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Regulating energy networks without the regulator

Chapter 1:
Capital Expenditure

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Overview & Introduction

Gas and electricity networks in Australia were placed under economic regulation as part of the microeconomic reforms of 1990s. In its original inception, this form of regulation was expected to be straightforward and largely mechanical in its conduct. Economic regulation was expected to see the end of gross inefficiency. The end of political interference. The end of over-investment and under-servicing. The end of an engineering mindset and the rise of economic discipline. This was to be the golden age of energy economics. The 'end of history' for energy networks.[1] But, the reforms fell short of expectations.

The energy sector is subject to one of the most labyrinthine regulatory frameworks in the Australian regulatory canon, consisting of thousands of pages of laws, rules, codes, guidelines, standards, mathematical models and spreadsheets. The process for the 30 network operators[2] requiring regulatory approval of their revenues takes years and involves hundreds of thousands of pages of submissions, engineering reports, business cases, economic modelling, consumer consultations, regulatory decisions, and so on.

At the heart of this regulatory framework lies an assumption that has been in place for so long, it has become invisible.

From the outset, it has been assumed that comprehensive rules and well-resourced regulators are needed as a foil against rapacious network operators. Despite the regulatory framework's ever-deepening complexity, the relevant authorities have never questioned the key assumption on which the entire edifice sits. This paper steps into the breach.

When it comes to the efficient level of capital expenditure on network assets, the Australian Energy Regulator (AER) determines everything and delivers nothing, while network operators deliver everything and determine nothing. All of which happens in line with rules created by the Australian Energy Market Commission (AEMC). So, who is responsible for the efficiency of a network? Who is responsible for the cost of network services? Who is responsible for ensuring the network is future-ready? There is no clear answer to these questions.

The regulatory framework is a jumble of misaligned responsibilities and risks. The well-acknowledged information asymmetry with which the AER must contend merely exacerbates the consequences of this misalignment for consumers (and taxpayers) who ultimately foot the bill.

The sector's regulatory authorities, the AEMC and AER, have sought to accommodate this misalignment rather than confront it. Regulatory 'workarounds' have been implemented layer-by-layer over the past thirty years – each layer adding to the regulatory framework's seemingly unbounded capacity for complexity. The Capital Expenditure Sharing Scheme (CESS) is one such regulatory workaround.

This paper tackles head-on the misalignment of responsibilities and risks associated with capital expenditure. (Future papers intend to look at other elements of the regulatory framework.[3])

[1] To borrow Fukuyama's famous phrase.
[2] AER (August 2025b) pp. 56 & 184
[3] For example: the regulatory treatment of inflation, demand forecasting, and operating expenditure.

Addressing this misalignment is not an abstract nicety. The complexity of the regulatory framework's efforts to accommodate the misalignment has created incentives for wasteful and costly behaviours by network operators and the regulator. These behaviours have been demonstratively lucrative for network operators but have come at a considerable cost for consumers.

This paper defies conventional regulatory wisdom. It demonstrates network revenue regulation does not require the regulator to act as a foil against network operators. Network regulation can be designed so that network operators are made fully (and solely) accountable for honestly and reliably forecasting and delivering their capital requirements.

In this sense, the paper establishes two important and related principles for regulatory design. First, the regulatory framework cannot create and solve the same problem. The problem can only be addressed by redesigning the framework so it does not cause the problem in the first place. Second, the regulator should not be second-guessing the parties it regulates. Network operators should be held responsible and accountable for honestly forecasting and delivering network investment and services.[4]

The paper is presented in three parts.

Part 1 provides an overview of the logic behind, and operation of, the economic regulation of electricity and gas networks in Australia. The discussion focusses on the framework's treatment of capital expenditure. This component of the framework has the most labyrinthine layers of regulatory safeguards given the long-lasting impact of capital expenditure on network prices. This discussion outlines how economic regulation has become a costly 'arms race' between network operators and the regulator. Ending the arms race requires realignment of the roles played by the regulator and network operators.

Part 2 turns to a close examination of the Capital Expenditure Sharing Scheme (CESS) which was introduced into the regulatory framework in 2013 and reviewed a decade later by the AER. The scheme seeks to create a financial incentive to promote efficient capital expenditure by network operators. The discussion describes the CESS and reflects on the findings of the review. It highlights that network operators' efforts to game their capital expenditure forecasts is the result of the misalignment of responsibilities and risks created by the regulatory framework.

Part 3 responds to these findings. It begins with a stylised mathematical model of the CESS. Through a series of steps, the scheme is modified to make network operators fully accountable for honestly and reliably forecasting and delivering their capital requirements. By internalising incentives for honesty and efficiency within the 'mind' of a network operator, the modified scheme removes operators' incentive to game the regulatory framework. And, because efficiency is measured at the level of the network, the regulator no longer needs to conduct *ex ante* assessments of the efficiency and prudency of the capital expenditures proposed by a network operator. Put simply, unlike the current regulatory approach, the modified scheme clearly focuses the regulatory framework on achieving outcomes rather than assessing inputs – as it should.

[4] Noting the general form of the national energy objectives requires the regulator to promote efficient investment in, and efficient operation and use of, electricity and gas services for the long-term interests of consumers – see: https://www.aemc.gov.au/regulation/neo

The modified approach gets the regulator out of the business of forecasting, reviewing and authorising network operators' capital expenditure. Network operators become unequivocally responsible for, and bear all the risk associated with, forecasting and delivering efficient capital expenditure – rather than just seeking to convince the regulator that this is what they are doing (as is currently the case). In doing so, this approach ends the arms race and supports significant simplification of the overall regulatory framework.

Importantly, the purpose of this paper is not to advocate for a particular model, such as the one described in Part 3. This paper seeks only to demonstrate that it is possible to design such a scheme. In other words, the model is presented for illustrative purposes only. Its details are far less important than its message about what is possible.

The paper concludes with a call to action.

It's time for the sector's regulatory authorities to 'rethink how they think' about their role and to recognise the costs their way of thinking is imposing on consumers. And if they cannot do so, then someone needs to do it for (and to) them.

PART 1. Economic regulation: Expectations and reality

The following discussion provides a brief reflection on the history and consequences of economic regulation of energy network infrastructure. It highlights how the expectations that motivated the introduction of economic regulation did not eventuate as anticipated.

The discussion begins with a very brief recounting of how the economic regulation of energy networks came to Australia. Section 1.2 then briefly describes how economic regulation is conducted. It highlights the back-and-forth exchanges between the regulator and network operators. Section 1.3 outlines the theoretical underpinnings of economic regulation while the discussion in section 1.4 reflects on some of its unanticipated consequences – namely, the emergence of economic regulation as an 'arms race' between network operators and the regulator. Section 1.5 ends the discussion with an exploration of the root causes of these unanticipated consequences. It identifies that ending the arms race requires the sector's regulators to stop seeing economic regulation as an analytical contest between the regulator and network operators.

1.1 A brief history of network regulation

Thirty years ago, it seemed Australia was finally becoming the sophisticated economy it was destined to be. The previous decade had seen the implementation of sweeping macroeconomic reforms that opened the Australian economy to the world. In 1993, the National Competition Policy review (the "Hilmer review") kicked off a wave of microeconomic reforms the likes of which had never seen before in Australia. The paragon of these reforms was the creation of the national energy (electricity and gas) markets.

These reforms were to be the 'end of history' for the local energy sector (to borrow Fukuyama's famous phrase). The end of gross inefficiency. The end of political interference. The end of gross inefficiency because of political interference. The end of overinvestment and under-servicing. The end of an engineering mindset and the rise of economic discipline. This was to be the golden age of electricity and gas production, delivery and consumption in Australia.

On every one of these expectations, however, the reforms fell short of expectations. More on that later.

The state-owned, vertically integrated monoliths were dismembered – or in the vernacular of the time, they were vertically disaggregated. In some states, their constituent components were privatised. In other instances, state ownership continued.

A competitive wholesale market was established while barriers were removed to a contestable retail market. Such reforms were not possible, however, for the natural monopolies that transported energy around the country –transmission and distribution networks for gas and electricity. Not only did these networks represent natural monopolies for which there was no competitive alternative, they also involved sunk assets worth tens of billions of dollars for which investors would need to be compensated if new investments were to be financed. Today, these network assets have a regulatory value of around $137 billion.[5] And growing.

