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Essential Energy 2024 to 2029 Regulatory Proposal

REVIEW OF PROPOSED EXPENDITURE ON CER AND NON-RECURRENT ICT

Report prepared for:

AUSTRALIAN ENERGY REGULATOR

August 2023

Preface

This report has been prepared to assist the Australian Energy Regulator (AER) with its determination of the appropriate revenues to be allowed for the prescribed distribution services of Essential Energy from 1st July 2024 to 30th June 2029. The AER's determination is conducted in accordance with its responsibilities under the National Electricity Rules (NER).

This report covers a particular and limited scope as defined by the AER and should not be read as a comprehensive assessment of proposed expenditure that has been conducted making use of all available assessment methods nor all available inputs to the regulatory determination process. This report relies on information provided to EMCa by Essential Energy. EMCa disclaims liability for any errors or omissions, for the validity of information provided to EMCa by other parties, for the use of any information in this report by any party other than the AER and for the use of this report for any purpose other than the intended purpose. In particular, this report is not intended to be used to support business cases or business investment decisions nor is this report intended to be read as an interpretation of the application of the NER or other legal instruments.

EMCa's opinions in this report include considerations of materiality to the requirements of the AER and opinions stated or inferred in this report should be read in relation to this over-arching purpose.

Except where specifically noted, this report was prepared based on information provided to us prior to 16th June 2023 and any information provided subsequent to this time may not have been taken into account. Some numbers in this report may differ from those shown in Essential Energy's regulatory submission or other documents due to rounding.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

Term	Definition
ACS	Alternative Control Service
ADMS	Advanced Distribution Management System
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMI	Advanced Metering Infrastructure
BAU	Business as Usual
BESS	Battery Energy Storage Systems
CBA	Cost Benefit Analysis
CECV	Customer Export Curtailment Value
CER	Consumer Energy Resources
CIS	Customer Information System
CLVC	Closed Loop Voltage Control
COP	Customer Online Portal
CRM	Customer Relationship Management
DER	Distributed Energy Resources
DERMS	Distributed Energy Resource Management System
DNSP	Distribution Network Service Provider
DOE	Dynamic Operating Envelopes
EG	Embedded Generation
EMS	Energy Management Systems
ERP	Enterprise Resource Planning
ESB	Energy Security Board
EV	Electric Vehicles
FTE	Full Time Employees
GE	General Electric
GIS	Geographic Information System
HCM	Hosting Capacity Model
HK	HoustonKemp
HV	High Voltage
ICT	Information and Communication Technology
IES	Inverter Energy System

Term	Definition
IFRS	International Financial Reporting Standards
ISP	Integrated System Plan
LDC	Line Drop Compensation
LV	Low Voltage
MDM	Meter Data Management
MI	Market Interactions
NBM	Network Billing Management
NEM	National Electricity Market
NER	National Electricity Rules
NPV	Net Present Value
NSP	Network Service Provider's
OGW	Oakley Greenwood
OLTC	On-Load Tap Changers
PQ	Power Quality
PV	Photovoltaic
RCP	Regulatory Control Period
RTA	Rostering and Time Attendance
SaaS	Software as a Service
SCS	Standard Control Service
TOU	Time-of-Use

1 INTRODUCTION

AER has asked us to review and provide advice on Essential Energy's proposed allowances over the next Regulatory Control Period for expenditure to facilitate increasing Distributed Energy Resources (DER) and for non-recurrent Information and Communication Technology (ICT). Our review is based on information that Essential Energy provided and on aspects of the National Electricity Rules relevant to assessment of expenditure allowances.

1.1 Objective of this report

1. The purpose of this report is to provide the AER with a technical review of aspects of the expenditure that Essential Energy has proposed to facilitate Consumer Energy Resources and aspects of its proposed Non-recurrent ICT expenditure. These items form part of its revenue proposal for the 2024-29 regulatory control period (next RCP).

2. The assessment contained in this report is intended to assist the AER in its own analysis of the proposed capex allowance as an input to its Draft Determination on Essential Energy's revenue requirements for the next RCP.

1.2 Scope of requested work

3. Our scope of work is as defined by AER. Relevant aspects of this are as summarised in Figure 1.1.

Figure 1.1: Scope of work

Requested scope for Essential Energy review covered in this report

The scope of this review covers components of the proposed ex-ante capex forecast and proposed opex step changes consistent with the AER's expenditure forecast assessment guideline. This comprises the review of expenditure relating to the following aspects:

- Essential Energy's capex and opex forecast for:
  - Distributed Energy Resources (DER)/CER; and
  - ICT non-recurrent programs

Further scope requirements for review of DER

The consultant is required to provide advice to the AER on whether the DNSP has sufficiently demonstrated the need for network investment to accommodate forecast levels of DER. The advice should consider the DNSP's approach to assessing network hosting capacity, including its level of network visibility and use of data (such as data provided by smart meters) to identify and forecast DER export constraints on its low voltage networks.

Scope - Non-recurrent ICT expenditure

The consultant is required to assess and advise on whether the NSW DNSP's forecast expenditure for non-recurrent ICT programs is prudent and efficient, consistent with clauses 6.5.6 and 6.5.7 of the NER. In particular, the consultant is required to provide an alternative forecast in the event that the findings are that the DNSP's forecast is not prudent and efficient.

1.3 Our review approach

1.3.1 Approach overview

4. In conducting this review, we first reviewed the regulatory proposal documents that Essential Energy had submitted to AER. This includes a range of appendices and attachments to Essential Energy's regulatory proposal and certain Excel models, and which are relevant to our scope.

5. We next collated some information requests. AER combined these with information request topics from its own review and sent these to Essential Energy.

6. In conjunction with AER staff, our review team met with Essential Energy at its offices on 19th April 2023. Essential Energy presented to our team on the scoped topics and we had the opportunity to engage with Essential Energy to consolidate our understanding of its proposal.

7. Essential Energy provided AER with responses to information requests and, where they added relevant information, these responses are referenced within this review.

8. We have subjected the findings presented in this report to our peer review and QA processes and we presented summaries of our findings to AER prior to finalising this report.

9. The limited nature of our review does not extend to advising on all options and alternatives that may be reasonably considered by Essential Energy, or on all parts of the proposed forecast. We have included additional observations in some areas that we trust may assist the AER with its own assessment.

1.3.2 Conformance with NER requirements

10. In undertaking our review, we have been cognisant of the relevant aspects of the NER under which the AER is required to make its determination.

