Attachment 9.6

Future of Gas

SA revised Final Plan July 2021 – June 2026

January 2021

Australian Gas Networks

1. Introduction

The future of energy networks, and in particular gas networks, as the Australian economy transitions to net-zero carbon emissions is a matter coming into sharp focus for the industry, regulators, stakeholders and customers. We note the AER, ENA and ECA are proposing to consider this matter in 2021 as part of its strategic priorities.

We also note the AER have considered aspects of the future of gas networks in response to proposals from Jemena Gas Networks (JGN) and EvoEnergy as part of their recent Access Arrangement review process. We note that each of the networks had proposed a shortening of asset lives for some new assets installed in the network.

As a substantial owner of gas transmission and distribution assets across Australia, we have also been considering this issue and what this means for our past and future investment in this infrastructure. We have also considered options to ensure that our investment is returned in a timely manner to minimise the risk of asset stranding.

This attachment focuses on how to determine what changes might need to be made to asset lives now to meet the challenges faced by gas networks in a decarbonising economy and more competitive energy sector. We did not propose any changes to asset lives across broad asset classes in our Final Plan, and we do not do so now. The AER accepted this approach noting "AGN has taken a sound approach to the uncertainties on its network."[1]

We note the AER is considering a wider process of stakeholder consultation on this important topic by elevating future of gas issues on its strategic priorities list;[2] an initiative we support. Based on our analysis across our networks it is becoming increasingly clear that the status quo in respect of asset lives is unlikely to remain fit for purpose for much longer. In this attachment, we provide our initial thoughts on this issue to feed into this process.

The case for changing asset lives made by EvoEnergy (and JGN before them) was based on decarbonisation policy; the ACT government has a net zero emission target of 2045 and various policies that inhibit new gas connections. Whilst hydrogen could play a role to meet that target, the conversion of networks from transporting methane to hydrogen is still uncertain so some asset stranding risk exists and it is therefore prudent to limit it by shortening asset lives.

The AER accepted this position and allowed the proposed changes in asset lives in the ACT. We understand and support the decision the AER made on the basis of the information available, and indeed support the AER for starting to think about how economic lives may need to change in the energy sector. However, we believe that a focus on local decarbonisation policy alone will be insufficient to support decisions on economic asset lives going forward.

This is because a focus on local decarbonisation policy alone misses a far more important factor impacting on the future of the gas distribution sector; the sharply falling cost of renewable electricity. Our customers in South Australia are not embracing rooftop solar because the government has a net zero target at 2050; they are doing this because it is cheaper for them right now.

Moreover, as the price of renewable electricity and storage falls further, not only will this new source of competition for natural gas, which is a fuel of choice, become fiercer, but it will start to create whole new modes of electricity production as consumers take full advantage of the distributed nature of renewable power, which is quite different from the centralised generation

[1] AER, Draft Decision, Attachment 4, p. 18.
[2] AER, Draft Decision, Attachment 4, p. 18.

model familiar in the NEM. We are seeing this already with the rise of "prosumers", of virtual power plants and of community batteries, among other initiatives.

This foreshadows not only a more competitive environment, but a very different one; potentially one where gas networks have no power to set prices above competitive levels. This happens whether we shift to hydrogen or not because it is associated with falling costs in a substitute to both methane and hydrogen. Decisions on economic lives need to take these developments into account.

Bringing information about the changing economics of the renewable electricity sector requires a framework of analysis. This is still a work in progress for us, but we think it is useful to work within a three stage process:

- Firstly, one defines a number of scenarios for the future energy market given (different, and ideally public) forecasts about declining energy costs, policy settings and other factors which may influence market development. These are not "most likely" or desired scenarios, but conceivable scenarios, and they should run the gamut from a "business as usual" right through to very different market structures and uses of networks. These scenarios should be relatively small in number (to bring some order to the analysis) and broad in scope (reflecting the genuine uncertainty as to how energy networks will evolve), and should ideally be developed with stakeholders and the AER so that there is a degree of wider ownership of them.
- Secondly, for each scenario, an investment and divestment plan should be developed to work out what assets need to be built and what assets retired in order to support that scenario. Once these plans are developed, the idea would be to go across all of the plans and look for elements common to many plans, and act on those which are in the largest number of plans, have the most benefits and have the lowest costs. These actions represent no regrets or more accurately low regrets actions that will have benefits in all or most of the scenarios and only low costs in others. This then informs both the capex and the depreciation schedule. The idea of doing this is to maximize the flexibility with which we face the future by prioritising actions which unlock the largest number of scenarios and avoid "picking winners".
- No credible scenario would have gas networks possessing market power forever; at some point in time, the falling cost of competitive substitutes will exert enough pressure on prices that monopoly pricing will become impossible. The third task is therefore to work out when competitive forces will produce prices lower than the regulatory building block price in each scenario. From here, one estimates the NPV of the revenues said assets could earn in a future competitive market and compares this to the RAB remaining at that point in time. If it is smaller, then the business is projected to suffer what the New Zealand Commerce Commission calls "economic asset stranding" and consideration is given to methods of bringing forward this economic asset stranding so it can be avoided. This makes use of the "WOOPS" model as a transparent framework to translate future information into current action which can easily be followed. One then chooses the smallest result amongst the scenarios as the prudent change to asset lives.[3]

The second and third steps outlined above will inform the depreciation (and capex, in the case of the second step) plan for a given network. From the second step will come information about specific assets which might need to be retired before their technical asset lives are concluded given changing market dynamics. From the third step comes information about appropriate changes in asset lives for whole classes of long-lived assets.