[5] AER (August 2025b) pp. 56 & 184

Newly formed 'economic regulators' were established in each state jurisdiction to oversee the compensation arrangements for these natural monopolies. A little over a decade later, much of this oversight function was transferred to a newly created Australian Energy Market Commission (AEMC) and the Australian Energy Regulator (AER). In brief, the former would be responsible for writing (and updating) national rules for compensation while the latter would apply those rules. Those arrangements remain in place to this day.

This paper reflects on what became of this regulatory framework, or at least, one specific element of it – namely, capital expenditure.

1.2 An outline of the regulatory process

Although the regulatory framework for network compensation has evolved incrementally over time, its basic elements remain largely unchanged. This paper is not the place for a detailed exposition on the intricacies of the regulatory framework, nonetheless, its core features consist of the following elements.

Every five years, each network operator submits a proposal to the regulator outlining the revenue it requires to cover its expected capital and operating expenditures for the coming five years. These are the expenditures it claims it must incur in order to meet service standards set by regulation. Over time, the extent to which consumers have been consulted about the contents of these proposals has varied (generally increasing over the past decade).

On receipt of a revenue proposal, the regulator (in this case, the AER) disassembles the proposal into its multitude of capital, operating and financing components. Each component is scrutinised by a phalanx of regulatory specialists and consultants to ensure it is consistent with the regulator's statutory objective of, promoting efficient investment in, and efficient operation and use of, electricity and gas services.[6]

After many months scrutinising these revenue proposals with its increasingly more microscopic analytical instruments, the regulator emerges from its bunker with a draft determination. This public document outlines which expenditures the regulator proposes to accept and those which it finds do not satisfy its efficacy-based requirements. The draft ruling is a public document. Network operators and the community at large are invited to respond to the regulator's draft findings, usually within a relatively short period of 2-3 months.

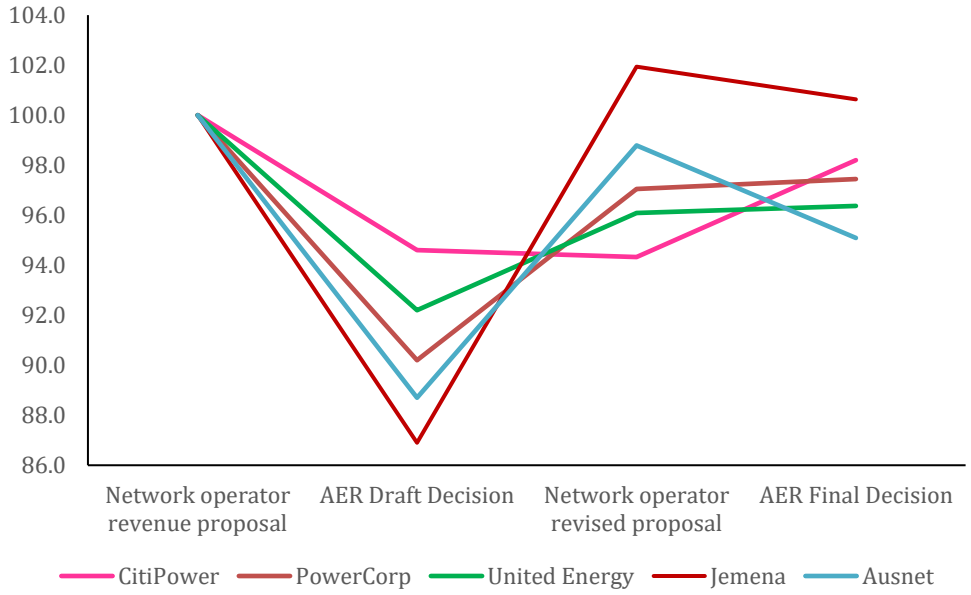
Some months later, having reviewed all the submissions it has received supporting and opposing its draft ruling, the regulator publishes its final determination. For electricity networks, these determinations cap the total revenue the network operator can collect from customers over the next five years. For gas networks, a determination will cap the prices the operator can charge for its services over the next five years.

Figure 1 highlights how outcomes shifted during the most recent regulatory process for determining the five Victorian electricity distribution businesses' 2026-31 revenue allowance. Revenue figures are indexed to a value of 100 for each network operator's initial revenue

[6] This is the general form of the national energy objectives consisting of the National Electricity Objective (NEO), National Gas Objective (NGO) and National Energy Retail Objective (NERO) – see: https://www.aemc.gov.au/regulation/neo

proposal. The figure illustrates the movement between the four stages in the revenue setting process – network operators' initial proposals, the AER's draft decisions, network operators' revised proposals, and the AER final revenue determination.

Figure 1 Victorian electricity distribution businesses 2026-31 revenue outcomes (indexed to 100 for each businesses' initial revenue proposal)



In the early years of economic regulation by the AER, revenue determinations were regularly subject to appeals by network operators to the Australian Competition Tribunal. Appeals were extremely time consuming and expensive to mount and defend. Despite the cost, mounting an appeal was generally a worthwhile option for network operators. Even small changes to the regulator's determination by the Tribunal could result in a substantial increase in revenue for a network operator. Given the available grounds of appeal, appeals to the Tribunal rarely fell in consumers' favour.

Almost a decade ago, legislators narrowed the grounds of appeal and made mounting an appeal a far riskier proposition for an appellant. Since then, no appeals have been mounted against any of the regulator's final determinations.

Even though it seems appeals to the court are no longer a standard feature of the regulatory process – and while the regulatory process is conducted with less belligerence than in the early years of economic regulation – some underlying behaviours remain unchanged, unproductive and undesirable.

Before turning to a discussion of one such undesirable feature of the regulatory process in Part 2 of this paper, it is first necessary to understand the underlying philosophy motivating economic regulation.

1.3 The underlying theory of economic regulation

No amount of legislation can make the provision of network services competitive. Natural monopolies are uncompetitive by definition. This is where economic regulation steps in. Unlike most other forms of regulation, *economic* regulation is not focussed on upholding and enforcing standards of conduct by regulated businesses. As already noted, an economic regulator's core objective is to promote efficiency. It does this by seeking to create incentives that attempt to mimic the discipline faced by firms elsewhere in the competitive economy. This is why economic regulation is also known as "incentive-based regulation" (or "revealed cost regulation").

Importantly, economic regulators (like many others) operate at a significant informational disadvantage. The regulator can never know as much about a network operator as the operator knows – or ought to know – about itself, its operating environment and its expenditures.

When approving a network's 5-year revenue proposal, the regulator is not seeking to approve individual expenditures *per se* – though it may often look that way. In fact, the regulator is only seeking to assess whether the revenue proposal represents prudent and efficient levels of capital, operating and financing expenditures. Once this quantum is identified, the final determination provides a corresponding revenue envelope. The network operator is then, in effect, free to redirect its allowed revenue towards other expenditures if this assists it to meet its service obligations more efficiently. [7]

At its core, economic regulation assumes that once a profit maximising network operator is provided with a 5-year revenue envelope, it faces an incentive to outperform the expenditures identified in its approved revenue proposal (while maintaining required service standards). If it succeeds, the operator retains the 'savings' it has identified. In doing so, it reveals to the regulator the true cost of efficiently delivering network services. That revealed information can then be used by the regulator to improve its scrutiny of future revenue proposals from the network operator.

Over successive regulatory cycles, this information supports the regulator becoming ever more proficient in its scrutiny of revenue proposals. Economic regulation proceeds on the contention that by revealing a network operator's true costs, it narrows the information asymmetry between the regulator and the network operators it regulates – thereby gradually eliminating an operator's opportunity to earn excess profits (discussed further in Part 2).

Or so the theory goes.

1.4 What could (and did) go wrong?

The theoretical foundations of economic regulation presume network operators have an incentive to pursue and therefore reveal their efficient costs of operation. This, however, is not the only incentive facing network operators when submitting a revenue proposal.

