionally more opex (e.g., because their networks are located in regions that require greater vegetation management).

Implementation of a totex framework in Australia

By contrast, the AER's capex benchmarking analysis did not play a determinative role in the overall capex allowances set by the AER. For example, in its final decision on capex allowances for Ausgrid for the 2015-19 period, the AER stated the following:[111]

> We looked at a number of historical metrics of Ausgrid's capex performance against that of other distributors in the NEM. These metrics are largely based on outputs of the annual benchmarking report and other analysis undertaken using data provided by the distributors for the annual benchmarking report. This includes Ausgrid's relative partial and multilateral total factor productivity (MTFP) performance, capex and RAB per customer and maximum demand, and Ausgrid's historic capex trend.

However, the AER went on to say that while it had regard to its capex benchmarking analysis, it did not rely on that analysis when determining Ausgrid's capex allowances:[112]

> We note that the NER sets out that we must have regard to our annual benchmarking report. This section shows how we have taken it into account. We consider this high level benchmarking at the overall capex level is suitable to gain an overall understanding of Ausgrid's proposal in a broader context. However, in our capex assessment we have not relied on our high level benchmarking metrics set out below other than to note that these metrics generally support the outcomes of our other techniques - which demonstrate that Ausgrid has room to find some efficiencies in its capex program. We have not used this analysis in a deterministic manner in our capex assessment.

The AER made similar statements in its recent determinations for other DNSPs as well as its determinations for TNSPs.

Our discussions with the industry suggest that there is a clear perception amongst DNSPs at least that the AER's opex benchmarking has a larger potential influence on revenue allowances than does the AER's capex benchmarking. This may create some incentive for DNSPs to favour spending on capex over opex. Use of a totex benchmarking approach to set totex allowances would, in principle, remove this incentive.

Different treatment of DNSPs and TNSPs?

For completeness, it is worth noting that when setting opex allowances for TNSPs in the most recent round of revenue resets, the AER had regard to, but did not

111 AER, *Ausgrid distribution determination 2015−16 to 2018−19, Final Decision, Attachment 6 – Capital expenditure*, April 2015, p.26.

112 AER, *Ausgrid distribution determination 2015−16 to 2018−19, Final Decision, Attachment 6 – Capital expenditure*, April 2015, p.26.

rely heavily on its opex benchmarking analysis. For instance, in its final decision on capex allowances for TransGrid for the 2015-18 period, the AER stated that:[113]

> As outlined in our draft decision, we have no evidence to suggest that TransGrid's revealed base year expenditure is materially inefficient. In arriving at this conclusion we had regard to the results of various benchmarking analyses.
>
> …
>
> At this stage, we are not confident that the MTFP model specification [the primary TNSP benchmarking technique used by the AER] and results are sufficiently robust to assess the efficiency of the transmission service providers' base opex. Economic Insights [the AER's adviser on benchmarking issues] explained that benchmarking of transmission services is in its relative infancy and caution against drawing strong inferences about transmission service provider efficiency levels from the MTFP results.

Therefore, the incentives faced by TNSPs to favour capex over opex, in order to perform better in the AER's benchmarking analysis is arguably weaker than the incentives faced by DNSPs. Nonetheless, if a totex approach is pursued in Australia, there are good reasons, in our opinion, to apply totex benchmarking to TNSPs as well as DNSPs. The AER's reluctance to rely heavily on benchmarking when determining TNSPs' opex allowances partly reflected the small dataset available to conduct benchmarking, and the AER's limited experience (to date) in conducting TNSP benchmarking. As more data become available over time, and as the AER gains more experience, it may be willing to place greater reliance on benchmarking when setting TNSP opex allowances. This, in turn, could foster a capex bias amongst TNSPs.

Therefore, we recommend that, if a totex approach is adopted in Australia, the NER should be changed to require the AER to have regard to totex benchmarking when assessing the expenditure forecasts of DNSPs and TNSPs.

Required changes to the NER

In order to implement the totex benchmarking approach discussed above, the following changes to the NER would need to be made:

- Rule 6 Part O and r.6A Part L would need to be amended to specify that the annual benchmarking reports must include a benchmarking analysis of DNSPs' and TNSPs' total expenditure.
- The new *total expenditure factors* for DNSPs and TNSPs (see section 5.1.1) would need to be amended to require the AER to have regard to the results of its *total expenditure benchmarking* in the most recent annual benchmarking report.

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113 AER, *TransGrid transmission determination 2015−16 to 2017−18, Final Decision, Attachment 7 – Operating expenditure*, April 2015, p.21.

Challenges associated with implementing totex benchmarking

Undertaking totex benchmarking properly, and in a way that is truly informative for the purposes of setting expenditure allowances, is a non-trivial task. One of the principal challenges lies in deriving a measure of totex for each business that accounts for differences in the profile of opex and capex.