Capex Objectives and Criteria

11. The most relevant aspects of the NER in this regard are the 'capital expenditure criteria' and the 'capital expenditure objectives.' Specifically, the AER must accept the Network Service Provider's (NSP's) capex proposal if it is satisfied that the capex proposal reasonably reflects the capital expenditure criteria, and these in turn reference the capital expenditure objectives.

12. The NER's capex criteria and capex objectives are reproduced below.

Figure 1.2: NER capital expenditure criteria

NER capital expenditure criteria

The AER must:

*(1) subject to subparagraph (c)(2), accept the forecast of required capital expenditure of a Distribution Network Service Provider that is included in a building block proposal if the AER is satisfied that the total of the forecast capital expenditure for the regulatory control period reasonably reflects each of the following (**the capital expenditure criteria**):*

(i) the efficient costs of achieving the capital expenditure objectives;

(ii) the costs that a prudent operator would require to achieve the capital expenditure objectives; and

(iii) a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives.

Source: NER 6.5.7(c) Forecast capital expenditure, v200

Figure 1.3: NER capital expenditure objectives

NER capital expenditure objectives

*A building block proposal must include the total forecast capital expenditure for the relevant regulatory control period which the Distribution Network Service Provider considers is required in order to achieve each of the following (**the capital expenditure objectives**):*

(1) meet or manage the expected demand for standard control services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;

(3) to the extent that there is no applicable regulatory obligation or requirement in relation to:

(i) the quality, reliability or security of supply of standard control services; or

(ii) the reliability or security of the distribution system through the supply of standard control services,

to the relevant extent:

(iii) maintain the quality, reliability and security of supply of standard control services; and

(iv) maintain the reliability and security of the distribution system through the supply of standard control services; and

(4) maintain the safety of the distribution system through the supply of standard control services.

Source: NER 6.5.7(a) Forecast capital expenditure, v200

Opex Objectives and Criteria

13. The most relevant aspects of the NER in this regard are the 'operating expenditure criteria' and the 'operating expenditure objectives.' The NER's opex criteria and opex objectives are reproduced below.

Figure 1.4: NER operating expenditure criteria

NER operating expenditure criteria

*(c) The AER must accept the forecast of required operating expenditure of a Distribution Network Service Provider that is included in a building block proposal if the AER is satisfied that the total of the forecast operating expenditure for the regulatory control period reasonably reflects each of the following (**the operating expenditure criteria**):*

(1) the efficient costs of achieving the operating expenditure objectives;

(2) the costs that a prudent operator would require to achieve the operating expenditure objectives; and

(3) a realistic expectation of the demand forecast and cost inputs required to achieve the operating expenditure objectives.

Source: NER 6.5.6(c) Forecast operating expenditure, v200

Figure 1.5: NER operating expenditure objectives

NER operating expenditure objectives

*(a) A building block proposal must include the total forecast operating expenditure for the relevant regulatory control period which the Distribution Network Service Provider considers is required in order to achieve each of the following (**the operating expenditure objectives**):*

(1) meet or manage the expected demand for standard control services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;

(3) to the extent that there is no applicable regulatory obligation or requirement in relation to:

(i) the quality, reliability or security of supply of standard control services; or

(ii) the reliability or security of the distribution system through the supply of standard control services,

to the relevant extent:

(iii) maintain the quality, reliability and security of supply of standard control services; and

(iv) maintain the reliability and security of the distribution system through the supply of standard control services; and

(4) maintain the safety of the distribution system through the supply of standard control services.

Source: NER 6.5.6(a) Forecast operating expenditure, v200

How we have interpreted the capex and opex criteria and objectives in our assessment

14. We have taken particular note of the following aspects of the capex and opex criteria and objectives:

- Drawing on the wording of the first and second criteria, our findings refer to efficient and prudent expenditure. We interpret this as encompassing the extent to which the need for a project or program or opex item has been prudently established and the extent to which the proposed solution can be considered to be an appropriately justified and efficient means for meeting that need;

- The criteria require that the forecast '*reasonably reflects'* the expenditure criteria and in the third criterion, we note the wording of a '*realistic expectation'* (emphasis added). In our review we have sought to allow for a margin as to what is considered reasonable and realistic, and we have formulated negative findings where we consider that a particular aspect is outside of those bounds;
- We note the wording '*meet or manage'* in the first objective (emphasis added), encompassing the need for the NSP to show that it has properly considered demand management and non-network options;
- We tend towards a strict interpretation of compliance (under the second objective), with the onus on the NSP to evidence specific compliance requirements rather than to infer them; and
- We note the word '*maintain'* in objectives 3 and 4 and, accordingly, we have sought evidence that the NSP has demonstrated that it has properly assessed the proposed expenditure as being required to reasonably maintain, as opposed to enhancing or diminishing, the aspects referred to in those objectives.

15. The DNSPs subject to our review have applied a Base Step Trend approach in forecasting their aggregate opex requirements. Since our review scope encompasses only proposed expenditure for certain purposes, we have sought to identify where the DNSP has proposed an opex step change that is relevant to a component that we have been asked to review. Where the DNSP has not proposed a relevant opex step change, then we assume that any opex referred to in documentation that the DNSP has provided is effectively absorbed and need not be considered in our assessment.

1.3.3 Technical review

16. Our assessments comprise a technical review. While we are aware of stakeholder inputs on aspects of what Essential Energy has proposed, our technical assessment framework is based on engineering considerations and economics.

17. We have sought to assess Essential Energy's expenditure proposal based on Essential Energy's analysis and Essential Energy's own assessment of technical requirements and economics and the analysis that it has provided to support its proposal. Our findings are therefore based on this supporting information and, to the extent that Essential Energy may subsequently provide additional information or a varied proposal, our assessment may differ from the findings presented in the current report.

18. We have been provided with a range of reports, internal documents, responses to information requests and modelling in support of what Essential Energy has proposed and our assessment takes account of this range of information provided. To the extent that we found discrepancies in this information, our default position is to revert to Essential Energy's regulatory submission documents as provided on its submission date, as the 'source of record' in respect of what we have assessed.

1.4 This report

1.4.1 Report structure

19. The substance of our review is contained in the following sections, which cover respectively our review of Essential Energy's proposed DER and our review of its proposed non-recurrent ICT. In each section, we have presented:

- An overview of the proposed expenditure
- An overview of the nature of the proposed works or projects and the justifications that Essential Energy has submitted, and

- Our assessment of each of the elements of what Essential Energy has proposed.

20. We have taken as read the considerable volume of material and analysis that Essential Energy provided, and we have not sought to replicate this in our report except where we consider it to be directly relevant to our findings.