[7] Importantly, a network operator is not bound to spend its allowed on the investments specifically identified in its revenue proposal. The investments identified in its proposal are only used by the regulator to calculate the efficient revenue envelope required by the network for the coming regulator period. Once the period commences, the network operator can reprioritise the investments on which it spends its allowed revenue (noting, the regulator may later question the network operator about the efficiency of any such reprioritisation during an *ex post* review – see the tenth line of defence in Box 1).

Regulatory review of an individual revenue proposal is not a single-shot game played between a network operator and the regulator. Each round is conducted in stages[8] and the entire game is repeated every five years. Each round not only reveals information to the regulator, but information *about* the regulator and the techniques it uses to assess a revenue proposal. Moreover, the AER is conducting revenue reviews on a near-continuous schedule across the 30 electricity and gas networks whose revenue it regulates.[9] These public processes provide a constant stream of information about the regulator to network operators. Network operators are not idle participants in the regulatory process. They are learning organisations who are constantly recalibrating their strategies for engaging with the regulator.

The regulator is also a learning organisation. It is aware of the network operators' incentive to 'game' the regulatory process. The information asymmetry noted above is the operators' strategic advantage in the regulatory process.

And so, economic regulation naturally devolves into a strategic game: an arms race.

Network operators strive to confound the regulator with claims of new or higher expenditures arising from emergent technical challenges, unexpected environmental developments, new regulatory obligations, changing market conditions, and so on (all while appearing to engage constructively with the regulatory process). In response, the regulator builds ever more elaborate methods to peer through the fog of information it receives. In turn, the operators seek ever new ways to confound the regulator. And on and on it goes. A very costly and time-consuming arms race.

Economic regulation has certainly provided a rich bounty of opportunities for consultants, engineers, lawyers and regulatory staff.

Part 2 of this paper delves more deeply into the regulator's efforts to ensure it only allows revenue for efficient and prudent capital expenditure. In the meantime, Box 1 demonstrates how the arms race has resulted in a regulatory framework that relies on 10 lines of defence against inefficient capital expenditure.

Even jumbo jets don't have an astonishing 10 levels of redundancy.[10]

That's worth repeating.

Even jumbo jets don't have 10 levels of redundancy.

Box 1. Ten regulatory lines of defence against inefficient investment

The regulatory framework developed and administered by the AEMC and AER uses a suite of methods to promote efficient capital expenditure by network operators.

[1st line] Revenue Pricing Principles (RPP) and Better Resets Handbook establish regulatory expectations of efficient investment.

[2nd line] The regulated rate of return (ROR) or Weighted Average Cost of Capital (WACC) is set at a rate to promote an efficient level of investment.

[8] Some of the main stages are shown in Figure 1.
[9] AER (August 2025b) pp. 56 & 184
[10] According to Google AI, Jumbo jets, specifically the Boeing 747, are designed with four-levels of redundancy for their most critical systems.

[3rd line]	Regulatory Investment Tests (RIT-D & RIT-T) provide a framework for assessing the economic efficiency of proposed investment options.
[4th line]	Tariff Structure Statements (TSS) requires tariffs that promote efficient use of network infrastructure services.
[5th line]	An *ex ante* review by AER of regulatory proposals to identify and remove inefficient expenditures as briefly described in section 1.2.
[6th line]	Guaranteed Service Level (GSL) payments are made available to customers in place of inefficient capital expenditures.
[7th line]	The AER can initiate a mid-period review (re-opener) during a regulatory period to reassess its previously approved revenue allowance.
[8th line]	The Demand Management Incentive Scheme (DMIS) provides a financial incentive for network operators to implement non-capital solutions to manage peak electricity demand.
[9th line]	The Capital Expenditure Sharing Scheme (CESS) rewards (penalises) reduced (increased) capital expenditure, discussed further in Part 2.
[10th line]	The AER can initiate an *ex post* review to assess the efficiency and prudency of expenditure toward the conclusion of a regulatory period.

1.5 The root cause of the regulatory arms race

An arms race can be productive in the sense that it spurs innovative thinking by those caught up in its throes. Those innovations, however, are typically of limited public benefit. They seek only to pre-empt or respond to the actions (or anticipated actions) of one's opponent in the arms race. Outside the arms race, these innovations may offer limited utility and are unlikely to represent the wisest deployment of society's scarce resources.

As outlined above, network regulation has become an arms race which suggests that network regulation does not represents the wisest or most efficient deployment of society's scarce resources. Indeed, a full cycle of regulatory reviews will produce hundreds-of-thousands of pages (if not more) of submissions, information notices, economic models, consultant reports, public consultations, regulatory documents and decisions, and so forth – the total cost of which does not bear thinking about.

Of course, all forms of regulation involve antagonists: the regulator and the regulated. It is odd, however, that economic regulation, with its claimed focus on efficiency, with its emphasis on incentives rather than decrees, has allowed itself to degenerate into such a costly arms race.

The root cause of this arms race lies in the foundational design of economic regulation – or at least how it has been interpreted and implemented by the regulatory authorities (the AEMC and AER). The rules and conduct of the regulatory process have come to be predicated on the belief that the regulator must play a countervailing role to network operators. Economic regulation has become a sporting competition between opposing and co-dependent teams. It has become a strategic preoccupation for those involved but an incomprehensible spectator sport for the consumers and taxpayers who must foot the bill for the spectacle.

It does not need to be this way.

It is possible to end the arms race, at least in large part. This requires a fundamental reconceptualisation of economic regulation – its objective, its design, its conduct, and its allocation of responsibilities and risks. It requires the regulator to redefine its role and its relationship with regulated network operators. It requires the regulator to stop seeing its role as investing in ever more powerful analytical tools. It requires the regulator to stop trying to 'out-analyse' network operators and to start looking to outsmart them. It requires the regulator to see its role in strategic terms rather than as an analytical competition.

A strategic and smarter approach to economic regulation may not fully eliminate the need for all the lines of defence listed in Box 1, but it would certainly reduce the regulator's need to invest in so many defences against inefficient capital expenditure. This would reduce the resources required by the regulator. By internalising the regulator's problem within the mind of a network operator, the regulator can step back and leave network operators to solve the regulatory problem of ensuring network investment is efficient.

Part 2 reflects on the ninth line of defence listed in Box 1, namely, the Capital Expenditure Sharing Scheme (CESS) and the AER's review of this scheme. Part 3 then demonstrates how the regulatory framework can be redesigned to avoid the costly and wasteful arms race it has become.

PART 2. The Capital Expenditure Sharing Scheme (CESS)

Since 2013, the Australian Energy Regulator (AER) has added numerous so-called, 'incentive schemes' to its arsenal for the arms race described at the end of Part 1. The following discussion closely examines one of these schemes, namely, the Capital Expenditure Sharing Scheme (CESS). It was introduced into the regulatory framework in 2013 and reviewed by the AER a decade later. The scheme seeks to create a financial incentive in support of efficient capital expenditure by network operators.

The following discussion proceeds as follows. Section 2.1 describes the key design features of the CESS while section 2.2 summarises the findings of the AER's review of the scheme. Section 2.3 reflects on the review's findings and the changes subsequently made to the CESS. The discussion in section 2.4 is important. It examines the real incentives created by the CESS and how the scheme contributes to the problem it is seeking to solve. Section 2.5 explains how the CESS misaligns responsibilities and risks between the regulator and network operators. It concludes that one party – and only one party – must be made fully responsible for efficient capital expenditure.

2.1 A brief description of the CESS

In November 2013, the Australian Energy Regulator established the Capital Expenditure Sharing Scheme (CESS) as part of a suite of reforms under its Better Regulation program. The AER has described the purpose of the CESS as follows.[11]

> *The overarching objective of the CESS is to provide NSPs* [network operators] *with an incentive to undertake efficient capex during a regulatory control period. It achieves this by rewarding NSPs that outperform their capex allowance and penalising NSPs that spend more than their capex allowance. The CESS also provides a mechanism to share efficiency gains and losses between NSPs and network users.*

For the purposes of the CESS, the AER defines efficiency gains in the following way:[12]

> *Efficiency gains are defined by reductions in capital expenditure compared with forecast expenditure allowances.*

The forecasts mentioned here refers to the revenue allowance for capital expenditure (capex) authorised by the AER in its final decision at the conclusion of the regulatory process described in section 1.2.