As noted above, opex tends to be smooth and relatively steady, whereas capex can be lumpy and infrequent. If these two different types of costs are not combined carefully when deriving an overall measure of totex, then assessments about individual regulated businesses can simply reflect investment cycles (with companies looking artificially inefficient when they are making necessary capital investments, and artificially efficient between investment peaks). If the regulator does not smooth capex appropriately, or take proper account of investment cycles when conducting totex benchmarking, incorrect inferences about the efficiency of the businesses may be drawn, and this in turn may lead to expenditure allowances being set inefficiently high or inefficiently low.[114]

The challenges of accounting for capex properly when benchmarking explains partly why many regulators overseas began by benchmarking opex and only later adopted totex benchmarking.

However, the challenges associated with developing and implementing totex benchmarking are not insurmountable, as evidenced by the fact that a number of regulators do in fact benchmark totex. We also note that the AER has developed totex benchmarking models,[115] but to date has not relied (heavily) on these models to assess the expenditure forecasts of NSPs.

If a totex approach were adopted in Australia, further work would need to be done to develop an appropriate totex benchmarking approach. Specifically, we recommend the following:

- The AER would need to undertake further work to consider whether its existing totex benchmarking models are fit-for-purpose, or whether new benchmarking models need to be developed.[116] For example, the AER's preference to date has been to give almost exclusive weight to an econometric benchmarking model when assessing the efficiency of DNSPs' revealed base year opex. If the AER wishes to continue using econometric benchmarking

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114 As discussed in section 4, this was a matter of contention in Bristol Water's appeal against Ofwat's totex benchmarking to the UK's CMA.

115 Specifically, Multilateral Total Factor Productivity models. The AER has not to date developed/ implemented totex econometric benchmarking models.

116 We note that prior to rolling out totex benchmarking at the first RIIO price controls, Ofgem undertook a significant program of work to develop and test alternative totex benchmarking models—notwithstanding that Ofgem already had many years of experience using benchmarking analysis for regulatory purposes.

techniques within a totex framework, it would need develop a suitable totex econometric benchmarking model. This would be a relatively substantive piece of work and would represent a sufficiently material change of approach that the AER would, in our view, need to conduct a comprehensive consultation process with stakeholders.

- In order to properly contextualise and interpret the results of the totex benchmarking, the AER should undertake analysis to understand:
  - the investment cycles that face different NSPs (e.g., by examining asset health indicators and other factors that may be driving the need for network augmentation, as well as examining past investment activity);
  - how these factors may have influenced the totex benchmarking results.[117]
- Due to the complexities and uncertainties associated with top-down totex benchmarking, in our view it would be prudent for the AER to give much less weight to economic benchmarking when assessing NSPs' expenditure forecasts (and in particular, DNSPs' expenditure forecasts) than the AER gave in the last round of resets. A recent Australian Competition Tribunal decision concluded that the AER had, in its recent determinations for DNSPs, given disproportionate emphasis to economic benchmarking in assessing the DNSPs' opex forecasts vis-à-vis other opex factors that the AER is required to have regard to under the NER.[118] A recent judicial review decision by the Full Federal Court found no error in the Australian Competition Tribunal's decision in relation to this matter.[119] If a totex benchmarking approach is adopted, there would be (in our view) even greater impetus to ensure that appropriate weight is given to economic benchmarking analyses (vis-à-vis other *total expenditure factors*) in the AER's determinations.
- There would seem to be a valuable role for the AEMC, when explaining the necessary NER changes to initiate a move to a totex approach, to provide clear guidance to the AER (and stakeholders) about the appropriate application of totex benchmarking, including on:
  - Totex benchmarking techniques and estimation methods;
  - Methods for accounting appropriately for capex within the measure of totex that is benchmarked;

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117 Even if best efforts have been made to smooth the lumpiness of capex within the totex measure, such a task is more art than science, and therefore difficult to do precisely. Therefore, a sound understanding of how investment cycles may be driving the benchmarking results, at least in a qualitative sense, would be indispensable.

118 Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [480].

119 Australian Energy Regulator v Australian Competition Tribunal (No 2) [2017] FCAFC 79.

- The factors and considerations the AER should take into account when interpreting the totex benchmarking results; and
- The appropriate weight to give economic benchmarking amongst the expenditure factors that the AER must have regard to when assessing NSPs' totex forecasts.

5.1.6 Activity based accounting

Background

Even if the regulator moves from benchmarking opex and capex separately to a situation where totex is benchmarked (for the purposes of measuring performance over time, and when determining expenditure allowances), the regulator may also benefit from understanding exactly where and how NSPs are spending their allowances.

