AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Response to the ERA's AR6 Draft Determination

April 2022

Proposal to the Economic Regulation Authority

Important notice

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VERSION CONTROL

Version	Release date	Changes
#1	28/04/2022	Submission to ERA

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Executive summary

This document presents AEMO's response to the ERA's draft determination[1] on allowable revenue and forecast capital expenditure (capex) for the 2022-23 to 2024-25 review period (commonly known as the AR6 period). AEMO has taken on board feedback from the ERA and market participants, and has reviewed its proposed work program, expenditure forecasts, and justifications.

AEMO accepts a number of the ERA's proposed reductions to the Wholesale Electricity Market (WEM) forecast revenue and capex. For example, AEMO agrees with feedback on aspects of the DER Roadmap program and the IT sustaining capex program, and has reduced the forecasts accordingly.

In other areas, AEMO considers the ERA's draft determination – if accepted – would place AEMO's ability to adequately resource market and system operations over the next three years at unacceptable risk. In these areas, AEMO provides additional evidence to clarify aspects of the original proposal and justify the forecast expenditure.

In particular, the cuts to Market Operations and Power System Planning would introduce heightened risk to market and power system operation during a period of particular vulnerability and unprecedented change. AEMO also maintains that all 22 WEM Reform projects must be delivered in full to make certain AEMO can deliver and operate the new market, comply with obligations, and manage risk appropriately. Wherever practicable, AEMO has attempted to address the ERA and market participants' concerns directly.

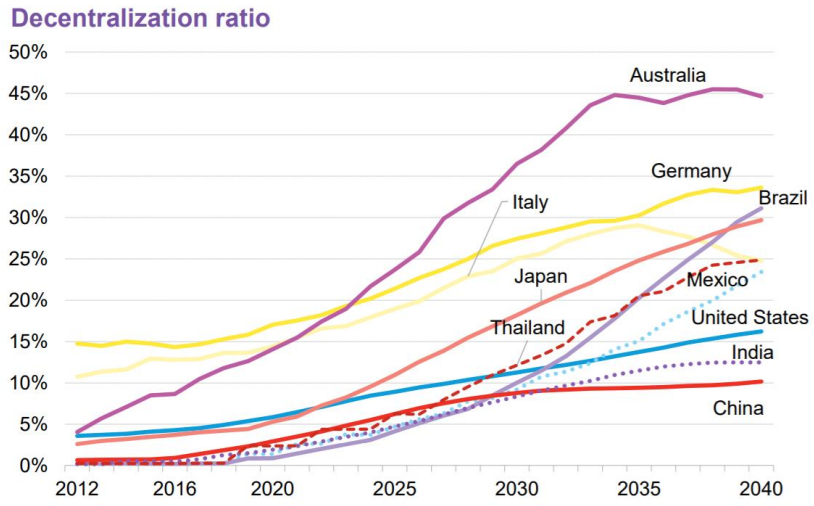
AEMO accepts the ERA's draft determination on the Gas Services Information (GSI) revenue requirement and has therefore not revised its GSI proposal.[2] AEMO also accepts the GSI forecast capex draft determination in principle, subject to adjustments to reflect AEMO's updated borrowing and labour cost estimates. These minor changes are discussed in section 4.

This document focuses predominantly on AEMO's response to the ERA's determination on WEM costs.

Managing the energy transition

Energy systems globally are undergoing a once-in-a-lifetime transition, moving towards greater use of variable renewables and distributed energy resources (DER). The power systems operated by AEMO, including the South West Interconnected System (SWIS), are at the forefront of this transition.

Figure 1 **Ratio of non-grid scale generation capacity (DER) to total installed capacity**



Source: Bloomberg New Energy Finance Note: decentralization ratio is the ratio of non-grid-scale capacity to total installed capacity.

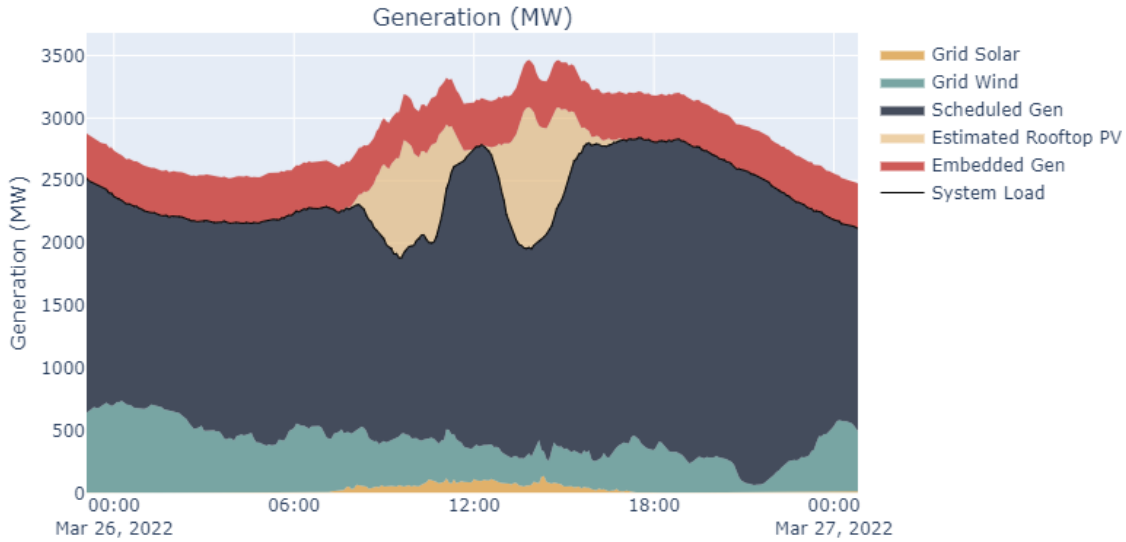
[1] ERA. Available online

[2] Note minor adjustments have been made to GSI forecasts to reflect the latest interest rates and Enterprise Agreement conditions.

Though relatively small in comparison with systems and markets elsewhere, the SWIS and WEM is experiencing the impact of the energy transition in a way no other jurisdiction has faced so far. As shown in Figure 1, the prevalence of rooftop photovoltaic (PV) systems means Australia will soon have a higher proportion of non-grid scale generation capacity supplying its power systems than anywhere in the world. The ratio in Western Australia is higher still.[3]

High penetration of PV and non-synchronous generation, coupled with low daytime demand, long network lines, lack of interconnected power systems, and extreme weather, is posing real-life challenges for Western Australia's principal power system. As recently as 26 March 2022, a swift cloud formation over the Perth Metropolitan area caused enormous power swings, resulting in a system load increase of >600 MW within 40 minutes, followed by >700 MW load decrease over 56 minutes as the cloud band passed. Figure 2 shows a snapshot of the large changes in the generation profile as the cloud cover came in.

Figure 2 Snapshot of power system event – generation swing – 26 March 2022



Not only do system events such as these place extreme stresses on the power system, they also impact AEMO's people. Controllers and power system planners are under growing pressure to respond quickly to system events, using their judgement and expertise to prevent widespread failure. The job is only getting harder, and operational teams in Western Australia are in urgent need of more sophisticated modelling, forecasting and tools to be able to keep the SWIS secure, as well as identify emerging risks and plan for the future power system. Plans to deliver these tools and models are underway via initiatives such as the Engineering Framework and discrete projects to facilitate the energy transition, but it will take time and resources to deliver them.

As Western Australian consumers continue to install rooftop PV, system events such as the one on 26 March 2022 are likely to become more frequent and more severe. The actions under the DER Roadmap and the Western Australian Government's ongoing Energy Transformation Strategy are expected to mitigate the issues caused by distributed PV over the longer term. Until the transition is complete, the risks to secure and reliable operation of the SWIS remain heightened and insufficient resourcing for the system operator could have disproportionate consequences for energy consumers. As outlined in AEMO's Renewable Energy Integration – SWIS update report[4], additional operational tools, new standards, system services, and regulatory arrangements are needed now to improve the resiliency of the power system in the short term.

Delivering change

Our grid is a small, isolated system, but it is experiencing change in a big way. Delivering this change requires a step up from the current 'business as usual'. The AR6 proposal reflects the resources, activities and costs necessary to continue to enable the energy transition. The ongoing costs of operating the WEM and the power system will

[3] The Clean Energy Australia Report 2022 shows installation rates of small-scale .05PV systems by state, with WA having more than 2 GW of installed PV capacity in 2021. Based on total installed capacity in the SWIS (all registered generation) of 6GW, and SWIS installed PV capacity of 1.1GW, the current decentralisation ratio in WA is 18%. Available online, page 77.

[4] AEMO. *Renewable Energy Integration – SWIS update*, September 2021. Available online.

normalise once the transition is complete and new market arrangements have bedded down, but there is a higher degree of cost, uncertainty and risk that must be managed during the next three years.

All stakeholders, including the ERA, acknowledge it is vital the WEM Reform program is implemented fully, the power system remains secure, and the new market runs effectively. We are all working towards the same goal.

Consistent with market participants' feedback, the ERA has sought to identify cost reductions without compromising AEMO's ability to deliver WEM Reform. AEMO has taken on board this feedback and has revised its forecasts where prudent to do so, deferring non-critical projects (such as the two excluded DER Roadmap projects) and making greater use of contractors and flexible staffing arrangements to manage the uncertainty associated with the energy transition.

This has reduced the forecast WEM revenue requirement to $152.6 million with the revised capex forecast at $72 million[5].

AEMO's response to key issues raised by the ERA and market participants, along with the revised AR6 forecast, is summarised in the following sections.

Opex labour – operating the market and power system

AEMO has reviewed its estimate of the labour requirements necessary to operate the power system and new real time market. This review includes consideration of analysis presented by the ERA and Lantau Group, as well as further external challenge.

AEMO took on board the ERA's views regarding the rigour of challenge applied to the labour opex forecast, and appointed independent consultants Robinson Bowmaker Paul (RBP) to review AEMO's AR6 resourcing estimates. RBP has a detailed understanding of AEMO's operations, systems and resourcing effort, having conducted the annual WEM and GSI market audit for several years. RBP also supported aspects of the Western Australian Government's ongoing Energy Transformation Strategy and was a significant contributor to the new market design. RBP therefore understands how the reforms will impact AEMO's core business at a granular level.

RBP has challenged AEMO's estimates, and while it considers AEMO's current resourcing to be efficient and forecast levels to be reasonable, RBP has identified several areas where the estimated uplift in resources could be slightly reduced. A copy of RBP's report is provided with this document and is available for publication.

Taking the RBP advice into consideration, along with the ERA and stakeholder feedback, AEMO has revised its resourcing uplift to 29.3 FTE. This is ~13% lower than the AR6 proposal. AEMO highlights that the majority of new positions are forecast as fixed term contractors (FTC), not permanent employees.

Drivers of the resourcing uplift

The new market is substantially different to the current market. The new arrangements *will* generate more activity. As detailed in analysis provided to the ERA with the AR6 proposal, the volume of settlement runs will double; there will be a need for more frequent credit limit reviews; and the period of parallel operation between future settlement and current settlement will require substantially more effort. Settlements is just one example of where it is reasonable to expect an uplift in activity.

Irrespective of the level of relative complexity between the WEM and other jurisdictions, the new market arrangements are a profound change for Western Australia. There is a need for more people to help manage that change. AEMO's approach is to ensure it has enough skilled people available during and after go-live, with a view to scaling back resources once the new market is bedded-down and the power system challenges have been met.

Impact of automation

The ERA is correct that automation will aid efficient operation of the new market. However, the increase in automation being delivered as part of the WEM Reform program at go-live is not as far reaching as the ERA may assume. In its independent report, RBP notes:

[5] AEMO's capex forecast for AR6 has increased by $2.6 million since the December 2021 Proposal but this is driven by movement of $6 million of WEM Reform funding from AR5 to AR6 (noting total WEM Reform program capex forecast remains at $91.2 million).

> *...the overall levels of automation will not increase as a result of the new market and that there is only one area in which automation will materially change the functions carried out by AEMO staff, and that is power system operations in the control room.*[6]

Many of AEMO's processes are already automated and will continue at similar levels of automation in the new market. AEMO has automated where opportunities to achieve efficiencies have been identified. Reform will change many of AEMO's existing processes, however, the extent of the opportunity to apply automation will not be fully understood until the new arrangements commence and have been bedded in. When AEMO has real data on the potential savings automation can bring in the new market, it will seek to apply technology where practicable. Until then, AEMO considers it prudent to make reasonable assumptions on the efficiencies automation will bring, and to include provision in the opex forecast to allow AEMO to adequately resource its functions during the most critical period for the new WEM.

AEMO maintains a resourcing uplift is essential:

- during the post reform period, particularly in Market Operations and Power System Planning; and
- to continue to manage the power system and enable the energy transition, particularly in Power System Planning and Market Development.

AEMO has provided additional evidence to the ERA to support this.

Capex and contingency

AEMO has listened to stakeholder feedback and will not include costs for the DER Market Visibility and DER Data Access and Management projects at this time. As per AEMO's original proposal and supported by market participants, AEMO will also defer its formal capex forecasts for implementing DER participation and 5-Minute Settlement (5MS) until there is sufficient detail and robust scope available.

AEMO welcomes the ERA's decision to include base costs for the majority of the WEM Reform projects. As requested by the ERA, further information is provided in this submission to demonstrate that the two excluded WEM Reform projects (System Operations Planning Tools and the Dispatch Training Simulator) are necessary, prudent and efficient. These two reform projects are essential to enable AEMO's staff to operate the power system and new market effectively following go-live.

As signalled by market participants, delivering the new market by 1 October 2023 remains a priority for the Western Australian energy sector. Subject to sufficient access to funding, AEMO remains confident this target can be achieved. AEMO has reviewed the workstreams and has reprofiled some expenditure to reflect resourcing availability and market conditions. This has the effect of shifting approximately $6 million of expenditure that was forecast to be delivered before 30 June 2022 (the end of the AR5 period) to later in the year and into 2022/23, which means it forms part of the AR6 forecast instead.[7] AEMO highlights that the overall forecast capital cost of the program (including contingency) remains unchanged at $91.2 million.

AEMO has made some reductions to WEM sustaining capex (including IT lifecycle costs), however, it maintains its position on the need for cyber security investment. As discussed in the AR6 proposal, cyber security is an area of increasing importance for AEMO, other critical infrastructure operators and the wider community. AEMO plays an important role in energy sector cyber security and is currently working with the Commonwealth Department of Industry, Science, Energy and Resources (DISER) and the Australian Cyber Security Centre to define roles and responsibilities on the issue, including in light of the *Security Legislation Amendment (Critical Infrastructure Protection) Act 2022*, which came into effect on 2 April 2022.

Estimating contingency

AEMO has considered the ERA's feedback on the contingency calculation methodology, and has revised several of the calculator/parameter inputs accordingly (e.g. rounding, consistent scales, updating risk calculations). Based on these revisions, the revised total contingency amount is $11 million, with individual project contingencies ranging from 6% to 30%.

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[6] RBP. *Review of AEMO Operational Staffing Estimate*, April 2022, page 3.

[7] Note this timing change has minimal impact on market fees as capex costs are recovered via expensed depreciation and amortisation after the assets are placed in service. Commencement of recovery of this capex will still commence in the AR6 period.

AEMO recognises that forecasting contingency requirements is difficult, and by its nature imprecise. AEMO remains of the view that its contingency forecasting approach – while not perfect – is a reasonable and repeatable method for estimating a prudent level of available funding. AEMO therefore proposes to retain some elements of the current contingency method such as including an estimate for 'unknown unknowns' and low likelihood risks, while adjusting the approach to ensure they are priced appropriately.

As with all contingency provisions, the intent is not to incur this expenditure. Rather, contingency amounts are included as a prudent measure to manage risk and to minimise the requirement for in-period adjustments. AEMO recognises that the overrun allowances available under the WEM Rules (Rules) provide some contingency, and in ordinary 'business as usual' circumstances they provide a sufficient buffer to manage uncertainty. However, the energy transition being managed during AR6 does not represent ordinary circumstances.

The level of uncertainty associated with delivering unprecedented change and major transformational projects is significantly greater than anything AEMO has had to manage in the past. Disallowing forecast expenditure and relying more heavily on overrun allowances and in-period adjustments only adds to that uncertainty, which in turn adds risk and cost. The overrun allowances under the Rules will only stretch so far, and allowances have been substantially reduced.[8]

In-period adjustments are a prudent method of managing new, un-scoped, high value, high impact projects (such as 5MS). However, these adjustments should generally be kept to a minimum. Over reliance on in-period revenue proposals, whereby AEMO essentially has to secure explicit approval from the ERA before incurring costs, brings further uncertainty to the work program, which in turn inhibits AEMO's ability to access funding and secure resources for an efficient cost. The cost and time spent developing and reviewing in-period submissions (for all parties) should also be considered.

AEMO submits that neither the ERA nor market participants want a situation where the ability to evolve and progress Western Australia's market and power systems is encumbered by the regulatory framework. AEMO should, within reason, be able to manage its portfolio of work autonomously and be afforded the ability to respond nimbly to change. AEMO recognises the need for balance – the allowable revenue determination should not be a 'blank cheque' – and suggests that balance could be achieved via greater transparency and stakeholder engagement in-period. AEMO is keen to continue engaging on opportunities to improve the current regulatory framework and ensure the framework best supports the ongoing energy transition.

In summary, as a sector we are undertaking the biggest change to the Western Australian electricity market, possibly since its inception. AEMO submits it is prudent to make sure sufficient contingency is available (beyond the overrun provisions in the Rules) to allow WEM Reform to be delivered in full and within reasonable risk tolerances.

Governance and overall efficiency

AEMO notes the ERA's observations on existing internal governance arrangements. Governance and program management are, and continue to be, key areas of focus for AEMO's Executive Leadership Team and Board, which established and oversaw a robust internal challenge process for the development of the AR6 submission. This process involved several cycles of review and refinement of the AR6 proposal, prior to its approval by the AEMO Board as a prudent and efficient proposal – a view which has been substantially confirmed, in the context of proposed labour costs, by the review undertaken by RBP. Given this, AEMO is unclear why the ERA formed the view that there was insufficient evidence of substantial reductions to the estimated resources and hence AEMO's governance of the process.

While AEMO has existing governance processes in place to ensure projects pass through appropriate decision gates throughout their lifecycle, AEMO seeks continuous improvement in program management and governance arrangements. For example, AEMO has already commenced implementation of improvements to its major program governance following AEMO-commissioned reviews (for example the recent Boston Consulting Group (BCG) report referenced in the December 2021 AR6 proposal and provided to the ERA).

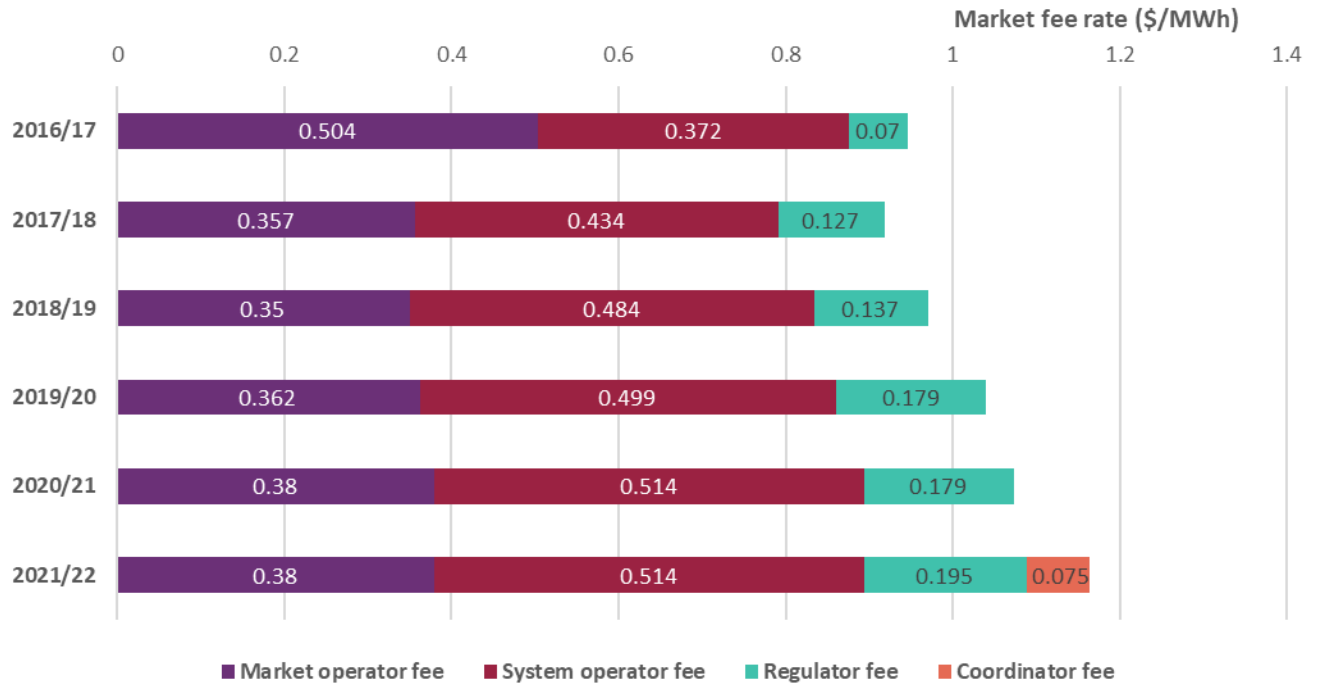
AEMO also seeks further opportunities to improve collaboration and integration across AEMO functions for overall efficiency benefits. Some examples of where this is already occurring are in the development and delivery of the Engineering Framework (discussed in the body of this submission), and the development of shared IT platforms and collaboration for DER integration trials in the National Electricity Market (NEM) and the WEM (Project Edge and

[8] Historically, overrun allowances under the Rules were 15% and 10% above the determined three-year forecast for opex and capex, respectively. The Rules have recently been revised to reduce this allowance to 10% or $10 million (whichever is the lower) for both opex and capex.

Project Symphony, respectively). The identification of further opportunities for collaboration and integration to enable more efficient and effective service delivery is an ongoing priority across the AEMO business.

Regarding efficiency, increases in controllable costs across the AR4 and AR5 period have been minor. As shown by Figure 3 and highlighted by the ERA's consultant (The Lantau Group)[9], market fees have remained steady in the WEM across the past six years (see Figure 3). AEMO has outperformed the ERA's revenue and capex determination in both AR4 and AR5. This indicates AEMO has maintained discipline on its spending and seeks to operate efficiently within its approved expenditure envelopes.

Figure 3 Summary of WEM fees over AR4 and AR5



When determining the AR6 forecast, given the current ERA-determined levels of expenditure and resourcing have already been assessed as being efficient, AEMO has focused on areas of change necessary to deliver and operate the market and power system during the energy transition. AEMO considers this is a reasonable and prudent approach and is consistent with good practice in regulatory submissions.

Benchmarking

AEMO notes the benchmarking work conducted by The Lantau Group, and will use this, in combination with the work BCG conducted for AEMO, to help assess its ongoing performance and efficiency. AEMO acknowledges Lantau's findings on the relative complexity of the new WEM compared to overseas, but highlights that it is the *change* in complexity between the existing arrangements and new WEM that drives risk and the need for additional resources, rather than the degree of complexity itself. This is particularly relevant in the short-to-medium term.

As noted by the ERA in previous determinations, benchmarking is a useful but challenging exercise. While benchmarking provides a useful guide, the fact that no two power systems and markets are identical means all benchmarking (including BCG's) is inherently imperfect and should be applied judiciously to inform decision making.

For example, benchmarking the SWIS against New Zealand and Singapore has some significant limitations, as these two jurisdictions are by no means comparable to the SWIS. While New Zealand has an 80% share of renewables in its generation mix, these are mostly synchronous generators (hydro-schemes), which present a distinctly different challenge to variable renewables and distributed PV and pose no low-load issues.

AEMO highlights that the comparison of total cost per MWh for a system operator is not a relevant measure of efficiency. There is a fixed cost component of dispatch – whether you are dispatching 1 MW or 1,000 MW, this cost is broadly the same. The WEM is a very small system in terms of the energy traded through its grid, however, it could increase the amount of energy it dispatches two or three-fold without increasing its costs substantially. It has the

[9] The Lantau Group. *Comparable Costs of Operating Electricity Markets in Different Jurisdictions*, April 2022. Available online - page 16.

features of a mature and advanced market, but the not the scale. Note this provides Western Australia an opportunity it can exploit if demand for electricity in and around the SWIS increases substantially as the economy decarbonises.

The limitations of comparisons between the SWIS and Singapore/New Zealand are discussed further in Appendix A.

Revised forecast

AEMO's revised WEM revenue forecast for the AR6 period is $152.4 million. This is 2.5% lower than the December 2021 forecast. The revised forecast capex is $72 million, which is 3.7% higher than the December forecast.

Based on the revised forecast, average market fees will increase by $0.567 over the AR6 period. This represents an estimated increase of $5.38 on the annual average residential tariff.[10]

While AEMO has accepted the ERA's draft determination on GSI in full, there have been some minor adjustments to the GSI forecast to reflect the latest interest rates and updated conditions in AEMO's Enterprise Agreement (EA). The revised GSI revenue forecast is $5.36 million (decrease of 1%) and the revised GSI forecast capex is $0.39 million (a 3% increase). These adjustments to GSI forecasts are discussed in section 4 of this document.

Table 1 and Table 2 present the revised WEM revenue and capex forecast, with a comparison against the December 2021 proposal and the ERA's draft determination.