At the time of its inception in 2013, the CESS rewarded network operators that outperformed their capital allowance (that is, spent less than the AER's forecast) by allowing them to retain 30 per cent of the unspent allowance.[13] This involved rolling this amount into the relevant operator's Regulatory Asset Base (RAB) – on which the operator would earn a regulated rate of return for decades to come. The return accruing to network operators is recovered through consumer bills.

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[11] AER (August 2025a), p.2
[12] AER (December 2021), p.51
[13] When applying the sharing ratio, the AER calculates the underspend (overspend) in net present value terms and subtracts the financing benefit (cost) that has accrued to the net operator due to its capital underspend (overspend). These adjustments, while important to ensuring the accuracy of the rewards or penalties made available under the scheme, are not central to the remainder of this paper.

In other words, consumers entirely fund the CESS (along with all other payments made under the AER's various incentive schemes). Conversely, if a network operator overspent its capital allowance, the AER would only roll 30 per cent of the overspend into that operator's RAB. The effect of this arrangement was to leave shareholders bearing the remaining 70 per cent of the overspend.

In this sense, the CESS's incentive framework was said to be 'symmetrical'

(While not particularly material to this paper, the sharing arrangement was modified following the review discussed below to apply the 30 per cent sharing ratio only to the first 10 per cent of any underspend and a sharing factor of 20 per cent to any underspend amount greater than 10 per cent of the approved forecast capital expenditure allowance.)

2.2 The AER's review of the CESS

Between 2021 and 2023, the AER conducted a review of some of its incentive schemes including the CESS. The review's key findings in support of the CESS include:

- Capital expenditure by network operators generally declined following the introduction of the CESS, though this trend eventually reversed.
- The rewards earned under the CESS far exceeded the penalties imposed on network operators, that is, network operators almost always outperformed the AER's authorised capital expenditure allowances and were rewarded by payments worth hundreds of millions of dollars.
- The gap between the AER's capital allowances and the capital expenditures by network operators has generally narrowed over time.
- There have been material improvements in the AER's expenditure forecasting techniques allowing it to "assess forecast capital expenditure needs more accurately".[14]

Nonetheless, the AER's review also acknowledged ongoing limitations or unexplained outcomes with the CESS, including:

- Applying a revealed cost approach to capital expenditure is more difficult than operating expenditures because it is often 'lumpy' and non-recurrent in nature.
- While the AER's claim of improved forecasting "inevitably reduces" the information asymmetry with network operators over time,[15] it does not eliminate it.
- The CESS rewards network operators for an underspend irrespective of whether that underspend is the result of genuine efficiency gains or a forecast error by the AER (or due to "changes in circumstances or happenstance"[16]).
- Although the CESS was expected to encourage smoother capital expenditure**,** network operators continue to spend more later in regulatory periods.

[14] AER (December 2021), p.54
[15] AER (August 2022), p.7, refers to this reduction in the information asymmetry as "inevitable".
[16] AER (December 2021), p.55

More broadly, AER also observed:

- a growing disparity between network operators' initial spending proposals and the authorised capital expenditure allowances in the AER's final decisions
- this growing disparity leads to "increased regulatory cost [for the AER] of examining expenditure proposals and determining reasonable forecasts of efficient expenditure"[17]
- although network operators' initial capital expenditure proposals are always higher than the AER's approved allowances, operators' actual expenditures typically underspend their approved allowances
- consumer concerns that CESS payments are rewarding network operators for errors in the AER's forecasts rather than genuine efficiency gains.

Having observed all-of-the-above, the AER's final report went on to find that the CESS was efficient, that is, the benefits to the consumers of capital expenditure underspending outweigh the costs of the CESS. The final report confidently concluded:[18]

> *[C]onsumers are significantly better off overall with the schemes* [including the CESS] t*han without them*.

As noted at the end of the previous section, the review also resulted in a modification to the sharing arrangements (as well as some additional procedural requirements).[19]

2.3 Reflecting on the AER's review of the CESS

The review's central findings in support of the CESS – the first four dot points in the previous section – are circumstantial in nature. The report's conclusion relies on sweeping inferential thinking. Alternatively stated, the review did not establish a causal relationship between the outcomes it described and the role played by the CESS. Causation was simply asserted.

The CESS rewards network operators when their actual (or *ex post*) capital expenditures are lower than those forecast by the AER. The review concludes that observed payments made under the CESS demonstrate its success. This conclusion embodies logical flaws and spurious empirical interpretations.

- The quantum of expenditure by a network operator, even when lower than the AER's authorised allowance, is neither an indication of that expenditure's efficiency nor whether it has improved the overall efficiency of an operator's network. The CESS is simply applied on the dollar difference between authorised and actual capital expenditure.
- Payments made under the CESS embody no information about network utilisation, performance or service delivery. The scheme only rewards non-expenditure.
- The quantum of CESS payments are calculated using the AER's forecast of capital expenditure. These estimates are subject to inaccuracies due to incomplete information

[17] AER (December 2021), p.57
[18] AER (April 2023), p.6
[19] See AER (April 2023)

and information asymmetries (which the review acknowledges despite improved modelling).

- If the AER's modelling of the efficient level of expenditure has improved (as it claims), then outcomes under the CESS – that is, rewards and penalties –should become increasingly symmetrical. This has not been the experience of the scheme which see rewards greatly exceeding penalties.

- Despite acknowledging CESS payments may be due to either genuine efficiencies or forecast errors, the review did not attempt to identify which cause was the primary source of the claimed underspends rewarded under the scheme. Observed underspends were simply attributed to the effectiveness of the CESS.

- As identified in Box 1, the regulatory framework involves nine other lines of defence against inefficient capital expenditure. These defences, particularly the risk of *ex post* exclusion of expenditure (see the tenth line of defence), can be expected to create an asymmetrical and disproportionate aversion to over-expenditure by operators – regardless of any efficiency considerations. The review accredited all estimated underspends to the CESS. It did not attempt to isolate the impact of the CESS.

- The CESS's failure to encourage smoother capital spending during a regulatory period signifies that it is not modifying operator conduct as expected. Despite acknowledging this failure, the review does not explain why it then concluded that in all other regards the scheme's incentive framework has been successful.

The review effectively offers only two pieces of evidence in support of its finding that the AER's forecasts of efficient capital expenditure are improving, namely, (i) the narrowing gap between its forecasts and out-turn expenditure by network operators,[20] and (ii) its assertion that information asymmetry between the AER and network operators "inevitably reduces over time".[21] The above observations mean the first claim is highly questionable, and certainly unproven. The second claim is far from self-evident.

Consumers remain sceptical about whether the CESS is doing what the AER claims, or whether it is rewarding networks for deficiencies in the AER's forecasts and the network operators' efforts to 'game' the scheme. Other concerns raised by consumers include:[22]

- The case for applying a 30 per cent sharing ratio in the CESS was not rigorously demonstrated, relied on unsupported assumptions, and was likely to be overly generous to network operators.

- The 'regulatory bargain' with consumers that sits behind economic regulation involves consumers only being required to pay for the efficient cost of delivering network services. The CESS (and other efficiency schemes) is an invented cost. It does not reflect a direct cost of delivering services.

[20] For example, see AER (April 2023), p.5, which states, "the gap between our forecasts and actual expenditures has narrowed over time."
[21] AER (August 2022), p.7
[22] CCP (March 2022, September 2022, March 2023)

- Network operators' observed enthusiasm for the CESS strongly suggests they see it as a low risk feature of the regulatory framework, and one that closely aligns with their financial interests – irrespective of the schemes' claim to being symmetrical.
- Consumers supported the second and lower tier of payments proposed by the review (described in section 2.1), but were concerned by the lack of analysis on how this would alter operators' conduct.