[3] Although we did not formally follow these three steps for our SA networks, our preliminary analysis showed that, of the scenarios we considered internally, the smallest economic asset stranding was zero, and thus we proposed no change to our asset lives.

Note that this three stage approach is not intended as a once-off analysis. At each AA proposal, each network would develop (with stakeholders) a new set of scenarios reflecting the then latest information, then develop investment/divestment plans associated with each, and finally consider anew the question of economic asset stranding and appropriate responses. This makes it a sustainable approach which continues to make the smallest, most option-generating changes that are appropriate to the information set existing at a point in time. This, in turn, allows us to ensure that we have the greatest flexibility to meet the widest range of potential future scenarios, and to do so at the lowest cost. In applying this methodology, there are some complexities, and we outline our thinking on these issues below.

We look forward to discussing this framework with the AER and other stakeholders.

2. AER approach in the EvoEnergy decision

In EvoEnergy's AA proposal,[4] its arguments around shortening asset lives were based on decarbonisation policy; specifically the ACT's legislated target of net zero emissions by 2045 and other measures to achieve this target. To address the stranded asset risk associated with this policy, EvoEnergy proposed to reduce the standard asset life of HP mains from 80 to 50 years and MP mains and services from 50 to 30 years. In all cases, this applies to new assets only, and not to existing assets in the same class.

EvoEnergy do not explain why these particular reductions will meet the particular stranded asset risk discussed. Since the reductions will still leave some assets exposed post 2045, EvoEnergy has not sought to remove all stranded asset risk, and indeed makes this point clear.

The Evo Energy proposal is essentially the same as that put before the AER by JGN in respect of its NSW network, except that the net zero policy was not legislated and the NSW Government has not implemented additional policy measures which inhibit gas network growth, and its date was 2050, not 2045. The AER rejected that proposal from JGN noting:[5]

- that the NSW policy was not mandated by legislation and thus may be subject to change; and
- that JGN was still projecting a business as usual capex program and market growth; and
- that New South Wales had recently entered into agreements with the Commonwealth to support gas in the state; and
- that all of AEMO's forecasts suggested stable gas demand through to 2039.

The AER accepted the proposed new asset lives for EvoEnergy's ACT assets, but not for those in NSW, noting:

- that the ACT Government has legislated a target of net zero emissions by June 2045;[6] and
- that the strategy of the ACT Government associated with the net zero would encourage a shift from gas to electric by removing the mandated requirement for gas connection in new suburbs, supporting gas to electric upgrades and encouraging new builds to be electric;[7] and
- that the ACT Government has noted that a net zero target could be met by renewable electricity or renewable hydrogen (or both) but that, even if hydrogen becomes cost-competitive for customers over the next 10-15 years, the ACT Government proposal to get customers to switch from gas to electricity now could lead to a decline in future usage of the EvoEnergy network, regardless of what gas is then being used;[8] and
- that the Suburban Land Agency will not be applying to connect gas to new residential estates, which means that EvoEnergy has potential for short-term growth in brownfield sites but limited growth opportunities outside established suburbs;[9] and

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[4] EvoEnergy AA Proposal, Attachments 4 and 4.3, accessible at:https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/evoenergy-access-arrangement-2021-26/proposal
[5] AER, JGN Final Decision, Attachment 4, pp. 8-9. There was also an argument around nearer term demand for gas (ibid) which the AER also rejected.
[6] AER, EvoEnergy Draft Decision, Attachment 4, p. 16. The fact that this target was not legislated in NSW was a key reason for rejecting the JGN proposal and, being consistent in its reasoning, the AER has likewise rejected the shortening of asset lives for EvoEnergy's NSW assets (AER, EvoEnergy Draft Decision, Attachment 4, pp. 26-7).
[7] AER, EvoEnergy Draft Decision, Attachment 4, p. 16.
[8] AER, EvoEnergy Draft Decision, Attachment 4, p. 18.
[9] AER, EvoEnergy Draft Decision, Attachment 4, p. 19.

- that these pieces of evidence above are enough to conclude that new assets will not reach their technical lives, but is insufficient to conclude that all assets will be stranded by 2045, meaning that EvoEnergy's proposed asset lives are reasonable for this AA period and would be reassessed when there is more policy clarity in the next AA period;[10] and
- that, to avoid customers paying twice when rapidly depreciated assets are replaced more quickly than originally planned, and then replaced with new assets, networks need to show a change in the capex profile which points towards reducing asset stranding risk by being smaller and reducing the RAB, before any shortening of asset lives. EvoEnergy has done this (but JGN did not), proposing half the capex of their current AA period and reducing their RAB at the end of the forthcoming AA period by 5.5% in real terms.[11]
- That the AER would consider matters further if there were more certainty about the phasing out of gas in the next AA period, but would also consider whether the tools the AER currently uses for assessing demand, incentives, prices and expenditure remain fit-for-purpose, and in particular whether it ought to consider:[12]
    - whether a more rigorous new connection test is required, which may involve higher capital contributions so that those who wish to connect to a network which may become stranded will pay the costs of doing so up-front;
    - whether marketing expenditure is required;
    - whether the CESS should continue to be used; and
    - whether exit fees or different pricing mechanisms need to be introduced.