Table 1 Total revised forecast WEM allowable revenue by cost category, $ million nominal

	AR6 proposal (Dec 21)	ERA draft determination	AR6 revised proposal (Apr 22)				
Cost category	AR6 total	AR6 total	2022-23	2023-24	2024-25	AR6 total	Variance to Dec 21 (%)
Labour	73.2	60.9	21.6	23.9	24.7	70.2	(4.3%)
Accommodation	5.2	5.2	1.8	1.7	1.7	5.2	0.0%
IT & telecommunications	11.0	9.0	2.5	3.2	3.7	9.4	(16.9%)
Supplies and services	13.0	10.7	3.7	3.5	3.7	10.8	(20.6%)
Borrowing	5.2	4.4	0.6	3.4	4.3	8.3	37.9%
D&A	50.9	48.0	10.5	17.3	21.0	48.8	(4.5%)
Adjustment for over/under recovery	-2.3	-2.3	-0.3	0.0	0.0	-0.3	568%
Total revenue	**156.2**	**135.9**	**40.3**	**53.1**	**59.0**	**152.4**	(2.5%)

Table 2 Total Revised AR6 forecast WEM forecast capex by cost category, $ million nominal

	AR6 proposal (Dec 21)	ERA draft determination	AR6 revised proposal (Apr 22)				
Cost category	AR6 total	AR6 total	2022-23	2023-24	2024-25	AR6 total	Variance to Dec 21 (%)
WEM Reform	44.6	37.2	37.4	13.3	0.0	50.8	13.8%
WA DER	9.4	4.2	5.8	0.8	0.0	6.5	(31%)
WA technology	9.7	7.2	2.5	2.2	4.1	8.8	(9.3%)
Enterprise systems	5.8	3.4	2.2	2.6	1.1	5.9	2.3%
Total capex	**69.4**	**52**	**47.9**	**18.9**	**5.2**	**72.0**	**3.7%**

[10] Assumes Synergy passes full costs through to consumers, based on average residential consumption of 13.00 kilowatt hours (kWh)/day.

AEMO has reviewed its forecasts to ensure they are *sufficient to cover the forward looking costs of performing AEMO's functions* and reflect only costs which would be incurred by a *prudent provider of the services provided by AEMO in performing its functions, acting efficiently, to achieve the lowest practicably sustainable cost of performing AEMO's functions, while effectively promoting the Wholesale Market Objectives.*[11] AEMO highlights that the test under the Rules is not solely to achieve the lowest forecast. Rather, it is to achieve the lowest practicably sustainable cost necessary to perform its functions. That is, the lowest cost capable of being put into practice successfully and then sustained without compromising services to market participants and consumers.

A prudent provider of services is one that is sensible and careful when making judgements and decisions, avoiding unnecessary risks. Frugality and sound financial stewardship are prudent behaviours. So too is ensuring expenditure forecasts do not constrain AEMO's ability to operate the market and power system effectively. AEMO is addressing both these traits, taking steps to improve internal governance while ensuring funding constraints do not place delivery of market and power system functions at risk. AEMO considers that its forecast – including contingency – represents a level of expenditure that will enable AEMO to manage the energy transition over the longer term in a reasonably efficient manner and within acceptable risk tolerances.

Governance arrangements, regulatory oversight and transparency of reform activities will promote efficient expenditure during the AR6 period. AEMO submits the costs it actually incurs will be the lowest capable of being put into practice while delivering its ongoing functions and the WEM Reforms, and that delivering reform and then operating the new market are central to the Wholesale Market Objectives.

[11] WEM Rules 2.22A.5(a) and 2.22A.5(b), available online

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Tables

Figures

1. Background and context

1.1 Structure of this document

This document presents AEMO's response to the ERA's AR6 draft determination, released on 31 March 2022. To aid the reader, this document is structured in the same order as the ERA's draft determination report.

- Section 1 provides background and context to AEMO's response including the review process to date and AEMO's response to concerns raised regarding governance.
- Section 2 presents AEMO's response to the ERA's draft determination on WEM forecast opex.
- Section 3 presents AEMO's response to the ERA's draft determination on WEM forecast capex.
- Section 4 presents AEMO's response to the ERA's draft determination on GSI forecast opex and capex.
- Section 5 presents the revised WEM and GSI forecast opex and capex, and an estimated impact on WEM and GSI Fees.

1.2 Values used in this document

All financial information in this document is presented in nominal dollars unless otherwise stated. Some tables may not sum precisely due to rounding.

1.3 Review process to date

To support the AR6 proposal AEMO has provided the ERA with a substantial volume of information. Alongside the formal AR6 proposal document, two additional public documents were submitted to the ERA on 17 December 2021 detailing AEMO's IT roadmap for the period and supporting information on labour forecasts for each of the core operational teams supporting the WEM and GSI functions. To support the ERA in making its determination AEMO has also provided additional 'in-confidence' data, documents and information including:

- Financial data including a staff manifest, workforce planning data, detail of each cost line items, depreciation & amortisation listings and borrowing expense calculations.
- Investment request documents, contingency calculators and detailed cost estimation models for all future projects.
- Detailed cost forecast models and contingency calculators for all in-flight projects.
- Corporate procedures and policies.
- Templates, framework and methodology explanatory documents.
- The report provided by BCG to AEMO.
- Meeting minutes, internal presentations, and other governance documentation.

Following submission of the AR6 proposal, AEMO has engaged with the ERA to confirm, clarify, and provide additional information to support its submission and address questions raised by the ERA and its consultants. AEMO provided responses to 126 of the 133 questions prior to the date at which ERA would finalise its draft determination for approval. The outstanding questions relate to software licensing and cloud costs, which AEMO has sought to address in this draft determination response.

AEMO is keen to continue to work with the ERA and its consultants to answer any further queries that emerge as a result of this draft determination response and address any concerns prior to the ERA's final determination.

Table 3 Breakdown of AEMOs response to ERA questions in relation to proposal areas

	Capex projects	Opex finance	Governance process	FTE Labour Forecast	Total
Clarification of provided information	42	21	-	-	63
Identification of errors in provided information	4	2	-	-	6
Provision of more information	21	31	4	1	57
	67	54	4	1	126*

* Responses provided to ERA prior to 22 March 2022 out of a total of 133 questions.

AEMO notes that in addition to this draft determination response document, it has provided ERA with another significant body of supporting documentation including a revised set of financial templates, financial tracking spreadsheets and contingency calculators.

1.4 Governance and program management

In its draft determination, the ERA states that it *has longstanding concerns about AEMO's governance process around preparing its funding proposals, which it has raised in previous allowable revenue determinations*[12] and that it *considers that opportunities exist for AEMO to improve its governance*[13] – principally around options analysis, critical decisions and project scoping. AEMO also notes concerns and/or suggestions raised by some stakeholders regarding AEMO's governance and decision making in relation to funding of its operations.

AEMO takes these concerns seriously. AEMO recognises the importance of governance and the trust placed in it by market participants to make prudent investments and provide WEM services for an efficient cost.

AEMO wishes to again convey to stakeholders that appropriate and prudent assessment of the AR6 proposal was undertaken. The governance approach taken for AR6 was an incremental improvement on the governance approach adopted for the AR5 review and in previous determinations.

The ERA raised no concerns with AEMO's governance approach in its AR5 determination, stating that:

> *The ERA reviewed AEMO's standard approach to cost estimation for AR5 and acknowledges that the approach is reasonable and AEMO has demonstrated clear project governance and accountability for internal approvals*.[14]

The ERA's concerns regarding AEMO's governance approach was first signalled in its consideration of AEMO's in-period capex adjustment proposal for DER Roadmap projects. In its December 2020 determination, the ERA noted that it accepted AEMO's DER forecast costs were assessed through AEMO's internal governance processes and that AEMO had provided information on how the DER funding application had been challenged. However, the ERA was concerned that because AEMO could not provide detailed notes from the various committee meetings and Board challenges, it could not ascertain how effective the challenge process was.[15]

AEMO took this feedback on board for the AR6 review process and made sure it could demonstrate that internal governance process had been followed, including making key meeting minutes available.

As noted by the ERA, there were 11 internal reviews of the AR6 proposal between July 2021 and December 2021; four of those by AEMO's Board. The ERA's review confirms that AEMO's proposal underwent multiple top-down reviews.[16]

[12] ERA. Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination, 31 March 2022, available online – page iv

[13] *Ibid*, page 25

[14] ERA. *Australian Energy Market Operator Allowable Revenue and Forecast Capital Expenditure 2019/20 to 2021/2022 Final Determination*, June 2019, available online – page 29.

[15] ERA. Australian Energy Market Operator in-period funding submission for implementation of the Distributed Energy Resources Roadmap actions – Determination report, 17 December 2020, available online – page iii.

[16] ERA. Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination available online – page 25.

AEMO acknowledges that despite this additional information and transparency provided in the AR6 review, the ERA considers opportunities exist for AEMO to improve its governance. AEMO will again take the ERA's advice on board and will seek to enhance its internal processes further during the AR6 period.

AEMO has already begun taking measures to improve governance, and over the past two years has undertaken several reviews and change activities to uplift its internal processes. These include:

- An independent maturity review and subsequent uplift of AEMO's Project Management framework – this included the establishment of a revised Project Delivery Framework (e.g. investment governance, project risk management, planning and scheduling, estimation, contingency).
- Ensuring focus on operational improvements, with 'Evolving the way we work' being one of the four pillars of AEMO's Corporate Plan.
- Undertaking AEMO's Organisational Excellence Program and responding to the BCG review of AEMO's organisational effort, costs, and operating model[17], which includes the ongoing establishment of an Enterprise Portfolio Office (EPO) to further strengthen investment governance and consistency across AEMO.

AEMO also acknowledges the ERA's feedback on the rigour and transparency of investment decisions, project scoping, and options analysis.

Options analysis

AEMO acknowledges that the investment briefs provided to the ERA as part of the AR6 proposal provide limited information on the various options available to meet a capex requirement, and will seek to address this recommendation ahead of the next allowable revenue forecasting process. However, AEMO notes that the level of detail will necessarily be less at preliminary stages of the project planning process. More specific and detailed estimation becomes possible as a project nears the delivery stage, whereby costs can be estimated with greater confidence (though market testing and other means). Undertaking fulsome options analysis well in advance of project delivery commencing requires additional resources, which ultimately come at a cost – and this analysis may be limited and/or likely need to be repeated for projects that will not be commenced for another two to three years.

Within an allowable revenue period, AEMO's investment governance process requires revised/new investment briefs to be developed and approved prior to projects commencing. This requires further evidence of options analysis.

Critical decisions

AEMO agrees that there is benefit for market participants (and the ERA) in providing transparency over 'critical decisions' related to project and operational delivery. AEMO has sought to provide this transparency (and sought stakeholder feedback) via its Western Australian Electricity and Gas Consultative Forums (WAECF and WAGCF), and as a key contributor and presenter to industry on WEM Reform delivery via the Transformation Design and Operation Working Group (TDOWG) and WEM Reform Implementation Group (WRIG).

AEMO consistently provides information on both risks and challenges associated with its operations and investments, and builds stakeholder feedback into its program of work. For example, the Balancing Merit Order Tiebreak project was initiated out of a WAECF conversation on risks with dispatch at the Balancing Price floor. AEMO also regularly presented on progress against the AR5 Determination, including how it was using underspends in some areas to fund additional digital and technology projects that were initially part of AEMO's AR5 proposal.

An example of both transparency and considered decision making is AEMO's approach to the WEM Dispatch Engine (WEMDE) project within the WEM Reform program. As per information provided to the ERA as part of the review process, AEMO publicly discussed its plans to leverage the NEM Dispatch Engine (NEMDE) as part of TDOWG discussion and its AR5 proposal, and subsequently initiated the project on this basis. However, taking on board feedback and challenge from a number of stakeholders – and wanting to ensure the original WEMDE decision was still most efficient – AEMO tested the market and a full set of options (e.g. build, buy, Software as a Service). It used this options analysis to determine the most appropriate approach based on a total cost of ownership, prior to making its final commitment to the WEMDE approach.

[17] AEMO. As noted in AEMO's AR6 proposal, this review commenced in July 2021, available online – page 35.

Project scoping

AEMO notes the ERA's request for additional information to better understand the alignment of project scope with AEMO's functions and will aim to provide further evidence as part of its future submissions. Appropriate scoping (and on-going management of scope) is a core component of AEMO's project delivery framework. AEMO highlights the detailed approach used for the WEM Reform program – outlined in Figure 38 of the AR6 proposal. This approach was Rules-driven with accepted scope items limited to 'must do' and 'should do' regulatory and business requirements.

As part of this (and wider processes) AEMO also acknowledges the natural trade-offs that exist between scope, quality, cost effectiveness, time and risk – both delivery and operational. In any project, scope is rarely immovable. Project scope may be increased (or decreased) to deliver the overall best outcome, hence the requirement for adequate contingency and governance.

2. WEM operating expenditure

2.1 Opex labour costs

The ERA's draft determination is to reduce forecast labour costs by $12.3 million across the AR6 period. The ERA has reached this determination using three methods:

1. The ERA estimates a $1.8 million reduction by applying its own method of backfilling AEMO's staff, and addressing a number of errors in the original labour workbook calculations.
2. The ERA reduces the labour opex forecast by a further $7.4 million by developing its own estimate of the number of staff it believes AEMO requires to be able to perform its market and system operation functions for the next three years.
3. The ERA cuts a further $3.1 million by eliminating labour costs for opex projects it does not consider are required during the period.

AEMO has reviewed the ERA's determination and has revised its labour opex forecast. There are aspects of the ERA's draft determination AEMO accepts, such as addressing inconsistencies in the labour forecast workbooks, and some reductions in forecast headcount. However, AEMO does not accept the magnitude of the ERA's cuts to the forecast number of full time equivalent (FTE) staff.

AEMO considers that the ERA's draft determination – if accepted – would place AEMO's ability to adequately resource market and system operations over the next three years at unacceptable risk. In particular, the cuts to Market Operations and Power System Planning would introduce heightened risk to market and power system operation during a period of particular vulnerability for the WEM.

The potential consequences of this heightened risk are severe. Material breaches, settlement errors, and dispatch errors are all likely if AEMO's resources are stretched too thinly. As discussed in section 2.3.5, power system security is already facing unprecedented levels of risk and volatility, with PV generation swings of more than 700 MW in less than two intervals. An under-resourced system management function will only exacerbate this risk.

The period during and immediately after new WEM go-live will pose AEMO and the market many challenges – both expected and unexpected. Neither AEMO nor market participants have ever delivered such a far-reaching and profound change to Western Australia's energy market. It is prudent to assume there will be unforeseen issues that need to be addressed quickly. There will also be a period of parallel running, particularly in the market settlements space as participants transition to the new arrangements and historical transactions are reconciled.

As such, it is imperative AEMO has resources available to operate the new market and provide maximum support to participants during this period of uncertainty. This will eliminate unnecessary risk and help ensure the market transition – and broader energy transition – runs smoothly.

AEMO stresses that the vast majority, of new FTE roles proposed for AR6 are fixed-term contractors (FTCs), not permanent employees. No party can foresee the precise level of resourcing and effort that will be required to operate the new market until it commences. Therefore, rather than appointing permanent employees and 'hard coding' ongoing operating costs into future forecasts, AEMO is taking the prudent step of using contractors and flexible staffing arrangements to manage the energy transition. This will allow AEMO to scale back (or scale up) resources as required, until such time that the new market is bedded in and staffing levels can be normalised.

When the Balancing Market was launched in 2012, there was a significant volume of issues, queries and rule changes required to enable effective market participation and operate the new arrangements effectively, which required an uplift in resources while the new markets were bedded in. The launch of the new real-time market and new essential system services (ESS) markets is a larger and more far-reaching change. It is reasonable to assume there will challenges as there were in 2012/13 and that resourcing levels will need to increase, particularly in Market Operations. In any event, it is not reasonable to assume the resourcing uplift in Market Operations will be zero.

By including provision for a ramp-up in flexible resources in the labour opex forecast, AEMO is mitigating the risk of being unable to manage the inevitable issues that will arise during and following go-live. Including provisions in the forecast does not commit AEMO to recruiting these staff. AEMO will only incur efficient labour costs – dictated by prevailing market conditions – as and when required.

Further discussion on the ERA's specific concerns with the labour opex forecast is presented in the following sections. Labour costs associated with opex projects disallowed by the ERA are discussed in section 2.9.

2.2 Backfilling and labour costs

AEMO has reviewed the ERA's concerns with regards to labour cost calculation errors and inconsistencies and has addressed these in the revised confidential financial workbook provided to the ERA with this submission.

AEMO notes the ERA has applied backfilling assumptions based on AEMO's EA higher duties practices. However, AEMO does not agree with the rest of the backfilling assumptions. AEMO decides backfilling requirements at an aggregate level, and may also backfill roles slightly earlier so the incoming employee can have an adequate handover.

Since the December 2021 proposal, AEMO has revised the labour rates to incorporate recent negotiations under the 2022 EA. This has resulted in a slight increase to labour rates. AEMO has maintained its original backfilling assumptions and has used the updated labour rates in its revised estimates for WEM and GSI costs.

2.3 FTE staff numbers

The following sections address concerns raised by the ERA on AEMO's FTE forecasting approach and the resulting AR6 resource estimates for each function.

Forecasting method

One of the ERA's primary concerns is that AEMO has focused on justifying the incremental increase in resourcing levels, rather than conducting bottom-up assessment of labour requirements for the new market. The ERA states:

> *One common element across all divisions was the assumption that existing processes and resourcing was efficient. Rather than demonstrating need through a bottom up assessment of workplace needs for the new market, AEMO opted for a lighter review focused on incremental changes to market functions.*[18]

AEMO submits that focusing on the incremental change in resourcing is reasonable, aligns with good practice, and is consistent with the approach adopted by the ERA in past allowable revenue determinations.

Current resourcing levels at AEMO are consistent with the AR5 determination. During the AR5 review process, the ERA assessed AEMO's forecast labour costs and staffing levels, and determined an opex forecast it felt satisfied the prudence and efficiency tests under the Rules. AEMO is currently operating within this opex forecast, and staffing levels across the functions are not substantially different from those anticipated in the AR5 determination and subsequent in-period adjustment for DER Roadmap actions. The forecast AR5 resourcing levels were deemed efficient in the relatively recent AR5 determinations; it is not unreasonable to assume these resourcing levels are efficient today.

[18] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 36.

For the purpose of developing an opex forecast, rather than re-assessing the entire resourcing requirements of the AEMO WA functions, AEMO considered it prudent to concentrate on identifying what the incremental change in resources will be following the commencement of the new market and throughout the energy transition over AR6. This exercise included estimating the effort required to undertake current activities and performing a bottom-up build of current and future requirements. This bottom-up build was provided to the ERA with the AR6 proposal in December 2021.

AEMO highlights that while the changes being delivered through WEM Reform are significant, there are several areas where there is no or very limited change. This supports the incremental approach. Further, where functions have changed significantly – for example Market Operations – AEMO has conducted a bottom-up assessment of workplace needs to inform the forward-looking forecast. This has been provided to the ERA.

This approach of focusing on the incremental increase in costs is consistent with that taken by AEMO and the ERA in past allowable revenue reviews. In both the AR5 process and in the in-period adjustment to fund DER Roadmap actions, AEMO's starting point for forecasting opex was to take the existing recurrent costs and use them as a base estimate, applying step and trend changes as appropriate. This base-step-trend approach is accepted common practice in regulatory revenue processes.

Further, during the AR5 in-period DER adjustment, the ERA's review was primarily concerned with identifying additional or incremental costs associated with the new obligation.[19] AEMO therefore submits that in this context, the approach of focusing on incremental or additional costs AEMO will incur in executing its obligations under the new market arrangements is reasonable and is a suitable method of estimating revenue requirements for the next three years.

Independent review

To test the prudence and efficiency of the current and forecast resource levels of AEMO's WA functions, AEMO has appointed independent consultants Robinson Bowmaker Paul (RBP) to review AEMO's AR6 resourcing estimates.

RBP is an expert consultancy, with in-depth experience and understanding of the WEM, and system and market operations. RBP has conducted the annual WEM and GSI market audit (and previously for the Independent Market Operator (IMO) and Western Power System Management) for several years. In its capacity as market auditor, RBP has reviewed AEMO's internal and external process documentation and systems extensively and has seen how AEMO's obligations have evolved over the years. This means they have a detailed understanding of AEMO's operations, systems, and resourcing effort.

RBP also supported aspects of the Western Australian Government's ongoing Energy Transformation Strategy and was a significant contributor to the new market design. RBP therefore understands how the reforms will impact AEMO's core business at a granular level.

As a specialist energy market consultancy, RBP has experience working with other market operators around the world and can make well-informed observations on the relative complexity, compliance requirements and risk tolerances of the WEM and other markets.

A copy of RBP's report is provided with this document and is available for publication.

2.3.1 Market Operations

The ERA has rejected AEMO's estimated uplift in Market Operations labour requirements in its entirety and includes no explicit provision in the expenditure forecast to enable AEMO to scale up resources in support of the new market.

AEMO disagrees with this position. AEMO considers it prudent to provide for a resourcing uplift in Market Operations. As demonstrated in the detailed analysis on Market Operations activities provided to the ERA, there is considerable evidence that the volume of work will increase and processes will change in Market Operations when the new market arrangements commence.

[19] ERA, Australian Energy Market Operator in-period funding submission for implementation of the Distributed Energy Resources Roadmap actions – Determination report, 17 December 2020, available online – page 11.

For example, from 1 October 2023, there will be multiple new markets in operation. The new ESS markets will commence and a new real time market that co-optimises energy with ESS via the new WEM Dispatch Engine (WEMDE) will come into effect. Allied with this, changes to supporting administrative processes such as settlements and prudentials will occur, as well as the introduction of ongoing requirements to test, manage and evolve WEMDE and other market systems. It is reasonable to assume current resourcing levels will be insufficient.

If AEMO was to maintain existing resourcing levels in Market Operations, it would be running the new market at a risk level higher than the risk tolerances approved by AEMO's Board, who have considered the overall market risk that AEMO is required to manage. It will also mean service levels currently experienced by market participants are likely to decline.

AEMO estimates that a shortfall in Market Operations resources under the new market arrangements will result in the following risks:

- There is heightened risk of failures in operational processes for example:
  - Settlement invoices might not be issued on time, which may lead to delayed payment (at best) and defaults of participants (at worst).
  - Errors in settlement statements will be increased due to insufficient input (i.e. metering) and output validations.
  - Prudential issues may not be identified and actioned within appropriate timeframes. This may lead to increased liabilities incurred in the market in the event of participant failure.
  - IT system outages may not be responded to and resolved within agreed service level agreements (SLAs).
- There will be an increase in the number of non-compliances by AEMO with increased materiality. It will take longer to report and rectify those non compliances, which may impact participants financially. Participant behaviour breaches that impact the effectiveness of the market may not be identified and reported. Potentially anomalous market outcomes might not be analysed and understood. These will have a direct impact of the effectiveness of the market.
- Stakeholder service will be decreased from current levels – Market Operations will not be able to answer emails and phone calls within SLAs, so they will have to be renegotiated. Registrations may take longer to process.

RBP's findings

As part of its expert review, RBP was asked to draw upon its experience of market reform in other jurisdictions, its understanding of AEMO's current processes, and its view on the impact of new market design, to provide advice on whether it considered the Market Operations resourcing uplift is reasonable.

In summary, RBP found:

> *Market Operations existing resourcing levels are largely reasonable as are their uplift estimates; although there may be some areas in settlement and prudentials where there is opportunity to reduce the estimated effort slightly. We conclude that some level of uplift is required in this area and current levels of resourcing will be insufficient. We particularly note that as owner of WEMDE, Market Operations will require staff who understand the mathematics and logic of WEMDE so that anomalous issues can be identified, diagnosed and resolved. Such issues will occur frequently as the new market is bedded in but will continue in steady state. Additionally, we note that while settlement calculations are automated and the system is certified, the settlement process itself is a complex process with multiple points of input data failure. In 2018, we performed a detailed risk assessment of the current settlement process and noted that the inherent settlement risks even after accounting for certification are high, and it is Market Operations' robust validation and verification controls (much of which cannot be automated) which reduce the residual risks to a tolerable level. Our previous experience auditing the settlement process indicates that 2.6 FTE is not a sufficient level of resourcing to operate a weekly settlement process.*[20]

[20] RBP. *Review of AEMO Operational Staffing Estimate,* April 2022, page 7.

AEMO agrees with RBP's detailed assessment, including the areas where RBP has highlighted AEMO may be able to reduce its estimated uplift in resourcing effort. For example, RBP recommends the increased resourcing effort associated with prudentials management and some aspects of settlement (invoicing and settlements processing) is less certain than AEMO assumes, and that the uplift could be scaled back marginally.

Taking on board the ERA's draft determination and RBP's recommendations, AEMO has revised its FTE forecast for Market Operations to 15.1 FTE at the end of the AR6 period. This is an increase of 5.1 FTE compared to current staffing levels.

Table 4 Market Operations revised FTE forecast

Function	FTE at end AR5	AEMO initial estimated increase	ERA draft determination increase	AEMO revised proposed increase
Market Operations	10.0	6.0	0.0	5.1

The ERA's specific concerns raised in its draft determination are discussed in the sections below.

Impact of automation

Central to the ERA's draft determination on Market Operations' labour opex requirements is the assumption that any increase in labour requirements will be wholly offset by efficiencies resulting from automation. For example, the ERA states:

> *It [AEMO] has not explained why the shortcoming in the current system cannot be rectified in the development of the new market systems and why automated screening cannot be used to automate the high degree of manual validation currently undertaken.*[21]

With regard to the broader impact of automation, in its independent report RBP notes:

> *…the overall levels of automation will not increase as a result of the new market and that there is only one area in which automation will materially change the functions carried out by AEMO staff, and that is power system operations in the control room.*[22]

RBP also highlights that one of the drivers of reform was to automate the dispatch process, which is where the bulk of technology uplift in the WEM Reform program lies.