In Great Britain, the introduction of a totex framework by Ofgem was accompanied by the introduction of 'activity based accounting', where the companies it regulates are required to record their expenditure according to standardised categories of activities (e.g., direct network expenditure, indirect network expenditure, business support) and associated subcategories. These categories and subcategories are defined precisely in detailed reporting guidelines issued by Ofgem so that expenditure is recorded by different businesses (and over time) in a consistent way.

Through close and constant engagement with the businesses, Ofgem revisits these definitions regularly to ensure that they are sufficiently clear, and that the businesses are reporting accurately and consistently against them. Ofgem will, if required, make refinements to the definitions (and apply adjustments to the existing data to ensure consistency with the revised definitions). The result is a rich, granular (and largely consistent) dataset, improved iteratively over time, on the businesses' expenditures on different activities of interest to the regulator.

Ofgem then uses these data to undertake more detailed, activity-based benchmarking to understand how allowances are being spent over time, and to inform cost allowances. In its final RIIO-ED1 decisions, Ofgem placed 50% weight on the results from its totex benchmarking models and 50% weight on the results from its disaggregated benchmarking analysis.[120] Hence, the disaggregated benchmarking played a material role in determining the businesses' expenditure allowances in Ofgem's latest price controls.[121]

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120 Ofgem, *RIIO-ED1: Final determinations for the slowtrack electricity distribution companies: Business plan expenditure assessment, Final Decision*, 28 November 2014, p.10.

121 By contrast, as discussed in section 4, Ofwat did not undertake any disaggregated benchmarking at PR14, and this was criticised by the CMA in its Bristol Water appeal decision.

If a totex approach is adopted in Australia, it may be useful for the AER to collect disaggregated data that it can use to understand how totex allowances are being spent by NSPs over each RCP.

Potential problems with using disaggregated benchmarking to determine allowances

There are two main problems with disaggregated benchmarking of the kind undertaken by Ofgem:

- Firstly, the results of the benchmarking will only be meaningful to the extent that all businesses report data consistently, in line with common definitions. In practice, it is very difficult to specify the definitions of categories and activities to a degree of precision that eliminates ambiguity. The more granular the disaggregation of the categories, the greater the need to allocate aggregated costs, and the more scope for misreporting. It may take many years before a common understanding is reached within the industry about how data ought to be reported, and for businesses' reporting systems to adjust accordingly.[122] Therefore, as was the case for Ofgem, the compilation of a useful and consistent database is likely to be a long, iterative process of refinement that requires ongoing engagement between the AER and the industry. This means that, at least over the short-term, the disaggregated data (and any benchmarking undertaken using those data) should be treated very cautiously.
- Secondly, disaggregated benchmarking based on expenditures on different activities could potentially create incentives to favour certain activities (or, in the absence of sufficient clarity on reporting rules, record expenditure towards certain activities) over others. This is similar to the capex bias problem that is created through a differential regulatory treatment of opex and capex: by benchmarking different activities individually, and setting expenditure allowances based on the outcome of that benchmarking, the regulator may inadvertently incentivise businesses to favour some activities over others, even if that ultimately leads to less-than-efficient outcomes for consumers.

Of these two issues, the second is the more problematic, in our view. There would be little to gain from eliminating the capex bias (by introducing a totex approach) only to replace it with an 'activity bias' (by introducing perverse incentives to game the regulator's disaggregated benchmarking analysis).

For this reason, we recommend that whilst it is desirable for the AER to collect, analyse and benchmark disaggregated data on NSPs' costs and activities, any disaggregated benchmarking should not be used *directly* to set expenditure allowances for NSPs in the way Ofgem does. In other words, we recommend that

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122 For instance, the information systems of the businesses may not be set up to capture and report information in the way required by the regulator's guidance.

the AER use totex benchmarking (within a totex framework), rather than disaggregated benchmarking when determining expenditure allowances. That said, as noted above, any totex benchmarking should be conducted with due care (given the complexities and uncertainties associated with it), and given appropriate weight amongst the various expenditure factors that the AER must have regard to under the NER.

Nevertheless, disaggregated data collected by the AER could be used *indirectly* to influence the setting of allowances by:

- Providing some insight into the results of the totex benchmarking (e.g., to understand why have some networks become more/less efficient);
- Testing the information in NSPs' regulatory proposals; and
- Providing the AER with a deeper understanding of the differences in the operating environments of different NSPs by drilling down more deeply into their activities.