This suggests that the AER will only accept the shortening of asset lives in response to policy changes if those policy changes are legislated and have demonstrable impacts now which might impact demand for a future gas network whether it shifts to hydrogen or not.[13] Moreover, the AER expects networks to be making different, and potentially lower capex proposals, and it expects to see tangible evidence of changes in demand now.

By and large, if the rationale for shorter asset lives is based around decarbonisation policy, then the high bar the AER has set in that respect is probably appropriate and the relatively small changes the AER has allowed are probably apt. Our issue here is that consideration of a richer information set allows one to develop a more robust support to any change in asset lives, and we discuss this in more detail in the following section.

We have some issues in respect of capex, demand and the other tools the AER discusses in its EvoEnergy draft decision. We think that within the context of a richer information set informing the decision, more nuanced views about some of these issues are possible, and we explore these further below.

Firstly, in respect of demand, the AER appears to have dropped the reasoning it employed in the JGN draft decision whereby any proposal which did not show falling demand now is not logically consistent with arguments about shorter asset lives being needed to address future demand

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[10] AER, EvoEnergy Draft Decision, Attachment 4, p. 19.
[11] AER, EvoEnergy Draft Decision, Attachment 4, p. 21.
[12] AER, EvoEnergy Draft Decision, Attachment 4, pp. 24-25.
[13] In fact, the AER is quite specific on this point, noting in particular that the SA Government's support for our approach in SA not to apply accelerated depreciation given the potential for the network to use hydrogen means that the fact of a zero-emissions target does not automatically mean the gas network will become stranded unless the jurisdictional government is taking active steps to encourage consumers to disconnect from gas. More positively, the AER does note that gas networks of the future could be very different; without providing any detail on what this means (AER, Draft Decision, Attachment 4 p. 27-8).

issues.[14] This is a positive development. As Biggar (2009) points out, part of the monopoly power a network has arises from the sunk costs a customer needs to make to access the network;[15] if someone has just spent thousands of dollars on new gas space and water heating, they are not going to switch to electricity if gas prices rise by five percent.

Based on replacement rates for household equipment which uses gas, customers amortise their equipment over about ten years. Thus, even if a customer fully expected to switch to electricity 11 years from now, it would be rational to demand a connection now, and we would see growth. By contrast, since we amortise our assets over 50 or more years, we need to plan beyond a horizon of ten years, and thus waiting for a clear drop in demand will likely mean a regulator acts much too late.

In the EvoEnergy decision, the AER has focused on brownfield growth and the limits to greenfield growth appear to be a key driver for allowing changes in asset lives. There are reasons in the case of EvoEnergy which are specific to it, namely the policy stated by the Suburban Land Agency, but we do not consider that zero greenfield growth is the only test for shortening asset lives.

Due to the effects noted above in respect of amortising sunk costs, it is possible, and indeed likely, that at least some greenfields demand will remain in the short to medium term, even in cases where the longer term future of the network is in question. We note in this context that there is a linkage between such growth and what the network may be used for in the future, which we discuss in the following section. In some cases, greenfields growth may actually be desirable if it allows for a smooth transition into a particular energy future. This is obviously something which would need to be considered on a case-by-case basis.

In respect of capex, we suggest that it is insufficient to apply a simple rule which only accepts the shortened asset lives if the capex is lower than it was in a previous AA period and if it results in a smaller RAB at the end of the forthcoming AA period. A capex plan, as per our three stage approach described briefly in the introduction and in more detail in the following section, should be informed by the particular scenarios which are under consideration and should be aimed at producing the flexibility to meet the maximum number of scenarios.

When this is done, it is not clear whether capex will always decline, but rather it is something which would need to be considered on a case-by-case basis.

Finally the new measures the AER proposes have some merit, and we appreciate that the future trends driving the need to consider changes in depreciation approaches will also drive other aspects of business behaviour. In respect of the specific points raised by the AER above:

- Capital contributions (effectively network entry fees) and exit fees may be a way of avoiding the socialisation of stranded asset risk across the whole network, but they also have equity considerations as they impact disproportionately on vulnerable customers. Higher entry fees may prevent vulnerable customers from connecting to our network now, and thus obtaining the benefits it currently provides, and higher exit fees may result in their being unable to leave the network, and thus facing higher future costs as those who can pay the exit fee leave.
- In scenarios where a network is on a pathway to obsolescence, there is likely a strong case for reduced marketing spend, and definitely a case for a change in marketing focus to those customers who might be able to forestall the end or reduce stranded asset risks, such as those with low marginal connection costs. However, scenarios where the lowest long run cost to

[14] AER, Draft Decision Overview, p. 11.

[15] See Biggar, D, 2009, "Is Protecting Sunk Investments by Consumers a Key Rationale for Natural Monopoly Regulation?", Review of Network Economics, 8(2), pp. 28-52.

consumers involves hydrogen in networks, there may be a need for an increase in marketing spending in order that this case is made. Again, a case-by-case approach is necessary.