> *One of the key arguments for reform was that the manual nature of dispatch combined with portfolio dispatch of Synergy under the current arrangements leads to sub-optimal economic outcomes and that manual dispatch is not sustainable given the increasing complexity of the power system (i.e. increasing congestion, changing fleet characteristics and renewable penetration). WEMDE addresses this concern – because dispatch schedules will now be automated, power system controllers will no longer need to manually determine constraints in real-time (unless intervention is required) or determine how Synergy's portfolio is to be dispatched.*[23]

The current level of manual processing in Market Operations is not driven by a lack of automation. Currently automated processes include settlement calculation, prudential calculation, alerting and monitoring. Despite this automation, to manage risk appropriately you still need to have people that:

- Can respond when things go wrong.
- Can support market participants.
- Understand the market fundamentals at a granular level of detail.

[21] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 84.

[22] RBP. *Review of AEMO Operational Staffing Estimate*, April 2022, page 3.

[23] *Ibid.*

- Can analyse market data and outcomes to draw conclusions.

Given the volume of activity in the new market is likely to increase, and the high likelihood of issues when the new arrangements commence, it is reasonable to assume Market Operations will require more people during AR6.

AEMO will apply automation where an opportunity for achieving efficiencies is identified. Reform will change many of AEMO's existing processes, however the scope of the WEM Reform program does not currently extend to increasing the level of processes automation compared to current levels in the WA Market Operations related functions.

The extent of the opportunity to apply automation will not be fully understood until the new arrangements commence and have been bedded in. When AEMO has real data on the potential savings automation can bring in the new market, it will seek to apply technology where practicable. Until then, AEMO considers it prudent to make reasonable assumptions on the efficiencies automation will bring, and to include provision in the opex forecast to allow Market Operations to adequately resource its functions during the most critical period for the new WEM.

Operation of the real time market

In its draft determination, the ERA appears to overestimate the level of automation that will be achieved during the AR6 period in the operation of the new real time market and the extent to which this differs from current arrangements. For example, the ERA makes the following assumption:

> *A greater degree of automation and some staff practices, such as reviewing submissions in the 90 minutes ahead of dispatch, might be expected to reduce the staffing requirement in the new market. The new market systems will also have in-built input filters to prevent non-compliant offers from being accepted.*[24]

The ERA is correct that determining the dispatch order across services for energy and ESS will be automated. However, there is already automation in place. Under current arrangements the dispatch order for load following ancillary services and energy are automated via the Load Following Merit Order and Balancing Merit Order. Under the new arrangements, while the complexity of the dispatch calculations that can be processed will increase, there is no significant increase in the level of automation, rather the current level is maintained.

As part of its review, RBP was asked to provide its opinion on the changing level of complexity in market processes and where automation may have an impact. RBP's findings are as follows:

> *Below, we briefly summarise the key areas in which we think complexity will increase materially and where automation will not necessarily lead to a reduction in resourcing requirements.*
>
> - *Market clearing and pricing (include pre-dispatch and real time schedules). As owner of WEMDE, the Market Operations team is responsible for this function (and have included it as part of their daily operations functions). The market clearing logic in the new market is an order of magnitude more complex than the current Balancing Market which is a straightforward merit order stack for energy only. The new market, on the other hand, will have a constrained dispatch algorithm that includes the co-optimisation of five different types of Frequency Co-optimised Essential System Services (FCESS). The clearing itself will be automated. However, the market clearing function is not as simple as leaving WEMDE to run with no oversight. The process requires oversight to identify, detect, diagnose and resolve anomalous issues and dispatch outcomes. For example, Transpower New Zealand has a dedicated team that monitors dispatch and pricing outcomes and responds to participant queries. Even though the New Zealand market has been in place for over 20 years, and the last major update to the market platform was bedded in over ten years ago, incidents are still raised to investigate anomalous prices, schedule failures and data feed issues. It is worth noting that diagnosing anomalous outcomes produced by a constrained optimisation algorithm that includes co-optimisation is not a trivial task. For example, when we certify similar market clearing engines, we often use a substantially reduced dataset (i.e. with fewer generators/locations and simplified assumptions). Even so, when anomalous behaviour is detected (particularly in the co-optimisation testing phases), diagnosis can sometimes take 1-2 days of effort. Diagnosing an anomalous outcome or even explaining a non-intuitive dispatch outcome to a participant with a full input dataset could reasonably take*

[24] RBP, *Review of AEMO Operational Staffing Estimate*, April 2022, page 83.

a few days. Regarding the latter point, we note that it is not uncommon for participants to query correct but unintuitive dispatch outcomes, particularly where the market is still being bedded in. Such non-intuitive outcomes will be common as the algorithm is performing trade-offs between energy and multiple FCESS products while trying to respect not only network constraints, but a series of complex ESS trapezium and mixed integer constraints as well.[25]

Given this substantial change in WEM operations, and the New Zealand precedent, AEMO considers it reasonable to assume there will be similar issues in the WEM and that additional resources will be required to manage these. It is not prudent to assume there will be no need for an increase in resources.

Prudentials and market settlement

In its draft determination, the ERA states it is unclear why there will be a net increase in effort required to administer prudentials and market settlements in the reformed WEM:

> *With more frequent settlements, the prudential requirements should reduce as they are smaller quantities being settled at a time, diminishing the exposure. The overall quantity of verification through settlements is the same, it is simply broken into smaller portions so that while the number of runs will increase, the number of intervals to settle reduces. It isn't clear there will be a net increase in effort required.*[26]

Prudentials

With regard to prudentials, AEMO proposed a minor uplift in resourcing effort, increasing from 0.7 FTE today to 0.9 FTE in the future. As explained in the detailed labour forecasting information provided to the ERA, AEMO expects this minor increase in effort relates to:

- Credit limit reviews.
- Monitoring trade margins.
- Managing credit support.

In light of the ERA's concerns around the prudentials process, AEMO asked RBP to provide its independent view on future resourcing requirements. RBP advises that AEMO's estimates of current prudentials management efforts are reasonable, however, it highlighted there may be opportunity to reduce the proposed resourcing uplift. RBP's findings are as follows:[27]

- Credit limit reviews

  The uplift in this process is related to the additional seasonal review added by AEMO. The overall effort (20 person days or 160 hours per review) is driven by the highly manual nature of this process. While the Credit Limit calculation itself is semi-automated, AEMO's interpretation of clause 2.37.5(k) involves reviewing the trading behaviour of all active participants to determine whether there are any other factors that should be considered. In the last review, there were approximately 50 such participants. The process also includes obtaining internal approvals for Credit Limit outcomes from the Group Manager, the issuing of Credit Limit review outcomes and responding to submissions / requests from Participants. The effort in this area looks largely reasonable; however, there may be some scope to marginally reduce the effort associated with Credit Limit reviews. For example, assuming 50 participants being reviewed per cycle, an effort estimate of 15-16 person days per review may be more reasonable.

- Monitoring trading margins

  AEMO's uplift in this area is based on the assumption that under the dynamism in the new market exposure will increase leading to more breaches of the Trading Margin. This does not seem plausible unless the level of bilateral

[25] RBP. *Review of AEMO Operational Staffing Estimate*, April 2022, page 4.

[26] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 83..

[27] RBP. *Review of AEMO Operational Staffing Estimate*, April 2022, pages 22-23.

cover is likely to reduce materially. At this stage, there is no reason to assume that ESS costs will be volatile enough to cause participants to regularly breach their trading margins (as a result of higher overall ESS costs). Given that prudential monitoring should be automated, and there is no reason to assume increased exposure, the uplift in this area is not warranted.

- Managing credit support

  This process includes both managing the initial lodging of Credit Support as well as managing amendments thereafter. It is a completely manual process and while we understand there is administrative burden pertaining to paperwork and ensuring all documents are complete and correct, a day per review seems high and AEMO may wish to consider whether there is opportunity to marginally reduce the per review effort here. Given the manual nature of the process and the potential financial and reputational impacts of errors, we would expect at least half a day per review.

RBP also recommends that the two-week allowance for audits and documentation management is reasonable and should not be reduced.

AEMO's proposed uplift in this area was relatively minor at 0.2 FTE. During detailed discussion with RBP, AEMO agreed with the challenges raised by RBP and the opportunities to refine estimates.

Based on these findings, AEMO has decided to remove the proposed uplift in prudentials resourcing effort. The proposed FTE for the prudentials function will therefore remain unchanged from current effort at 0.7 FTE.

Settlement

With regard to settlement, there is sufficient evidence to suggest resourcing requirements will increase as the number of settlement runs increases. The move to weekly settlement increases the total number of settlement runs per year from 100 to 208. The effort required to conduct one settlement run is largely fixed and will not vary depending on the value of what is being settled or the interval between settlement runs.

Automation will have a limited impact in the settlement space. While new systems will enable a greater volume of settlement runs to be administered, a key driver of workload in this space is validation and issue resolution. The transition to weekly settlement will deliver significant benefit for participants, however, the efficiencies associated with AEMO currently validating settlements on a monthly cycle will be significantly diminished. More settlement runs means more validation activity, which in turn will lead to more issues being identified. Issue resolution requires manual intervention and cannot generally be automated.

AEMO maintains that the increase in settlement runs per year will drive additional resource requirements. This position is supported by RBP's advice. RBP states:

> *We particularly note that as owner of WEMDE, Market Operations will require staff who understand the mathematics and logic of WEMDE so that anomalous issues can be identified, diagnosed and resolved. Such issues will occur frequently as the new market is bedded in but will continue in steady state. Additionally, we note that while settlement calculations are automated and the system is certified, the settlement process itself is a complex process with multiple points of input data failure. In 2018, we performed a detailed risk assessment of the current settlement process and noted that the inherent settlement risks even after accounting for certification are high, and it is Market Operations' robust validation and verification controls (much of which cannot be automated) which reduce the residual risks to a tolerable level. Our previous experience auditing the settlement process indicates that 2.6 FTE is not a sufficient level of resourcing to operate a weekly settlement process.*[28]

However, RBP highlights two areas where it considers the forecast uplift in settlement resourcing effort could be reduced.

The first area is in relation to settlement processing:

[28] RBP. *Review of AEMO Operational Staffing Estimate*, April 2022, page 7

> *Market Operations has allocated 2 days per run for settlement processing (under the post-amended WEM rules). In this process, AEMO collates inputs from WEMDE and from other AEMO teams to run batches to create settlement outputs. Additionally, it includes running and verifying IRCR calculations (including NTDL assessment). The bulk of the effort will be spent on the IRCR related calculations. While this estimate is not unreasonable, there may be some scope for efficiencies here as the vast majority of settlement inputs will be coming from WEMDE (which will have been certified). We note that scope for reduction is not material per run (possibly a reduction from 2 to 1.5 days per run), but may add up over the multiple runs required.* [29]

AEMO is comfortable with RBP's recommendation and has reduced the estimate for settlement processing from 2 days per run to 1.5 days per run as suggested. Due to the large number of settlement runs (208 total runs) this results in a reduction of 104 days of effort over a 12-month period.

The second area is in relation to issuing statements:

> *Market Operations has allocated 4 hours per run for statements and invoicing. While statements are automated, there are manual activities involved such as prepayment application, uploading trades to Austraclear (in preparation for settlement day) and implementing approval controls (to ensure managerial approvals have been given). There may be some opportunity to reduce the effort here. Again, the reduction in effort per run is likely not to be material.*[30]

AEMO is comfortable with RBP's recommendation and has reduced the estimate for issuing settlement statements from four hours per run to two hours per run as suggested. Due to the large number of settlement runs (208 total runs) this results in a reduction of 13 days of effort over a 12-month period.

AEMO originally proposed an uplift in settlement resourcing from 2.6 FTE to 4.5 FTE on an ongoing basis, with an additional 0.7 FTE required for the 12 months post go-live to accommodate the transitional settlement requirements of settling under both current and future market rules. AEMO does not propose any change to the transitional settlement effort however AEMO has taken the RBP advice into consideration and reduced its ongoing estimated settlements resourcing requirement by 117 days/year. This results in a reduction from 4.5 FTE to 4.0 FTE.

Training requirements

The ERA has expressed concern regarding to training requirements, pointing out that these requirements should be temporary:

> *It is expected there will be an increase in the level of service necessary to support market participants in the transition to the new market. The capital expenditure projects include substantial internal training allocation and the allocation of training specialists to develop and deploy training materials. Any training requirements are expected to be temporary and short term*.[31]

AEMO highlights that Market Operations proposed no uplift in training requirements for market participants. While AEMO expects there will be a short period where participants require additional support or training, these requirements will be transient and for the most part will be managed as part of the WEM Reform program.

The AEMO WEM training program provides a series of courses tailored for existing and potential market participants and the companies that service them. The courses cover the operational aspects of the WEM and have been broken into three sessions.

The WA Market Operations team is responsible for developing training content as well as delivering the training itself. This includes incrementally improving and updating training materials to reflect changes in the market. There are approximately 28 half-days of training per year. Each training course requires two trainers. This equates to 28 days per year or 2.3 days per month. Delivering training is therefore 0.12 FTE alone. The additional annual FTE effort of

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[29] RBP. *Review of AEMO Operational Staffing Estimate*, April 2022, page 22

[30] *Ibid*.

[31] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 84.

approx. 0.18 FTE relates to the additional internal and external courses Market Operations runs, plus the effort to train the trainers and maintain/update content.

AEMO highlights that the training effort is estimated based on actual experience and that no increase in training resources has been proposed for AR6. Market Operations did not provide for an uplift in participant training in its labour opex forecast in the AR6 proposal and does not propose an uplift in this response.

Market system business owner

Market Operations is the business owner for most of the market related IT systems at AEMO. Market Operations identified a requirement for a minor uplift for resourcing provisions in the labour forecast (0.3 FTE) to accommodate the additional effort associated with owning the new market systems.

The ERA has rejected this uplift on the basis that *no explanation has been provided for the existing staff allocation for a fairly static requirement, where much of the documentation would be integrated into the software development process*.[32]

As business system owner, Market Operations plays an important role in the day-to-day management of critical business systems. This includes the activities listed below:

- Identification and prioritisation of bug fixes and improvements across IT systems. This includes working with system users, including market participants and internal stakeholders, to understand any bugs or any requested improvements and working with the IT team understand and prioritise.
- Development of business requirements. Once work has been prioritised, Market Operations will undertake detailed analysis of the bug or improvement and develop requirements for the IT team to use for development and testing.
- Support to the development and testing process. During the development and testing process, Market Operations will provide support to the developers and testers by answering questions, providing contextual information / knowledge and reviewing any interim deliverables.
- User acceptance testing (UAT). Once a fix or improvement has been completed, WA Market Operations will undertake detailed UAT of the system.
- Release management (documentation updates, communications etc.). Once a release has been finalised, Market Operations will ensure all relevant documentation, such as release notes, user guides and technical specifications are created or updated, approved and released to participants.
- Releases. During a system deployment or release, Market Operations will be part of the deployment team responsible for sending communications, monitoring the market and systems, undertaking smoke testing and coordinating any issues that may arise.

These activities currently take approximately 0.3 FTE of effort per year for current systems. This is a lower-than-usual level of effort, as the number of bug fixes and improvements to current systems is limited to critical changes only given new systems will soon be delivered through WEM Reform. Effort associated with production releases for WEM Reform changes is currently allocated to capex.

Once the suite of new systems is implemented as part of reform, AEMO expects the resourcing requirement to increase to normal levels, particularly during the go-live and post go-live bedding in periods. The typical resourcing requirement in this area is 0.6 FTE.

AEMO asked RBP to review the reasonableness of Market Operations current and forecast FTE effort in this space.

RBP notes:

[32] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 83.

> *Current and projected resourcing estimates are reasonable; projected resourcing levels should decrease once systems are bedded in.*[33]

And:

> *During the Transition period, it is expected that the number of issues will ramp up and given the increased complexity of WEMDE and some areas of the Settlement system, a doubling of the effort in this area is reasonable. We would expect, however, for the effort to revert to AR5 levels once the systems have been bedded in.*[34]

AEMO will therefore ensure that new resources appointed to help manage this peak in market system management will be FTC rather than permanent employees and will review whether the 0.6 FTE requirement remains prudent in AR7.

Sharing resources with Reserve Capacity

The ERA suggests that AEMO will have the capacity to use overrun provisions (under the Rules) or can share floating resources with the Reserve Capacity team.[35]

AEMO will use overrun provisions only where absolutely necessary but maintains the position it is more prudent to include labour provisions in the opex forecast for roles where there is reasonable certainty the additional resources will be required. The overrun provisions under the Rules are limited and therefore should be reserved for unforeseen events or reacting to emergencies.

Sharing floating resources with the Reserve Capacity team is not prudent. The depth of knowledge required in Market Operations and Reserve Capacity is substantial and different. Market Operations and Reserve Capacity account for around 70% of AEMO's Rule obligations and staff need to understand a myriad of market and Reserve Capacity Mechanism (RCM) processes in considerable detail. It would be unreasonable to expect individuals to understand all of this and float interchangeably from team to team.

Further, the ERA highlights Reserve Capacity is an area that is under-staffed.[36] It would not be prudent to stretch these resources further.

General concerns

The ERA also raises some general concerns regarding Market Operations' current resourcing arrangements:

> *The staffing functions are estimates prepared by AEMO, as this team does not use timesheets. Some elements of the allocation of resources look unreliable.*
>
> *A substantial amount of time is spent conducting metering verification, nearly double that of operating the balancing and LFAS markets and individually reviewing the settlements systems outputs. The staff allocation to training delivery is seven times the estimated time spent delivering training of three half days every one to two months.*[37]

The estimates of the time allocation of Market Operations resources was developed collaboratively by the Manager and Principal Analysts, who intimately understand the operational activities of the team. Collectively, the resources involved in developing these estimates have over 25 years of experience working at all levels in the Market Operations function. While the FTE forecasts are estimates, they are based on actual practice by the individuals who carry out the activities currently. AEMO is unclear why the ERA considers the estimates to be unreliable.

The ERA is correct that a substantial amount of time is spent conducting metering verification. Metering data is one of the most critical inputs into market operations and it is vital that the information is checked thoroughly and any

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[33] RBP. Review of AEMO Operational Staffing Estimates, April 2022, page 23.

[34] *Ibid*, page 24.

[35] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 84.

[36] *Ibid*, page 36.

[37] *Ibid*, page 83.

issues addressed before processing. AEMO works activity with Western Power to resolve metering issues to ensure settlements outcomes are as accurate as possible. AEMO recognises that metering validation is currently subject to greater manual intervention than other Market Operations activities and has been identified as an area where AEMO may be able to introduce automation post go-live. AEMO highlights that no increase in metering validation effort is proposed for AR6.

2.3.2 Reserve Capacity

The ERA has partially endorsed AEMO's estimated uplift in Reserve Capacity labour requirements. The ERA has allowed provision for an uplift of 2.0 FTE compared with the 4.0 FTE proposed by AEMO.

AEMO has reviewed the ERA's analysis and accepts the draft determination position at this time. AEMO maintains that an uplift in resourcing will be necessary and will aim to fulfil its reserve capacity obligations within the labour opex amounts determined by the ERA.

AEMO has provided evidence and further information to the ERA to justify the 10 FTE to undertake RCM operations. AEMO accepts the draft determination position of two additional resources (from 8.0 to 10.0) required to run the RCM operations.

AEMO remains of the view that its assessment of the number of capacity applications for forthcoming Reserve Capacity Cycles is reasonable, and ongoing discussion with potential participants and new facility owners validates the initial forecast. Due to the confidential nature of the capacity registration process, AEMO cannot share detail of applications in this public review process. AEMO has provided some detail on capacity applications in strictest confidence during the course of the review process to date, and can provide further information upon request.

Table 5 Reserve Capacity revised FTE forecast

Function	FTE at end AR5	AEMO initial estimated increase	ERA draft determination increase	AEMO revised proposed increase
Reserve Capacity	8.0	4.0	2.0	2.0

2.3.3 WA Reform and Market Development

In its draft determination, the ERA does not include the labour forecast for the WA Reform and Market Development function, on the basis that the ongoing requirements of WEM Reform are uncertain.[38] Further, the ERA considers that:

> *Any ongoing reform requiring substantial support from AEMO would be expected to lead to new projects likely to be capitalised in the same manner as the current reform program. The staff requirements to deliver the reform program might be expected to form part of this cost. AEMO's additional staff requirements in this unit are not considered justifiable at this time.*[39]

AEMO agrees that the ongoing requirements of WEM Reform are not certain and that there is potential for market development costs to be capitalised as part of specific projects (as per the WEM Reform program). However, until specific market development projects are scoped and developed, for the purpose of the revenue forecast AEMO considers it prudent to assume WA Reform and Market Development resources will be expensed. Should these resources be seconded to market development/reform projects, then the appropriate accounting treatment will be applied at the time.

[38] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 36.

[39] *Ibid*, page 87.

AEMO highlights that the additional FTE resources[40] included in the opex forecast does not reflect a resourcing increase. Rather, it reflects resources currently booked to capex as part of WEM Reform returning to their former 'business as usual' roles. As the ERA notes[41], following the transfer of functions from the former IMO to AEMO, the number of Market Development resources at AEMO was four. This is the same number as is being proposed going forward (4.0 FTE). There is no overall increase.

It its draft determination, the ERA draws comparisons with the activities of the former IMO's Market Development Team, which operated with 5-7 staff. The ERA considers that these 5-7 staff were substantially responsible for the rule change process and notes that responsibility for making changes to the WEM Rules no longer sits with AEMO.

AEMO is concerned that the ERA's comparison significantly underestimates the role and obligations of AEMO's WA Reform and Market Development function, and possibly the volume of activity expected as the Energy Transformation Strategy and other market developments progress. The WA Reform and Market Development team is conveyed the following functions under the WEM and GSI Rules:

- Procedure changes (clause 2.1A.2(h)) – coordination of AEMO Procedure Changes and supporting processes.
- Rule changes (clause 2.1A.2(IA)) – development of rule change proposals, provision of information to support all rule change submissions and providing formal submission or response.
- Market Advisory Committee / Gas Advisory Board support (clause 2.3.5(g)) – support meeting attendees and processes required of AEMO.
- Market development reviews (clause 2.1A.2(II)) – support and provide AEMO input to reviews [42](e.g. RCM, cost allocation, Short Term Energy Market (STEM), WEM / GSI procedure change process, forecast quality, Energy and Governance Legislation Project ('Project Eagle') and Power System Security and Reliability Standards).
- Regulatory reports (clause 2.1A.2(IA) & 2.1A.2(II)) – support and respond to reports by the ERA, Energy Policy WA (EPWA) etc. (e.g. Ancillary Service parameters, Benchmark Reserve Capacity Price, Energy Price Limits, market effectiveness, and non-AEMO WEM Procedure changes).
- Business process and system impact elaboration (clause 2.1A.2(IA) – assess all rule changes and provide impact of effort assessment.
- Project planning and establishment (clause 2.1A.2(II)) - operational aspects of standing up an initial project brief including costing.
- Allowable revenue (clause 2.22A.2 & 2.22A.14) – leadership and coordination of submissions and responses.

WA Reform and Market Development's obligations are not limited to administering rule changes. AEMO submits its historical (pre WEM Reform program) resourcing level of 4.0 FTE is the minimum requirement to manage its obligations going forward. AEMO also notes that under the former IMO and Western Power System Management arrangements, total staff across the rule change body was 10-12. Placed in this context, AEMO's estimate of four dedicated resources is reasonable.

The effort required to support reform and market development going forward is highly dependent on the expected change in the market. EPWA's forward work program indicates market evolution will continue for the foreseeable future. For example, the RCM review is currently under way and expected to progress over the next 1-2 years. The WA Reform and Market Development team will coordinate AEMO's efforts with expertise provided by subject matter experts across the internal operational teams to provide rule change design and development expertise. Procedure management is also expected to increase in the AR6 period, as the total WEM Procedure count will increase by approximately 25 new WEM Procedures.[43]

[40] Note AEMO proposes an uplift from 1.2 FTE to 4.0 FTE, an increase of 2.8 FTE.

[41] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 87.

[42] Energy Policy WA. *Market Advisory Committee Meeting Papers*, 5 April 2021, available online

[43] AEMO. WEM Procedure Register, September 2021, available online

EPWA has identified seven reviews to commence within the AR6 period for which the WA Reform and Market Development team will be required to lead and coordinate AEMO's input as required under 2.1A.2(II). While the precise level of input required from AEMO has not yet been defined, as the market and system operator it is reasonable to assume AEMO will be called upon to provide technical support and subject matter expertise. The WA Reform and Market Development resources will manage this engagement. Note, the 5MS review is not included in the scope for the WA Reform and Market Development team during the AR6 period.[44]

As part of its expert review, RBP has assessed AEMO's proposed WA Reform and Market Development resources. RBP finds that:

> *The uplift is driven by AEMO's assumption that there will be a steep increase in rule and procedure changes after the new market goes live. This assumption is reasonable. For example, when the Balancing Market went live in 2012, there were 12 rule changes over the 12 month bedding in period. We would expect more changes when the market goes live in October 2023 given the significantly more complex nature of trading arrangements. Additionally, the ongoing reform activity (which includes Stage 2 of the Energy Transformation Strategy and regulatory review) will require AEMO involvement.*[45]

And

> *…assuming 7-8 regulatory reviews over the next two years, and 15-20 rule changes post go live and associated WEM Procedure changes, the 4 FTE estimate is reasonable. We further note that other teams have (in total) allowed for 1.65 FTE effort for SME input into the rule and procedure change process (this includes the Reserve Capacity team allowing for 0.35 FTE input into the RCM review process). AEMO teams may wish to revisit the overall estimate to ensure they are not double counting activities that Market Development would be performing.*[46]

Given the ongoing government-driven market evolution program and AEMO's obligations to promote market development, AEMO highlights the importance of ensuring it has sufficient access to funding such that it can provide support to the Minister, EPWA, ERA and market participants.