Disaggregated data collection already occurs in Australia

As part of the AER's Expenditure Forecast Assessment Guideline, the AER undertook to develop a standardised dataset to "conduct benchmarking, trend and driver-based assessments at the disaggregated activity or expenditure category level" ('category analysis').[123] The AER states that it will use these 'category RIN' data to:[124]

- undertake analysis of trends in disaggregated expenditures;
- examine differences in costs incurred on comparable activities undertaken by NSPs;
- use the above analysis to form views on where forecast expenditure allowances and components thereof proposed by NSPs appear reasonable and in accordance with the NER criteria;
- publish trend and benchmarking analysis in annual benchmarking reports in order to generally improve dissemination and greater awareness amongst interested stakeholders on NSP performance, with the aim of enabling network users to better engage in the process of determining regulated network prices and revenues; and
- take a more pro-active stance in regulating network businesses and make better decisions on efficient expenditure allowances.

123 These data are collected through Regulatory Information Notices (RINs).

124 For more details, see, AER, *Final regulatory information notices to collect information for category analysis, Explanatory Statement*, March 2014.

The AER does not use category RIN data for economic benchmarking; the data for that purpose are collected through separate economic benchmarking RINs, and these two datasets are treated as distinct by the AER. The AER uses, but does not *rely* on, its category analysis to assess NSPs' expenditure forecasts. We agree with this approach, for the reasons discussed above.

Required changes to the NER

As noted in section 5.1.1, we recommend that the new *total expenditure factors* for DNSPs and TNSPs should, under a totex framework, be amended to require the AER to have regard to the results of its *total expenditure benchmarking* in the most recent annual benchmarking report. No further change would be necessary beyond this amendment.

5.1.7 Post-tax revenue model and roll-forward model

Existing arrangements

The NER obliges the AER to develop a post-tax revenue model (PTRM)[125] and a roll-forward model (RFM).[126]

The purpose of the PTRM is to set out the manner in which the NSP's regulated revenue within each year of a regulatory control period is to be calculated.[127] It is to incorporate all the relevant building block components that go towards the setting of annual regulated revenues, including:[128]

- Indexation of the RAB
- Return on capital
- Depreciation
- Estimate cost of corporate income tax[129]
- Revenue increments or decrements associated with incentive schemes including the EBSS, the CESS and the STPIS.

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125 NER 6.4.1 and

126 NER 6.5.1 and

127 NER 6.4.2 and

128 NER 6.4.1-6.4.3 and 6A.5.1-6A.5.4.

129 To the extent that the tax accounting rules create any bias in favour of opex over capex (because opex can, for tax purposes, be expensed within the year in which it arises, whereas taxpayers can claim deductions on capex only over a number of years), the introduction of a totex approach would neither exacerbate nor diminish any such bias. This is because this bias (if it exists at all) arises from tax rules, which are independent of any regulatory rules that might apply to specific industries within the economy.

- Forecast opex.

The purpose of the RFM is to determine the roll forward of an NSP's RAB from one regulatory control period to the next and from one year of a regulatory control period to the next. In broad terms, the RFM is to adjust the RAB on an annual basis to account for:[130]

- Forecast capex
- Depreciation
- Asset disposals
- Inflation.

Approach under a totex framework

One of the main changes involved in the implementation of a totex approach is to eliminate any distinction between the traditional opex and capex allowances that make up regulated revenues.

The implementation of a totex framework would likely require a major change to the structure of the PRTM and RFM to reflect the changes discussed earlier in this section – such as the setting of totex (rather than capex and opex) allowances, the split between totex capitalisation and expensing, and a totex incentive scheme. For example, at present the roll-forward of the RAB within a regulatory period depends on the efficient capex incurred during the period. However, under a totex approach, the roll-forward will depend on the capitalised portion of efficient totex. The models may also need to be capable of accommodating differences in splits of fast and slow money across different NSPs.

Other elements of the models may not need to change greatly, such as those addressing the indexation of the RAB, corporate tax and the treatment of asset disposals.

If a menu regulation approach were implemented jointly with a move to totex, the models would also need to be able to take account of differences in incentive sharing rates across NSPs.

5.1.8 Financeability assessments

Financeability considerations in other jurisdictions

In a regulatory context, 'financeability' refers to the ability of regulated businesses to secure financing for investment on reasonable terms.[131] Financeability is an

130 NER S6.2.3.

131 For example, Ofgem defines financeability as: "the ability to secure financing in a timely way and at reasonable cost". See: Ofgem, *RPI-X@20 current thinking working paper on Financeability*, May 2010, p.3.

important consideration for economic regulators in the UK because, to varying degrees, these regulators all have some statutory obligation to ensure that the businesses they regulate remain financeable (see Table 7).