1.4.2 Information sources

21. We have examined relevant documents that Essential Energy has published and/or provided to AER in support of the areas of focus and projects that the AER has designated for review. This included further information at virtual meetings and further documents in response to our information requests. These documents are referenced directly where they are relevant to our findings.

22. Except where specifically noted, this report was prepared based on information provided by AER staff prior to 16th June 2023 and any information provided subsequent to this time may not have been taken into account.

23. Unless otherwise stated, documents that we reference in this report are Essential Energy documents comprising its regulatory proposal and including the various appendices and annexures to that proposal.

24. We also reference information responses, using the format IR#XX being the reference numbering applied by AER. Noting the wider scope of AER's determination, AER has provided us with IR documents that it considered to be relevant to our review.

1.4.3 Presentation of expenditure amounts

25. Expenditure is presented in this report in $2024 real terms, to be consistent with each NSW DNSP's RP unless stated otherwise. In some cases, we have converted to this basis from information provided by the business in other terms.

26. While we have endeavoured to reconcile expenditure amounts presented in this report to source information, in some cases there may be discrepancies in source information provided to us and minor differences due to rounding. Any such discrepancies do not affect our findings.

2 RELEVANT CONTEXT TO OUR CER ASSESSMENT

Our review of proposed CER expenditure, and which includes some items of ICT expenditure, is conducted in the context of an accelerating transition of the energy sector towards a lower carbon future. Aspects of this that are most relevant to DNSPs such as Essential Energy include further increases in CER, such as PV and increased electrification including for transport (such as EVs) and within homes (e.g. through the phase-out of gas).

This transition creates a prima facie potential case for increased network augmentation capex, where this satisfies the NER criteria. However, it also provides the opportunity for non-network 'CER' initiatives that can help to moderate the levels of network augmentation capex that might otherwise be required. For example, this can be through improving 'visibility' of the LV network and through dynamic services, including dynamic tariffs and dynamic controls that may combine to 'orchestrate' distributed electricity production, storage and demand, thereby minimising the net impact on the distribution network.

Changes in the regulatory landscape are taking place to accommodate the changed and changing roles of DNSPs such as Essential Energy. This includes changes to the NER and AER guidelines, which we have considered in our assessment.

An overarching consideration in assessing both network augex and non-network CER-related expenditure, is uncertainty on the specifics of the energy transition over investment assessment timeframes of the order of 15 to 20 years. The energy transition and its impact on electricity networks will be driven by and leverage off technologies that will evolve and likely assist both technically and economically. Consumer behaviours as they adopt CER will also evolve. In our assessments we are therefore particularly cognisant of future uncertainties, the consequent value of retaining options to adapt as uncertainties resolve, and the potential regret that could arise from over-investment if based on a false perspective of future certainty.

2.1 Energy transition

2.1.1 Network investments and the transition to renewables and storage

27. The NEM is experiencing a significant transition away from reliance on thermal generation towards renewable generation and storage. This is supported by the Powering Australia Plan including reducing emissions by boosting renewable energy.

28. As a result, the location of these larger renewable energy sources is also shifting to be more geographically distributed and diverse. This will require a substantial investment in transmission infrastructure to enable connection of these new technologies and to facilitate benefits for consumers by way of a lower cost of electricity.

29. At the same time, there has been significant growth in distributed energy resources led by roof-top solar. Customers are now more engaged with their energy system, which is demanding different services in terms of their ability to supply, consume and trade energy. This has implications for investments in energy infrastructure, and digital applications and infrastructure to support changes in how the energy system is used.

30. The transition is being driven by a number of forces, including decarbonisation and 'net zero' emissions policies. Not only will this result in investments in new technologies, but there is also likely to be significant changes in the costs of such technologies, consumers' interactions with these technologies and the services provided to consumers by DNSPs, by electricity retailers and potentially by other parties (including 'aggregators').

31. We have necessarily undertaken our review in accordance with the current planning and regulatory framework. Nevertheless, to the extent that benefits are based on an assessment of future energy systems, or a projection of a future climate scenario, it is necessary to consider the likelihood of continuing changes to technologies and also changes to the regulatory and planning framework that may affect justification for projects of this type.

2.1.2 Definition of CER/DER

32. Distributed energy resources (DER) encompass a range of consumer level technologies used by households and businesses, such as inverter connected generation and storage systems (IES) which include solar photovoltaic (PV) and battery energy storage systems (BESS), energy management systems (EMS), controllable loads, and electric vehicles (EV) and their charging points.[1]

33. Consumer energy resources (CER) is often used interchangeably with DER although we note that AEMO considers that DER encompasses both CER (behind the meter resources at a consumer's premise) and distribution connected energy resources, including for example, neighbourhood batteries.'[2] Although Essential Energy tends to use CER in its relevant documentation, we refer to CER and DER interchangeably in this document.

2.1.3 CER developments and the regulatory landscape

34. In its Post-2025 Market Design Review, the Energy Security Board (ESB) developed a DER Implementation Plan ('Plan') to support the effective integration of DER and flexible demand. Three horizons were included in the Plan, with phasing in of DOEs over 2022-2025 included as a long-term feature of the NEM DER 'ecosystem' among other things.[3]

Figure 2.1: Recognition of the need for transition to a 'two-sided market'

Energy Security Board, Clean and Smart Power in the New Energy System:

> *'Coordination or management of distributed energy resources is important to keep the system safe and stable so everyone can use energy as they wish to do so.'*
>
> *'Now more consumers are buying and producing their own power. They might choose to produce to use; they might want to sell back to the grid.*
>
> *All this is made possible by renewables technology – with people putting solar PV on their rooftops, and turning on smarter home devices like air conditioning, hot water systems and pool pumps.*
>
> *We are seeing the start of a two-way market. With all the right technical and security settings under the hood, advances in technology digital technology can enable appliances and systems to talk to each other securely.'*

Source: Energy Security Board, Clean and smart power in the new energy system, final report (July 2021), page 3

[1] Based on AEMO 2019, *Technical Integration of Distributed Energy Resources*, p10

[2] AEMO, submission to AEMC regarding the draft report *Consumer Energy Resources Technical Standards Review (EMO0045)*, 25 May 2023, p2

[3] ESB 2021, DER Implementation Plan – Three Year Horizon

35. The Australian Energy Market Commission (AEMC) made a rule determination in 2021 to introduce technical standards that will enable distribution network service providers (DNSPs) and the Australian Energy Market Operator (AEMO) to better manage the growing number of micro-embedded generators connecting across the national electricity market (NEM).