AEMO has followed RBP's advice and reviewed its overall market development forecast across each of the WA functions to ensure there is no double count. Downward adjustments to Reserve Capacity and OGI forecast have been made that accommodate this, and this has also influenced the proposed adjustment to the Market Operations forecast.

For the WA Reform and Market Development function, AEMO maintains that the appropriate number of dedicated opex resources is 4.0 FTE.

Table 6 WA Reform and Market Development revised FTE forecast

Function	FTE at end AR5	AEMO initial estimated increase	ERA draft determination increase	AEMO revised proposed increase
WA Reform and Market Development	1.2	2.8	0.0	2.8

[44] Due to the size and specific skillset required for this work, AEMO identified that an operational project would be initiated to develop the proposed solution and scope for implementing 5MS in the WEM. Refer to section 2.9.

[45] RBP, Review of AEMO Operational Staffing Estimate, April 2022, page 37.

[46] *Ibid*.

2.3.4 Power System Operations

The ERA accepts the control room is currently understaffed and that it is a critical function for AEMO.[47] Given the two-year lead time on training new control room operators, the ERA has included provision in the labour opex forecast for an additional trainee.

AEMO welcomes the ERA's proposal to include funding for an additional controller. However, AEMO considers the originally proposed uplift of 2.8 will be sufficient to ensure the control room will be adequately staffed during AR6.

AEMO submits it is more prudent to include the opex provision for this additional control room resource in the opex labour forecast for AEMO's other functions, such as Power System and Market Planning or Market Operations, whose resourcing requirements are subject to greater volatility over the period.

Table 7 Power System Operations revised FTE forecast

Function	FTE at end AR5	AEMO initial estimated increase	ERA draft determination increase	AEMO revised proposed increase
Power System Operations	15.0	2.8	3.8	2.8

2.3.5 Power System and Market Planning

The ERA has determined a partial uplift in Power System and Market Planning (PSMP) labour requirements providing for an uplift of 3.5 FTE compared with the 8.8 FTE proposed by AEMO.

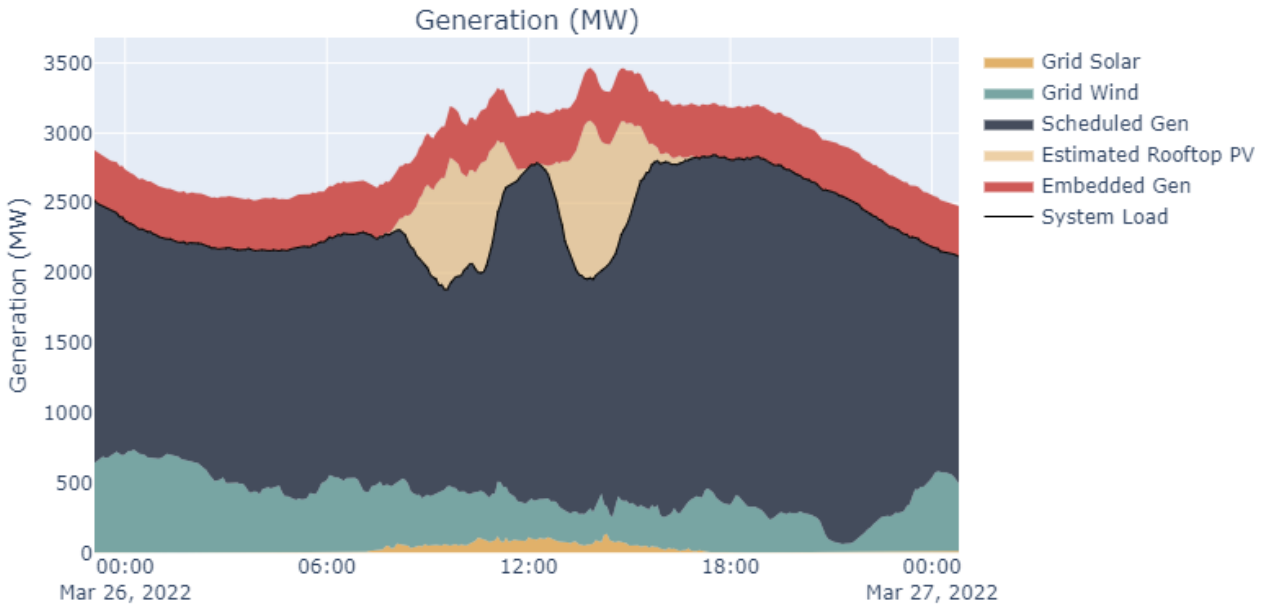
The ERA recognises that AEMO's operating environment has become more challenging and that additional resources may be necessary to meet emerging system security needs. AEMO supports this view, however, AEMO considers an uplift of 3.5 FTE will be insufficient to allow AEMO to manage the system security risk within acceptable risk tolerances.

Western Australia's principal power system (the SWIS) is experiencing real-life challenges caused by distributed PV. On 16 March 2021, for the first time since the Frequency Operating Standards came into place, AEMO's power system operators were unable to maintain system frequency within the Normal Operating Frequency Excursion Band (NOFEB), following a loss of approximately 400 MW in distributed PV generation over 26 minutes. The frequency excursion to 49.5 Hz came despite spinning reserve and load following upwards levels being adequately maintained prior to the event.

Only one year later, on 26 March 2022, the power swing from distributed PVs almost doubled. On this day, there was a swift cloud formation over the Greater Perth Metro area between 10:30 and 13:30, resulting in a system load increase of more than 600 MW within 40 minutes, followed by a more than 700 MW load decrease over 56 minutes after the cloud band passed. Figure 4 shows a snapshot of the sudden change in generation profile as the cloud cover came in, alongside a stacked chart showing generation types through the day.

[47] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 88.

Figure 4 Snapshot of power system event – generation swing – 26 March 2022



AEMO anticipates uptake of distributed PV by Western Australian consumers to continue to rise over the coming years and expects security risks due to weather events (such as major cloud bands) to remain and likely increase. Operational teams in WA must continue to increase sophistication in modelling, forecasting and training to provide power system operators with the necessary support to manage these events.

System events such as the one on 26 March 2022 are likely to become more frequent and more severe. While the actions under the DER Roadmap and EPWA's ongoing Energy Transformation Strategy should mitigate the issues caused by distributed PV over the longer term, until the transition is complete the SWIS remains at heightened risk.

AEMO considers it prudent to include provision in the PSMP labour opex forecast to enable sufficient resources to be employed to manage the system security risk and inform Energy Transformation Strategy initiatives, which seek to design the power system of the future. As discussed in the AR6 proposal and in further information provided to the ERA during the review process, additional PSMP resources are required to:

- Improve forecasting and modelling efforts, to improve visibility of weather events that may pose a risk to system security.
- Decrease price distortion in the market by giving market participants more accurate information about expected demand.
- Increase preparedness of power system operations to manage and respond to PV-related contingency events.

Resource investments in PSMP will also deliver benefits in other areas such as system restart and ancillary service planning.

Provision in labour opex forecast for a 3.5 FTE uplift will not be sufficient to allow PSMP to perform the above functions and to adequately mitigate power system security risks. To test this view, AEMO asked RBP to review AEMO's PSMP resourcing estimates.

In summary, RBP finds that:

> *Power System and Market Planning's (PSMP) current levels of resourcing are reasonable. ERA's draft determination to grant 3 additional FTE to this team is unlikely to be sufficient. Particularly, PSMP's assumption that increasing power system complexity will require a continual improvement approach with respect to modelling and forecasting is credible and aligns with prudent power system operations practice. Particularly,*

the effort estimates associated with model maintenance, forecasting and incident investigation is reasonable, and we further note that these functional areas are a critical component of managing the power system in an increasingly volatile and dynamic environment. Additionally, the proposed transition planning (to manage a system with significant asynchronous generation) and ongoing engineering analysis is prudent and critical to preventing reactive responses. The estimates in this area while not unreasonable, are uncertain and may be subject to future changes.[48]

However, RBP recommends there is potential to reduce the uplift request in the areas of constraint management and Generator Performance Standards (GPS) negotiation.[49] AEMO has reviewed RBP's advice and accepts there is scope to reduce the forecast uplift in constraints management and revises the forecast to 2.5 FTE during go-live and 2.0 FTE thereafter (down from 3.0 FTE and 2.5 FTE, respectively).

AEMO notes RBP's advice that there may be scope to reduce the GPS negotiation forecast, however, AEMO considers its assessment of the work involved is already conservative, and it is prudent to retain funding for up to 1 FTE in the labour opex forecast. AEMO highlights that the 1 FTE forecast is a decrease relative to the current resourcing level of 1.5 FTE.

On this basis, AEMO considers it prudent to include an amount for up to 8.3 FTE in the opex forecast. This will provide sufficient funding for PSMP to be able to maintain the power system and manage risk during the energy transition.

Table 8 PSMP revised FTE forecast

Function	FTE at end AR5	AEMO initial estimated increase	ERA draft determination increase	AEMO revised proposed increase
PSMP	16.2	8.8	3.5	8.3

ERA's specific concerns with the PSMP forecast

The ERA's draft determination does not provide any detail on how the ERA arrived at its 3.5 FTE forecast. However, the ERA raises some concerns regarding AEMO's PSMP resourcing estimates.

Specifically, the ERA seeks more information on AEMO's Engineering Framework[50], and suggests that AEMO should consider the use of specialist engineering consulting services[51]. These concerns are discussed below.

Engineering Framework

The Engineering Framework is a framework that has been developed, principally for the NEM, to facilitate an orderly transition to a future energy system with reduced synchronous generation, more renewables and enabling integration of DER. The same challenge applies to the energy transition currently underway in the SWIS. The Engineering Framework is analogous to the DS3 program[52] in Ireland (which started in 2011), which has recently enabled the Irish Grid to run to 75% over an 11-month trial. The work which the NEM has put into developing the Engineering Framework is being used (and will continue to be used) by the WEM without having to redo all the initial analysis to support the development for the SWIS. The work for the SWIS in this space is two-fold:

- Develop a plan of what needs to be done to facilitate a structured change in managing the power system as it transitions over the next few years. It is envisaged this will involve at least 1 FTE effort for a year, with a reduction

[48] RBP. *Review of AEMO Operational Staffing Estimate*, April 2022, page 6

[49] *Ibid*, page 14 and 16.

[50] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 90.

[51] *Ibid*.

[52] Eirgrid. *DS3 Program*. Available online.

in this effort required over the years after. This work will support that being done by consultants such as EPRI (through the Operations Technology Roadmap) to make it relevant and implementable for the SWIS.

- Develop the operational analysis, engineering design work, testing and implementation of various strategies, to enable the system to continue to increase its proportion of non-synchronous generation. Utilising the tools and models being develop in the power system analysis and modelling space, this work builds on that with new technologies, identifying system limits and what needs to change to enable the SWIS to continue to evolve.

A link to the AEMO engineering framework and roadmap is provided for reference.[53]

Use of engineering consultants

AEMO has made use of consulting services in the past and will continue to do so. These services support the work being done by the internal teams, both from a capacity perspective (insufficient resources) and capability perspective (where different capabilities are required).

As new skills are needed more frequently, it is important AEMO can develop these in house, particularly when the outcome will be needed in an operational time frame. An example of this relates to electro-magnetic transients (EMT) modelling.

Historically, AEMO's need for EMT modelling capability was limited to system restart studies. This work was contracted out and a consultant was able to provide the specific outcomes. With the growing penetration of inverter-based resources, EMT studies are now also required for system strength analysis and understanding interaction of non-synchronous generators (both in the operations planning time frame and closer to real time). As such, it is no longer prudent or cost effective to rely solely on consultants. It is necessary to develop the skills and build up the internal models that can then be used for multiple purposes with quick turnaround times.

Much of PSMP's actions to facilitate Western Australia's energy transition are not single one-off pieces of work, but ongoing evolution as AEMO pushes the boundaries of what can be operationalised. It is not practical for consultants to be on board permanently and make small modifications to test for various sensitivities in operational time frames.

As part of the AEMO proposal, an expected spend on consultant budget was included. It is also important to note that senior engineering/management effort is required to support this consultant work, ensuring appropriate scope of works and outcomes are delivered.

2.3.6 Operations Governance and Integration

The ERA does not support AEMO's proposed 1.1 FTE uplift for the Operations Governance and Integration (OGI) function.

AEMO has reviewed the ERA's analysis and accepts the draft determination position at this time. As the ERA highlights, the needs associated with any future reform program are not yet defined and it is unclear as to what additional obligations these will place upon the OGI function.

AEMO maintains there is potential for OGI's workload to increase during the market go-live and post go-live period, depending on whether there is a material increase in compliance issues. However, AEMO will seek to manage this within the final allowable revenue determination (and if necessary, uncertainty mechanisms).

Table 9 OGI revised FTE forecast

Function	FTE at end AR5	AEMO initial estimated increase	ERA draft determination increase	AEMO revised proposed increase
OGI	8.0	1.1	0.0	0.0

[53] AEMO. *Engineering framework.* Available online.

2.3.7 WA support staff

The ERA has excluded AEMO's estimated uplift in WA Support labour requirements in its entirety. From a base of 37.3 FTE in FY22, AEMO proposed an uplift of 2.0 FTE in FY23, 7.6 FTE in FY24, and 9.9 FTE across its support functions, with the majority of this forecast uplift in the Digital department with incremental changes to the Operations and Strategy departments.

Operations

AEMO's national operations team provides services to the WEM including control room training and grid modelling. During AR5 this averaged at 1.6 FTE (peaking at 2.0 FTE in FY22). The requirement for these services is expected to increase during the AR6 period to 3.0 FTE each year.

Strategy

AEMO operates in a challenging environment that is changing quickly. This requires the challenge to reconcile short-term activities with long-term strategic goals and successfully execute the work plan. The strategy function crosses the entirely of AEMO functions and will support the identification of improvements in in business activities and opportunities for greater integration to ensure AEMO delivers its responsibilities efficiently and effectively into the future.

During the AR6 period, WA's contribution to this department is expected to start at 0.4FTE in the first year, rising to 0.8 across subsequent years as AEMO has identified a need to invest further in this area moving forward, to ensure it is making the best use it can of its skills and resources as the energy transition accelerates.

Technology (Digital)

AEMO submits that the increase in Digital resources is necessary to ensure the new IT systems that underpin the reformed WEM are fully supported, as well as managing emerging cyber security threats.

The ERA has disallowed the uplift in resourcing costs from the AR6 opex forecast on the basis that it *requires AEMO to demonstrate that the increase in IT staff over AR5 is efficient before requesting additional staff for the IT team over AR6.*[54] The ERA provides no analysis in its draft determination as to whether it considers AR6 forecast costs satisfy the tests under clause 2.22A.5 of the WEM Rules.

The ERA links the increase in IT resources over the AR5 period to the digital roadmap project. The ERA states:

> *In its submission on AR5, AEMO provided no indication the digital support team would near double in size. The ERA did not support the level of expenditure on AEMO's digital roadmap, and it is not clear where the higher expenditure has come from.*[55]

And:

> *The ERA's draft determination is to reject AEMO's proposed new staffing positions for WA support services until it is clear where the funding for the existing staff has come from, and that the allocation of resources is demonstrably efficient.*[56]

It appears the ERA is concerned that the uplift in resourcing over the AR5 period was driven by the digital roadmap project undertaken during the AR5 period, and that this implies AEMO's IT opex during the AR5 period was inefficient.

AEMO would like to clarify that the entire uplift to the Digital team during the AR5 period was included in the ERA's AR5 final determination. The uplift was driven by transfer of IT systems from Western Power's System Management function to AEMO as part of the System Management Systems Transition (SMST) project, and the introduction of a

[54] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 37.

[55] *Ibid*, page 92.

[56] *Ibid*.

new prudentials application following delivery of the Reduction of Prudential Exposure (RoPE) project. These projects and the resulting IT resourcing requirement was included by the ERA in its AR5 revenue determination. This is discussed below.

The digital roadmap project did not add any opex FTEs during AR5 and in no way contributes to the resourcing uplift over the period.

Labour uplift was included in the ERA's AR5 revenue determination

In Section 2.4.1 of its 2019-22 allowable revenue and forecast capital expenditure submission (AR5), AEMO identified that the employee expense for Digital would increase. That increase would be related to the transfer of systems from Western Power and the RoPE project:

> *Addition of 9.5 FTE (ramping up within the first year) due to establishing IT systems within AEMO to support System Management functions. These resources will provide support for all the systems and applications that have been established in house and enables AEMO to end the current services agreement with Western Power for these services. This includes 6 FTE to support the systems delivered through the SMST project, and 3.5 FTE to support the Energy Management System delivered through the Power System Operations project.*[57]

Section 5.1.3 of the ERA's Draft Decision (Australian Energy Market Operator Allowable Revenue and Forecast Capital Expenditure 2019/20 to 2021/2022) notes:

> *Taking into account these additional IT systems AEMO will fully own from AR5 onwards, the ERA considers that the proposed supplies and services expenditure is reasonable. Bringing systems in-house has resulted in an overall reduction in supplies and services expenditure, consistent with AEMO seeking least cost solutions.*[58]

This draft decision was upheld in the final AR5 determination.

While the AR5 submission originally proposed that this increase would occur in the first year of AR5, delays to the SMST and Power System Operations (PSO) projects led to these changes being staggered across the period. Additional technology resources were recruited to provide operational support to the new infrastructure, databases, software, and grid systems delivered by those projects.

AEMO highlights that actual opex on Digital labour resources during the AR5 period is within the forecast amount included by the ERA. It is therefore reasonable to assume that for the purpose of the AR6 forecast, the current Digital resourcing level is an efficient base.

Table 10 Digital FTE AR5

Digital resources (FTE)	2019-20	2020-21	2021-22
ERA determination	20.3	24.2	24.2
Actual	12.2	18.7	22.9

IT support requirements increased following the system transfer

In its draft determination, the ERA questions whether AEMO's support requirements *materially increased with the transfer of existing applications from Western Power to AEMO for systems that will subsequently be replaced through capital expenditure projects*.[59]

[57] AEMO. 2019-22 allowable revenue and forecast capital expenditure submission to the Economic Regulation Authority, March 2019. Available online – page 39.

[58] ERA. Australian Energy Market Operator Allowable Revenue and Forecast Capital Expenditure 2019/20 to 2021/2022 Draft decision, 8 May 2019. Available online – page 15.

[59] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 92.

As discussed above, the ERA reviewed the proposed increase for AR5 and subsequently included the labour uplift in its determination. Actual experience during the AR5 period shows that the level of IT support requirements rose dramatically as a result of the new systems transferring to AEMO.

A dedicated WA System Management (WASM) application support team was established when the SMST project was completed and transitioned from a capital project to operational support in November 2020. In the 12 months from April 2020 until March 2021, this team was responsible for the following:

- Resolving 76 incidents (restoring service following degradation or interruption).
- Resolving 9 problem tickets (conducting root cause analysis for significant incidents or events and implementing recommended remediation activities).
- Implemented 98 application changes.
- Resolved 145 software tickets (bugs, tasks etc.).
- Resolved 17 cyber risks.

Note this is an uplift from a base of zero, as all these issues were managed by Western Power under a services agreement prior to the transition.

This volume of activity could not have been accommodated by the existing WA software team as it was at full capacity providing support to the existing WA Market applications. The above information applies only to the WASM support team.

No double count of resources

In its draft determination, the ERA has questioned whether some forecast development activities (such as the Network Access Quantity (NAQ) and constraint management) are double counting capex and opex resources. AEMO would like to clarify that there is no double count. The increased labour requirement does not begin until after the WEM Reform program is delivered in October 2023.

This is validated by the fact that the resources recruited to join projects such as RCM NAQ and WEMDE have been specifically hired with the intention of them transitioning into operational support roles following the program delivery. This is an approach that has been successful in reducing operational risk and improving knowledge transfer for the SMST and RoPE projects during the AR5 period.

Digital resourcing requirements for the AR6 period

Section 1.2.8 of the supporting labour document[60] provided to the ERA as part of AEMO's AR6 proposal, discusses the estimated resourcing uplift required for the Digital team. The most significant of these increases is within the Technology (Digital) department and is across three key areas:

- Enterprise Application Services – WA Solutions team
- Cyber Security; and
- Strategy and Architecture.

It should be noted that the AEMO submission did not address whether these resources would be permanent roles or FTC – although the support costing data was based on FTC.

Enterprise Application Services – WA Solutions team

The operational support requirements for ~50 WA System Management and Market applications will be unchanged prior to the delivery of WEM Reform, with the 13 FTE currently allocated continuing to support those systems for the first 18 months of the AR6 period. Following the delivery of WEM Reform, the team will need additional support to

[60] AEMO. *Western Australian supporting labour document, December 2021.* Available online.

ensure those systems remain operational for the remainder of the AR6 period. This may be a temporary uplift to support a post-reform transitional period but will likely be needed until the end of the AR6 period.

The drivers of the uplift are discussed in AEMO's initial AR6 proposal, and summarised below:

- +1 FTE to provide 24 x 7 production support and development capabilities and +0.5 FTE testing and quality assurance for the new WA Market applications including RCM NAQ and Real Time Market Submissions.
- +1 FTE to provide 24 x 7 production support and development capabilities and +0.5 FTE testing and quality assurance for those new WA System Management applications including WEMDE, Outage Management and Constraints Management.
- +0.4 FTE development and +0.2 FTE test capabilities to support the new Enterprise Data Platform delivered by WEM Reform.
- +0.4 FTE development and +0.2 FTE test capabilities to support the new Integration delivered by WEM Reform.
- +1 FTE development and 0.5 FTE test capabilities to support the increased cyber security requirements imposed across the application landscape.

To date, AEMO has received no questions from the ERA on this forecast. However, AEMO appointed RBP to conduct an independent review of AEMO's estimates of new staff requirements to test they have been prepared on a sound basis. RBP finds that:

> *The uplift requested by the Digital team to support market applications post market start are reasonable and critical to ensuring issue backlogs are cleared efficiently. Resourcing a dedicated cyber security team is prudent, and while AEMO WA's share of the overall enterprise resource is reasonable, we cannot comment on whether the total enterprise resource dedicated to cybersecurity is efficient.*[61]

Cyber security

AEMO has a national cyber security team comprising 19 FTE. This national team provides operational support to the entire business – including AEMO WA – on:

- Cyber risk, solutions and assurance.
- Cyber threat and operations.
- Identity and access management.

Of the 19 FTE, 2.2 FTE provide support to the WA departments. However, during the AR5 period AEMO's WA departments did not contribute to the operational budget of this team, despite benefitting from its services. This was an internal accounting oversight.

In the AR6 proposal, AEMO sought to correct this disparity over the course of the AR6 period by uplifting labour costs for the operational cyber security team incrementally across each year of AR6 – rising from 0.0 at the end of AR5, to 0.7 FTE in FY23, 1.4 FTE in FY24, and 2.2 FTE in FY25.

AEMO has reconsidered this position and submits it is more equitable to address the disparity immediately, and charge AEMO WA for its full allocation of cyber security resources from the first year of AR6 onwards. AEMO's allocation is 11.8%, or 2.2 FTE per year (see Table 11).

Table 11 AEMO WA revised cybersecurity allocation

Cyber security	2022-23	2023-24	2024-25
WA allocation	11.8%	11.8%	11.8%
FTE	2.2	2.2	2.2

[61] RBP. *Review of AEMO Operation Staffing Estimates*, April 2022, page 8.

The increase in cyber security labour opex for the AR6 period does not reflect a resourcing uplift. Rather it is a correction to ensure AEMO WA is paying its fair share of the cyber security service.

As discussed in the AR6 proposal, cyber security is an area of increasing importance for AEMO and other critical infrastructure operators. AEMO plays an important role in energy sector cyber security and is currently working with DISER and the Australian Cyber Security Centre to define roles and responsibilities on the issue, including in light of the *Security Legislation Amendment (Critical Infrastructure Protection) Act 2022*, which came into effect on 2 April 2022.

Taking this into consideration, AEMO submits it is essential AEMO's cyber security function is adequately resourced, and that AEMO WA pays for its portion of this service.

Strategy and architecture

As part of the original submission, AEMO proposed a minor uplift of the operational architecture team by 0.2FTE. This uplift is to help operationalise the capabilities that were provided by the AR5 Enterprise Architecture project, which was included in the ERA's AR5 determination.

2.3.8 Revised AEMO WA FTE forecast

Table 12 presents AEMO's revised FTE forecast for the AR6 period.

Table 12 Revised AEMO WA FTE forecast for the AR6 period

Function	FTE at end AR5	AEMO initial estimated increase	ERA draft determination increase	AEMO revised proposed increase	AEMO revised FTE total
Market Operations	10.0	6.0	0.0	5	15.1
Reserve Capacity	8.0	4.0	2.0	2.0	10.0
WA Reform and Market Development	1.2	2.8	0.0	2.8	4.0
Power System Operations	15.5	2.8	3.8	2.8	17.8
PSMP	16.2	8.8	3.5	8.3	24.3
OGI	8.0	1.1	0.0	0.0	8.0
WA Support	37.3	9.9	0.0	9.9	47.2
Total	96.2	35.4	9.3	30.8	126.4

2.4 Depreciation and amortisation

The ERA completed a detailed review of AEMO's depreciation and amortisation (D&A) methodology. In its draft determination, the ERA is satisfied the method is accordance with Australian Accounting Standards for intangible assets and concurs with AEMO's initial assessments for effective life. AEMO therefore maintains this D&A method in this revised proposal.