Table 7: UK regulators' statutory duties with regard to financeability

Regulator	Statutory provision
Ofgem	**Electricity** *to have regard to the need to secure that license holders are able to finance the activities which are the subject of obligations on them* **Gas** *to secure that such persons are able to finance the provisions of gas supply services*
Ofwat	*to secure that companies…are able (in particular, by securing reasonable returns on their capital) to finance the proper carrying out of their functions*
Ofcom	**Royal Mail** *Ofcom must have regard to a) the need for the universal postal service to be financially sustainable*
Civil Aviation Authority	*the need to secure that each holder of a licence…is able to finance its provision of airport operation services in the area for which the licence is granted*
Office of Rail and Road	*not render it unduly difficult for persons who are holders of network licences to finance any activities or proposed activities*

Source: Various statutes governing the roles and duties of UK regulators

In order to meet these statutory obligations, a number of UK regulators conduct financeability assessments to ensure that the revenue allowances they propose to allow would likely maintain the financial health of the business at a level that would allow the business to raise the finance it requires on reasonable terms. For instance, Ofwat states that:[132]

> Price limits must secure that efficient companies can be financeable, such that a company's revenues, profits and cash flows are sufficient to allow it to raise finance on reasonable terms.

These financeability assessments involve testing whether the cash flows implied by the maximum allowed revenues proposed by the regulator would result in credit metrics (indicators of financial health) that are consistent with the business being able to service its debt obligations and maintain a credit rating that is comfortably investment grade. The objective of these assessments is to ensure that the regulator does not inadvertently impose a regulatory outcome on the business that would

132 Ofwat, *Financeability and Financing the Asset Base – a discussion paper*, March 2011.

lead to a deterioration in its creditworthiness such that it faces difficulty in raising debt finance to fund necessary investments.

Financeability assessments are a useful regulatory tool within a totex framework because they can be used to check if the rate of capitalisation of totex within the RAB is appropriate.[133] For instance, if too high a proportion of allowed totex is capitalised, the business may have insufficient cash within a RCP to meet its operational needs and debt servicing requirements. This, in turn could create a near-term financeability problem (e.g., through pressure on credit metrics, a weakening of its credit rating and an increase in its borrowing costs). If, on the other hand, a high proportion of approved capex is expensed within the forthcoming RCP, the NSP may have excess cash flow within that RCP (with the current cohort of consumers paying more than an efficient level), and insufficient cash flow for the business in later years. In other words, the NSP may be storing up a financeability problem for the future.

Ofgem, in its latest price control for electricity distribution businesses (RIIO-ED1) used its financeability analysis to check that the capitalisation rates proposed by the businesses were appropriate and, as a result, made adjustments to the allowed capitalisation rate for some companies. For example, Ofgem stated in its RIIO-ED1 decision the following:[134]

> 5.30. The change to ENWL's [Electricity North West's] capitalisation rate has a neutral effect on the present value of allowed revenues over time. It improves the company's cash flows and gearing levels in RIIO-ED1 and we believe it provides a better foundation for any owner initiatives to reinforce its financial position further. Although this change means lower revenues after RIIO-ED1 it should mean less new borrowing at the end of RIIO-ED1 and better financial metrics thereafter. We think ENWL's proposal is in the consumer interest.
>
> 5.31. The changes to SSEH's [Scottish Hydro Electric Power Distribution's] capitalisation rate have a broadly neutral effect on the DNO's revenue requirement in the affected years. At the time of our draft determinations, interim costs associated with supplying energy on Shetland were assumed to be remunerated as fast money. In Annex 7 we explain our decision to fund these costs as part of totex. This means they are included in the capitalisation. Without any change, this would inappropriately defer the recovery of some of the costs. It would mean they are met by future

133 Regulators in the UK also use financeability analysis to assess whether the overall revenue allowance within a RCP is sufficient (i.e., the analysis is not restricted to assessing whether the allowed capitalisation rate is appropriate). In principle, any financeability problem that is identified could be addressed by increasing the business's expenditure allowances, or by allowing a higher rate of return. However, in practice regulators in the UK have tended to address financeability problems by re-profiling cash flows (typically by adjusting the depreciation allowance) in a NPV-neutral way. Ofgem, for instance, has done this for a number of gas networks and for the transmission operator, National Grid.

134 Ofgem, *RIIO-ED1: Final determinations for the slowtrack electricity distribution companies, Overview: Final Decision*, 28 November 2014.

> consumers. We have reduced SSEH's capitalisation rate in the first half of RIIO-ED1 to avoid this anomaly.