36. In making this final rule determination, the AEMC stated that '*…[it] recognises the importance of promptly addressing the concerns of AEMO and the Energy Security Board (ESB) about the impact significant growth in distributed solar PV connections can have on networks and the electricity grid. In particular the final rule focuses on the ability and role DER in managing voltage disturbances.*'[4]

37. Throughout this report, the term 'compliance' is used to capture the technical settings requirements across the supply chain. This broad term is intended to encapsulate the requirements at manufacture to Standard, setting selection at install, and ongoing behaviour after install. Primarily, compliance is in respect of AS/NZS4777.2, which is a standard for the grid-connection of small-scale inverters. AEMO put forward a review to raise the performance requirements, with a major focus on improving the inverter's disturbance ride-through capabilities. The new Standard AS/NZS4777.2:2020 was published on 18 December 2020, and became mandatory for all new installations in Australia one year later.[5]

38. The key features of the final rule are:[6]

- *'The creation of DER Technical Standards which embedded generating units connecting to a distribution network by way of a micro EG connection service must comply with*
- *DER Technical Standards that include the requirements set out in AS 4777.2:2020 as updated from time to time*
- *A requirement that model standing offers for basic connection services for embedded generating units include that embedded generating units the subject of the basic micro EG connection service must be compliant with the DER Technical Standards*
- *An obligation on DNSPs that the information to be provided to connection applicants in order for them to negotiate a connection contract must include the requirement that if the connection applicant is proposing to connect a new or replacement embedded generating unit by way of a basic micro EG connection service, that the micro embedded generating unit must be compliant with the requirements of the DER Technical Standards*
- *A requirement that the minimum content requirements of connection offers under Schedule 5A.1 to the NER must include the requirement that if the connection applicant is proposing to connect a new or replacement embedded generating unit by way of a basic micro EG connection service, that the embedded generating unit the subject of the connection application is compliant with the DER Technical Standards.*
- *The DER Technical Standards will apply only to new connections and replacement inverters and connection alterations (including upgrade, extension, expansion or augmentation)*
- *The rule [commenced] on 18 December 2021, approximately 10 months after it [was] made, to allow for the implementation of the new requirements*
- *Transitional provisions have been included so that if before the commencement date of the rule:*
  - *a connection applicant in relation to a basic micro EG connection service has made a connection application but not received a connection offer, the new Chapter 5A will apply to that connection offer and connection contract*
  - *if a connection applicant in relation to a basic micro EG connection service has received a connection offer from the relevant DNSP but has not yet entered into a*

[4] AEMC 2021, *Rule determination Technical Standards for DER*, pi

[5] AEMO 2023, *Compliance of DER with technical settings, p3*

[6] AEMC 2021, Rule determination Technical Standards for DER, pi, ii

connection contract, the old Chapter 5A will apply to that connection offer and connection contract.'

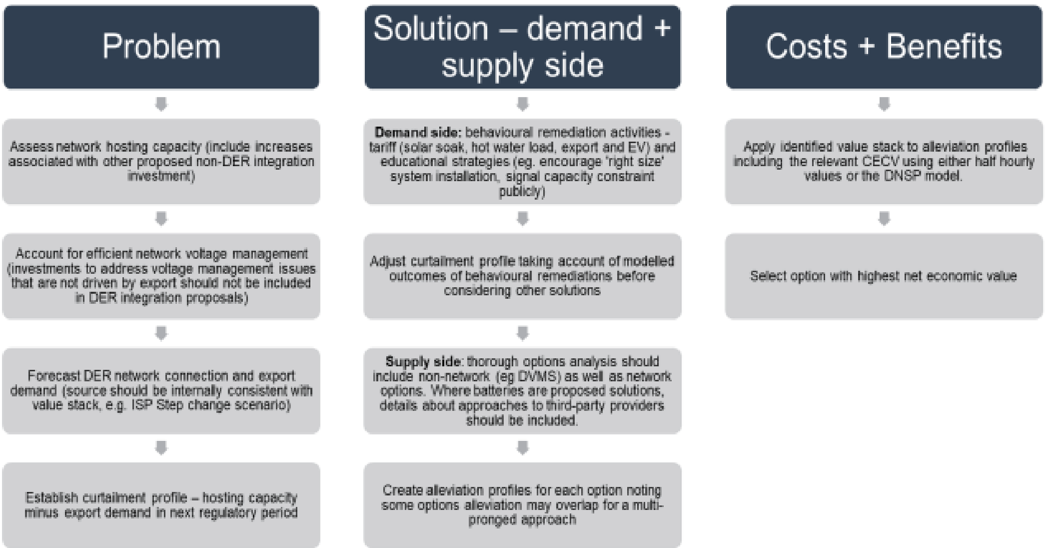
2.2 Our framework for assessing proposed CER-related expenditure

2.2.1 Relevant AER Guidelines

39. The AER has noted that as *'DER penetration levels increase and customer expectations with respect to DER use evolve, [DNSPs] are responding by investing in projects aimed at increasing DER hosting capacity and supporting a broadening range of DER services.'*[7]

40. The AER published a 'DER integration expenditure guidance note' in mid-2022. It is designed to help DNSPs work through the process of developing DER integration plans and expenditure proposals. The figure below summarises the process.

Figure 2.2: AER's process for developing DER integration investment proposals



Source: AER 2022, DER Integration Guidance Note, Figure 1.1

41. Our assessment follows this sequence in that we have first assessed Essential Energy's problem definition, then its proposed solutions and finally its cost benefit analysis.

42. The following AER and industry rules and guidelines are also particularly relevant to our assessment:

- CECV methodology, Oakley Greenwood, report to AER (June 2022). This includes our consideration of matters raised by Houston Kemp in its submission on behalf of Energy Networks Australia, and Oakley Greenwood's response to that submission in its report; and
- Rule determination on National Electricity Amendment (Technical Standards for Distributed Energy Resources) Rule 2021, AEMC, (25 February 2021).

2.2.2 Taking account of uncertainty in considering network investments

43. Given the factors described above, and the reality that network investments tend to be both capital-intensive and attract long technical / economic lives, it is particularly necessary to consider option value in assessing deep investments into the electricity network.

7 AER 2022, DER Integration Guidance Note, page 4

44. Considerations of option value and the timeframe over which benefits are adequately able to be modelled, can help to ensure that any network investment is prudent and efficient in accordance with the regulatory objectives. This in turn helps in meeting the objective of ensuring that consumers do not end up paying the risk costs of projects that are developed earlier than required or which become stranded or 'regretted' due to changes in the electricity market, energy system, climate and the technologies deployed there.