In its draft determination, the ERA's D&A calculation varied from AEMO's AR6 proposal to reflect changes the ERA made to the AR6 capex forecast. AEMO has since revised its capex forecast for the AR6 period (see section 3).

The resulting D&A forecast is presented in Table 13.

Table 13 WEM D&A revised AR6 forecast, $ million nominal

WEM D&A – revised proposal	2022-23	2023-24	2024-25	Total
Depreciation and amortisation	10.4	17.3	21.0	48.8

AEMO notes final D&A costs will depend on the ERA's forecast capex determination for the AR6 period.

2.5 Accommodation

In its draft determination, the ERA accepts AEMO's accommodation forecast for the AR6 period. AEMO's accommodation opex forecast remains unchanged from the AR6 proposal.

Table 14 WEM accommodation revised AR6 forecast, $ million nominal

WEM D&A – revised proposal	2022-23	2023-24	2024-25	Total
Accommodation	1.8	1.7	1.7	5.2

2.6 Supplies and services

The ERA proposes a reduction in AEMO's forecast opex for supplies and services from $13.0 million to $10.7 million, a 17.7% cut. The ERA has determined this revised forecast by making specific reductions to legal costs, subscriptions and costs associated with the DER network service marketplace trial and design project. The ERA has also made downward adjustments to training and corporate allocation (enterprise recovery) costs to reflect its alternative FTE estimate.

AEMO accepts the ERA's revised supplies and services forecast in part. AEMO accepts the ERA's reductions to legal costs, subscriptions and the DER network service marketplace trial. However, AEMO has revised its forecast training and enterprise recovery costs to reflect the revised FTE forecast (discussed in section 2.3).

Table 15 shows AEMO revised supplies and services forecast.

Table 15 WEM supplies and services revised AR6 forecast, $ million nominal

WEM supplies and services – revised proposal	AEMO AR6 proposal	ERA draft determination	AEMO revised proposal
Legal consultants	0.9	0.5	0.5
Enterprise recovery	2.7	2.4*	2.6
DER Network Service Marketplace Trial and Design project	0.5	0.0	0.0
Training	1.6	0.9	0.9
Subscriptions and research data	1.3	0.8	0.9
Total	7	4.6	4.9

2.7 IT and telecommunications

The ERA has proposed a reduction to AEMO's forecast opex for IT and telecommunications from $11.0 million to $9.0 million, an 18.2% cut. The ERA has determined this revised forecast by excluding $0.5 million of costs associated with the DER Network Services Marketplace Trial and Design project and reducing AEMO's cloud cost forecast by a further $1.0 million.

AEMO accepts both revised forecasts. AEMO agrees that there remains a lack of confidence regarding progression of the DER Network Services Marketplace Trial and design project during the AR6 period and has removed it from the AR6 opex forecast at this time. If this DER project is required during the AR6 period, AEMO will likely require an in-period submission.

Since the original AR6 submission, AEMO's understanding of cloud costs has matured and a Cloud Management Framework (CMF) has been established to manage and control these costs on an ongoing basis. A review of the expected cloud costs during AR6 was conducted against the CMF and broadly aligns with the findings of the ERA and its consultant's. AEMO has revised the forecast for AR6 accordingly.

Table 16 shows AEMO revised IT and telecommunications forecast.

Table 16 WEM IT and telecommunications revised AR6 forecast, $ million nominal

WEM IT and telecommunications – revised proposal	AEMO AR6 proposal	ERA draft determination	AEMO revised proposal
Cloud costs	3.4	2.4	2.4
Software support	7.0	6.6	7.0
Other IT (includes DER Network Service Marketplace Trial and Design project)	0.5	0.0	0.0
Total	11.0	9.0	9.4

2.8 Borrowing expenses

The ERA has proposed reductions to AEMO's forecast borrowing expenses from $5.2 million to $4.4 million, a 15.4% cut. The ERA said it is not satisfied by the accuracy of AEMO's proposed borrowing costs and has therefore developed its own estimate.

The ERA determined its revised forecast by constructing its own cash flow calculation based on an opening asset base of $28.1 million with equal monthly revenues and recurring expenditure for each year and with capital projects included in the month those projects are expected to become operational. The ERA has calculated interest based on these monthly cash flows.

Since submitting the December 2021 proposal economists are now forecasting bank borrowing rates will increase from June 2022. AEMO has reviewed the ERA's calculation and AEMO's original estimating method and updated both to reflect the latest advice on the bank bill swap rate. When updated to for the latest information, the differences between the two is not material.

For the purpose of this opex forecast, AEMO has maintained its borrowing cost methodology, which results in a revised estimate of $8.3 million.

Detailed workings on borrowing costs are included in the confidential financial workbooks provided to the ERA.

2.9 Opex projects

AEMO's AR6 proposal included $3.9 million of forecast opex on projects expected to occur during the AR6 period. This comprised:

- $2.0 million for DER Network Services Marketplace Trial and Design – this project is driven by obligations under the DER Roadmap.
- $0.9 million for 5MS project planning.
- $1 million for WEM Reform decommissioning – this is the forecast cost for taking existing WEM systems out of service once the new market design, and underlying new system, is operational.

As the ERA highlights in its draft determination, a large proportion of costs for these projects fall in the final two years of the AR6 period. At the time of developing the AR6 proposal, there was some uncertainty as to the timing of these projects.

The ERA proposes to exclude all but $0.2 million of these costs in its opex draft determination. The ERA includes only the $0.2 million required for work on the development of the initial design framework for a distribution services market under the DER Network Services Marketplace Trial and Design, on the basis that *this project is the most certain and most advanced of the operating projects*.[62]

AEMO has since sought further clarity on the need and timing of each of these projects and accepts the ERA's draft determination in part. When AEMO receives clarification from EPWA around the timing and need for this project, AEMO will make an in-period submission as required.

AEMO accepts the ERA's decision to remove $1.0 million from the opex forecast for WEM decommissioning activities. While AEMO will need to decommission some legacy market systems at some point post-reform, there remains some uncertainty around the most prudent time for decommissioning to commence. Much of the decommissioning work depends on what happens during and post market go-live, and the volume and nature of issues that arise. It is not possible to determine the optimal timing and priority for decommissioning at this time. It is feasible some decommissioning activities may get pushed in to the AR7 period. AEMO will therefore aim to manage market system decommissioning work during the AR6 period with opex allowances and will submit and in-period adjustment should there be a funding shortfall for this work, if necessary.

However, AEMO maintains that cost for 5MS planning be included in the AR6 opex forecast. As discussed in the AR6 proposal, while some of the costs and scope of the introduction of 5MS cannot yet be determined in detail, it remains a crucial part of the Government's Energy Transformation Strategy and this uncertainty will in part be remedied by AEMO's proposed planning activity. The Minister for Energy has already legislated amendments to the Metering Code[63] in 2021 and specified an indicative commencement date of 1 October 2025[64].

Since the December 2021 proposal, AEMO's regular engagements with both the Minister's Office and EPWA have confirmed that 5MS remains an important component of Western Australia's Energy Transformation Strategy. Settlement reform was also included in the Stage 2 Energy Transformation Strategy document published on the EPWA website In July 2021[65]. On this basis, it is highly likely that AEMO will be required to commence work on implementing 5MS during the AR6 period.

The capital cost of 5MS is likely to be significant. AEMO will engage with EPWA and stakeholders through the TDOWG to help develop the detailed design of 5MS for the WEM. Subject to clarification of scope and timing, the 5MS implementation project will likely be submitted as an in-period capex adjustment.

Work to develop this business case and commence early planning for 5MS – working in conjunction with EPWA – will start during the first year of the AR6 period. As per its obligations under clause 2.1A.2(II), AEMO must support the Coordinator of Energy in preparing for delivery of the 5MS program. This is a substantial piece of work and will require dedicated resources. AEMO therefore proposes opex $0.95 million be included in the AR6 forecast.

AEMO submits there is sufficient certainty this planning work is required, and it is prudent to include an opex allowance in the AR6 determination rather than making an in-period opex adjustment for planning costs and then a subsequent capex adjustment for implementation. AEMO accepts that an in-period adjustment is likely the best way to manage the 5MS capex forecast, however, it would be more efficient for both the AEMO and the ERA to avoid the time and costs associated with developing and reviewing multiple in-period proposals where possible.

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[62] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 46.

[63] Energy Policy WA. *Electricity Industry (Metering) Code 2012*. Available online.

[64] Energy Policy WA. *Proposed changes to the metering code.* Available online.

[65] Energy Policy WA. *Leading Western Australia's brighter energy future Energy Transformation Strategy Stage 2: 2021-2025 July 2021*. Available online.

5MS opex work

The 5MS operational project is comprises three distinct stages that will be initiated and progressed during the first year or the beginning of the second year of the AR6 period:

1. Design a five-minute capable metering solution. AEMO will undertake options analysis, solution design, cost estimation and initial project planning to initiate a capex project to implement an identified cost-effective solution.

   Estimated cost = $0.25 million

2. Support EPWA to revise the WEM Rules. AEMO is required to support EPWA in the design, development, and drafting of revisions to the WEM Rules in order to enact five-minute settlement. As with the rule development process for the WEM Reform, AEMO will provide EPWA with subject matter expertise in the systems and processes surrounding the settlement and surrounding systems.

   Estimated cost = $0.3 million

3. Initiate a 5MS delivery program. AEMO is required to undertake options analysis, solution design, cost estimation and initial project planning to commence implementation of the 5MS program.

   Estimated cost = $0.4 million

These three stages are discussed further below.

5MS capable metering solution

As a priority task AEMO needs to commence the design of a five-minute capable metering solution. As noted in the AR6 proposal, AEMO's meter data handling capabilities in the WEM require an uplift to be able to receive, store and process five-minute data provided by Western Power's IT Systems. AEMO's experience from its 5MS project in the NEM has indicated a capex project will take approximately two years to complete. It is imperative AEMO commences an opex project in the first year of AR6 to ensure the 1 October 2025 commencement date can be achieved.

Considering the limited availability of AEMO resources during this period AEMO may look to partner with a trusted party to help deliver this work, pulling in available resources as required from teams across the WEM and NEM. AEMO estimates costs of $0.25 million to undertake the options analysis, metering solution design, cost estimation and planning.

5MS rule changes

It is anticipated EPWA will commence the design process to revise the WEM Rules to enact five-minute settlement in early 2023. As with WEM Reform, it is important AEMO is involved in the design, development and drafting of the WEM Rules, to promote efficient implementation. AEMO's indicative assessment of the required revisions to enact 5MS in the WEM Rule include changes to chapters 1, 4, 6, 8, 9 and some appendixes. The effort required from AEMO is larger than can be resourced from within the WA Reforms and Market Development team considering their workload as outlined in section 0.

To deliver these 5MS rule changes, AEMO estimates it will need 1 x Workstream Lead, 1 x Principal Analyst and 2 x Senior Analysts at 50% capacity for 9 months, at a cost of approximately $0.3 million.

5MS delivery

AEMO anticipates several capital projects will be required to implement 5MS in the WEM. During the first year of AR6, AEMO will commence the analysis, design, cost estimation and initial program planning for the 5MS delivery program. A small team consisting of Program Manager, Change Manager, 2 x Business Analysts, Solution Architect, Developer supported by 1 x Workstream Lead, 1 x Principal Analyst and 2 x Senior Analysts at 50% capacity for 4 months will be tasked with initialising program, at an estimated cost of $0.4 million.

Revised opex project forecast

Table 17 WEM opex projects revised AR6 forecast, $ million nominal

WEM opex projects – revised proposal	AEMO AR6 proposal	ERA draft determination	AEMO revised proposal
DER Network Services Marketplace Trial and Design	2.0	0.2	0.2
5MS planning	0.9	0.0	1.0
WEM Reform decommissioning	1.0	0.0	0.0
Total	3.9	0.2	1.2

2.10 Summary of revised AR6 forecast opex

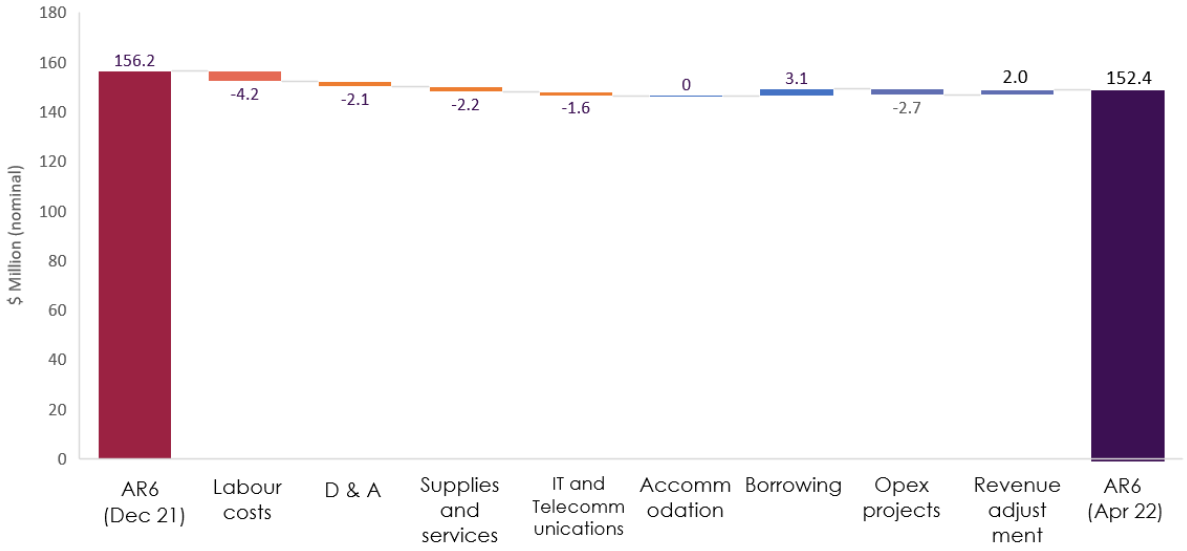
Table 18 presents the revised AR6 opex forecast compared with the AR6 proposal and ERA draft determination.

Table 18 Summary of revised AR6 opex forecast by category, $ million nominal

WEM AR6 opex – revised forecast	AEMO AR6 proposal	ERA draft determination	AEMO revised proposal	Change from initial proposal (%)
Labour costs	73.2	60.7	69.0	(6%)
Depreciation and amortisation	50.9	48	48.8	(4%)
Supplies and services	13.0	10.7	10.8	(20%)
IT and telecommunications	11.0	9	9.4	(17%)
Accommodation	5.2	5.2	5.2	0%
Borrowing	5.2	4.4	8.3	37%
Opex projects	3.9	0.2	1.2	(225%)
Revenue adjustment for over/under recovery[66]	(2.3)	(2.3)	(0.3)	568%
Total	156.2	135.9	152.4	(2.5%)

Figure 5 shows the movements in the opex forecast since the December 2021 AR6 proposal.

Figure 5 Movements in opex forecasts between Dec 21 proposal and Apr 22 revised proposal



[66] AEMO notes that the data provided in the original proposal were budget figures only. This revised data represents a forecast as at end-February 2022 and further adjustments will take place with AEMO estimating a slight increase in the over-recovery from the end-February forecast (i.e. that will further offset WEM Fee increases in 2022-23.)

3. WEM capital expenditure

3.1 Capex labour

3.1.1 Revised labour tier rates

In its draft determination, the ERA raises concerns with AEMO's use of tier rates when estimating the labour cost of its capital work program. The ERA notes that using ten tier rates is a more convenient cost guide for the early stage of project planning than using numerous individual staff costs. However, the ERA considers the tier rate overestimates forecast costs.

AEMO acknowledges the ERAs opinion in this matter but does not agree with the conclusion that the use of AEMO's tier rates for project planning purposes overestimates cost forecasts.

AEMO has continued to determine the forecast capital labour costs using the tier rate methodology for the following reasons:

- The actual salaries of AEMOs employees is highly confidential. Project costs estimates are created by the project teams who should not have access to this confidential and sensitive information.
- The tier rate method is based on actual salaries of AEMO employees with five tiers for permanent employees and five tiers for full time contractors. The tier rates are reviewed periodically to adjust for changes in market conditions.
- AEMO does not capitalise the cost of the project using the tier rates at project completion. The actual cost is determined using the specific employees' salary rates during the delivery of the project.
- The grouping of like specialisations into the five tiers is the AEMO's chosen method to determine the applicable rate for unnamed resources. While changing to a named employee salary is technically possible, AEMO does not consider this efficient or necessarily accurate as the actual resources deployed on a project at any given time will reflect the resources actually available, which can vary for example as a result of staff turnover and the needs of other projects and functions.

AEMO has noticed in the current labour market of record low unemployment and high job vacancies the current tier rates used in this re-forecast would benefit from a revision to factor in the higher salaries sought by employees, specifically those working in IT and specialist professions that make up the majority of AEMO's project workforce.

3.2 WEM Reform program

In its draft determination, the ERA proposes to include $37.2 million in capital costs for the WEM Reform program. This is a 16% cut to the $44.6 million forecast included in AEMO's December 2021 AR6 proposal. The ERA has reached this draft determination by:

- Substituting AEMO's tier rate method of estimating labour costs with its own methodology.
- Reducing contingency cost estimates in line with its alternative approach to assessing AEMO's contingency calculations.
- Excluding costs for the System Operations Planning Tools and Dispatch Training Simulator Integration projects, on the basis that insufficient information was provided to enable the ERA to determine that these two projects meet requirements of clause 2.22A.5 of the Rules.

In making this determination, the ERA has considered the implications of a reduction in AR6 funding on the overall delivery of the WEM Reform program. The ERA has looked at each of the 22 reform projects proposed for the AR6

period and, subject to adjustments in labour and contingency costs to reflect its alternative calculations, includes forecast capex for 20 of the 22 projects.[67]

AEMO welcomes this approach of considering the broader implications on program delivery and supports the ERA's position to include forecast costs for the bulk of the proposed projects. Despite some concerns regarding the overall cost of the program, the majority of market participants have continually supported reform and are eager for the new market arrangements to commence in October 2023 as planned. Both Alinta and Synergy have expressed a preference for AEMO (and the ERA) to prioritise delivery of reform to ensure timely delivery of a functioning market. AEMO remains committed to achieving the 1 October 2023 go-live date.

AEMO maintains the position that all 22 projects are required to be delivered in full to make certain AEMO can deliver and operate the new market, comply with obligations and manage risk appropriately. AEMO provides additional information in this document to support the two excluded projects (see section 3.2.1 below). AEMO trusts the additional information is sufficient to satisfy the ERA that the System Operations Planning Tools and Dispatch Training Simulator Integration Projects are necessary, prudent and efficient, and that the forecast capex meets the requirements of clause 2.22A.5 of the Rules.

With regard to the ERA's cuts to forecast labour and contingency capex, AEMO has considered the ERA's findings and has made some minor adjustments to its tier rate and contingency methodologies. These are discussed in section 3.1.1 and 3.6 of this document.

However, AEMO maintains that its capex labour forecasting and contingency forecasting approaches are reasonable and result in capex forecasts that reflect costs which would be incurred by a prudent provider, acting efficiently, to achieve the lowest practicably sustainable cost of delivering the WEM Reform program. As such, the labour and contingency components of the overall forecast have not changed materially.

AEMO maintains that the total estimated cost of delivering reform is $91.2 million, and that the two excluded projects must form part of this estimate.

AEMO highlights that the timing of some of some projects within the Program have shifted, resulting in around $6 million of costs expected to be incurred prior to 30 June 2022 (i.e. within the AR5 period) being moved to later in the year and into the AR6 period. Note that this is a reprofiling exercise only. The overall capex forecast of $91.2 million remains, and cost recovery of the D&A will still commence during AR6 as originally planned.[68]

The following sections provide further information on the two excluded WEM Reform projects and the reprofiled WEM Reform capex forecast for the AR6 period.

3.2.1 Excluded projects

The ERA has excluded the following projects from the AR6 forecast capex in its draft determination:

- System Operation Planning Tools ($0.9 million); and
- Dispatcher Training Simulator (DTS) integration and Security Constrained Economic Dispatch (SCED) tools ($2.1 million).

Information on these two projects was provided to the ERA as part of the AR6 proposal. AEMO did not receive any questions from the ERA on these projects during the question-and-answer process and engagement sessions after the proposal was submitted. However, in its draft determination, the ERA has raised some concerns relating to these two projects and seeks clarification of the prudence and benefits of each.

[67] The two exceptions being the System Operations Planning Tools and the Dispatch Training Simulator projects.

[68] Capex is recovered via market fees as expensed D&A costs. Recovery of these costs does not commence until the year the asset is placed in service. Therefore this small shift in timing will not materially alter AR6 Fees.

System Operations Planning Tools

The ERA expressed concerns that *there is insufficient information provided by AEMO for the ERA to determine how these projects directly contribute to AEMO performing its system management function under the WEM Rules*,[69] and that it is unclear how the additional of minor tools will improve AEMO's performance.[70] AEMO acknowledges these concerns and accepts that the project description may not have been as clear as it could have been.

The WEM Reform activities are introducing changes to the systems and processes used by System Management to support planning and operation of the SWIS. All these systems and process changes require new or revised WEM Procedures.

Many of these new Procedures are being drafted as part of the system-related projects – for example new WEM settlement procedures are being developed as part of the Settlement workstream. However, there are some Procedures that span multiple functions and departments within AEMO and do not fit neatly into one of the existing workstreams, for example the:

- Power System Security WEM Procedure.
- Power System Reliability Implementation WEM Procedure.
- Low Reserve Condition WEM Procedure.
- Emergency Operating States WEM Procedure.
- Information Management System Specification.
- Network Modelling WEM Procedure.
- System Restart WEM Procedure.

The System Operations Planning Tools project is designed to deliver these Procedures. As part of this project, AEMO will review, draft, test and communicate these new Procedures, all of which are essential for secure and efficient market operation.

The System Operations Planning Tools project will also cover:

- Development of standards, protocols and processes required to manage power system security that form part of new obligations under the WEM Rules (for example the ESS accreditation process, Supplementary ESS Mechanism standards and procurement framework, and required revisions to the operating protocol).
- Documentation in the form of internal procedures and work instructions for processes not related to application specific projects (for example under frequency load shedding specification, monitoring and adjustment).

With regard to the 'tools' aspect of the project, work will be undertaken to modify existing power system security management tools to interface to new systems implemented by WEM Reform (e.g. E-terra, PowerFactory). System management tools include models, macros and other programming tools that AEMO's engineers and operators to analyse and operate the market and power system. Examples are:

- High speed recorder data – Western Power deposits all high-speed recorder data files onto a portal where they are manually retrieved and processed. Although not ideal, this process has been adequate until now due to the relatively low volumes of data. Moving forward, high speed data recordings will be required to support ongoing assessment of generator performance standards and for monitoring and accrediting ESS providers. The increased volumes expected will require more automated mechanisms for retrieving, processing and storing the high-speed data such that it can be used to support these new processes.
- Engineering study case loader – an outage submission requires AEMO's engineers to assess the security of future dispatch. AEMO uses its energy management system (EMS) and offline power system modelling tools to perform engineering studies examining the resulting power system state and identifying risks for subsequent contingency

[69] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 55.

[70] *Ibid.*

events. These engineering studies require the study cases within the EMS and modelling tools to be initialised with relevant data such as expected demand forecast quantities, expected network configuration and expected dispatch profiles. The modification to this tool is not in the scope of the Outage Management Project and will be captured in the System Operations Planning Tools project.

- Power system security models – with the introduction of the new market and the removal of the Synergy Dispatch Plan, the variability in dispatch profiles and service provision is expected to increase and a new tool is required to support initialising the engineering study cases from other systems (i.e. the new outage system, Projected Assessment of System Adequacy (PASA) systems and new pre-dispatch/week-ahead market schedules). This tool will support both planning engineers and controllers in assessing the security of future dispatch profiles and outage scenarios, intervening where necessary to ensure that the security of the SWIS can be maintained.

AEMO highlights the development of the new WEM Procedures and tools are not required to *improve* AEMO's performance, rather they are mandatory to enable AEMO and participants to perform their functions under the new market arrangements.

WEM Procedures are core to the operation of the SWIS for Rule Participants and AEMO, describing the mechanics of how power system security and power system reliability are managed and setting out requirements for the provision of information to support those processes. Together these form the framework that underpins many other WEM Procedures and systems (e.g. Constraint development, Outage Management and Short Term (ST) and Medium Term (MT) PASA).

AEMO is required to publish the revised standards and frameworks as a result of new obligations under the WEM Rules, commencing prior to new market cutover. These standards inform subsequent requirements and obligations, both for AEMO in terms how it is required to develop plans and contract for services, and for other Rule Participants in process and infrastructure development.

In summary, this project ensures that mandatory obligations are met (WEM Procedures and Standards), and that all required procedures, processes, and tools required to support the operation of the power system in the post WEM Reform environment are developed and fit for purpose.

Dispatch Training Simulator Integration

In its draft determination, the ERA notes *that training of power system operators is an important part of AEMO's competency in system management*.[71] However, the ERA notes that AEMO has provided no assessment of how or if the current power system operator training will be insufficient.