For the purposes of this paper, perhaps the most important concern raised by consumers during the review related to the widening gap between network operators' initial regulatory proposals and their approved capital allowances. Despite drawing attention to this widening gap and the costs it imposes on the AER, the review offered no explanation for this observed shift in conduct. The review even questioned whether this conduct signalled a deficiency in the scheme's design.[23]

> *The observed pattern of underspending and over-forecasting* [by network operators in their initial proposals] *is one example of a trend that raises a concern as to whether these CESS rewards were commensurate with efficiency gains.*

Despite identifying this concern, the review provided no further contemplation or analysis of its significance for the design, operation or effectiveness of the CESS. Its response was limited to proposing new requirements for network operators to better explain the reasons for variations between outcomes and forecasts.[24]

Consumers were not convinced about the sufficiency of this response. They considered network operators' observed conduct is:[25]

> *…explained by the incentive the CESS provides network businesses to overstate their capital requirements in the hope of upwardly influencing the regulatory allowance, and therefore the payment that they obtain under the CESS.* […] *Clearly, behaviour such as this delivers no benefit to consumers.*

This paper agrees with this judgement about the fundamental consequence of the scheme on network operators' conduct. The review's recommendation that additional information requirements be imposed on network operators does not alter the behavioural incentives created by the CESS, as discussed in the following section.

The review's assessment of the CESS lacked genuine curiosity; let alone healthy scepticism. Its analysis lacked depth, and its conclusions seem preordained at times. Most significantly, it treats the impact of the scheme as exogenous. It assumes network operators robotically respond to the CESS without making any effort to influence how it operates. Alternatively stated, the review views network operators as responding mechanically rather than strategically to the scheme.

[23] AER (December 2021), p.57
[24] AER (April 2023), Final decision
[25] CCP (September 2022), p.6

2.4 "The CESS is the problem that the CESS is trying to fix"

Economic regulation does not create a 'clockwork universe' occupied by automatons who respond mechanically and unthinkingly to the regulatory framework. Incomplete information, imperfect rules, information and operational asymmetries, environmental and human vagaries, all serve to introduce potential opportunities for network operators seeking to gain advantage. It is the probabilistic nature of these potential gains that represents the true incentive-basis of economic regulation.

The same limitations exist for the CESS.

The AER's response to network operators proposed capital expenditure is not predetermined. If it were, then the AER would not require many months to assess these proposals. It would not require the regulator to assess and judge operators claimed capital requirements. If there were no uncertainties in capital expenditure, there would be no need for these regulatory judgements. And, if there were no uncertainties in regulatory judgement, there would be no need for network operators to submit regulatory proposals. In the absence of uncertainty, the AER could just announce operators' capital allowances without going through the regulatory process described in section 1.2, and operators would be able to anticipate these announcements perfectly.

It is the unavoidable presence of regulatory judgement, and all the uncertainties such decisions embody, that creates potential gains for operators from acting strategically.

When it comes to the CESS, the greatest opportunity for gain lies with the AER's forecast capital expenditure allowance. If a network operator can upwardly influence this forecast so that the AER's forecast exceeds the operators privately held expectation of capital expenditure, then the operator can maximise it profits under the scheme.

And network operators know it.

As the review highlights at some length, the gap is widening between network operators' capital expenditure forecasts (in their regulatory proposals) and the final allowances determined by the AER. Consumers were deeply concerned about this ongoing and widening gap, leading them to conclude that:[26]

The CESS is the problem that the CESS is trying to fix.

This paper agrees. The CESS heightens the incentive for networks to overstate their capital expenditure requirements as they seek to upwardly influence the AER's forecast allowance. In response, the AER invests in fortifying its many "lines of defence" (listed in Box 1) and bolstering its forecasting methodologies. In turn, operators work even harder to take advantage of their informational and operational advantages over the regulator. In turn, the regulator must make even greater effort to counter confounding information and spurious expenditure claims. And on, and on, and on, it goes – a costly arms race that benefits staff in network operators and the regulator, but produces questionable, if any, benefits for consumers.

[26] CCP (September 2022), p.13

Even though the review recognised the increasing regulatory cost of examining network operators' expenditure proposals (see above[27]), it ultimately endorsed the CESS's design. Its recommendations did little, if anything, to quell network operators' efforts to influence the AER's capital expenditure forecasts. Indeed, consumers warned that the proposed two-tiered sharing ratio (described in section 2.2) may further exacerbate operators' incentive to game the CESS.

Competent network operators will – or at least should – have a clear idea of the true level of investment they require and can deliver within a regulatory period. Under the current regulatory framework overseen by the AEMC and administered by AER, network operators gain no benefit from sharing this proprietary information with the regulator. The CESS exacerbates this problem. It formally offers rewards to network operators who can successfully influence their regulatory allowance by overstating their expected capital expenditure requirements.

Put bluntly, the CESS means the regulatory framework accepts dishonest capital expenditure forecasting by network operators to be inevitable. It is certainly true that the regulatory framework unintentionally rewarded such conduct prior to the introduction of the CESS. The introduction of the scheme in 2013, however, made that previously unintended consequence a formal and accepted feature of the framework – with consumers left to pick up the tab.

2.5 The misalignment of responsibilities and risks

As demonstrated at some length in this paper, economic regulation operates as a battle of wits between the regulator and network operators. The latter are obliged to submit their forecast capital expenditure requirements, seemingly without limits on their imaginative efforts at overstatement. The regulator in turn relies on its spreadsheets and judgements to assess the validity of these claims.

So, who is ultimately responsible for determining the efficient level of capital expenditure by network operators?

The AER is unequivocal on this question.[28]

> *This regulatory regime assumes that a forecast capex allowance that we determine in a regulatory determination, taking into account all the information available at the time, is the efficient and prudent amount of capex for a NSP to incur during a regulatory control period.*

While the AER is solely responsible for determining what is efficient, it bears no risks from miscalculating required capital expenditures. Networks and consumers bear all the risk. So far, this has proven to be notably profitable for networks (and costly for consumers).

Risks and responsibilities are misaligned in the regulatory framework. The effects of this misalignment are magnified by operational and informational asymmetries. And magnified further by the participatory advantages conferred on network operators by the knowledge and resources required to participate effectively in the regulatory process.

[27] Also, AER (December 2021), p.57
[28] AER (December 2022), p.22

It is this misalignment that creates incentives for network operators to exaggerate their capital expenditure requirements and the AER's observation about the "increased regulatory cost of examining expenditure proposals and determining reasonable forecasts of efficient expenditure".[29]

This wasteful and costly arms race can only be solved by ending the misalignment of responsibilities and risks currently embodied in the regulatory framework. One party – and only one party – must be made fully responsible for efficient capital expenditure.

Part 3 provides a stylised model demonstrating how network operators can be held fully accountable for honestly and reliably forecasting and delivering capital expenditure. Alternatively stated, the following section demonstrates how to get the regulator out of network regulation – thereby ending the arms race.

[29] AER (December 2021), p.57

PART 3. Regulating capital expenditure without the regulator

This paper highlights the true nature of the incentives created for network operators by the regulatory framework overseen by the AER and AEMC. Part 2 outlined the incentives created for network operators by the Capital Efficiency Sharing Scheme (CESS), and in turn the role it requires of the regulator. The discussion concluded that this costly arms race can only be ended by making network operators fully and solely accountable for honestly and reliably forecasting and delivering their efficient capital expenditure requirements.

Using a highly stylised model of the CESS, the following discussion outlines a mechanism for promoting honesty by network operators when forecasting their efficient capital expenditure requirements.[30]

The model presents the CESS as a single-period scheme. This simplified approach avoids the need to calculate the net present value of capital expenditures or financing implications over, say, a 5-year regulatory period.[31] Such refinements to the model can be made at a later time. For now, the purpose of the model is to enliven the idea that the CESS can be modified to make network operators fully accountable for honestly and reliably forecasting and delivering their capital requirements.

The following discussion proceeds as follows. Section 3.1 introduces a mathematical representation of the CESS. Sections 3.2 and 3.3 reflect on the honesty of network operators' capital forecasts and how honesty can be recognised in a regulatory model. Section 3.4 develops a modified scheme that holds network operators fully accountable for honestly and reliably forecasting and delivering capital expenditure that enhances the efficiency of their network assets. In doing so, it removes the need for the regulator to produce its own forecasts of efficient capital expenditure. Section 3.5 graphically illustrates the operation of the modified scheme, while section 3.6 provides a broader discussion of the scheme's benefits.