2.2.3 Taking account of uncertainty in considering non-network CER-related investments

45. In considering economic business cases for CER-related expenditure, we are particularly cognisant of two factors:

- For the most part, the required investments are relatively short-lived, involving the development and integration of information systems and obtaining the information from those systems to enable the provision of new services to customers and the continuing prudent and efficient provision of existing services; and
- CER and the use of electricity in residential premises will both be strongly influenced by technological and consumer changes. While the pace and exact nature of such changes is a matter for conjecture, it is likely to involve reducing costs and increasing capacities for local storage, increasing uptake of EVs, increased electrification within households, and increased capability to integrate between and to orchestrate CER with in-home usage.

46. These factors, and their uncertainties emphasise the value of agility and optionality in considering CER 'solutions' and the disadvantage of solutions that may result in material regret through over-investment based on an unrealistic view of future certainty. While it is important to undertake a degree of preparation for the future, the nature of non-network solutions to CER lends itself to taking a relatively agile approach that can leverage off technological and consumer behavioural changes as they become evident. An example of this is likely to be the way in which some combination of increasing EV uptake (with or without the addition of V2H and V2G capabilities), more cost-effective options for higher capacity home batteries and increased controlled electrification of storage hot water, may significantly reduce the incidence of PV exports and their impact on DNSPs' LV systems.

47. In undertaking our assessments in this report, our consideration of these factors has led us to be wary of business cases that involve significant investments over the next regulatory period on the basis that they will solve supposed issues that will become evident or significant in 10 to 20 years' time. There is a balance to be struck between prudent preparation and the potential for over-investment that may burden consumers with costs that turn out to be excessive or not to be needed for a cost-effective energy transitions.

3 REVIEW OF PROPOSED CER EXPENDITURE

Essential Energy has proposed an SCS expenditure allowance for CER, totalling $119.7m over the next RCP. This comprises $88.0m capex and an opex step change of $31.7m. Essential Energy proposes a program that will provide it with increased network visibility and a 'basic' DOE service through to 2032, after which it expects to deploy 'advanced' DOE services. Most of the proposed capex is for ICT and program management, with other amounts proposed for network capex and network visibility. Its direct cost opex i.e. after excluding network and corporate overheads) is for licences and to acquire data.[8]

While we consider that Essential Energy has reasonably demonstrated that there is a need for it to undertake progressive interventions to assist in facilitating increasing DER, we consider that it has overstated its required expenditure in the next RCP. In particular, we consider that it has overestimated the [redacted] ICT project (capex and opex) that it proposes for its Network of the Future initiative and we observe that this is several times greater than other DNSPs that are currently under review, have proposed.

Based on our assessment of input assumptions, we consider that Essential Energy has not demonstrated that its proposed program will provide a net economic benefit. The key factors for our finding are that Essential Energy has overestimated the level of investment that is warranted in the next RCP and overestimated benefits in the distant future in seeking to justify those projects. We consider that the CER projects that Essential Energy has proposed are over-scoped and therefore overstated relative to the level of investment that is justified, and that they are proposed too far in advance of when Essential Energy proposes to deploy them at scale, and therefore to realise sufficient benefits.

3.1 What Essential Energy has proposed

3.1.1 Overview and summary of proposed expenditure

Proposed CER capex and opex step change

48. Essential Energy has proposed CER-related totex of $119.7m, comprised of capex of $88m and a related opex step change of $31.7m for the next regulatory period, as shown in Table 3.1.

8 Refer to Table 3.8

Table 3.1: Essential Energy proposed CER related expenditures - $million, real FY2024

Description	2025	2026	2027	2028	2029	Total
CER export services capex	18.0	18.0	18.0	17.0	17.0	**88.0**[9]
CER/Data Enablement – opex step change	5.7	5.7	5.7	7.6	7.0	**31.7**
CER proposed SCS totex for assessment	**23.7**	**23.7**	**23.7**	**24.6**	**24.0**	**119.7**

Source: Essential Energy RP document page 69 and Att. 9.03.07 Opex model

Business case

49. Essential Energy's business case report provides five-year cost assumptions totalling $146.9m, comprising $92.4m capex and $51.8m opex, as shown in Table 3.2.[10]

Table 3.2: 5-year estimates of CER for the next RCP $million, real FY2024

Description	2025	2026	2027	2028	2029	Total
ICT & program management	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Network visibility	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Network	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Capex Subtotal	**28.17**	**17.76**	**10.86**	**12.56**	**23.08**	**92.43**
Non-network	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Network overhead	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Corporate overhead	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Opex Subtotal	**10.57**	**9.37**	**9.28**	**11.01**	**11.52**	**51.75**
GRAND TOTAL [1]	38.76	**27.21**	**20.27**	**25.58**	**35.04**	**146.87**

Source: Attachment 10.05 Future Network Business Case, Table 11;

[1] The totals in this row do not correspond exactly to the addition of the capex and opex subtotals, nonetheless, this table replicates the source figures.

50. In response to IR#015, Essential Energy explains that the differences between tits proposal and the business case information result from different inflation assumptions that it applied in its business case, from an allocation of total costs between SCS, ACS and unregulated services and the inclusion of network and corporate overheads in its opex forecast.

Expenditure in Essential Energy's CBA

51. In the Future Network Cost Benefit Analysis (CBA) model that Essential Energy provided[11], the totex over the next regulatory period sum to [redacted], comprising [redacted] capex and [redacted] opex. We have necessarily used these figures where we refer to CBA of the proposed program; however any conclusions that we draw on the program should be related to the amounts that Essential Energy has proposed in its regulatory submission, being the amounts referenced in Table 3.1 for SCS expressed in $real FY2024.

CER expenditure included under proposed ICT

52. The non-recurrent ICT capex for the 'Future Networks Strategy' is shown as [redacted] capex and [redacted] associated ICT opex in Essential Energy's proposed ICT expenditure allowance, as we show in Table 4.2. We assess this program as part of our assessment of CER in the current section and we propose any consequent adjustments to CER-related ICT expenditure as part of our assessment in section 4.9.

9 A figure of $86.6m is shown in Essential Energy's SCS capex model, and on this basis the CER totex would be $118.3m.

10 The numbers in the table differ from those shown in the table in the Executive Summary of the Att. 10.05 Future Network Business Case Overview, page 4 ($92.6m capex and $54.4m opex = $147.0m totex)

11 10.05.01.02 Future Network CBA, January 2023

3.1.2 Summary of the drivers for Essential Energy's proposed CER program

Essential Energy is experiencing increasing power quality issues from CER

53. Essential Energy has identified an increasing 'penetration' or volume of CER being connected - primarily to its low voltage (LV) network. Increasing numbers of CER in turn leads to increasing levels of reverse power flow[12] which causes over-voltages[13] at times of low demand and can also lead to thermal overloading[14] of network assets.[15]

54. Over-voltages in the local network are experienced by customers' premises and can lead the inverters within the PV to trip off.[16] This in turn is leading to increasing power quality issues on Essential Energy's LV network, and which is reflected in an increasing number of power quality complaints and increasing expenditure/resources to rectify.