Providing and maintaining an adequate level of training to AEMO's controllers and operational staff is essential to ensure that they have the knowledge and skills necessary to manage the SWIS under the range and breadth of operating conditions that can arise. Currently this training is provided through a combination of systemised training via the DTS and desktop-based training activities that simulate the operation of the current market. While not ideal, manual simulation of the market has been adequate to support new and ongoing controller training and accreditation largely due to the manual interaction that AEMO has with the Synergy Portfolio.

When the new market commences, market operation procedures and processes will change, the current Dispatch Training Simulator will be obsolete (as it simulates the current market), and AEMO's interaction with the Synergy Portfolio will cease. Therefore, new training and simulation requirements are required.

This project provides the integration between market systems (WEMDE, ST PASA, Forecasts) and the existing DTS, which will allow AEMO to build training packages that much more closely match the expected operation of the SWIS and allow controllers and operational staff to use the systems in ways that will mimic real time operation.

AEMO acknowledges that implementation of this project is not scheduled for go-live. Ideally, it would have been developed in parallel with implementation of the new market ready for market start, however, resourcing and time constraints mean AEMO has prioritised delivery of the new market ahead of delivery of the training packages.

[71] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 55.

AEMO is able to bridge this gap for a short time, as adequate training for its current, experienced group of controllers can be provided during the development and market trial phase of WEM Reform. However, AEMO requires a suitable simulator as soon as reasonably practicable to make certain controllers can maintain accreditation and develop work instructions for market scenarios.

Further, as the ERA highlights in its review of AEMO's labour forecasts, the power system control room is currently understaffed. During the AR6 period (and into AR7), AEMO will need to develop and train new controllers – a process that takes around two years. AEMO requires a suitable simulator and training packages to enable it to develop any trainees that come on board. It is not prudent nor practical to rely on the relatively short development and market trial phase of WEM Reform to train new recruits.

AEMO proposes that this project commences in May 2023, for completion by April 24. This will ensure training gaps are adequately covered and the simulator is fully integrated within a reasonable timeframe after go-live.

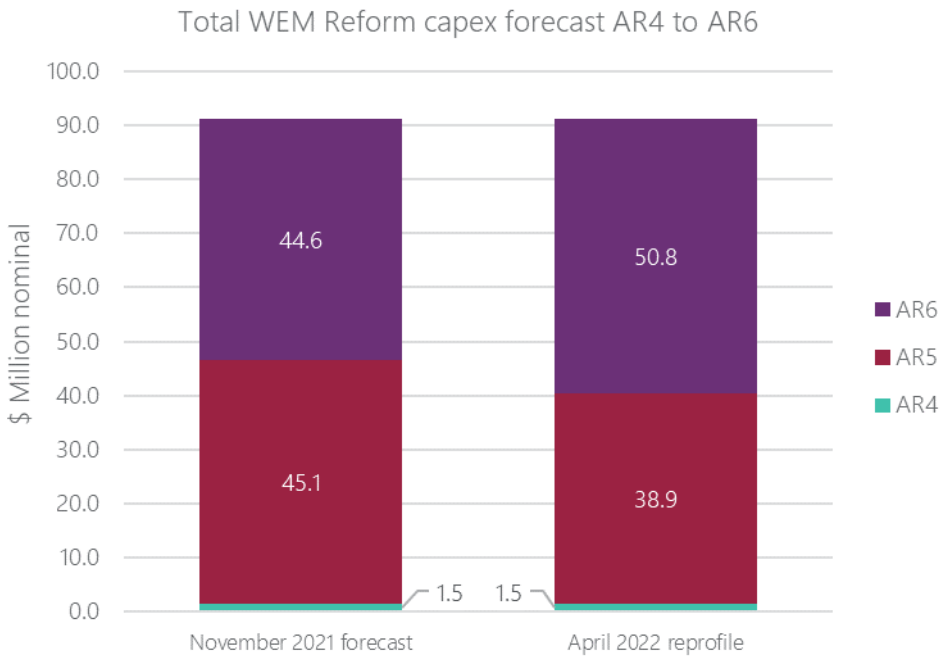
3.2.2 Reprofiled capex forecast

As signalled by market participants, delivering the new market by 1 October 2023 remains a priority for the Western Australian energy sector. Subject to sufficient access to funding, AEMO remains confident this target can be achieved.

AEMO has reviewed the workstreams and has reprofiled some expenditure to reflect resourcing availability and market conditions. This has the effect of shifting approximately $6 million of expenditure that was forecast to be delivered before the end of the AR5 period into the AR6 period instead. AEMO highlights that the overall forecast cost of the program (including contingency) remains unchanged at $91.2 million.

Figure 6 presents the total WEM Reform capex program across the AR4, AR5 and AR6 periods and shows the change in profile compared to the November 2021[72] forecast.

Figure 6 Revised WEM Reform capex profile AR4 through to AR6, $ million nominal



The reprofiling exercise was conducted as part of ongoing program governance, and reflects AEMO's latest view of resourcing availability, labour market costs and the time and effort required to deliver each of the workstreams. This

[72] Though the AR6 proposal was submitted in December 2021, the forecast exercises within it were conducted and refined over several months through to November 2021.

includes a review of contingency attached to each project, with base estimates and contingency amounts being adjusted upwards/downwards based on a further six months of project maturity.

The rate of progress of the projects within WEM Reform has seen a steady increase in pace since implementation commenced. The volume of work is significantly more than can be implemented by AEMO's existing WEM resources and has required the secondment of other AEMO employees, the recruitment of contract staff, and strategic partnerships with vendors. The current tight labour market, across Australia and particularly in Western Australia, has led to a higher than planned for level of attrition, with some delays resulting from the need to recruit and on-board replacement resources.

These resourcing challenges, alongside dependencies on the finalisation of revised WEM Rules, have contributed to some shifts in project timing and/or spend on some inflight projects. AEMO does not see this impacting the go-live of the program, as critical path activities have been maintained and delays can be appropriately managed with resource and schedule contingency.

Table 19 shows the change in forecast expenditure profile across the seven WEM Reform workstreams.

Table 19 Reprofiled total WEM Reform capex forecast by workstream, $ million nominal

WEM Reform program – reprofiled forecast capex	Previous AR periods (AR4 + AR5)	AR6 Period	Program total
Design, Planning and Management	13.3 (↓0.2)	8.5 (↑0.3)	21.8
SCED	8.5 (↓2.0)	7.1 (↑0.5)	15.5
Settlement	4.8 (↑0.5)	3.8 (↑1.1)	8.7
System Planning	2.9 (↓1.5)	6.0 (↑0.9)	8.9
Legacy Markets	5.1 (↓0.7)	7.4 (↑2.7)	12.5
Registrations	1.6 (↓0.3)	1.5 (↑0.2)	3.0
Integration	4.3 (↓2.0)	16.4 (↑0.3)	20.8
Total	**40.4 (↓6.2)**	**50.8 (↑6.2)**	**91.2**

As shown in Table 19, the largest shift in capex occurs in the Settlement and Legacy Markets workstreams. Costs associated with these two workstreams are higher than originally forecast, however they are offset by decreases in System Planning, SCED and Integration.

Settlement workstream

The Settlement workstream will implement the system and processes require to calculate and invoice the settlement amounts introduced by weekly settlement arrangements under the reformed market. The Settlement Enhancements project implemented the Prudential and Settlements Systems on which the Settlements Reform project will implement the required changes of the reforms.

Since the December 2021 submission the Settlements Reform project has completed the elaboration of requirements and moved into execution. The detailed analysis and planning undertaken during elaboration identified the need for more effort than anticipated in the initial high-level estimate, and a shift to utilisation of external resources to enable that greater amount of work to complete within the required timeframe.

The revised forecast total cost of the Settlement Reform project is $6.2 million, with $3.8 million of this being incurred in AR6.

Legacy markets workstream

RCM Reform Project

The RCM project categorises the obligations of the RCM into three distinct phases of work to modify systems and processes for:

- Phase 1 – Changes to apply for and receive Certified Reserve Capacity (CRC) and other applicable Year 1 processes for the 2021 Reserve Capacity Cycle.
- Phase 2 – Implementation of the NAQ assessment and associated amendments, for the 2022 Reserve Capacity Cycle. This also includes some modifications to the Year 1 assessment processes, and RCM portal augmentation.
- Phase 3 – Year 3 changes to Reserve Capacity Testing and Reserve Capacity Obligation Quantities to reflect the introduction of Facility Technology Types in the 2021 Reserve Capacity Cycle.

In the AR5 period the RCM Reform project has delivered the functionality required for Phase 1 and has implemented this into the production environment to allow CRC applications for the 2021 Reserve Capacity Cycle to commence from 1 December 2021. Subsequently Phase 2 of the project has completed its detailed elaboration and identified an increase in project costs above the previously forecast project costs from September 2021[73]. The increased cost is due to greater understanding of the NAQ implementation framework, which will need to be implemented within a linear solver, a reconsideration of the approach to implement RCM Constraints, and unforeseen scope in Phase 1, which has delayed some spend in AR5 that will be carried over to AR6. AEMO estimates $7.3 million in capex funding in the AR6 period to implement the proposed RCM reforms.

STEM Reform project

The STEM is a bespoke market mechanism in the WEM with only consequential changes to its functions under the WEM Rules. The STEM rules and application have gone largely untouched since commencement of the WEM. The core STEM engine was updated to modern software during the AR5 period which reduced some of the legacy functionality in the system. The remaining legacy functionality can be attributed to its scheduling application and participant submission and reporting functionality. AEMO noted in the December 2021 AR6 proposal that the STEM project will upgrade the STEM systems to remove its reliance upon a legacy scheduling application. To de-risk the implementation timeline the participant submission and reporting functionality was included as contingency and would be implemented either prior to go-live or after go-live pending the assessed risk at the time of commencing the project.

The costs attributed to the STEM project in the initial submission included $0.6 million to implement the required changes to the scheduling application an additional contingency of $0.6 million in which to address the participant submission and reports. In its draft determination the ERA has not included any contingency for STEM Reform which would prevent AEMO from implementing the required changes to reduce the legacy risk of the STEM systems. AEMO still deems the requirement to address the legacy issue of the STEM application a critical requirement in support the WEM systems and is committed to reducing the legacy software risk. Noting the high contingency estimate in its earlier forecasts, AEMO has refined and revised the STEM project costs to include better estimates of the effort to replace the legacy risk. AEMO is now estimating $1 million in base project costs and $0.2 million in contingency.

Revised costs by workstream

The elaboration process for the Settlement and Legacy market workstreams, as well as detailed review of the other workstreams has allowed AEMO to develop a firmer view of base and contingency costs. Where project scope has matured and AEMO has a greater understand of deliverables and risk, AEMO has been able to revise its contingency estimates accordingly. This includes increasing and decreasing the ratio of base to contingency costs where necessary.

[73] CAPEX forecasts were 'locked down' at 30 September 2021 to allow for finalisation of AR6 estimates against the original obligation to submit the Proposal by 30 November 2021.

Table 20 shows the change in the total capex forecast by WEM Reform workstream in the sixth months since the AR6 forecast was developed in November 2021.

Table 20 Total revised WEM Reform capex forecast (base + contingency), $ million nominal

WEM Reform workstream	November 2021			April 2022		
Total costs AR4 to AR6	Base	Contingency	Total	Base	Contingency	Total
Design, Panning and Management	19.1	2.5	21.6	21.0	0.8	21.8 ↑0.2
SCED	14.4	2.7	17.1	13.8	1.8	15.6 ↓1.5
Settlement	6.3	0.7	7.1	8.7	0.0	8.7 ↑1.6
System Planning	7.6	1.9	9.5	7.4	1.5	8.9 ↓0.6
Legacy Markets	8.2	2.2	10.4	12.3	0.2	12.5 ↑2.1
Registrations	2.7	0.4	3.2	2.6	0.5	3.1 ↓0.1
Integration	17.1	5.4	22.4	17.7	3.0	20.8 ↓1.7
Total	75.5	15.7	91.2	**83.4**	**7.8**	**91.2 (0.0)**

3.3 WA DER Program

The ERA proposes significant adjustments to AEMO's DER activities, reducing the capex forecast from $9.4 million to $4.2 million. The ERA reached this draft determination by:

- Excluding costs for two non-mandatory projects (Market Visibility and DER Data Access and Management) that are not fully scoped and not currently supported by stakeholders.
- Excluding costs for external consultants to conduct a cyber security assessment as part of the Technology Integration workstream.
- Excluding costs for undefined scope of early planning activities in the DER Participation workstream.
- Excluding approximately half the forecast costs for the EVs in the DER Project.
- Adjusting the forecast as per the ERA's alternative contingency assumptions.

AEMO notes that the SWIS and WEM are becoming increasingly volatile and challenging to manage, with DER (especially PV) as a key driver for these issues. While AEMO accepts some aspects of the ERA's draft determination – for example exclusion of the non-mandatory projects – AEMO has modified its forecasts for the other excluded costs. AEMO also maintains its view that its contingency calculations are reasonable and that reasonable contingency for the DER Program is necessary.

During the December 2021 to February 2022 period, some of AEMO's projects were subject to change through internal governance processes, leading to greater confidence of dependencies, scope, and deliverables over the AR6 period. Taking this latest information into consideration, along with feedback from the ERA and stakeholders, AEMO has revised its DER capex forecast for the AR6 period to $6.6 million. This is a 30% reduction from AEMO's original proposal.

AEMO highlights that the revised forecast now also includes $1.6 million of costs for Project Symphony in response to significant scope movement from AR5 into the AR6 period driven by project partner delays – noting that the Project Symphony capex forecast to completion remains unchanged.

The following sections present AEMO's revised DER forecast and AEMO's response to issues raised by the ERA in its draft determination.

3.3.1 Proposed projects

AEMO has reviewed the ERA's draft determination and stakeholder feedback to the ERA's issues paper. AEMO accepts that costs for the DER Data Access and Management project and the Market Visibility project should not be included in the forecast capex determination at this time. Both these projects are in the very early stage of scoping and discovery, and AEMO agrees it is reasonable to defer inclusion of forecast capex until a more granular and coordinated scope of activities can be developed.

AEMO maintains the view that these projects will deliver benefits for market participants and ultimately end consumers, and will continue to review the scope, need and costs of these projects. AEMO will engage market participants and other key stakeholders on both projects and will develop an in-period capex adjustment proposal as required.

DER Data Access and Management

As highlighted in AEMO's proposal, the DER Data Access and Management project is driven by the system need of reliable DER information to provide visibility of DER devices and the influence of DER on the market and therefore AEMO's operations. The WEM and SWIS are undergoing transformational change driven by consumers towards a more decentralised system that relies increasingly on DER as primary source of energy. AEMO's 2021 Electricity Statement of Opportunities forecast that by the end of the AR6 period an additional 900 MW of rooftop PV are anticipated to be installed on rooftops across the SWIS[74].

AEMO's experience through other actions under the DER Roadmap is that the capability of DER technologies is being continually '*trialled*' under real-world operational conditions. For example, through our work on inverter standards, we have identified systemic risks in the form of inverter disconnecting behaviour during system disturbances, requiring immediate action to improve inverter performance[75]. Monitoring inverter compliance with new standards is ongoing work under DER Roadmap Action 1.

Visibility of DER at the distribution network level will be critical to the efficient and secure operation of the WEM and SWIS, and solutions will be required during the AR6 period. This becomes increasingly critical as the SWIS becomes more reliant on DER. However, AEMO also accepts that the scope is currently not clear and there are a number of external related activities underway or planned. These include the decommissioning of irradiance and distributed PV recordings by Western Power, investments in monitoring equipment under the AA5 capital program, and the scope of work to be undertaken in the DER Participation project. AEMO's preference is to allow these activities to progress and to provide a more refined and coordinated scope of activities to the ERA for an in-period determination during the AR6 period if required.

Electric Vehicles in the DER Register

AEMO estimated capex of $0.6 million to expand the DER Register for electric vehicle (EV) data, which was based on largely known implementation effort for the project, inclusive of a contingency allowance that reflects reduced project risk. The ERA has proposed reductions to this forecast to $0.3 million on the basis it considers the resourcing allocation is inefficient and should be scaled back to be at the same level as the original DER Register project.

AEMO submits that the ERA's resourcing assumptions are incorrect and does not accept the ERA's revised estimate. However, since submitting the AR6 proposal, the scope and requirements for this project have become clearer. For example, a national process identified desired data fields for EV charger information during 2021, and this has been agreed with EPWA as the basis for data collection[76]. Further the legal avenue for AEMO to develop market procedures has also been clarified through discussions with EPWA. As a result, AEMO has reviewed its forecasts for this project, and proposes a revised forecast of $0.5 million inclusive of $0.06 million contingency.

[74] AEMO. *2021 Wholesale Electricity Market Electricity Statement of Opportunities*. Available online – page 42.

[75] Western Power. *Changes to solar inverter systems standards - online information session*, May 2021. Available online.

[76] AEMO. *Distributed Energy Integration Program – Electric Vehicles Grid Integration*, February 2021. Available online.

As the ERA notes, AEMO successfully completed the DER Register project within its allocated resources. The project was delivered within budget and did not require contingency draw-down. When developing its resourcing requirements for the EVs in the DER Register project, AEMO considered lessons learnt from implementing the DER Register in the SWIS. One of those lessons was that AEMO's project team, management and subject matter experts had to spend considerably more time engaging with Western Power and negotiating requirements to support their implementation than had been originally forecast. This has been factored into the EVs update forecast, for example, by forecasting higher business management support than project manager support.

The scope of work required for the EVs in the DER Register is not dissimilar to that of the original DER Register project. It is not a simple update of readily available information. The project will require regulatory effort to update the WEM Procedures, technical requirements, API development, testing and verification. It will also require substantial engagement with Western Power as the data provider.

AEMO submits that the ERA's assumptions on resourcing levels are not correct. In its draft determination, the ERA finds that *approximately 13 FTEs are resourced over the project life*[77], this statement is not substantiated by the data provided confidentially to ERA, which shows between one and four full time resources are forecast for any given month. AEMO submits that is resourcing estimates for this project are prudent and efficient.

Error! Reference source not found.Table 21 compares resource types across forecasts and actuals to demonstrate how AEMO has applied the learnings from the DER Register project.

Table 21 DER Register v EVs in the DER Register project resource types and days allocated

Resource Type	DER Register Forecast (days)	DER Register actual (days)	EVs in DER Register (revised) forecast (days)
Business management	20	12	39
Project management	170	190	162
SME	78	106	71
Technical delivery	758	703	255

In its draft determination, the ERA also notes AEMO has not provided analysis of alternative solutions for this project.

AEMO considers the expansion of the DER Register to include EV charging data the most appropriate and efficient way to capture this data. The benefit of the DER Register is that it is a platform that it can be extended to be the repository for DER related data from external sources. The DER Register includes data validation arrangements that largely automate the process of data quality management and provide information to the data provider autonomously where issues arise. Given the high volumes of data associated with DER standing data and continuous ongoing provision of the data as new equipment is installed it would be inefficient for AEMO to implement a solution without these supporting arrangements or duplicating this in another separate system.

In the absence of a consistent approach with minimum manual handling and quality assurance AEMO's operational teams will not have confidence to use the data operationally. Hence, any alternative solution built outside of the existing DER Register systems would have to also rebuild this validation and quality management capability, leading to higher costs. Alternatively, solutions that do not include this capability would lead to data sets that could not be relied on operationally, undermining the potential benefits from the investment.

Given the above, AEMO does not consider it efficient to undertake a detailed costing exercise for alternative options[78]. The proposed project builds on existing infrastructure and capability rather than duplicating capability leading to the most efficient solution to deliver while also minimising operational costs beyond the project.

[77] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 116.

[78] Note that benchmarks such as the completed DER Register project, and the benchmarks used in the DER Roadmap in-period submission remain relevant.

3.3.2 In-flight projects

Project Symphony

The DER Orchestration Pilot has been faced with delays to achieving go-live for its minimum viable product and trial period, leading to expected delays of up to six months for the project. This delay is due to dependencies on project partners, who have faced some delays. As such, expenditure that was expected to be incurred during 2021/22 (within the AR5 period) will now be incurred during the AR6 period and therefore forms part of the AR6 capex forecast.

This has the effect of shifting approximately $1.6 million from AR5 to AR6. AEMO highlights that the project remains within budget and an overall cost increase is not being proposed at this time. However, project delays mean the contingency allowance for the AR6 periods is necessary, as there is potential for further delays, which could also impact costs.

AEMO's revised forecast of costs to be incurred during the AR6 period, accounting for the shift in timing and contingency need, is $2.7 million[79], inclusive of $0.86 million contingency.

DER Participation

The ERA proposes a significant reduction ($0.6 million) to the DER Participation project based on undefined scope for early implementation activities.[80] At the time of submitting the AR6 proposal, AEMO was undertaking to resolve this gap, based on required actions to drive early outcomes with regards to managing instances of DER aggregation across the SWIS.[81] AEMO's expectation that DER aggregation will grow across the SWIS as retailers gain better tools to manage their portfolio is supported by EPWA's revised DER Roadmap implementation plans.[82]

The revised scope of work aims to establish AEMO's requirements for DER aggregations to develop while maintaining the security of the SWIS through clarifying information requirements, consideration of DER aggregations in market and system planning, and expectations for operational information to be provided to AEMO. Drawing parallels with the registration requirements for other generators, AEMO will be seeking to establish initial control expectations for DER Aggregators.

AEMO notes that these actions will be taken in consideration of DER Roadmap Actions 27 to 30 and are also required as early actions to meet AEMO's function of ensuring the SWIS operates in a secure and reliable manner (clause 2.1A.1A) whilst enabling innovation and the organic growth of DER aggregation as proposed by EPWA.

AEMO has resubmitted the updated forecasts for the DER Participation project inclusive of this updated scope, removing the uncertainty highlighted by the ERA. However, AEMO's revised DER Participation capex forecast remains unchanged, at $0.9 million inclusive of $0.18 million contingency.

Technology Integration

Over the period to February 2022, AEMO made some progressive changes to this project's forecast costs in AR6. As work on the national standards for cyber security around DER has progressed over the early parts of this year, AEMO has also been able to confirm that forecast consultancy costs for WEM-specific cyber security assessment, testing and implementation can be avoided.

AEMO's revised forecast for this project is $0.7 million, inclusive of $0.16 million contingency.

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[79] Note that as with AEMO's proposal this is *after* accounting for receipt of grant funding (recently updated by Western Power to $1.26 million in FY23 and $0.22 million in FY24)

[80] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 58.

[81] AEMO. *Allowable Revenue and Forecast Capital Expenditure 2022-23 to 2024-25*, December 2021. Available online – page 116.

[82] EPWA, public forum presentation held on 29 March 2022.

3.3.3 WA DER program revised forecast

Table 22 presents the revised WA DER program for the AR6 period, compared against the original proposal and the ERA draft determination.

Table 22 WA DER program revised AR6 forecast capex by project, $million nominal

WA DER program – revised proposal	AEMO AR6 proposal	ERA draft determination	AEMO revised proposal
Project Symphony (DER Marketplace Orchestration)	1.1	1.0	**2.7**
Technology Integration	1.2	0.7	**0.7**
DER Participation	0.9	0.4	**0.8**
DER Participation Implementation	2.0	1.8	**1.8**
Market Visibility	1.5	0.0	**-**
DER Data Access & Management	2.1	0.0	**-**
EVs in DER Register	0.6	0.3	**0.5**
Total	**9.4**	**4.2**	**6.5**

3.4 WEM sustaining capex

The WEM sustaining capex program is a suite of IT capital projects necessary to enable AEMO to continue to perform its core system management and market operation functions. Projects includes critical IT upgrades and system lifecycle replacements designed to maintain (or in some cases) uplift AEMO's IT capabilities and ensure its systems remain fit-for-purpose and secure from cyber-attack.

The ERA appointed a specialist consultant, Intelligent Energy Systems (IES), to inform its draft determination on these projects. IES suggested multiple reductions across the program, which it details in its findings report.[83] The ERA has adjusted the WEM sustaining capex forecast based on IES' findings, as well as adjusting forecast contingency capex in line with its alternative contingency calculation. The ERA's draft determination is $10.5 million, a 33.1% reduction.

AEMO has reviewed the ERA's determination and feedback provided by IES and has revised its capex forecast. While AEMO does not accept all of IES' findings, it has adjusted its forecast downwards by $1.4 million (9%) for the period.

Table 23 presents AEMO's revised AR6 forecast for WEM sustaining capex.

Table 23 WEM sustaining capex revised AR6 forecast capex by project, $million nominal

WEM sustaining capex – revised proposal	AEMO AR6 proposal	ERA draft determination	AEMO revised proposal
Wide area monitoring systems	0.2	0.1	0.2
Transient stability tool	0.2	0.2	0.2
Operations simulator	0.9	0.5	0.9
Lifecycle EDP	1.9	1.4	1.6
Lifecycle integration	1.2	1.0	1.0

[83] IES. *Review of AEMO's Allowable Revenue and Forecast Capital Expenditure 2022-23 to 2024-25*, 6 March 2022. Available online.

WEM sustaining capex – revised proposal	AEMO AR6 proposal	ERA draft determination	AEMO revised proposal
Lifecycle legacy market systems	1.9	1.5	1.7
Lifecycle Perth computer room	2.0	1.9	2.0
ITRON upgrade	0.4	0.3	0.4
Certificate authority	0.3	0.2	0.3
Rule changes	1.0	0.3	0.3
NORWEST Data Centre	0.2	0.2	0.2
Energy Management System (EMS)	1.4	1.8	1.4
Operations forecasting	1.1	0.1	1.2
Cyber security	3.0	1.3	3.0
Total	**15.7**	**10.8**	**14.4**

AEMO maintains it is prudent to include contingency for these projects in the capex forecast, and that the original contingency estimates across each of the projects remains valid. AEMO's response to the ERA's concerns regarding AEMO's contingency calculation methodology is discussed in section 3.6.