- In respect of the CESS, since many assets have much shorter lives than, say 2045, there may still be customer benefits in keeping a CESS scheme for, say, IT expenditure and other short-lived assets. The same may be true of assets which could support hydrogen, indeed it may be very useful early on when the cost of these assets is less certain. As above decisions on CESS may differ across scenarios and should be considered on a case-by-case basis.

3. Our preferred approach

We now turn to our preferred approach in respect of information and its use to determine appropriate depreciation schedules. We discuss each of the three stages in more detail being:

- the development of scenarios; and
- the development of investment and divestment plans; and
- consideration of economic asset stranding and changes to depreciation now to avoid it.

Box One: Policy and technology as driving forces

Both technology and policy are capable of driving the evolution of the energy sector, and forecasts of the future will typically rely to some degree on both factors (along with other factors; demography, or economic conditions, for example). What is important is the inter-relationship between each. In particular, policy can drive technology and can alter the relative costs of energy technologies with either explicit or implicit carbon prices, which can then drive the future of the energy sector. This occurs when a net-zero target is announced in some jurisdiction, and firms invest in research and development to meet this target in the lowest cost manner and thus increase their market share. This force can be strengthened if the policy is also supported by subsidies.

Crucially, the link between policy and technology is not limited to the jurisdiction which initiates the policy change. Research and development is a fixed cost, and firms recoup it in as many markets as they can. For example, if a firm invested in research and development to meet targets in Europe or California and that allowed the firm to produce solar cells which were cheaper than other non-renewable sources of electricity, that firm would sell those solar cells in every market they could, regardless of whether those markets had net-zero emissions targets or not. Moreover, consumers in those markets would buy the solar cells if they could reduce their energy bills by doing so.

This is exactly what has happened; there are many companies active in Australia selling solar (and other renewable energy) solutions at scales from individual households right up to grid scale producers of electricity and major mining and industrial customers. Our customers are buying solar cells in South Australia because of the benefits they get right now, and not because of SA government emissions targets which, in any case, are many decades past the lifespan of the solar cells and batteries being bought today.

Thus, whilst decarbonisation policy is important, the focus on whether a particular jurisdiction in Australia has or does not have a decarbonisation policy and the strictness of that policy is somewhat misguided. Each Australian state has a different approach to encouraging the decarbonisation of its network – the ACT is somewhat of an outlier with policies specifically targeting the electrification of gas usage, whereas in other jurisdictions we have seen more effort in encouraging new renewable electricity generation. However, all States have seen significant increases in renewable electricity driven both by policy but even more so by technology costs. Arguably, the most important decarbonisation policies are those in large markets like the US, Europe or China, and they are important because of the research and development which they engender, which is then encapsulated in the renewable technology and storage options which our customers then buy.

3.1. The development of scenarios

Perhaps the key element in our approach is the development of appropriate scenarios, as the quality of the subsequent two steps depend upon the quality of the scenarios. We believe the scenarios need to be developed in collaboration with the AER and other stakeholders, and that they need to be wide ranging in scope (possible futures for the energy sector are very different from today that do not overlap) and small enough in number to be tractable; say 4 to 6.

The collaborative nature of scenarios is necessary for two reasons. Firstly, consumers have a great deal of useful information which can help us understand how behavior might change under very different market conditions.

Secondly, the development of scenarios is the element of our approach which requires the most judgement; there is a large amount of third party information and forecasts available, but distilling this into the particular scenarios chosen and working out which information to use and which to discard (noting that the forecasts are far from being in agreement) is an exercise of judgement. Unless the development of scenarios is collaborative, the analysis will be clouded by a perception that networks have simply chosen the scenarios which give them the best short-term outcomes, and appropriate change will be stymied.

The wide-ranging nature of scenarios is necessary because of the nature of changes affecting the industry. Renewable electricity is not merely a cheaper way of producing the same energy, it is a different and distributed technology, accessible at scales from an individual household right up to large-scale generation. The same is not yet true of hydrogen, but it may be; there is a company called Lavo which is selling electrolysers for use in the home that are currently too expensive for most customers, but which may allow households to be hydrogen producers for our network in future as prices fall.[16]

Distributed technology such as this changes the nature of customers profoundly; no longer are they passive consumers of different delivery networks for their energy needs, but they are rather "prosumers", making decisions about supply of as well as demand for energy. Moreover, they are not doing this in an isolated way where each household makes its own decisions independently of each other, but rather initiative that group households (such as community batteries or virtual power plants) arise to extend the range of what households can do in isolation.[17]

The net result is not just more competition of the same kind that we face as a fuel of choice today (ie electric appliances being ready substitutes for gas appliances),[18] but a profoundly different competitive environment. In particular, the degree of market power gas networks have in the face of multiple price-competitive substitutes may be very limited.

Moreover, and perhaps more importantly for the debate about depreciation, the value of the services provided by gas networks in future energy markets, even unconstrained by regulatory pricing, may be less than the efficiently-incurred cost of investments made today under an environment without competition. This would have profound consequences for regulation as it is currently practiced.

[16] See https://lavo.com.au/.