55. Essential Energy also expects that more CER devices will result in more coordinated behaviours from customers, less diversification of peak demand, and reduced ability to forecast system needs.[17]

> *'While our network has some inherent capacity to accommodate exports, that capacity is being reached as more and more customers export ever-growing amounts of energy. As such we now need to invest to manage this modern network challenge.'*[18]

Essential Energy has developed a CER Integration Strategy

56. Without investment in increasing the CER hosting capacity of the network ('hosting capacity'), Essential Energy forecasts increasing system constraints and curtailment of exports from CERs. Based on feedback from its customers, rather than continue to invest solely in traditional network augmentation to increase the hosting capacity, Essential Energy has developed an approach that combines:
    - Implementation of dynamic operating envelopes (DOE); and
    - Network solutions including HV/LV reinforcement, distribution transformer upgrades, voltage control and regulation settings, and community BESS.

57. Essential Energy engaged with a number of external parties to develop its DER Integration Strategy, as shown in the figure below. In the next section, we consider each of the elements in our assessment of the reasonableness of Essential Energy's proposed CER expenditure in the next RCP.

[12] Customers can export CER generation that is in excess of the demand of their respective premises, leading to power flowing from the customer to the network rather than the 'normal' supply of electricity from large generators through the network to end-customers

[13] Voltages above (over-voltage) or below (under-voltage) limits prescribed to help ensure acceptable power quality

[14] Loading of network assets beyond the rated current-carrying capacity of network elements

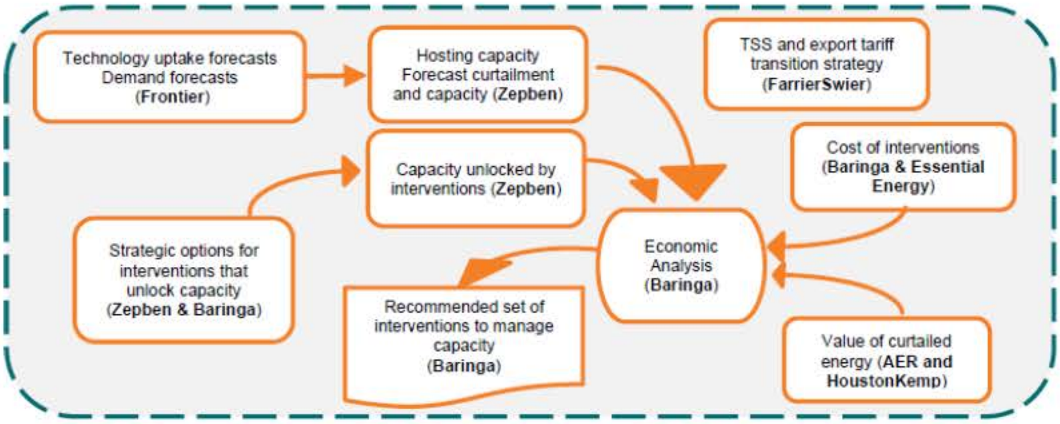
[15] Based on Essential Energy, Slide 5 On-site presentation

[16] The inverter settings should comply with the relevant version of Australian/New Zealand Standard 4777, but as discussed later, many inverter systems do not comply

[17] Based on Essential Energy, slide 5 On-site presentation

[18] Essential Energy, Att 7.01 DER Integration Strategy 2024-29, page 3

Figure 3.1: Essential Energy's approach to building its CER integration strategy



Source: Essential Energy Att 7.01 DER Integration Strategy – Jan23, p4

3.1.3 CER-related investment in the current regulatory control period

58. Essential Energy is currently investing in improving the customer connection process, increasing network visibility, increasing hosting capacity, and technology and tariff trials. The actual and forecast expenditure for the current RCP is shown in the table below.

Table 3.3: Actual and forecast DER integration expenditure for the current RCP ($m, FY24)

Category	2020	2021	2022	2023	2024	Total Current RCP
Capex	7.3	5.7	7.1	7.9	8.3	**36.3**
Opex	2	2.5	2.4	2.3	5.2	**14.4**
Total	**9.3**	**8.2**	**9.5**	**10.2**	**13.5**	**50.7**

Source: Essential Energy 2023, 7.01 DER Integration Strategy 2024-29, p13

3.2 Assessment of Essential Energy's CER problem definition

59. The potential drivers for investments to accommodate increased CER relate to voltage management issues and the ability to host customer exports. These are functions of the network's inherent hosting capacity, assumptions regarding the future increases in CER and other factors that might mitigate the effects of such increases, and the way in which the network is managed to accommodate these. A key outcome from this aspect of the assessment is the extent to which exports may be curtailed as part of such voltage management.

60. In this section we consider the steps Essential Energy (with its advisor, Zepben) has taken to establish its future export curtailment profile, being the hosting capacity[19] less the export demand over time. Of particular focus is the next regulatory period, but as discussed in section 3.4, Essential Energy and Baringa conduct a cost-benefit analysis over a 20-year period.

19 Defined by the AER as *the ability of a power system to accept DER generation without adversely impacting power quality such that the network continues to operate within defined operational limits (without experiencing voltage or thermal violations)*

3.2.1 Essential Energy's derivation of its hosting capacity

Essential Energy's assumptions on its hosting capacity

61. As shown in Figure 3.1, Essential Energy's assessment of its network hosting capacity was undertaken in conjunction with Frontier Economics ('Frontier') and Zepben, with the latter leading the analysis. Zepben describes the approach as follows:

> *Each feeder was modelled in OpenDSS*[20] *using a continuously connected MV and LV network, with the real and reactive power inputs supplied from each of the approx. 850,000 connection points in the mode, with the load flow studies incorporating the following:*[21]

- *A baseline study to confirm each feeder model was calculating voltage and power correctly…*
- *A base year assessment of current network voltage issues and thermal constraints across the entire network*
- *15-year forecast of voltage and thermal constraints under a set of forecast future DER scenarios.'*

Our assessment of Essential Energy's analysis of its hosting capacity

Zepben's network model and load flow study capability is adequate for the purpose

62. Essential Energy provided two artifacts for us to review pertaining to Zepben's development of the hosting capacity model: its report and the related cost-benefit analysis.