The following sections discuss AEMO's response to the ERA and IES' position on each of the WEM sustaining capex programs.

3.4.1 Wide area monitoring systems

AEMO proposed forecast capex of $0.2 million for this project. The ERA determined $0.1 million due to uncertainty about the number of licenses required and cloud cost accounting treatment in the cost of this project. This is also reflected in the report produced by IES.

The issue relates to the $74,200 software license costs associated with this project. This cost is to use and configure the vendor implemented software required for the system to interface with data inputs from Western Power. The costs are required to implement the functionality into the DTS and production environments. As AEMO is already operating with this functionality in the NEM there is no development phase and the project will configure in the DTS before moving to production.

AEMO's Fixed Assets and Intangibles Policy has been provided to the ERA. Section 7.2 (Acquisition of assets) addresses the question of when an asset can be capitalised. This project meets those criteria.

AEMO maintains its original capex forecast of $0.2 million.

3.4.2 Transient stability tool

AEMO proposed forecast capex of $0.2 million for this project. The ERA determined $0.2 million but challenged contingency costs.

Section 3.6 below addresses AEMO's response to the ERA's draft determination on contingency calculations. AEMO maintains its original forecast of $0.2 million.

3.4.3 Operations simulator

AEMO proposed forecast capex of $0.9 million for this project. The ERA determined $0.5 million due to uncertainty about the number of licenses required and the license cost accounting treatment. This is reflected in the report produced by IES.

The issue relates to the $342,000 software license cost. AEMO's Fixed Assets and Intangibles Policy has been provided to the ERA. Section 7.2 (Acquisition of assets) addresses the question of when an asset can be capitalised. This project meets those criteria. Ongoing annual software and hardware maintenance fees would be opex.

The uncertainty was likely caused by reference to additional hardware in the draft Investment Brief (provided separately to the ERA and its consultants) but it has been confirmed that only additional software licenses are required as there is sufficient capacity in the existing infrastructure to accommodate WEM requirements.

AEMO maintains its original forecast of $0.9million.

3.4.4 Lifecycle EDP

AEMO proposed forecast capex of $1.9 million to replace certain functional capabilities of legacy applications with an Enterprise Data Platform (EDP) capability. The ERA determined $1.4 million due to insufficient information provided by AEMO to justify costs regarding licenses and license accounting treatment, and cloud cost accounting treatments. The IES report also identified an adjustment related to the inclusion of penetration costs.

AEMO accepts the reduction in costs related to the penetration tests. A review has confirmed that AEMO will be leveraging an existing enterprise capability that does not require additional testing of this type.

The issue around the software licensing cost relates to the $250,000 cloud costs included in the project. This is required to uplift the EDP to support the additional data requirements of the ten existing applications. AEMO's Fixed Assets and Intangibles Policy has been provided to the ERA. Section 7.2 (Acquisition of assets) addresses the question of when an asset can be capitalised. This project meets those criteria.

AEMO has adjusted its forecast and proposes the revised amount of $1.6 million.

3.4.5 Lifecycle integration

AEMO proposed forecast capex of $1.2 million to replace certain functional capabilities of legacy applications with an enterprise integration capability. The ERA determined $1 million and rejected some penetration testing costs and contingency costs.

The penetration testing costs were rejected because *AEMO allocated these costs on a per application basis, which sometimes resulted in penetration testing costs being up to 40 per cent of some base costs. AEMO applied penetration costs to validate that no vulnerabilities were introduced through remediation work. However, many of the application costs, with penetration costs that AEMO included, do not and will not interface with applications external to AEMO systems*.[84] This is also reflected in the IES Report.

AEMO's cyber security policy requires that any significant changes to the enterprise production integration layer require a penetration test to confirm that no additional vulnerabilities have been introduced. This is regardless of whether or not the capabilities introduced interface externally. Viewed from an enterprise perspective, this layer does have external connectivity and as such there is no tolerance for introducing risk. AEMO does acknowledge that, with appropriate planning in place, this requirement could be mitigated by completing migration activities in parallel; however, it is unrealistic to suggest that all nine applications could be replaced in that way. As such, AEMO believes it appropriate to include sufficient forecast capex to conduct three penetration tests, aligned to software delivery cycles, during this project at a cost of $60,000.

AEMO has adjusted its forecast and agrees with the ERA's draft determination of $1.0 million.

3.4.6 Lifecycle legacy market systems

AEMO proposed forecast capex of $1.9 million to upgrade legacy components of WA Market applications to ensure the entire software stack remains supported. The ERA's draft determination proposes the reduction of some contingency costs. The ERA has also proposed to remove the funding proposed for the Gas Bulletin Board, as this same funding request was also proposed in AEMO's GSI capital expenditure.

[84] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 125.

AEMO accepts the ERA's draft determination with regards to the Gas Bulletin Board. Section 3.6 below addresses AEMO's response to the ERA's draft finding on contingency calculations.

AEMO has adjusted its forecast and proposes the revised amount of $1.7 million for the WEM component of this project.

3.4.7 Lifecycle Perth computer room

AEMO proposed forecast capex of $2 million in capex funding to replace all end-of-life computer room hardware. Both the ERA draft determination and IES report are broadly supportive but have rejected ~$100,000 contingency.

Section 3.6 below addresses AEMO's response to the ERA's draft finding on contingency calculations.

AEMO maintains its original forecast of $2.0 million.

3.4.8 ITRON upgrade

AEMO proposed forecast capex of $0.4 million to maintain support levels for Itron MetrixIDR. This is the incumbent load forecasting software and will need to be upgraded during the AR6 period.

The ERA's draft determination includes the project costs as proposed[85], however, in the supporting table[86], the ERA has proposed a reduction of $0.1 million.

The IES report recommends a reduction of a similar amount subject to distinction between opex and capex treatment of licenses. AEMO's Fixed Assets and Intangibles Policy has been provided to the ERA. Section 7.2 (Acquisition of assets) addresses the question of when an asset can be capitalised. This project meets those criteria. The ongoing annual software fees would be opex.

AEMO maintains its original forecast of $0.4 million.

3.4.9 Certificate authority

AEMO proposed forecast capex of $0.3 million to replace the expiring PKI certificates using a new AEMO enterprise solution. In its draft determination, the ERA has proposed a small reduction of the total cost forecast related to contingency costs. Section 3.6 below addresses AEMO's response to the ERA's draft finding on contingency calculations.

AEMO maintains its original forecast of $0.3 million.

3.4.10 Rule changes

AEMO proposed forecast capex of $1.0 million to accommodate rule changes that occur during the AR6 period. Without an allowance for rule changes, there is a risk AEMO will not be able to comply with rule amendments or require Commencement Dates for new amendments to be delayed.

The ERA has proposed a reduction of $0.7 million. The ERA considers AEMO must demonstrate better governance over WEM Rule change costs. The IES report recommends an in-period submission if there is a significantly large rule change.

AEMO accepts the ERA's draft determination of $0.3 million for rule change projects. While AEMO considers there is likely to be an uplift in the number of rule changes requiring system implementation post WEM Reform go-live, AEMO accepts that it is not possible to forecast them with any accuracy at this time. AEMO will aim to manage any costs within the forecast capex budget and/or via the overrun allowances under the rules. If required, an in-period submission may be required but as above, AEMO notes this may require the deferral of preferred Commencement Dates to allow for completion of the process.

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[85] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 125.

[86] *Ibid,* page 121

3.4.11 NORWEST Data Centre

AEMO proposed forecast capex of $0.2 million for WA's share of costs for planned upgrades for all end-of-life hardware in the Norwest Data Centre. In its draft determination, the ERA has challenged some of the contingency costs, however it has included $0.2 million in the forecast.

Section 3.6 below addresses AEMO's response to the ERA's draft finding on contingency calculations.

AEMO maintains its original forecast of $0.2 million.

3.4.12 Energy Management System (EMS)

AEMO proposed forecast capex of $1.4 million for WA's share of EMS costs. The ERA's draft determination challenges the contingency but includes $1.8 million in both the commentary and supporting table. The IES report recommends the $1.4m originally requested.

AEMO maintains its original forecast of $1.4 million.

3.4.13 Operations forecasting

AEMO proposed forecast capex of $1.1 million to onboard the WA System Management team into AEMO's existing operations forecasting capability. The ERA's draft determination proposes a reduction of $1.0 million due to issues with the contingency and labour costs. The IES report endorsed the project.

The AR6 proposal included $0.76 million in labour costs and $24,000 in contingency costs. However, the ERA has determined only costs sufficient for hardware procurement. No costs are provided for installing it.

AEMO restates the requirement for sufficient labour budget to install and configure this system, as it is necessary to improve WEM forecasting accuracy and power system requirements.

AEMO maintains its original forecast of $1.1 million.

3.4.14 Cyber security

AEMO proposed forecast capex of $3.2 million for WA's share of enterprise Cyber Security projects during the AR6 period, $3.05 million (11.8%) for WEM and $0.15 million (0.6%) for GSI. The ERA has excluded the software costs. The draft determination includes only $1.45 million across both WEM and GSI. The IES report recommends approving $2.5 million with $0.5 million excluded for software costs.

AEMO WA's share of software costs in the original submission was only $0.37 million across both WEM and GSI. It is unclear from the draft determination as to why an additional $1 million was rejected. AEMO has provided some additional details of the type of software that will be procured in the following table.

Table 24 AR6 cyber security software (WA allocation), $ million nominal

Software enhancement	2022-23	2023-24	2024-25
Identity management	0.013	0.047	-
Multi-factor authentication	-	0.005	-
Privileged access management	-	0.043	0.059
Vulnerability management	0.029	-	-
Endpoint protection	0.035	-	-
Security information and event management	-	0.027	0.029

Software enhancement	2022-23	2023-24	2024-25
Cloud security	0.015	0.009	0.023
Certificate management	0.027	-	-
Total	**0.129**	**0.127**	**0.111**

AEMO's Fixed Assets and Intangibles Policy has been provided to the ERA. Section 7.2 (Acquisition of assets) addresses the question of when an asset can be capitalised. This project meets those criteria.

AEMO maintains its original forecast of $3 million for WEM capex costs.

3.5 Potential projects not included in AR6 forecast

In its AR6 proposal, AEMO identified several projects that have the potential to be required during the AR6 period but opted not to include in the capex forecast at this time. These are:

- 5-minute settlement (5MS).
- DER participation implementation.
- Implementation of changes arising from EPWA's RCM and cost allocation reviews.

AEMO's current estimates of the potential additional expenditure associated with these projects ranges from $32 million to $64 million. Given the magnitude of the potential spend, lack of detailed scope, and ambiguity around timing, AEMO proposes that capex for these projects should be estimated and reviewed as part of an in-period submission, when sufficient clarity is available to inform a robust forecast. An in-period submission process will also give stakeholders greater opportunity to input into the specific need, design and cost of these major projects.

AEMO highlights that this approach of using in-period adjustments should be done sparingly and should be reserved for high value transformational projects that will have a direct impact on market participation and/or market operations (such as those listed above). It should also only be reserved for occasions where the timing of these projects does not coincide with a revenue reset and delivery of them would cause AEMO to exceed it capex/opex allowances under the Rules. AEMO considers it would not be efficient to utilise in-period adjustments for all variations to forecast, nor to seek explicit approval of all new/emerging capex projects from the ERA where they can be delivered within overrun allowances.

AEMO sought feedback on this treatment of the 5MS and DER participation implementation projects from stakeholders during its public forums prior to submitting its AR6 proposal. The ERA similarly requested feedback on AEMO's proposed approach in its issues paper on the AR6 proposal.

Feedback from stakeholders was generally supportive of AEMO's approach of not including these costs at this time and allowing greater opportunity to for scoping and challenge before proceeding with them. Key stakeholder feedback highlighted by the ERA includes:

> *Bluewaters noted that it was yet to see a cost benefit analysis which provides comfort to market participants that five-minute settlement should proceed.*
>
> *Perth Energy requested that AEMO's move to five-minute settlement was backed up by some analysis, based on experience within the NEM, and showing how the cost of five-minute settlement will flow through to customers.*
>
> *Synergy supported AEMO's proposal to exclude less certain projects like five-minute settlement, participation of DER aggregation, and participation in stage two, Energy Transformation Strategy, projects from the AR6*

forecast until they are better understood or required by policy and substantiated by an out of period funding request.[87]

AEMO appreciates this feedback and maintains it position not to include capex for these projects in the AR6 forecast until the projects are further defined. Where it becomes clear what form these projects are proceeding in and if there is insufficient funding available to deliver them within the AR6 capex determination, AEMO will develop an in-period adjustment proposal.

Since the December 2021 proposal, AEMO's regular engagements with both the Minister's Office and EPWA has confirmed that 5MS remains an important component of Western Australia's Energy Transformation Strategy. It is likely an in-period submission will need to be developed during the second year of AR6.

As discussed in section 2.9, AEMO has included an amount of forecast opex in the AR6 forecast to allow AEMO to commence early planning and scoping of 5MS, which will ultimately help inform the capex forecast an in-period submission. As requested, AEMO will work with EPWA to scope the 5MS solution and identify the costs and benefits of implementing it. This will incorporate engagement with market participants.

3.6 Contingency costs

AEMO welcomes the ERA and market participant's review and feedback of its revised approach to calculating contingency costs. AEMO acknowledges this area of forecasting costs remains a challenging one, with tension arising between forecast certainty, managing delivery risk and overall efficiency. AEMO maintains that its approach to estimating contingency is a prudent, reasonable and repeatable method of forecasting costs. AEMO has re-submitted contingency calculators for all relevant capex projects, making a number of amendments in line with (and independent of) ERA's recommendations – while maintaining its approach in others.

AEMO's response to broader areas of query/concern are set out below with specific responses to issues raised by the ERA detailed in Table 25 below.

3.6.1 Mechanisms for managing uncertainty

AEMO notes that in addition to the calculation of contingency, the regulatory model provides other mechanisms for helping to manage (cost) uncertainty and risk. These include the capex and opex overrun allowances under the WEM and GSI Rules[88], ability to forecast partial project funding, and use of in-period submissions. While collectively these provide a balanced approach, AEMO remains of the view that appropriate calculation of project-level contingency remains the primary method for managing uncertainty for the following reasons:

- A consistent method of calculating project cost and risk is important for AEMO's overall project governance and investment planning. While AEMO's WA functions can utilise the overrun allowances and other mechanisms in the Rules, they do not apply to the rest of the organisation. Having a tailored processes for WA projects introduces unnecessary inconsistency and inefficiency.
- AEMO must develop an organisation-wide capex forecast for the purposes of forecasting and securing appropriate and efficient levels of debt. A total view of potential capex is required for these purposes. Relying on the overspend allowance and/or in-period allowances would leave AEMO with a potential gap in budget/debt funding.
- The overrun allowances in the WEM Rules were not designed for, nor are they of a magnitude to cover, the scale of transformational change currently underway in the WEM.
- AEMO remains of the view that use of in-period submissions should be minimised, and the intent of this mechanism is for 'backstop' purposes and new major projects that don't align with the timing of the allowable revenue cycles. AEMO also respectfully disagrees with stakeholders' views that this mechanism provides greater

[87] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 63.

[88] Ability to for capital expenditure within an Allowable Revenue period to exceed ERA's Determination by the lower of 10% or $10 million.

certainty overall. As noted above, in an environment of fast-paced and large-scale change, the requirement to repeatedly step through additional regulatory processes adds both delivery risk (e.g. paused projects and loss of key staff) and operational risk (e.g. distraction of key staff and management) – both of which may lead to inefficiency or poor market/power system outcomes. Though expenditure forecasts may be more accurate at the time of an in-period submission than prior to the start of an allowable revenue period – the revenue recovered (via market fees) will only reflect the delivered project costs, with subsequent additional costs for re-running of the regulatory process.

- AEMO agrees that including an amount for planning costs in a forecast for projects that do not have a defined scope – as suggest by the ERA[89] - is an appropriate mechanism for managing uncertainty. However, the ERA has excluded proposed planning costs for 5MS from its opex forecast (see section 2.9 of this document). It is therefore unclear whether including planning costs is a mechanism available to AEMO.

[89] ERA. *Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 Draft determination*, 31 March 2022. Available online – page 63.

3.6.2 AEMO responses to specific ERA issues

The following table provides a summary of updates AEMO has made to the contingency calculations in line with ERA's proposed changes.

Table 25 AEMO responses to ERA's contingency calculation methodology

ERA issues	AEMO response/justification
Issue 'Unknown unknowns' valued at 5% of the value calculated using the fixed contingency calculator is carried forward to and included in the calculation of contingency using the EMV tool **ERA determination** Reject the 5% carried forward to execution stage in the EMV calculation. **Rationale** At the execution stage, the percentage included to accommodate risks should reflect the outstanding project spend required at that stage (not at the idea stage). The risk of unknown unknown's materialising (e.g., a rule change affecting the project) is less likely the closer to completion a project is, as stakeholders (including EPWA) are fully informed of AEMO's progress. They do happen but not often. No provision is made in AEMO's fixed contingency calculator for unknown unknowns, yet a portion of the fixed contingency is carried forward to the EMV tool to cover 'unknown unknown' risks. Not all risks come to fruition in a project and not all projects use contingencies, so there should be left over contingency from within and across projects to cover unknown unknowns if they arise. If unknown unknowns arise, they can also be addressed using the $10m overspend provision. Prudency principle.	**Partially accept** AEMO disagrees with the decision to remove unknown unknowns but has made adjustments to the manner in which it calculates this component, ensuring that the multiplier for the underlying 5% of fixed value risk uses estimate to completion (ETC) as compared to estimate at completion (EAC). This reflects the ERA's recommendation that the cost of risks should reflect the stage of delivery. In response to the ERA's concerns: • AEMO must build a capex forecast that provides confidence of a total potential cost for budget/debt planning – it cannot simply rely on overspend allowance. • Unknown unknowns are a widely accepted element of risk management for projects and while there are means to better identify and convert to 'known unknowns' some element of uncertainty will always remain, with a 'management reserve' often retained to account for these risks.[90,91]. • AEMO's fixed contingency tool is used to estimate known unknowns (e.g. general risk categories but not defined risks) and so it is a reasonable model for assigning some unknown unknown risk cost as it moves through the project stages. It provides a consistent model for all project managers but can also be challenged (reduced or increased) by AEMO's Investment and Steering Committees. Some examples of unknown unknowns arising through AR5 are: • DER resources were diverted to work on unplanned emergency solar management activities with EPWA, Western Power and Synergy. This required additional effort and the use of c. $35k contingency funding to cover this as it was government policy but not covered in the DER Roadmap. • The level of competition in the Western Australian labour market which has placed significant pressure on recruitment and retention and associated labour costs.[92] • A major impact of the Covid-19 pandemic on the WEM Reform program has been the limitation on in-person working and relationship building between east and west coast team members. With a large-scale and long-term program like WEM Reform, personal engagement is extremely important for managing technical challenges and enhancing productivity.

[90] Kim, S. D. (2012). *Characterizing unknown unknowns*. Paper presented at PMI® Global Congress 2012—North America, Vancouver, British Columbia, Canada. Newtown Square, PA: Project Management Institute. Available online.

[91] Shrivastava, N. K. (2014). *A model to develop and use risk contingency reserve*. Paper presented at PMI® Global Congress 2014—North America, Phoenix, AZ. Newtown Square, PA: Project Management Institute. Available online.

[92] A reasonable level of competition and associated risk was forecast but many data points (see CCI WA, *Business Confidence Survey*, , December 21, available online) highlighting the extreme labour market conditions – which are particularly acute for resources (e.g. IT, business analysis) required to deliver WEM Reform.

ERA issues	AEMO response/justification
Issue Value of each risk rated as 'N/A' or 'immaterial' is added to the total risk in the fixed calculator as 0.5%. **ERA determination**: Reject impact values for risks that are labelled 'N/A' or 'immaterial. **Rationale** If risks are unlikely to occur, such that they are not applicable or so insignificant that they are not assessable, they should not be considered as risks. If risks are likely to occur but their impact is 'immaterial' they should not have an impact value. Not all risks come to fruition in a project and not all projects use contingencies, so there should be left over contingency from within and across projects to cover risks that are rated N/A or immaterial if they arise. If N/A or immaterial risks arise, they can also be addressed using the $10m overspend provision.	**Partially accept** AEMO recognises that referring to risks as 'not applicable' is misleading and has updated all contingency calculators to use 'immaterial', which is consistent with AEMO's broader risk management framework. However, AEMO disagrees with the blanket removal of these risks from the calculator. In response to the ERA's concerns: • Primarily this approach is consistent with AEMO's broader risk management framework – with consistency a key principle identified by the ERA. Immaterial is the fifth scale of impacts and risks with no impacts are not included in the calculator. • The AEMO framework states that these risks have a cost impact less than (up to) 5% of the total project costs. • If all immaterial risks were removed from the fixed cost calculator, then a project may return a 0% contingency, where it is relatively small and well understood. AEMO believes it is unreasonable to determine any project as completely risk-free and the 5% contingency applied by including these immaterial risks is an appropriate approach. • AEMO recognises there is potential to use the overspend provision but this is a regulatory construct and AEMO requires a total view of potential costs for its budget and investment planning activities.
Issue Calculated risks are rounded up to the nearest whole number. **ERA determination** Reject rounding and work with actual calculated risks.	**Accept** AEMO has resubmitted all contingency calculators ensuring all fixed calculator outputs are using one decimal point precision. AEMO will also update its guidance documents to ensure this approach is clear for all future projects.
Issue Different scales are used for different projects in the fixed calculator. **ERA determination** Requires AEMO to review and recalculate contingency costs using a consistent contingency calculator.	**Accept** AEMO noted during the review period that some of the calculators submitted were utilising 'old' risk scales. The existence of the different scales was due to top-down review/challenge by AEMO's governance who believed the first iteration of the model was overly conservative (i.e. calculating contingency figures higher than required). As such, the calculator was adjusted to reflect an agreed higher risk threshold/lower contingency cost. All contingency calculators have been re-submitted using the updated and less conservative scale.
Issues Other (aggregated) proposed costs inflated the contingency cost calculation at the project level. AEMO carried forward some contingency costs from AR5 to AR6. The contingency cost calculators for some WEM Enterprise projects, included costs for both the NEM and the WEM.	**Partially accept** AEMO's has reviewed its contingency calculations and its response to the ERA's three recommendations are as follows: **Cost 'carryover' from AR5 to AR6** AEMO disagrees that some element of carryover is inappropriate. The AR6 forecast needs to reflect the costs that may occur in the period. A project that starts in AR5 but concludes in AR6 may still carry the total cost of a risk from one financial year to another.

ERA issues	AEMO response/justification
AEMO employed a fourth method of contingency cost calculation that is inconsistent with other methods. ERA determination Recalculate contingencies so that they are calculated as a percentage of the base cost estimates for AR6 and include WA only. Reject contingency costs calculated using unjustifiable bespoke methods. Rationale AEMO noted that it put off a project for which it had calculated a contingency percentage of 115% and decided to make an in-period submission for that project. AEMO noted that AEMO calculated the contingency for one project using a 'bespoke' method, based on a previous update to that system, due to the uncertainty surrounding the project. WEM Rule 2.22A.3: Funding proposed, and approval is tied, where practicable, to individual projects, or where not practicable, to specific functions, in AEMO's proposal. Extremely risky projects should not be funded. With very uncertain projects, AEMO can wait till more details come to light and make an in-period submission. Including some contingency in a cost estimate is good practice. A probabilistic approach should be used to cost estimation for all major initiatives, and wherever possible otherwise.	However, AEMO has adjusted base costs for EMV risk calculations in the live projects (e.g. WEM Reform and WA DER) to use ETC as opposed to EAC to provide a more balanced view of existing risk cost. (Note ETC is taken as of end-Feb 2022). **Inclusion** of NEM Costs in contingency calculators AEMO agrees that the WEM should only bear the appropriate proportion of contingency costs for enterprise projects. However, AEMO has reviewed the financial tracking spreadsheet and contingency cost calculators submitted and found no evidence that non-WEM costs were included in the AR6 proposal. The proportional allocation of capex to the WEM is based on an appropriate fixed percentage (per project relevant to the scope/outcome) and this was applied to both base and contingency cost forecasts. **Use of** inconsistent model The model referred to by the ERA relates to the STEM Reform project within the WEM Reform program. As discussed with the ERA during the review process, AEMO notes that while different from the standard model for contingency calculation the approach was taken as the nature of the risks were specific and known (i.e. the potential for additional scope to be included). As such, AEMO calculated the potential cost of that scope/risk via its project estimation method (i.e. generated a financial tracking spreadsheet with project management, development, testing costs). AEMO argues this is a more prudent model for calculating risk/contingency costs where information is available to do so and that the principle of consistency is of lower priority in such circumstances. Notwithstanding, AEMO has subsequently reviewed the STEM Reform project and determined that the additional scope is required and has adjusted its base forecast and developed a revised contingency calculator consistent with other projects.
Issue Allowance is included for risks that are considered 'unlikely' to happen and 'rare' in AEMO's EMV tool. ERA determination: Reject contingency for risks that are unlikely to happen or are considered rare. Rationale It does not make sense to make an allowance for a risk that you consider is 'unlikely' to occur, or a risk that is rated as less than 'unlikely' to occur. Not all risks come to fruition in a project and not all projects use contingencies, so there should be left over contingency from within and across projects to cover risks if they arise.	**Partially accept** As per its response to the proposed removal of immaterial risks from the fixed tool, AEMO disagrees with the blanket removal of lower likelihood risks from the EMV tool. In response to the ERA's concerns: • AEMO disagrees with the ERA's view that it does not make sense to make an allowance for unlikely risks. Consistent with AEMO's broader risk management framework (and broadly accepted risk management practices) these risks have a scaled likelihood and this multiplier is used to calculate total cost of risk. • AEMO recognises there is potential to use the overspend provision but this is a regulatory construct and AEMO requires a total view of potential costs for its budget and investment planning activities. • AEMO notes that its approach to EMV already includes a materiality approach with many more risks under management not included in the calculation (e.g. for WEM Reform there are ~130 active risks under management with only ~40% of these costed).