[17] Obviously, the same applies to larger commercial and industrial customers, which have greater opportunities to achieve economies of scale. Indeed, the mining customers of our transmission assets in Western Australia are already exploring renewable power options and assessing them against gas and diesel as part of their power solutions (see https://energyandmines.com/).

Box Two: Regulation and asset stewardship

At present, the key task of the AER is to ensure that the prices charged by gas networks today do not include monopoly rents, but just reflect current efficient costs of service provision. If market power is eternal, this is all a regulator need concern themselves with. However, if it is recognised that market power is not eternal, and the advent of competition is considered likely within the lifespan of sunk-cost efficient investments in assets which could play a role in potential future competitive markets, then the regulator gets an additional job of asset stewardship so that the transition to competition is as smooth as is feasible and imposes the least cost on consumers.

It is sometimes argued that asset stranding risk (where a new competitive market arises that prices services lower than a building block cost of existing assets at that future point in time, and thus leaves some asset value unrecoverable) is simply a cost of doing business and that customers should not have to bear this risk. This is a rather short-sighted approach in any environment where current assets might play some role in a future marketplace, and investment cannot be compelled.

Consider a situation where asset lives for a gas network end in 2080, but a competitive future means that building block regulatory prices will be above the prevailing competitive energy price in 2050. Consider further that there are two futures for the whole energy sector and two things the network operator can do now:

- For the energy sector as a whole, there is a low-cost option whereby the gas network assets are re-purposed to carry hydrogen, competing with other energy sources at prices below regulatory building blocks and a high cost option where the gas network is retired, and its capacity needs to be built anew (say by building up the electricity network).
- For the gas network operator, it can either plan and invest for this competitive future or it can run down its existing assets so that they are incapable of being used post 2050.

The best option for customers is for the assets to be repurposed. However if the network owner needs to bear all of the asset stranding risk, the best option for it is to sweat the assets so they are no longer capable of being used post 2050, as this at least allows the assets to be recovered and minimises losses. The same is true if there is uncertainty now about what the regulator might do in future. In particular, if the cost of a substitute is falling such that the gas network can see that it would not be able to react by sweating assets in, say, 2040 because the price rise created by the rise in depreciation then needed to avoid asset stranding would put the network out of business given falling prices of substitutes, then the better option for the network is to take a worst-case scenario view of the future, which, in turn, prevents the lower cost option for customers from being realised. Infrastructure is path-dependent and, when there is a great deal of uncertainty about the future at the early stages of the evolution of an industry, it is very easy for a poor path to be chosen.[19] For this reason, clear, early signalling on the nature of stewardship the AER proposes to take is vital. We believe this can be done as part of its approach to asset lives, and using something like our framework to assist in providing clarity.

The nature of evolving competition in the energy sector makes it easy to make only one prediction; that our networks will not be transporting a different gas (hydrogen) under the same regulatory environment, to the same customers who will be using it for the same purposes they use methane for today. Rather, some potential futures might include:

- A tube and trailer network directly supplying a relatively small number of customers, such as large industrial customers, with hydrogen, rather than relying on network delivery.
- A "trunk line" business serving major customers directly with local networks in relevant communities operated on a smaller scale by someone else connected to our hubs.

[19] By way of an example unrelated to energy, around the 1850s, both NSW and Victoria were planning their rail networks and, originally, both proposed broad-gauge networks. Then the chief engineer in Sydney was replaced and the new engineer favoured standard gauge. Our two largest states still have different railway gauges, and our two largest cities were not linked by a single gauge until 1965. A nationwide standard-gauge network linking all mainland capital cities was not completed until the 1990s (See Puffert, D, 2002, "Path Dependence in Spatial Networks: The Standardization of Railway Track Gauge", Explorations in Economic History, 39, 282-314). Relatively small changes sufficiently early in an evolving marketplace which uses infrastructure subject to path-dependency can have profound long run consequences for consumers.

- A small and declining legacy business of supply to residential areas which already have a network connection, but unable to compete in new residential areas.
- A completely different business model whereby we have no focus on residential gas (or hydrogen) supply at all, but rather help facilitate a niche role for hydrogen in the electricity market by connecting grid-scale wind and solar producing hydrogen via spilled energy.
- Networks as the facilitators of trade in a decentralised energy market whereby various players, down to the level of individual residential households, sell hydrogen as an energy storage service into a grid, which we operate.

The list above is by no means intended to be exhaustive, but merely serves to indicate what we mean when we talk about wide ranges for the options. We note that actual development of scenarios will need to consider not only competitive forces in the energy sector (which we emphasise because of the differences with today), but also factors like:

- Local-level decarbonisation policy which may, if it is early enough, mean that change happens faster than driven by competitive forces. This is what the AER believes is likely to occur for EvoEnergy.[20]
- Other decarbonisation related policy initiatives, such as carbon prices, contracts for differences for renewable power projects.
- Wider economic and demographic forces.
- In some instances, changes to network orientation unrelated to renewable technology such as, potentially, changes caused by climate change risks like increases in bushfires.
- The age of gas networks and thus the level of asset exposure.
- Changing customer preferences for energy consumption per se, influenced by, for example, improvements in energy efficiency.