Application of financeability assessments in Australia

No role for financeability assessments under the current NER

At present there is no formal role for financeability assessments within the NER.[135] Indeed, the AER has made this point in its most recent decisions for a number of DNSPs. For example, during the last round of revenue resets, a number of DNSPs, including Ausgrid, Essential Energy, Endeavour Energy and ActewAGL argued that sizeable reductions in opex allowances (relative to the levels forecast by those businesses) over a single RCP would threaten their financeability (by means of a material deterioration in credit rating, possibly below investment grade).[136] In its final determinations for these businesses, the AER responded that the financeability of NSPs was not a consideration that it need have regard to under the NER:[137]

> The financeability implications of our decisions do not form part of our obligations under the NER

The AER went on to elaborate:[138]

> Neither the NEL nor the NER include an explicit obligation requiring us to consider the impact of our determination on the viability of the service provider in its actual circumstances. Our task is to determine the revenue that a service provider can recover from its customers with reference to what is the efficient and prudent level of expenditure. The service provider's actual ownership circumstances and the financial structure of its shareholders are not factors that we are required to consider in fulfilling our task under the NEL or the NER.

As the AER notes, under the NER, there is no formal role for financeability assessments. Under a totex framework, it would be desirable to introduce a requirement for the AER to undertake financeability assessments, at least when determining the rate at which the totex allowance is to be capitalised within the RAB.

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135 However, a number of other regulators in Australia, including the Independent Pricing and Regulatory Tribunal and the Essential Services Commission of Victoria, do have some regard to financeability assessments when making regulatory decisions.

136 Ausgrid, *Revised Regulatory Proposal and Preliminary Submission 1 July 2014 – 30 June 2019*, 20 January 2015, pp.37-38.

137 See, for example, AER, *Ausgrid distribution determination 2015−16 to 2018−19, Attachment 7*, April 2015, pp.7-46.

138 See, for example, AER, *Ausgrid distribution determination 2015−16 to 2018−19, Attachment 20*, April 2015.

Need for greater clarity on what financeability means

In the last round of resets, whilst the AER considered that it faced no obligation to have regard to any financeability analysis, it decided that since some NSPs had raised financeability as an area of concern, it would consider the issue and the supporting material submitted by the businesses by conducting its own analysis on "financial viability". In doing so, the AER considered whether the businesses:[139]

> …would be at material risk of insolvency

and concluded that there would be no material risk of insolvency.

We note that the 'insolvency' is a very different concept to 'financeability' as understood by and applied by regulators in the UK, and indeed the DNSPs that made submissions to the AER. The argument put forward by the businesses was essentially that the cash flows that would result from the AER's decision would put significant pressure on the business's ability to service its existing debt obligations, and that this would be interpreted by financial markets as a reduction in the creditworthiness of the business. If this were to result in a downgrading of the DNSP's credit rating (potentially below investment grade), this could result in a significant increase in future borrowing costs.

However, when the AER analysed the issue, it viewed it in terms of 'insolvency' (i.e., the inability to meet debt obligations), which is a more extreme financial circumstance than non-financeability.

The AER's decisions suggest that there was, in its mind, ambiguity over what 'financeability' means:[140]

> Ausgrid has not been clear about what it means by the term financial viability. In our analysis, we have considered whether Ausgrid would be at material risk of insolvency. We understand this to be consistent with Endeavour Energy's interpretation of threats to its financial viability.

However, it is clear to us that the material submitted by the NSPs referred to financeability as it would be understood by regulators in the UK, and not as insolvency as interpreted by the AER. Given the ambiguity over the meaning of 'financeability' (at least from the AER's perspective), it would in our view be useful for the AEMC to issue written guidance clarifying what financeability means, and how financeability assessments should fit within the regulatory framework.

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139 See, for example, AER, *Ausgrid distribution determination 2015−16 to 2018−19, Attachment 20*, April 2015.

140 See, for example, AER, *Ausgrid distribution determination 2015−16 to 2018−19, Attachment 20*, April 2015.

Summary

In summary, if a totex framework is adopted in Australia:

- It would be useful for the AER (and indeed, NSPs) to conduct financeability assessments (of the sort undertaken by UK regulators) to test if the capitalisation rates proposed/allowed would ensure the financeability of the NSPs;
- The NER should be changed to include an obligation on the AER to have regard to financeability considerations when assessing the totex forecasts of NSPs. The AER's latest decisions suggest that it is unlikely to have regard to these considerations because the AER does not view this as a relevant obligation under the NER; and
- The AEMC could issue the AER and stakeholders with written guidance on what would constitute an appropriate financeability assessment, and this written guidance should be informed by the financeability approaches developed and applied by UK regulators that operate totex frameworks.

Required changes to the NER

The following changes would need to be made to the NER in order to incorporate financeability considerations into the totex framework:

- A new *total expenditure factor* could be inserted into the NER requiring the AER to have regard to the implications for the financeability of the NSP in question over the RCP.
- The NER should specify that when determining the *capitalisation rate* (see section 5.1.3) for a NSP for a RCP, the AER should have regard to the implications for the financeability of the NSP in question within the RCP.