ERA issues	AEMO response/justification
If risks arise, they can also be addressed using the $10m overspend provision. Prudency principle.	However, AEMO does believe improvements to its approach can be made and has adjusted contingency calculators and enduring guidance to reflect: • EMV risks will only be included where a financial impact is assessable. • Rare or unlikely risks will only be included where the consequence is deemed moderate or above. • Always review risks and update the risk as per the schedule, risks are managed every month. • Monthly review of risk.
Issue Contingency cost calculations using the EMV tool include imprudent costs. Any risk can be considered 'possible' and can be included to pad out costs **ERA determination:** Require AEMO to review and recalculate contingency costs using the EMV Tool. Remove funding for any risks that do not appear logical and that cannot be justified in the final determination	P**artially a**ccept AEMO agrees that only prudent risks/costs should be included in the EMV tool and has reviewed and updated relevant contingency calculators (i.e. those for in-flight projects). AEMO also notes that: • Risks included in an EMV tool and forming the contingency are/will be scrutinised by AEMO's PMO and governance committees as projects pass through relevant gates (e.g. planning to execution). • Risks are regularly reviewed as part of standing program management and governance practices when a project is in the execution phase. In response to the ERA's concerns: • As a blanket rule it is not imprudent to 'carry forward' risk cost from AR5 to AR6 as it is not necessarily the passing of time that retires risk but the conclusion of project deliverables and/or risk mitigation activities. However, AEMO has reviewed its contingency calculators to update based on ETC figures where appropriate. • While all risks are possible[93] and could be included, as noted above only a portion of total risks under management are included in the EMV tools with focus on those that are most material or calculable. • Costs are calculated based on residual risk and while AEMO is implementing mitigating activities it is still reasonable to include costs to reflect that these will not always be successful (e.g. there is significant coordination with EPWA but it is an external organisation that must make independent decisions that do not always align with AEMO's project needs). • AEMO is best placed to understand what risks are reasonable and appropriate for inclusion and that ERA is not (and cannot be expected) to be across all levels of detail and context. In reference to the labour cost risks raised by the ERA, AEMO included the additional amount in its EMV tool (over and above 'standard' labour indexation) to reflect actual experience on the NEM 5MS program. This reflects tendency for some contract resources to depart a project ahead of Go Live as they (reasonably) look to secure a longer-term position elsewhere – with additional contingency reserved for retention or higher cost recruitment/procurement to offset delays. Overall, determining the prudence of risks/costs is inherently subjective and as noted by the ERA the risk of bias must be addressed. However, this risk of bias extends in both directions and in many cases a contingency framework is designed to tackle optimism bias as opposed to pessimism. Whilst AEMO notes in its proposal that it is beneficial for some level of over-estimation (to off-set costs and uncertainty of an in-period submission) this does not mean that AEMO systematically over-estimates risk or is overly pessimistic. This is evidenced by:

[93] Note that possible is defined as an 11-50% probability in AEMO's Risk Management Framework (as provided to ERA in support of the initial AR6 Proposal).

ERA issues	AEMO response/justification
	• An increase in WEM Reform forecast and contingency costs prior to Board approval in August 2021 following an independent review of forecasts and comparisons with the NEM 55MS program. These increases were principally driven by a view that the team had been optimistic in a number of areas of cost estimation/risk management. • As noted in AEMO's AR6 proposal, the overall contingency proportion relevant to capex forecasts is well within accepted and experienced boundaries. Given the underlying risks and impacts associated with power system management and the transitioning nature of the WEM, AEMO remains confident the overall estimates are reasonable.
Issue Whilst not specifically raised as an issue in the draft determination, the ERA and its consultants' raised queries about the appropriate use of likelihood ratings in the EMV Tool during the review period,	R**evisions of EMV tool** As part of the broader review of contingency calculators, AEMO has made an update to the EMV tool so that the likelihood multiplier consistently uses the midpoint of the relevant range set out in AEMO's risk management framework. In some cases, this was slightly higher than the midpoint or at the upper bound of the range. The multiplication rates are now as follows: • Almost Certain (80-100%) – 0.9 • Likely (50-80%) – 0.65 • Possible (10-50%) – 0.35 • Unlikely (1-10%) – 0.05 • Rare (<1%) – 0.005

4. GSI costs

AEMO accepts the ERA's draft determination on Gas Services Information revenue determination in full, and therefore has not revised its GSI proposal in substance. However, AEMO has made some adjustments to the GSI revenue requirement (opex forecast) to reflect the latest interest rates and updated conditions in the latest Enterprise Agreement (EA), which have taken effect since December 2021.

AEMO also accepts the ERA's draft determination on GSI forecast capex in principle. However, AEMO has updated the capex forecast to reflect AEMO's current borrowing rates, which have been updated to reflect the latest interest rates (see section 2.8). AEMO also maintains is tier rate approach to estimating forecast capex labour, which has a minor impact the GSI capex forecast. AEMO's position on the tier rate approach is discussed in section 3.1.

4.1 Adjusted forecast

Table 26 shows the adjustments to the GSI allowable revenue forecast for the AR6 period.

Table 26 Adjusted AR6 forecast GSI allowable revenue, $ million nominal

GSI opex	2022-23	2023-24	2024-25	AR6 total
AR6 GSI opex proposal	1.6	1.8	1.9	5.3
Revised GSI opex forecast	2.0	1.8	1.9	5.8

Table 27 shows the adjustments to GSI forecast capex for the AR6 period.

Table 27 Adjusted AR6 forecast GSI forecast capex,$ million nominal

GSI capex	2022-23	2023-24	2024-25	AR6 total
AR6 GSI capex proposal	0.05	0.28	0.05	0.38
Revised GSI capex forecast	**0.05**	**0.29**	**0.05**	**0.39**

5. Revised forecasts

This section presents AEMO's revised allowable revenue and capex forecast for the AR6 period. The revised forecast reflects AEMO's position on each of the matters raised in sections 2, 3 and 4 of this document.

AEMO has reviewed its forecasts to ensure they are *sufficient to cover the forward looking costs of performing AEMO's functions* and reflect only costs which would be incurred by a *prudent provider of the services provided by AEMO in performing its functions, acting efficiently, to achieve the lowest practicably sustainable cost of performing AEMO's functions, while effectively promoting the Wholesale Market Objectives*.[94] AEMO highlights that the test under the Rules is not solely to achieve the lowest forecast. Rather, it is to achieve the lowest practicably sustainable cost necessary to perform its functions. That is, the lowest cost capable of being put into practice successfully and then sustained without compromising services to market participants.

A prudent provider of services is one that is sensible and careful when making judgements and decisions, avoiding unnecessary risks. Frugality and sound financial stewardship are prudent behaviours. So too is ensuring expenditure forecasts do not constrain AEMO's ability to operate the market and power system effectively. AEMO is addressing both these traits, taking steps to improve internal governance while ensuring funding constraints do not place delivery of market and power system functions at risk.

AEMO acknowledges that the proposed AR6 expenditure may not be the lowest possible forecast. However, it considers that the forecast – including contingency – represents a level of expenditure that will enable AEMO to manage the energy transition over the longer term in a reasonably efficient manner and within acceptable risk tolerances.

Governance arrangements, regulatory oversight and transparency of reform activities will promote efficient expenditure during the AR6 period. AEMO submits the costs it actually incurs will be the lowest capable of being put into practice while delivering its ongoing functions and the WEM Reforms, and that delivering reform and then operating the new market are central to the Wholesale Market Objectives.

5.1 WEM Allowable revenue and forecast capex

5.1.1 WEM allowable revenue (opex)

Table 28 Total revised forecast WEM allowable revenue by cost category, $ million nominal

	AR6 proposal (Dec 21)	ERA draft determination	AR6 revised proposal (Apr 22)				
Cost category	AR6 total	AR6 total	2022-23	2023-24	2024-25	AR6 total	Variance to Dec 21 (%)
Labour	73.2	60.9	21.6	23.9	24.7	70.2	(4.2%)
Accommodation	5.2	48	1.8	1.7	1.7	5.2	0.0%
IT & Telecommunications	11.0	9	2.5	3.2	3.7	9.4	(16.9%)

[94] WEM Rules 2.22A.5(a) and 2.22A.5(b)

	AR6 proposal (Dec 21)	ERA draft determination	AR6 revised proposal (Apr 22)				
Supplies and services	13.0	10.7	3.7	3.5	3.7	10.8	(20.6%)
Borrowing	5.2	4.4	0.6	3.4	4.3	8.3	37.9%
D&A	50.9	48.0	10.4	17.3	21.0	48.8	(4.5%)
Adjustment for over/under recovery	(2.3)	(2.3)	(0.3)	0.0	0.0	(0.3)	568%
Total revenue	**156.2**	**136.1**	**40.3**	**53.1**	**59.0**	**152.4**	**(2.5%)**

5.1.2 WEM forecast capex

Table 29 Total Revised AR6 forecast WEM forecast capex by cost category, $ million nominal

	AR6 proposal (Dec 21)	ERA draft determination	AR6 revised proposal (Apr 22)				
Cost category	AR6 total	AR6 total	2022-23	2023-24	2024-25	AR6 total	Variance to Dec 21 (%)
Facilitating the Energy Transformation Strategy							
WEM Reform	44.6	37.2	37.4	13.3	0	50.8	13.9%
WA DER	9.4	4.2	5.8	0.8	0	6.5	(30.8%)
Subtotal	54.0	41.4	43.2	14.1	0	57.3	(16.8%)
WEM sustaining capex							
Capability uplift	1.3	0.9	0.2	0.2	0.9	1.3	0.0%
Lifecycle	7.7	5.9	2.1	2	2.9	6.9	(10.4%)
WEM Rule changes	1.0	0.3	0	0	0.3	0.3	(67.5%)
Energy management system	1.4	1.8	1.1	0.3	0	1.4	0.0%
Cyber	3.0	1.3	1	1	1.1	3.1	3.3%
Operational forecasting	1.1	0.1	0	1.2	0	1.2	9.1%
Infrastructure	0.2	0.2	0.1	0.1	0	0.2	0.0%
Subtotal	15.4	10.5	4.5	4.8	5.2	14.4	(6.3%)
Total capex	**69.4**	**52.0**	**47.7**	**18.9**	**5.2**	**72.0**	**3.4%**

5.2 GSI allowable revenue and forecast capex

5.2.1 GSI allowable revenue

Table 30 Total revised forecast GSI allowable revenue by cost category, $ million nominal

	AR6 proposal (Dec 21)	ERA draft determination	AR6 revised proposal (Apr 22)				
Cost category	AR6 total	AR6 total	2022-23	2023-24	2024-25	AR6 total	Variance to Dec 21 (%)
Labour	3.1	3.1	1.04	1.07	1.04	3.15	1.62%
Accommodation	0.3	0.3	0.11	0.11	0.11	0.33	0.00%
IT & Telecommunications	0.2	0.2	0.06	0.06	0.07	0.19	(7.01%)
Supplies and services	1.3	1.3	0.48	0.37	0.41	1.26	(3.30%)
Borrowing	0.1	0.1	0.03	0.04	0.05	0.12	17.02%
D&A	0.6	0.6	0.33	0.17	0.24	0.75	25.47%
Adjustment for over/under recovery	(0.2)	(0.2)	(0.43)			(0.43)	(112.6%)
Total revenue	**5.43**	**5.43**	**1.62**	**1.83**	**1.92**	**5.36**	**(1.1%)**

5.2.2 GSI forecast capex

Table 31 Total revised forecast GSI forecast capex by project, $ million nominal

	AR6 proposal (Dec 21)	ERA draft determination	AR6 revised proposal (Apr 22)				
GSI capex project	AR6 total	AR6 total	2022-23	2023-24	2024-25	AR6 total	Variance to Dec 21 (%)
GBB lifecycle investment	0.23	0.23	0.0	0.24	0.0	0.24	4.35%
Enterprise-wise cyber security	0.15	0.15	0.05	0.05	0.05	0.15	0%
Total	**0.38**	**0.38**	**0.5**	**0.29**	**0.5**	**0.39**	**4.35%**

Glossary

Term	Definition
5MS	Five-Minute Settlement
AEMO	Australian Energy Market Operator
API	Application Programming Interface
AR4	The fourth allowable revenue period – 1 July 2016 to 30 June 2019
AR5	The fifth allowable revenue period – 1 July 2019 to 30 June 2022
AR6	The sixth allowable revenue period – 1 July 2022 to 30 June 2025
AR7	The seventh allowable revenue period – 1 July 2025 to 30 June 2028
BCG	Boston Consulting Group
Capex	Capital expenditure
CRC	Certified Reserve Capacity
Draft determination	Australian Energy Market Operator's allowable revenue and forecast capital expenditure proposal for the period 1 July 2022 to 30 June 2025 - Draft determination, 31 March 2022.
D&A	Depreciation and amortisation (costs)
DTS	Dispatcher Training Simulation
DER	Distributed Energy Resources
EA	Enterprise Agreement
EAC	Estimate at Completion
EDP	Enterprise Data Platform
EMS	Energy Management System
EMV	Expected Monetary Value
EPWA	Energy Policy Western Australia
ERA	Economic Regulation Authority
ESS	Essential System Services
ETC	Estimate to Complete
EV	Electric Vehicles
FCESS	Frequency Controlled Essential System Services
FTC	Fixed Term Contractor
FTE	Full Time Equivalent

Term	Definition
GBB	Gas Bulletin Board
GPS	Generator Performance Standards
GSI	Gas Services Information
IES	Intelligent Energy Systems
IMO	Independent Market Operator
IRCR	Individual Reserve Capacity Requirement
IT	Information Technology
MT PASA	Medium Term Projected Assessment of System Adequacy
MW/MWh	Megawatt/Megawatt hour
NAQ	Network Access Quantity
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NTDL	Non-Temperature Dependent Load
OGI	Organisational Governance & Integration
Opex	Operational expenditure
PASA	Projected Assessment of System Adequacy
PMO	Project Management Office
PSMP	Power System & Market Planning
PSO	Power System Operations
PV	Photovoltaic
RBP	Robinson Bowmaker Paul
RCM	Reserve Capacity Mechanism
RoPE	Reduction of Prudential Exposure
The Rules / Rules	The WEM or GSI Rules
SaaS	Software as a Service
SCADA	Supervisory control and data acquisition
SCED	Security Constrained Economic Dispatch
SME	Subject Matter Expert
SMST	System Management Systems Transition
ST PASA	Short Term Projected Assessment of System Adequacy
STEM	Short Term Energy Market

Term	Definition
SWIS	South-West Interconnected System
UAT	User Acceptance Testing
WA	Western Australia
WASM	WA System Management
WEM	Wholesale Electricity Market
WEMS	Wholesale Electricity Market System
WEMDE	Wholesale Electricity Market Dispatch Engine

Appendices

Appendix A. Power System Comparisons

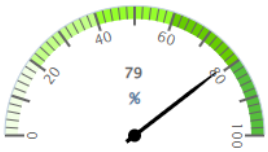
AEMO welcomes the use of benchmarking to assist in the determination of prudent and efficient cost forecasts for the AR6 period. As noted however, benchmarking is a difficult exercise as no two jurisdictions are the same. In specific reference to the use of New Zealand and Singapore as power system comparators, AEMO provides the following brief responses.

New Zealand

Whilst New Zealand has c. 80% share of renewables in their energy mix they are predominantly synchronous generators (hydro-schemes) which are controllable and present no challenge to the system operator in term of energy transition. In addition, New Zealand's share of distributed solar is effectively non-existent, as shown in the figures below:

% Renewables Generating

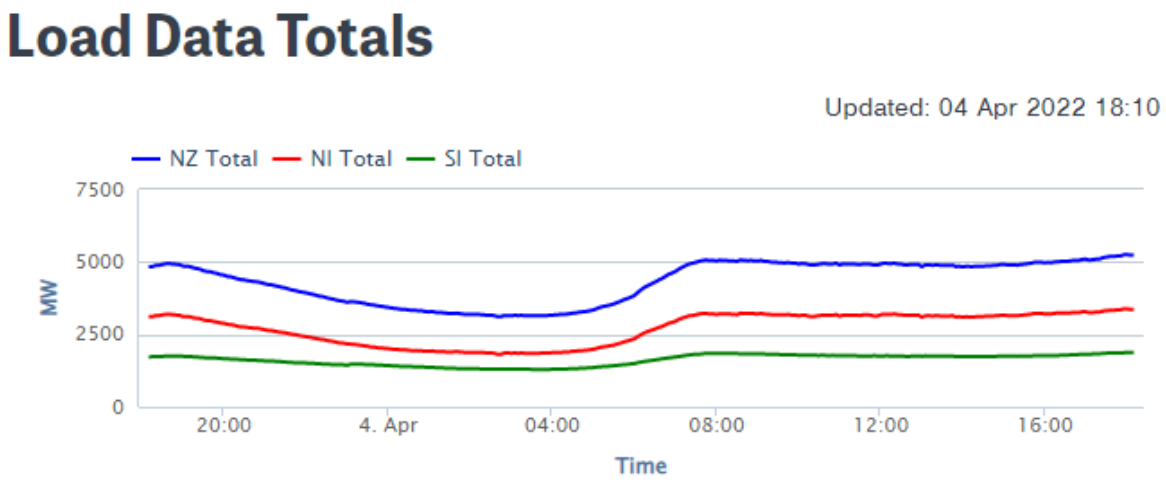
% Renewables (as at): 04 Apr 2022 17:30



Current Generation (MW)

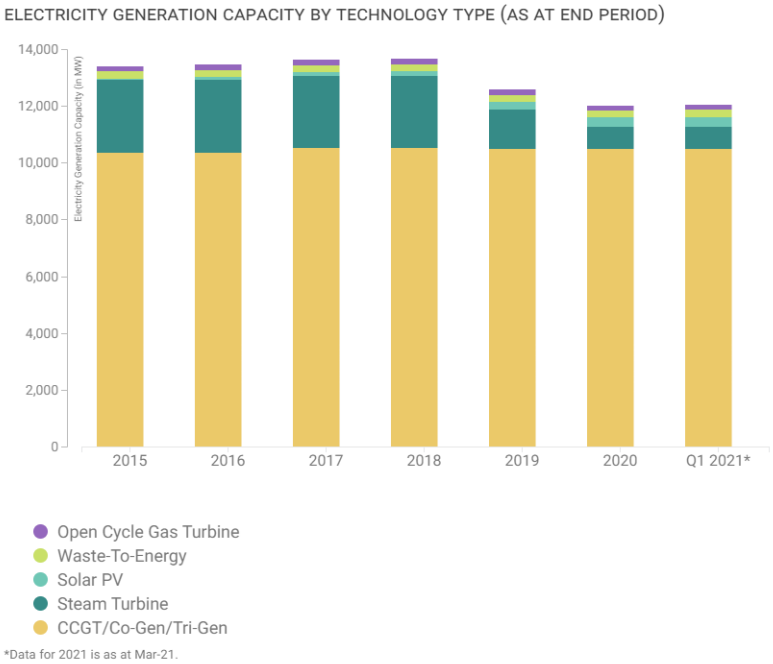
Power Generation	(as at) 04 Apr 2022 17:30
Battery	0 MW
Co-Gen	163 MW
Coal	426 MW
Gas	561 MW
Geothermal	835 MW
Hydro	3156 MW
Liquid	0 MW
Wind	261 MW

The below graph[95] shows the daily profile of New Zealand load, which has no comparison with the 'Duck Curve' experienced in the WEM. Note also the steady state load profile during what are the most challenging hours of the day for the WEM.



Singapore

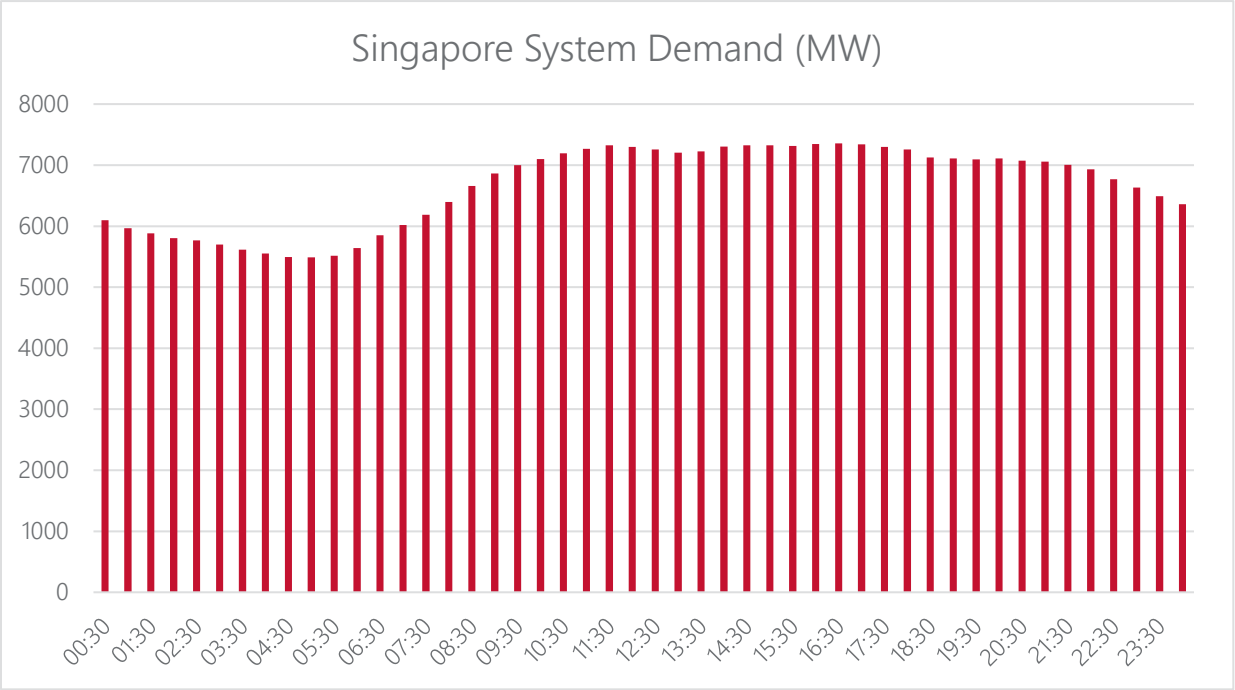
Similar to New Zealand (and dissimilar to the WEM) of non-synchronous generation in the energy mix in Singapore is negligible as shown in the graph below[96]:



[95] Transpower. Available online, accessed 04/04/2022

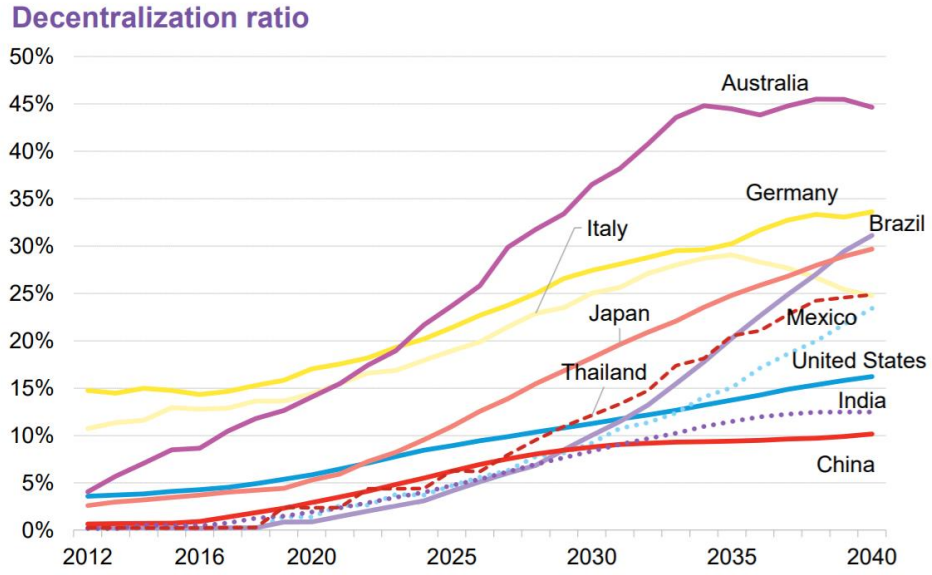
[96] Electricity Market Authority – Singapore. Available online, accessed 04/04/2022

The typical system demand data for Singapore (Monday 21st March 2022)[97] also shows a very stable load profile during the day, which is not comparable with the WEM.



Decentralisation

In the WEM, the most critical challenge faced is the degree of decentralisation which is related to penetration of Distributed Energy Resources (DER) and in particular rooftop photovoltaic (PV). The graph below shows where Australia stands as a country compared with other jurisdictions around the world. Importantly, the WEM would demonstrate a higher degree of decentralisation if measured independently.



Source: Bloomberg New Energy Finance Note: decentralization ratio is the ratio of non-grid-scale capacity to total installed capacity.

[97] Electricity Market Authority – Singapore. Available online, accessed 04/04/2022