Consideration of these factors is likely to make the development of scenarios challenging, and it is undoubtedly an area where knowledge will grow through time. However, it is important to remember what these scenarios are for; we are not "picking winners" amongst the scenarios and trying to drive the energy sector towards that outcome as there is nowhere near enough information to do this at present.

Rather, our focus is on modest changes we can make today to asset lives (and capex; see below) to maximize the flexibility with which we are able to meet a wide range of futures. This means that imperfections in the scenarios have impacts which are modified by what we plan to do with them, as discussed below.

3.2. Developing investment and divestment plans for each scenario

Once the scenarios have been developed, the next step is to develop investment and divestment plans which will leave the network with a particular set of assets required to meet the needs of each scenario in the timeframes that are inherent to that scenario. Each plan therefore has a capex and depreciation component; to invest in the new assets required and to remove from the RAB those assets which are not required either because they cannot physically carry hydrogen, or the new market circumstances no longer require that asset.

[20] See AER, EvoEnergy Draft Decision, Attachment 4, p. 18.

The basic process of developing these plans is based in the technical and engineering assessments which the AER already does, and for this reason, there is perhaps less need for widespread stakeholder consultation. Certainly, there is far less judgement required than in the development of the scenarios themselves.

There is, however, a need to consider timing and staging of investment and divestment in ways which differ slightly from the approaches the AER have used to date, which typically focus mainly on the current AA period and its needs. Since the scenarios play out over decades, some parts of the analysis will need to change; for both gas networks and the AER.

Within each scenario, there will be a degree of uncertainty about when certain events or tipping points might happen and the investment plan will need to respond to that. For example, just because a particular scenario suggests a move to 100% hydrogen by 2035 does not mean that one should start investing in required kit as soon as it is feasible to do so in an engineering sense. Rather, the plan should adopt a real-options approach. This means two things.

Firstly, the plan should recognise that there is value in waiting when making irreversible investments under conditions of uncertainty, and the investment plans should in some way reflect this value to ensure that the timing of investments delivers the lowest costs to consumers. There might not be a need for a formal real options model (which depends in any case for its success on the tractability and nature of the uncertainty), but the AER should challenge networks to provide evidence in their plans that the value of waiting has been considered.

Secondly, the plans should recognise that there are some relatively low cost actions that can be taken early which can rapidly speed up future progress. These represent no regrets or more accurately low regrets actions that will have benefits in all or most of the scenarios and only low costs in others. For example, changing the definition of natural gas in the NGL (something that is already occurring) or obtaining planning and environmental permissions.

Even if the full-scale investment does not go ahead, the costs of these activities relative to their benefits if the investment does go ahead are relatively small. For this reason, the AER should challenge networks to show that they have properly considered the staging of their investments.

Divestment and depreciation are, in a certain sense, opposite to how one considers investment, because there may be a value in moving early, rather than waiting. If the elasticity of demand is relatively low, and is expected to remain low through time, then there is arguably very little need to consider changes to the status quo approach of only allowing accelerated depreciation when it is clear that the asset will be retired in the forthcoming AA or that it is no longer being used (unless the asset is very large).

However, if the elasticity of demand is rising through time then the situation changes because the effect on demand of a price rise through more depreciation now will be less than the effect on demand of a price rise in the future. In some instances, it may, therefore be preferable to allow acceleration of depreciation to begin earlier than right before the asset is due to be retired.

This is because it will have less of an effect on demand through time and will avoid situations like future customers who cannot switch (since elasticity of demand is not uniform; vulnerable customers with fewer alternatives have lower elasticity) being left to pay costs that current customers would have been willing to pay because the price rise from foreseeable, necessary acceleration of depreciation is delayed.

The key point here is that falling costs for a substitute creates a situation where demand elasticity will rise, and therefore the situation above is likely to be created by the falling costs of renewables, requiring, potentially, changes to the AER's approach to accelerating the depreciation of assets. This does not mean that all assets will need to have accelerated depreciation start immediately, but it does mean that the AER will need to consider the new element of demand elasticity when making its decisions.

The development of investment and divestment plans, although it involves only a few new aspects to account for the longer timeframes and changing environment than the assessments of capex and depreciation the AER does already, is still likely to be a technically challenging component of the framework. It is also a component which will likely improve through time.

However, it is important to remember what the plans will be used for. These are not plans which need to be implemented in their entirely to support the development of a favoured scenario. Rather, the basic idea is to look across the plans and pick out "actions" which are common across many plans. From this smaller subset, the AER would choose the lowest cost actions first.

The aim of doing this is to ensure that we have the greatest flexibility to meet the widest range of potential future scenarios, and to do so at the lowest cost. For this reason, each plan does not need to be perfect from the outset; this stage has some deliberately in-built conservatism to ensure that customers are not asked to pay for more than they should.

3.3. Accounting for economic asset stranding

The final stage considers the way in which the life of whole asset classes (individual assets are captured in Stage 2) changes and the way in which one determines whether HP mains, say, changes from 60 years to some lesser number in a transparent fashion which is clearly linked to the inputs data drawn from each scenario. This is well-established in the economics literature, but perhaps less familiar to Australian economic regulators.

There are two hurdles to overcome in Australia before addressing the methodology by which information from forecasts in each scenario is drawn into changes in asset life. One is conceptual and grounded in regulatory practice and the other is legal. Neither are impediments to the framework we are describing here.