Importantly, the purpose of this paper is not to advocate for a particular model, such as the one described below. The following discussion seeks only to demonstrate that network regulation can be designed in way that avoids a costly battle of wits between the regulator and network operators – all of which is ultimately funded by consumers and taxpayers. The sole purpose of the following discussion is to show that is clearly possible to design such a scheme.

[30] The model expands on the work the author undertook when a member of the AER's consumer challenge panel ("CCP29") established by the AER as part of its 2021-23 review into some of its incentive schemes.
[31] See discussion in section 2.1

3.1 A simple representation of the CESS

In its simplest form, the CESS can be represented as a scheme consisting of three inputs and one control variable.[32] The three inputs are:

- The first step in the regulatory process described in section 1.2 requires a network operator to submit to the regulator its forecast capital expenditure requirement **(*F*)** for the upcoming regulatory period.
- At the end of the process, the regulator issues its final decision in which it sets the network operator's capital expenditure allowance **(*R*),** that is, the AER determines the efficient level of capital expenditure by the network operator.[33]
- At the end of the regulatory period, the network operator's out-turn (or actual) capital expenditure **(*A*)** during the regulatory period is observed.

Under the CESS, network operators receive an incentive reward (penalty) if their actual capital expenditure **(*A*)** is below (above) the regulator's forecast of efficient capital expenditure (***R***). The general form of this arrangement can be represented as:

$$Y = \alpha (R - A) \qquad (1)$$

where $\boldsymbol{\alpha}$ is the scheme's control variable or sharing ratio, and ***Y*** represents the value of the reward or penalty received by the network under the CESS. ***Y*** may be positive (reward) or negative (penalty) and is added to the relevant network operator's Regulatory Asset Base (RAB).[34] Prior to the 2023 review, the value of the sharing ratio was set at a single, flat rate of 30 per cent ($\alpha = 0.3$). Following the AER's review of the scheme, a two-part ratio was put in place.[35] This change is not material to the following discussion.

It is worth noting that a network operator's capital expenditure forecast (***F***) plays no direct role in determining the incentive outcome (***Y***) under the CESS. The role of a network operator's forecast is to inform – that is, influence – the regulatory allowance (***R***) authorised by the AER in its final decision after "taking into account all the information available at the time".[36]

The review's findings, as recounted in sections 2.2, can be expressed in terms of the three inputs listed above. The review found:

- ***F*** always exceeds ***R*** (with the gap becoming "more pronounced"[37])
- ***A*** almost always lies below ***R*** (though the gap appeared to be narrowing[38])

That is, there has been a generally consistent pattern over many years of ***A*** < ***R*** < ***F.*** As a result, the CESS has overwhelmingly resulted in positive outcomes for network operators (***Y*** > 0).

[32] CCP (March 2022)
[33] See AER quote in section 2.5
[34] Explained in section 2.1
[35] See end of section 2.1
[36] AER (December 2022), p.22
[37] AER (December 2021), p.57
[38] The review attributed this narrowing of the gap to improvements in its forecasting methodologies as discussed in section 2.2.

Section 2.2 notes the AER's review questioned whether this consistent pattern of "underspending and over-forecasting" (***A*** **<** **R** and **R <** ***F***, respectively) by network operators had any implications for the design of the CESS. It nonetheless concluded that the fundamental design of the CESS was sound. In other words, the review left the CESS in the general form given by equation (1).

The central contention of this paper is that network operators "over-forecasting" their capital requirements (***F*** > ***R***) is the rational consequence of the regulatory framework's design and the rewards offered under the CESS. Such behaviour has no negative implications for network operators, but if they are successful in upwardly influencing their regulatory allowance (***R***) then they increase the likelihood of reward (***Y*** > 0) under the CESS – provided ***A*** < ***R***, which has generally been the case. In these circumstances, it is hardly surprising that the review found the gap between ***F*** and ***R*** was becoming "more pronounced".

A regulatory framework that encourages (or just permits) such gaming behaviour is contrary to the interests of consumers (and taxpayers) who, after all, are underwriting this 'game' between network operators and the regulator. It undermines consumers' confidence and trust in the parties as well as the regulatory framework.

Part 2 concluded that this gaming can be ended by making network operators solely responsible for the honest and reliable forecasting and delivery of their capital expenditure requirements.

3.2 Honest forecasting by network operators

It is surely the case that network operators have superior information than the regulator about the condition of their network, the environment (physical, technical, commercial) in which they operate, and the demands placed on their network by consumers. Of course, this information is not perfect, but it is less imperfect than the regulator's information no matter how elegant the regulator's modelling might be. It must be this way according to the rationale of economic regulation.[39]

At the beginning of the regulatory process, a network operator will use its proprietary knowledge to internally forecast the minimum capital expenditure it requires to comply with regulated performance standards. This private forecast is expressed as $\boldsymbol{E_N\{A\}}$ which represents the network operator's private expectation of the capital expenditure (***A***) it will deliver in the upcoming regulatory period. Although this is the operator's best forecast of actual capital expenditure, the regulatory 'game' means it has no incentive to reveal this true value to the regulator. Instead, it will submit to the regulator a forecast expenditure (***F***) that exceeds its internal forecast.

$$F > E_N\{A\} \qquad (2)$$

[39] If a network operator did not possess better information than the regulator then (1) the community (and polity) could have no confidence in the competence of the network operator, (2) the revealed costs assumption motivating all of economic regulation (section 1.3) would be invalid, and (3) it would suggest the regulator would be a better manager of the network than the network operator – inviting questions about governance (and ownership) of the sector.

Of course, the regulator knows network operators behave according to equation (2) and so invest in modelling their own forecasts of efficient capital expenditure (***R***), which in turn, networks anticipate when determining the value of the forecasts they submit to the regulator (***F***), which in turn the regulator anticipates, and so on. This is the battle of wits described in section 2.5.

To make the CESS an efficient and worthwhile scheme, it is necessary to remove the incentive for this unproductive gaming between network operators and the regulator. This requires a scheme that encourages networks to reveal their true expectations of capital expenditure. An honest forecast by a network operator is represented by:

$$F = E_N\{A\} \qquad (3)$$

The regulator can never observe $\boldsymbol{E_N\{A\}}$. It can only observe ***F***. This means the AER can never know the extent to which equation (3) is violated because its forecast of efficient capital expenditure (***R***) relies on a narrower information set than the one used by the network operator when forming its internal expectations, $\boldsymbol{E_N\{A\}}$.[40]

The only efficient solution to the ongoing violation of equation (3) is to remodel the regulatory framework to provide network operators with the strongest possible incentive to provide honest forecasts. As shown below, this can be achieved by redesigning the CESS.

3.3 A scheme that promotes honest forecasting

A pure 'honesty-in-forecasting' scheme would penalise any *ex post* error in a network operator's capital expenditure forecast (***F***). Equation (4) represents one such scheme. It equally penalises over- and under-forecasts of the same magnitude by network operators.

$$Y = -\beta(F - A)^2 \qquad (4)$$

where $\boldsymbol{\beta}$ is a control variable set by the regulator.

Under this arrangement, a network operator would minimise its expected penalty by submitting a forecast (***F***) to the regulator that equalled its internal forecast of actual capital expenditure, $\boldsymbol{E_N\{A\}}$. This can be seen by taking the network operator's expectations of both sides of equation (4) and setting the expected outcome to zero, which is the minimum possible penalty.

$$E_N\{Y\} = -E_N\{\beta(F - A)^2\} = 0$$

This implies:

$$-\beta(F - E_N\{A\})^2 = 0$$

which solves to:

$$F = E_N\{A\}$$

[40] See previous footnote

Under a pure 'honesty-in-forecasting' scheme, and all else being equal, a network operator's optimum strategy would be to comply with the honesty condition given by equation (3) when submitting its forecast of capital expenditure to the regulator.

While this formulation would promote 'honesty' insofar as it creates a very powerful incentive for network operators to reveal their internal expectations of capital expenditure, it provides them with no incentive to pursue (and reveal) opportunities for the most efficient level of capital expenditure.[41]

An 'honesty-in-forecasting' feature can be used to modify the CESS to make network operators fully accountable for honestly and reliably forecasting and delivering their capital requirements, as shown below.