5.1.9 Shared services

Existing arrangements

Since the AEMC's changes made in late 2012, the NER has made provision for the revenues earned from 'shared assets'.[141] These are assets whose costs have been allocated to the provision of regulated services, but that provide both regulated (standard control distribution services or prescribed transmission) services as well as other services that are either not regulated network services or not network services at all.

In these cases, the NER provides that the AER may reduce the regulated revenue of an NSP "by such amount as it considers reasonable to reflect such part of the

141 NER 6.4.4 and 6A.5.5.

costs of that asset as the [NSP] is recovering through charging for the provision of [the other] service".

In making such a decision, chapters 6 and 6A of the NER require the AER to have regard to the shared asset principles and its own Shared Asset Guideline, which it is obliged to develop.

The shared asset principles are broadly that:[142]

> (1) the NSP should be encouraged to use assets that provide regulated services for the provision of other kinds of services where efficient and does not materially prejudice the provision of regulated services;
>
> (2) a shared asset cost reduction should not be dependent on the NSP deriving a positive commercial outcome from the use of the asset to provide other services;
>
> (3) a shared asset cost reduction should be applied where the use of the asset for the provision of other services is material;
>
> (4) regard should be had to the manner in which costs have been recovered or revenues reduced in respect of the relevant asset in the past and the reasons for adopting that manner of recovery or reduction;
>
> (5) a shared asset cost reduction should be compatible with the Cost Allocation Principles and Cost Allocation Method; and
>
> (6) any reduction effected under paragraph (a) should be compatible with other incentives provided under the Rules.

The AER's Shared Asset Guideline[143] provides that an NSP's regulated revenues will be reduced by 10 per cent of the value of the NSP's expected total unregulated revenues from shared assets in that year.[144] However, the AER may accept an NSP's proposal to reduce this amount if the unregulated services are provided by making only minimal use of the relevant shared assets relative to other assets used to provide that service.[145]

Approach under a totex framework

It is important to note that the shared asset provisions of the NER and the AER's guideline only apply to assets whose costs have been wholly allocated to the provision of standard control or prescribed transmission services in accordance with an NSP's approved cost allocation method (CAM). Because an NSP only allocates costs once, the shared assets mechanism applies to assets for which the initial allocation is no longer accurate because they are subsequently used to

142 NER 6.4.4(c) and 6A.5.5(c).

143 AER, *Shared Asset Guideline*, November 2013.

144 Section 3.1, p.11.

145 Section 2.6, pp.9.10.

provide other (unregulated) services. The shared asset provisions do not apply to new assets whose costs have not yet been allocated using the NSP's CAM, or whose costs have been allocated in part to the provision of unregulated services.

A key implication of any move to a totex framework is that NSPs will no longer receive a capex allowance *per se* – rather, a fixed proportion of their totex allowance will be capitalised and recovered gradually over time. However, this should not affect the application of the shared asset revenue arrangements to pre-existing assets that subsequently start being used to provide unregulated services. For any new assets, it is likely even under a totex framework that NSPs would continue to be required to apply their approved CAMs to ensure that they do not shift any or all of the costs of providing unregulated services to customers of regulated services.

As long as NSPs continue to be required to maintain records of assets they have developed to provide regulated services – and whose costs have been allocated entirely to such provision – there seems to be no obstacle to continuing to apply the shared asset arrangements broadly as they operate now even under a totex approach.

5.1.10 Differences in arrangements for DNSPs and TNSPs

In the sections above we have discussed a number of changes to the NER that would need to be made in order to implement a totex framework in Australia. We have not identified any reason why these changes should not apply equally to DNSPs and TNSPs. We note that Ofgem applies its totex framework equally to distribution and transmission networks.

5.2 Changes to the AER's implementation of the NER

5.2.1 New approaches to be developed by the AER

If a totex approach is adopted, the AER will likely need to undertake some development work before the totex approach can be implemented in practice. In section 5.1, when describing the various changes required to the NER in order to implement a totex approach, we touched on the various development work the AER would need to complete. In this section we summarise the below the main development projects the AER would need to complete in order to operationalise a totex framework:

- The AER would need to reconsider how it assesses the NSPs' forecasts. For example, the AER would need to revisit its revealed cost approach (including 'base-step-trend') is appropriate under a totex framework (section 5.1.1).
- The AER would need to design a new totex incentive mechanism that would apply to NSPs' totex allowances. The AER would also need to decide on the

strength of the incentive mechanism by selecting an appropriate incentive sharing rate (section 5.1.2).