On the conceptual side is the understanding of the notion of asset stranding. In the past, Australian regulators have considered physical asset stranding (something which is part of stage two above); when an asset is no longer used. For example:

- The Victorian gas distribution networks are replacing cast iron mains which have reached the end of their operational lives during their current AA period. These still have a value in their respective RABs, but the AER allowed the businesses to accelerate the remaining assets being replaced in the RAB over the current AA periods.[21]
- Subsequent to the Victorian bushfires of 2009, a Royal Commission required the electricity distribution companies to replace certain assets for safety reasons. Like the cast iron pipes above, these still had asset lives left in the RAB, but the AER allowed the businesses to accelerate their depreciation over the current access period. The AER did the same for copper communication lines that the businesses had replaced with optical fibres.[22]

[21] See, for example, the AGN Vic Draft Decision 2018-22, pp. 5-12, accessible at: https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/australian-gas-networks-victoria-and-albury-access-arrangement-2018-22/draft-decision

[22] See, for example, the Powercor Draft Determination 2016-20, pp. 5-22 to 5-24, available from https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/powercor-determination-2016-20/preliminary-decision

- In our recent AGN SA Draft Decision, the AER agreed with our proposal to accelerate the depreciation of some mains and inlet points that have already been replaced, or will be replaced during the forthcoming AA period.[23]

This approach works when the assets involved are relatively small and/or the price of a substitute is far above the network efficient costs. However, it reaches limits when either the assets are large (or an entire asset class) and/or the price of a substitute is close to the efficient cost.

In these conditions, adjustments to price to allow the recovery of the stranded asset could push the regulated price above the price of the competitive substitute and simply precipitate a death spiral for the network in question as customers leave rather than pay higher prices, now that a substitute is readily available. Action, if it is to occur in this scenario, may need to happen much earlier, when higher prices can be sustained.

This earlier action, moreover, is not simply depreciating the asset to zero before competition arrives to prevent stranding. This would work from the network perspective, but is a much more extreme reaction than is required. What is required is to reduce the value of the asset under competition and allow the early depreciation of the difference between that value and the RAB.

Thus, if the RAB is $1 billion, and only $600 million can be recovered in a competitive market, then the regulator needs to accelerate $400 million of depreciation, not the whole $1 billion. Moreover, it needs to do so, or at least provide clear commitments that it will do so as soon as the potential $400 million loss becomes apparent and a risk for investors.

As much is implicitly realised in the AER's EvoEnergy decision which acts well before the 2045 crunch point and still leaves some asset exposure post-2045; although we note that the AER's reasoning is not tied to competitive threats or the development of competitive marketplaces.

The notion is treated more formally by the New Zealand Commerce Commission which has introduced the notion of "economic asset stranding" in recognition of these issues and, in 2016, allowed networks to accelerate a certain part of their RAB more quickly to avoid economic asset stranding as outlined above. The subsequent history of this is covered by Incenta.[24]

The NZCC did not, however, propose any methodology to determine either the scale of economic asset stranding or the changes required now (beyond allowing for a maximum increase in depreciation of 15%). The "Window Of Opportunity PaSt" (WOOPS) model detailed below is our proposed approach to fill this gap.

Before we get to the WOOPS model, however, our work in WA has thrown up a potential legal issue. Economic life is commonly considered by regulators in Australia as being associated with assets which are being used; if an asset is being used, it still has an economic life. Under the framework of the NZCC, it is clear that the asset is still being used in the competitive marketplace, but it just has a different value, and a means of capturing this needs to be developed.

This was an issue for the ERA in its draft decision for DBP. It is an issue we addressed at length in our response to the ERA.[25] The issue arises because a definition of economic life which fails to consider that part of the time when the asset is being used may occur within a competitive marketplace where the asset may have a very different value to the value which comes from a

[23] See AER, Draft Decision, Attachment 4, p. 14. The AER disagreed with the amounts of depreciation, but not the principle.

[24] See DBP, Revised Final Plan 2021-25, Attachment 9.9, pp. 12-19, accessible at https://www.erawa.com.au/cproot/21505/2/DBP-revised-Final-Plan-Attachment-9.9-Incenta-stranded-asset-risk-Public-.pdf.

[25] See DBP, Revised Final Plan 2021-25, Attachment 9.7, pp. 8-16, accessible at https://www.erawa.com.au/cproot/21503/2/DBP-revised-Final-Plan-Attachment-9.7-Response-to-Draft-Decision-on-Capital-Base-Public-.pdf.

standard building block model and is based upon historically-incurred costs creates considerable problems in the stewardship of assets into a competitive future.

We do not think that section 89(1) of the NGR, which deals with depreciation precludes treatment of economic asset stranding and we see problems with an approach which uses straight line depreciation based on assets in use when the regime switches from regulation to competition. However, we accept that more clarity in the NGR would be helpful.

This means that it does not make it clear that things like economic asset stranding can be considered in forming the depreciation schedule. We therefore think it would be useful to consider changes to the NGR to provide such clarity. This need not involve extensive changes, and the result is a firmer basis for all stakeholders to consider this important issue.