3.4 Re-designing the CESS to hold network operators fully accountable

It is now possible to redesign the CESS so that it promotes both efficient expenditure and honest forecasting by network operators. For clarity of exposition, the model is built up in a series of steps.

Because network operators are being made fully accountable for honestly and reliably forecasting and delivering their capital requirements, there is no longer any need for the regulator to estimate a network operator's efficient level of capital expenditure (***R***). The network operator's forecast (***F***) now replaces the regulator's forecast in equation (1).

$$Y = \alpha\,(F - A) \qquad (5a)$$

As explained above, equation (5a) implies the network operator would seek to maximise the value of if forecast (***F***) using its proprietary knowledge about its expected level of capital expenditure ($\boldsymbol{E_N\{A\}}$). To counter this unwanted incentive, an honesty-in-forecasting mechanism such as the one described by equation (4) is added to the scheme described by equation (5a).

$$Y = \alpha\,(F - A) - \beta\,(F - A)^2 \qquad (5b)$$

The quadratic mathematical form of this illustrative model means equation (5b) produces two unhelpful artefacts. First, the optimum outcome for network operators would require them to overstate their forecasts above their internal estimates of actual outcome (which would violate equation (3)). Second, the model implies network operators would be penalised ($Y < 0$) even if they set their forecasts honestly. The constants δ_1 and δ_0 are included in the model to correct for these two mathematical artefacts, respectively.

$$Y = \alpha\,(F - A) - \beta\,[\,(F - A) + \delta_1\,]^2 + \delta_0 \qquad (5c)$$

where:

$$\delta_1 = \frac{\alpha}{2\beta} \quad \text{and} \quad \delta_0 = \frac{\alpha^2}{4\beta}$$

[41] It is conceivable that in the absence of any other incentive arrangements, networks would submit forecasts that reflected the *maximum* level of capital expenditure they expected they could undertake during the regulatory period (thereby maximising growth in their regulatory asset base (RAB). See section 2.1).

When set at this value, the constant δ_1 ensures network operators face an incentive to produce an honest forecast (*F*) as per equation (3). Setting the constant δ_0 at this value means an honest forecast produces the best possible outcome for a network operator (and consumers), that is, it will incur no penalty and receive no reward (*Y* = 0). Any other result at the end of the regulatory period (where *A* ≠ *F*) will see the network operator penalised (Y < 0). In other words, a scheme designed in line with equation (5c) offers no opportunity for network operators to earn a reward.

Setting the value of δ_0 in excess of the amount shown above would provide network operators a buffer against forecast errors – that is, a network could still earn a small reward, *Y* > 0, if its forecast (*F*) proves to have been slightly above or below the capital expenditure (*A*) actually delivered. This approach is not adopted, however, because there is a far more productive way of creating a buffer against forecast errors which is presented below. The remainder of this paper therefore assumes δ_0 is set at the value shown above.

Whereas the regulator actively determines the values of the control variables α and β based on the strength of the respective incentives it is seeking to create, the value of the two constants (δ_1 and δ_0) is entirely derivative and due to the stylised form of the mathematical model. They are required only for corrective purposes, and their values are entirely based on the values of α and β. In this sense, the two constants are of no great interest and are not discussed any further in this paper.

One problem remains, however. There is nothing in the model described by (5c) that provides network operators with an incentive to forecast and deliver an *efficient* level of investment. To overcome this problem, a variable representing efficiency ($\boldsymbol{e}$) is included in the model. Equation (6) represents the final form of the model.

$$\boldsymbol{Y = \alpha \left(F - \frac{A}{e} \right) - \beta \left[(F - A) + \delta_1 \right]^2 + \delta_0} \qquad (6)$$

The efficiency variable (***e***) represents the change in the efficiency of an operator's network during the regulatory period.[42] Unlike current regulatory practice, ***e*** does not represent the regulator's *ex ante* assessment of the efficiency of individual expenditures proposed by a network operator.

If there is no change in the efficiency of the operator's network, the efficiency variable takes a value of ***e*** = 1 in equation (6). If efficiency is improved during the regulatory period by, say, 2 per cent, the value of ***e*** would be 1.02. Conversely, if efficiency declines by this amount the value of ***e*** would be 0.98.

It should be noted that the efficiency variable ($\boldsymbol{e}$) is only required in the first element of the modified scheme described by equation (6). It is not required in the second element which ensures honesty in expenditure forecasting by a network operator. The inclusion of the efficiency variable ($\boldsymbol{e}$) in the first element ensures 'efficiency-inducing' effort is worth more for a network operator than just investing in maintaining the status quo. This benefit is demonstrated illustratively in the following section.

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[42] Equation (6) introduces an efficiency variable in the simplest possible way. The strength of the efficiency variable in the model could be increased in various ways. For example, it could be introduced into the model as e^n (where n ≥ 0) or $\frac{e}{e*}$ where *e** represents a target level of efficiency set by the regulator.

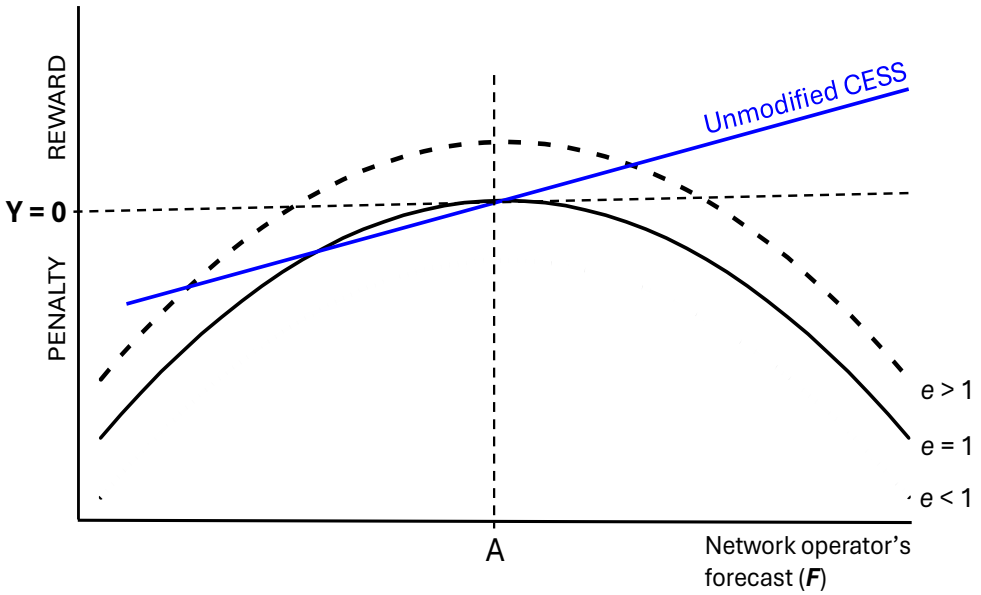
This paper does not delve into how the efficiency variable (e) is measured. It could, for example, be a measure of change in network utilisation, system stability or service quality; or most likely, a composite measure representing the change in network performance.

3.5 Network operators' pay-off curves under the modified scheme

Figure 2 demonstrates the pay-off curves (or outcomes) generated by the modified scheme including the important role played by the efficiency variable (e). Figure 2 is illustrative only.

The horizontal axis represents a network operator's forecast capital expenditure (F) compared to the actual amount expended (A) which is observed at the end of the period. An outcome to the right of the vertical line marked A represents over-forecasting of capital expenditure (that is, the network operator's actual expenditure was below its forecast, $A < F$). Outcomes to the left of the vertical line represents a network operator overspending its forecast ($A > F$).

Figure 2. Pay-off curves under the modified scheme



The straight upward slowing line in Figure 2 shows the outcomes a network operator can expect under an unmodified CESS – regardless of whether forecast capital expenditure is determined by the regulator or by the network operator, as R or F in equations (1) and (5a), respectively. In either case, the network operator has an obvious incentive to forecast the highest credible level of capital expenditure in anticipation that their actual capital expenditure will be below the forecast ($A < F$).[43] This would produce an outcome to the right of the vertical line marked by A, resulting in a reward ($Y > 0$) for the operator. Network operators have no incentive to understate their forecasts, that is forecast an outcome to the left of the vertical line. This concurs with the observation in section 2.2 that over-forecasting of capital expenditure by network operators is prevalent under the current CESS.