63. The report provides a detailed description of the three steps to developing the model: data acquisition, model development and validation; base case validation, and the hosting capacity analysis itself.

64. The digital asset information required to develop a digital twin of the distribution network was provided by Essential Energy from its Smallworld GIS and contains the information we would expect.[22] Zepben's report explains the process used to develop the digital twin and how it used its Energy Workbench platform to provide the capability of running models representing 20 years of hourly real and reactive power flows (350,400 time series), covering three future network scenarios (discussed in section 2.2.4) for 1,456 feeders, a total of 600 million load flow studies.

65. We are satisfied that the model is fit for purpose.

Model validation was undertaken by University of Melbourne

66. The University of Melbourne was engaged to review several feeder models, through two iterations of the model development. This review resulted in '*several improvements to the production of the OpenDSS models and confirmed that OpenDSS was being used correctly for the load flow studies*.'[23]

67. Furthermore, Zepben describes the process it undertook to identify data scope and quality issues and the steps it took to remediate the LV data provided by Essential Energy. Data quality issues included missing data, incompatible connectivity data, and phase connections.[24]

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20 Open source Distribution System Simulator - an electrical power system simulation package for distribution systems

21 Zepben 2022, Hosting capacity Study, pages 11-12

22 Essential Energy provided 11 sets of inputs, including, for example, the 11,kV, 22kV, 33kV HV network model, the LV model, feeder demand profiles, distribution transformer tap settings and impedance, and zone substation voltage regulation and source impedance

23 Zepben 2022, Essential Energy Hosting Capacity Review, page 12

24 Zepben 2022, Essential Energy Hosting Capacity Review, pages 21-26, 66, Table 5

68. The residual limitations are likely to have some effect on the model outputs, with some of the approximations likely to overstate DER impacts and some likely to under-state the impacts.

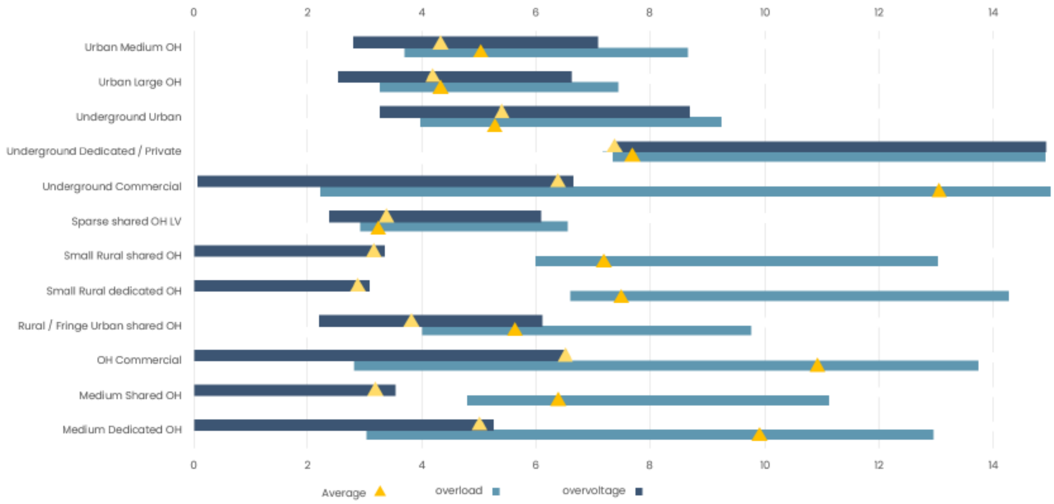
69. Overall, we are satisfied that Zepben took reasonable steps to ensure the network data was fit for purpose.

Essential Energy's hosting capacity model provides hosting capacity results over a 15-year study period

70. The objective of the modelling is to assess at what load levels and levels of CER penetration voltage violations against the prescribe AS4777 limits occur over time, with the particular focus on the next RCP. As shown in the figure below, Zepben's analysis forecasts that all feeder types will reach sustained overvoltage thresholds in the next RCP. Solar hosting capacity is defined in the next RCP by voltage limits rather than thermal overload, at least within the next RCP.

71. As shown in the figure below, the average constrained over-voltage triggered export levels for the various feeder types as calculated by Zepben lie within a range of approximately 2.8kW to 7.2kW, with the preponderance of constraints manifesting in the range of approximately 2.8kW to 4.2kW solar export. The current export limits are 3kW (rural connections) and 5kW (urban connections).[25]

Figure 3.2: Zepben forecast solar hosting capacity by feeder type (kW)



Source: Essential Energy – 10.05.01.01 Draft Future Network Business Case – Baringa – Jan 23 – Confidential, Figure 19

72. Of these clusters, 65% of Essential Energy's network is comprised of small rural dedicated overhead feeders (45%) and small rural shared overhead feeders (20%) with the largest proportion of the remainder being medium shared overhead feeders (11%).[26]

73. Zepben's analysis shows that these average export limits are reached within the next RCP for all feeder types (per Figure 38 in the Zepben report). With the exception of the issue raised below regarding the modelling overvoltage limit assumption, Zepben's published results from its modelling provide a reasonable basis for (i) determining the curtailment profile, and (ii) for evaluating options for alleviating curtailment.

74. It is also clear from the hosting capacity results that thermal overloads are likely to be less problematic until the following RCP and beyond when EV penetration rates are forecast to be significant, increasing rapidly from a relatively low 2023 base (as discussed further below). It is likely that unconstrained charging of EVs would (if it were to occur) lead to much

[25] Whilst Essential Energy has stated these limits, in its CBA model these are set at 6.62kW and 4.62kW respectively

[26] Zepben 2022, Essential Energy Hosting Capacity Review, Table 2

higher numbers of constrained feeders over time, particularly in the outer years of the study period.

The trigger point for over-voltage is set too low for new PV inverters

75. With the exception of the overvoltage setting, the modelling assumptions appear to be reasonable.[27]

76. Essential Energy has set the volt-watt overvoltage limit at 253 volts for greater than 1% of the year to define 'sustained' overvoltage. This is consistent with the 2015 version of AS/NZS 4777-2 settings[28] and is appropriate given that the majority of the PV inverters currently in Essential Energy's network are likely to have been installed when the prevailing limit was 253V.

77. However, two factors indicate that this is a conservative limit and would tend to under-estimate the hosting capacity:

- The overvoltage limit under the revised 2020 version of AS4777 is 258V (10 minute average) although the volt-watt ramp down of output triggers from 253V; and
- Whilst a large proportion of installed PV inverters are currently non-compliant with the 2015 standard, this will be progressively addressed as old systems are upgraded/replaced, which will increasingly be the case during the next RCP.