If the conceptual issue and legal issue above are overcome, what remains is a technical economic issue of how to transparently show how the economic asset stranding which may occur in the future absent of any action can be avoided at minimum cost to consumers today. This is the WOOPS model.

The WOOPS comes from a seminal paper by Crew and Kleindorfer.[26] The paper is part of a literature in economics on optimal schedules for depreciation, drawing much of its impetus from an earlier paper by Schmalensee.[27] In that paper, Schmalensee points out that, provided regulators set the allowed return on capital equal to the firm's actual cost of, then virtually any depreciation schedule will produce efficient prices.

Crew and Kleindorfer point out, however, that, amongst the many simplifying assumptions Schmalensee makes is a lack of technological progress, particularly amongst potential competitors to the regulatory service. Adopting an assumption of such technological progress makes a significant difference, as Daryl Biggar at the ACCC points out:[28]

> *A further piece of the jigsaw on depreciation/amortisation was suggested by Crew and Kleindorfer. This paper focused on the possibility of an external constraint on the ability of the firm to recover its costs in the future.*
>
> *Greenwald noted that the regulatory asset base could not increase above the present value of the future revenue stream for an unregulated monopolist. In the Crew and Kleindorfer paper, the present value of the future revenue stream for the unregulated monopolist is declining exponentially over time, perhaps due to forces of competition or technological change. This places a declining upper limit on the path of the regulatory asset base over time. The result, unsurprisingly, is that front-loading of capital recovery is essential if the regulated firm is to remain viable.*
>
> *In essence, when the regulated firm will be constrained by other forces in how much it can recover in the future, the regulator must take this into account in the present, and allow the firm a higher rate of depreciation. This*

[26] See Crew, M and Kleindorfer, P, 1992, "Economic Depreciation and the Regulated Firm under Competition and Technological Change", Journal of Regulatory Economics, 4(1), 1992, pp. 51-61.

[27] See Schmalensee, R, 1989, "An Expository Note on Depreciation and Profitability under Rate-of-Return Regulation", Journal of Regulatory Economics, 1(3), 1989, pp. 293-98. A later paper by Burness and Patrick (Burness , HS and Patrcik RH, 1992, "Optimal Depreciation Payments to Capital and Natural Monopoly Regulation", Journal of Regulatory Economics, 4, 35-501992) points out that the consequences of an allowed rate of return that is too high is a desire by regulated firms to delay depreciation (so they can earn extra profits on their RAB for longer) whilst the consequences of an allowed rate of return that is too low is a desire to depreciate more quickly, so that capital in the RAB can be deployed elsewhere to earn better returns for the risk level involved.

[28] See Biggar, D, 2011, The Fifty Most Important Papers in the Economics of Regulation, ACCC/AER Working Paper No. 3, May 2011, p. 21.

is the origin of the tilted annuity concept used by some regulatory authorities in telecommunications regulation. Crew and Kleindorfer point out that traditionally there has always been a sense among regulators and utilities that problems could be put right "at the next rate case". However, they emphasise that this is clearly not always true. If some other constraint – such as changes in demand or technology – prevents the regulated firm from earning a normal return in the future, the regulator must take that into account in its depreciation policy today.

The WOOPS model provides a framework to show how, and to what extent, depreciation should be increased today in order to ensure that the efficient costs of investment can be recovered, given the competitive environment which is forecast to exist in the future due to technological change and the regulatory pricing schedule up to the point that this competitive market emerges.

We do not provide further information about how we have adapted the WOOPS model to the purpose of informing asset lives (save to note that we do not use the whole paper, which spends much of its time showing how to work out when the last time is that a regulator can act – hence "opportunity past" in the title – but rather what it can do now).

We have discussed this extensively in various submissions to the ERA, which cover the basic methodology itself,[29] linkages with economic asset stranding and consideration of different depreciation pathways and the problems which occur if asset lives do not respond in some way to the advent of a competitive environment where the value is different.[30]

The WOOPS approach we outline above does involve some changes in thinking and introduces some techniques new to economic regulation in Australia, but ultimately is applicable within the Australian regulatory context, including the current NGR and NGL.

Like the first two stages above, there will be a degree of learning-by-doing as it is implemented; our ideas have already advanced, for example, from when we first proposed it to the ERA. However, as with the first two stages, the way in which the approach will be used will be key; rather than choosing a favoured scenario and aiming to capture the economic depreciation in that scenario, we take the minimum economic asset stranding across scenarios, and the smallest change in depreciation required to avoid that. Again, there is a strong degree of conservatism baked into the application of the model.

Moreover, the model would be revisited once every five years with each new Access Arrangement proposal. This means we do not need to get our forecasts of the future correct right now, but merely to act on the best available current information on a no-regrets basis.

[29] See DBP, Final Plan 2021-25, Attachment 9.2, accessible at: https://www.erawa.com.au/cproot/20983/2/Final-Plan-Attachment-9.2-Assessment-of-the-Economic-Life-of-the-DBNGP-Public-.pdf.

[30] See DBP, Revised Final Plan 2021-25, Attachment 9.7, accessible at https://www.erawa.com.au/cproot/21503/2/DBP-revised-Final-Plan-Attachment-9.7-Response-to-Draft-Decision-on-Capital-Base-Public-.pdf.