[43] Alternatively stated: $F > E_N\{A\}$

The modified scheme represented by equation (6) removes this incentive for over-forecasting by network operators.

The base case for the modified scheme is represented by the curve marked $\boldsymbol{e} = 1$ in Figure 2. In the base case, the out-turn level of expenditure (A) has no impact on the network's overall efficiency. In this sense, it represents the status quo level of investment by the network operator. The optimum outcome in the base case for a network operator is achieved when its actual level of capital expenditure equals its forecast, $A = F$. If it overspends its forecast ($A > F$) it will find itself to the left of the vertical line marked by A thereby incurring a penalty ($Y < 0$). Importantly, the network operator will suffer the same outcome if it underspends its forecast ($A < F$) and finds itself to the right of the vertical line.

Unlike the CESS currently administered by the AER, the modified scheme described by equation (6) removes any incentive for network operators to overstate their forecast capital expenditures (F) in violation of equation (3).

Figure 2 also highlights the benefit for a network operator from investing in improving the efficiency of its networks. Improving the efficiency of its network over a regulatory period lifts the pay-offs available to an operator, as shown by the curve marked $\boldsymbol{e} > 1$. Conversely, allowing the overall efficiency of its network to decline ($\boldsymbol{e} < 1$) guarantees a network operator would incur a penalty under the modified scheme.

Regardless of the *ex post* efficiency of its network, a network operator's optimum *ex ante* strategy will always involve it providing an honest forecast of its expected capital expenditure during the upcoming regulatory period, as given by equation (3).

Investing to improve the efficiency of its network provides a network operator with a secondary benefit, namely, it creates a buffer against honest errors in its capital expenditure forecast ($\boldsymbol{F}$). This buffer is represented by the bounded area between the curve marked $\boldsymbol{e} > 1$ and the line marked by $Y = 0$ in Figure 2.

An 'honest error' (ε) in a network operator's forecast can be represented as:[44]

$$F = E_N\{A\} = A \pm \varepsilon$$

When $\boldsymbol{e} > 1$, an honest error ($\varepsilon \neq 0$) would still see the operator earn a reward ($Y > 0$) under the scheme – albeit diminishing with the scale of the error and provided the error was not too large. Importantly, the regulator has no role in determining the scale of the error (ε).

Unlike the current scheme, the modified scheme rewards network operators for genuine improvements in network efficiency rather than the dollar-value discrepancy between the regulator's forecast and the actual level of capital expenditure.

[44] Where ε is independent and identically distributed (IID), meaning there is no trend in the network operator's forecasting errors.

3.6 Discussion

The purpose of this paper is not to advocate for a scheme with the mathematical form described by equation (6) but only to show that it is possible to design such a mechanism.[45] In other words, it is possible to design a regulatory incentive scheme that does not pit the regulator and network operators against each other in a wasteful arms race – the cost of which is borne by consumers and taxpayers.

The modified incentive scheme developed above makes network operators fully accountable for honestly and reliably forecasting and delivering capital investment without any need for counter-forecasting by the regulator. Network operators fully bear the risks of mis-forecasting their capital requirements. And, because efficiency is measured at the level of the network, the regulator no longer needs to conduct an *ex ante* assessment of the efficiency and prudency of the capital expenditures proposed by a network operator. Put simply, unlike the current regulatory approach, the modified scheme clearly focuses the regulatory framework on achieving outcomes rather than assessing inputs – as it should.

The modified scheme gets the regulator out of forecasting, reviewing and authorising network operators' capital expenditure. It relies solely on operators' forecasts. By internalising incentives for honesty and efficiency in the 'mind' of network operators, the modified scheme removes their incentive to game their forecasts.

Removing network operators' incentive to game their forecasts also removes (or at least substantially reduces) the need for all the lines of defence against inefficient capital expenditure listed in Box 1 – thereby reducing the costs of regulation.

Other benefits of the modified scheme include:

- Unlike the current CESS, the modified scheme provides network operators with a dual incentive to pursue genuine efficiency gains (rather than just rewarding networks for underspending the regulator's revenue allowance) because efficiency gains increase the reward on offer as well as providing a buffer against honest errors in forecasting.
- The power of the efficiency incentive in the modified scheme means networks will pursue such efficiencies by all means at their disposal. This might include through tariff design, demand-side measures, and optimising the mix of operating versus capital expenditure. There would be no need for the multiple incentive schemes currently in place (some of which are listed in Box 1).
- The modified scheme ensures consumers are only paying for genuine efficiency gains and not forecasting errors by the regulator. Removing the doubt that hangs over the granting of rewards under the current CESS would increase consumer confidence in the sector's regulation.
- By getting network operators to 'say what they'll do and do what they've said', the modified scheme makes them directly accountable to the community (rather than the regulator). Direct accountability establishes the basis for improved trust between consumers and the industry.

[45] This paper applies just one of many possible mathematical forms.

A modified approach to network revenue regulation can end the wasteful and costly arms race between the regulator and network operators, but this requires the regulator to relinquish its role in determining the efficient level of capital expenditure. The regulator's role becomes focused exclusively on setting the strength and balance of the incentives faced by network operators.

Within the stylised model described by equation (6) the regulator's role would be limited to determining (i) the magnitude of the control variables α and β, and (ii) the design and strength of the efficiency variable (*e*). In other words, the regulator's role goes not further than shaping and positioning the pay-off curves faced by network operators (such as those shown in Figure 2).[46]

Under the modified scheme, network operators would be unequivocally responsible for forecasting and delivering efficient capital expenditure – rather than just seeking to convince the regulator that this is what they are doing (as is currently the case).

[46] It is beyond the scope of this paper to consider whether all network operators should face incentives of the same balance and strength. There may be a case for setting (and updating) these regulatory control variables based on the observed conduct of individual network operators.

CONCLUSION: Rethinking the economic regulation of energy networks

For thirty years, the economic regulation of energy networks has been conducted as an analytical contest between the regulator and network operators – each manoeuvring and counter-manoeuvring; each seeking to influence the actions of the other through a lengthy and costly regulatory process. Of course, these costs must go somewhere. Generally, that means customers' energy bills.

When it comes to the efficient level of capital expenditure on network assets, the Australian Energy Regulator (AER) determines everything and delivers nothing, while network operators deliver everything and determine nothing. All of which happens in lines with rules created by Australian Energy Market Commission (AEMC).

This misalignment of responsibilities and risks has been in place for so long, it has become invisible. So, while the AER's review of the CESS in 2021-23 identified the consequences of this odd misalignment of responsibilities and risks, it could not see the oddity itself. It was therefore not surprising that the review left the CESS's core design features intact.

This paper steps into the breach. It demonstrates it is possible to design a regulatory scheme that is not centred on a regulator and its forecasts of efficient capital expenditure. Network operators can be made fully accountable for honestly and reliably forecasting and delivering their capital requirements. However, for such a scheme to succeed, the sector's regulatory authorities must relinquish their roles in overseeing the efficient level of capital expenditure.

Herein lies the shibboleth that must be swept aside. For such a scheme to succeed, the sector's regulatory authorities must accept their own redundancy. They must accept that what seems impossible, can be achieved. That what appears to be counterintuitive, can be solved. That what seems unworkable, can be designed effectively. They must accept regulatory forecasts of efficient capital expenditure are not needed.

The regulatory framework cannot create and solve the same problem. It cannot solve the incentives it creates. Despite the complex web of regulatory workarounds that have been implemented, such as the CESS, the framework's misalignment of responsibilities and risks remains unresolved and embedded. These workarounds can only ease symptoms. They cannot solve their underlying cause.

It's time for the sector's regulatory authorities to 'rethink how they think' about their role and to recognise the costs their way of thinking is imposing on consumers. And if they cannot do so, then someone needs to do it for (and to) them.

— END —

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