- The AER would need to develop an approach for determining the proportion of the totex allowance to be expensed, and the proportion to be capitalised within the RAB (section 5.1.3).
- The AER would need to develop an approach for setting depreciation allowances for existing assets and for depreciation allowances related to new assets — that part of the RAB, going forward, that reflects capitalised totex (section 5.1.4).
- The AER would need to consider whether its existing totex benchmarking models are suitable for use within a totex framework. If a need for improvement is identified, the AER would need to investigate and develop alternative totex benchmarking models. There is potentially a role for the AEMC in providing clear guidance to the AER (and stakeholders) about the proper application of totex benchmarking under the NER (section 5.1.5).
- The AER would need to restructure its existing post-tax revenue model in order to remove the current distinction between opex and capex (section 5.1.7).
- The AER would need to develop its approach to conducting financeability assessments (section 5.1.8).
- The AER would need to publish new guidelines setting out how it proposes to implement each of the measures above. Some of these guidelines could be developed by revising existing guidelines (e.g., the Expenditure Forecast Assessment Guideline).

5.2.2 Regulatory burden

A related consideration is whether a move to a totex framework (and the associated requirement on the AER to undertake further development work in order to implement the new framework) is likely to impose a significant regulatory burden on the AER.

Clearly, a move away from the current regulatory arrangements to a totex framework would represent a very material change. However, most of the costs associated with a change of approach are likely to be the upfront costs associated with switching regimes (i.e., the development work to be undertaken by the AER, and AEMC's efforts in amending the NER). If the capex bias problem is a material one in Australia, then it seems likely that the benefits to society of addressing the problem would more than outweigh the short-run costs associated with changing approach. It seems unlikely to us that there would be an increase in ongoing regulatory burden faced by the AER because most of the requirements for

implementing a totex approach involve modifications to existing activities already being performed by the AER.

It is worth noting, however, that a very material set of changes to the NER can create uncertainty about how the new rules should be interpreted and implemented. For example, the AEMC made some very material changes to the NER in 2012, which had implications for the way the AER conducts economic regulation of NSPs. The most significant of those changes related to the AER's approach to determining NSPs' allowed rate of return, and the application of economic benchmarking. Following the first round of regulatory resets since that rule change, a large number of limited merits review appeals were initiated by both NSPs and some consumer groups—principally on matters related to rate of return and economic benchmarking. It is our understanding that many of the parties that pursued these appeals were seeking to test whether the AER had applied the new rules written in 2012 correctly. This is entirely understandable, given the materiality of the 2012 reforms.

It is possible that another set of material changes to the NER may result in further appeals in which NSPs and/or other stakeholders seek to gain legal certainty over whether the AER is implementing the totex arrangements properly. We note that whilst there are moves afoot to reform (and potentially curtail or remove) the limited merits review arrangements in Australia, it will still be open to any party affected by the AER's decisions to pursue judicial reviews.

5.3 Timeframes for implementation

It is very difficult to predict with any precision the timeframes that would be necessary to implement a totex framework in Australia. However, we expect that a shift to a totex framework would likely take two to three years. This estimate assumes:

- A one-year timescale for the AEMC rule change process required to make the necessary amendments to the NER (although the AEMC is best-placed to assess the time required to consult and develop the changes to the NER); and
- A one-to-two year period for the AER to complete the various development work set out in section 5.2.1 above, and to consult appropriately with affected stakeholders in relation to that development work. Ultimately, the AER would be the best-placed to provide advice on the timeframes it would require to undertake this development work, so the AEMC would need to consult with AER on this issue before settling on a final view.

5.4 Changes to NSP business operations and regulatory obligations

We do not anticipate that a move to a totex framework would result in a material change in NSPs' regulatory obligations, other than contribution to the consultation processes considering whether/how such a change should be made.

It is unclear how NSPs' business operations are likely to change if a totex framework were adopted in Australia. When Ofgem and Ofwat moved to a totex approach, these regulators hoped above all that the equalisation of incentives as between opex and capex would stimulate a cultural change within the industry. In particular, they hoped that there would be a shift in mindset within the NSPs away from a grow-the-RAB strategy as safe way of maximising returns to shareholders towards a strategy of seeking out the most efficient solution (be it opex-focussed or capex-focussed) for delivering regulated services. As discussed in the sections above, it is too early to tell if any such change has occurred—partly because cultural change can be slow to manifest.

In our view, if the incentives for efficiency are set up properly within the regulatory framework that operates in Australia, there is little reason why a totex approach should not be transformative.

FRONTIER ECONOMICS
BRISBANE | MELBOURNE | SINGAPORE | SYDNEY
Frontier Economics Pty Ltd 395 Collins Street Melbourne Victoria 3000
Tel: +61 (0)3 9620 4488 Fax: +61 (0)3 9620 4499 www.frontier-economics.com.au
ACN: 087 553 124 ABN: 13 087 553 124