78. Therefore, under-estimation of the average hosting capacity due to the overvoltage setting is likely to less of an issue during the early years of the next RCP but will likely tend to over-estimate curtailment in the latter years of this decade and beyond. 253V is a conservative trigger for assuming curtailment for inverters installed under AS 4777.2:2020 given the volt-var and volt-watt settings described above and this would have the effect over over-estimating the extent of curtailment. We consider that 258V is a more appropriate setting.

3.2.2 Network voltage management

Essential Energy's modelling accounts for distribution transformer tap settings

79. The Zepben report identifies that[29] only 20% of Essential Energy's distribution transformers have been fully or partially adjusted to target the 230V nominal voltage standard defined by the current AS60038 standard and that this adjustment has been included in the model.[30]

80. This confirms that in practice there is considerable scope for retrospectively addressing distribution transformer settings, albeit that not all such adjustments will be sufficient of themselves to provide sufficient incremental hosting capacity to avoid curtailment.

Essential Energy does not plan to directly address non-compliant solar inverters as a means of improving hosting capacity for all

81. Addressing non-compliant solar inverters would have the twin effect of increasing available hosting capacity and creating a more equitable distribution of the available hosting capacity. However, Essential Energy is relying on the introduction of DOEs to help address non-compliance and, we assume, rely on replacements/upgrades of non-compliant systems to bring them into compliance with AS4777:2020 standards. Our understanding is that Essential Energy does not have the jurisdictional role or authority to undertake a program of retrospective compliance action, however we expect that a prudent operator would seek o improve compliance levels for new installations in order to minimise or defer the need for new investments to achieve the same result.

27 As descr bed in Zepben 2022, Essential Energy Hosting Capacity Review, sections 2.6.6 and 2.6.7

28 In which a range of between 244V – 258V (10 minute average trip) was 'permitted'

29 Zepben 2022, Essential Energy Hosting capacity Report, pages 34, 48

30 The remainder are still set in accordance with the obsolete AS2926, with a nominal low voltage standard of 240v +/-16% for single phase network and 415v +/- 6% for three phase networks

The voltage management issues modelled can be reasonably considered to arise from CER

82. The intention of this process check in the AER's guidance to DNSP's is to ensure that investments to address voltage management issues that are not driven by export are not included in the proposed DER integration expenditure.

83. Essential Energy has only made a relatively small inroad into its program of adjusting distribution transformer tap changer settings. However, the progress to date has been included in the Zepben model, as has adjusted voltage regulation float voltages.

84. The AER points out that '*DER is not the sole driver of high voltages…*',[31] however Zepben's analysis concludes that 83% of network sections with over voltage events incurred the over-voltages during peak solar generation hours (10am-4pm).[32]

85. We are satisfied that the Zepben model derives what can be considered as 'the intrinsic hosting capacity of the network'.

3.2.3 Forecast network connection and export demand

Essential Energy's forecasts

86. To provide the basis for the hosting capacity estimates and the consequent curtailment profile over time, forecast of future consumer behaviours were input to Zepben's model. Essential Energy engaged Frontier Economics to derive the underlying load data, electrification, and DER forecasts, as shown in Table 3.4.

87. The following inputs were included in the models:

Table 3.4: Forecasts and underlying data applied

Zone substation (ZS) level underlying demand forecast	ZS level electrification forecasts	PV panel capacity forecasts by ZS	Installed consumer BESS numbers by ZS
Registered EVs by type per ZS	Residential and commercial EV charger demand profiles	PV generation profiles	BESS charging profiles

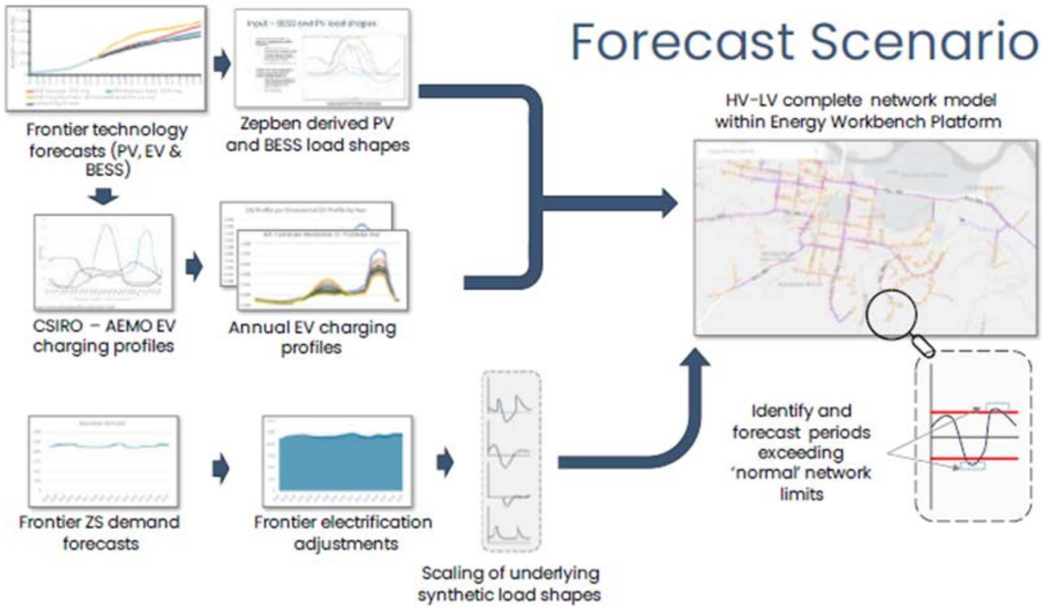
Source: Essential Energy – 7.01.01 Hosting Capacity Report, p13

88. Zepben combined the inputs to form three scenarios of future network performance, using the process illustrated in Figure 3.3.

31 AER DER integration guidance note, page 12

32 Zepben 2022, Essential Energy Hosting Capacity Report, page 47

Figure 3.3: Zepben's approach to combining inputs to form network performance scenarios



Source: Essential Energy – 7.01.01 Hosting Capacity Report, p14

Our assessment

Essential Energy's modelling includes reasonable estimates of forecast network connection and export demand

89. The process illustrated in Figure 3.3 is described in Zepben's report. It is beyond the scope of our assessment to consider the derivation of these forecasts, however we note that:

- Frontier Economics' modelling of current and future demand draws on AEMO 2022 ISP, with the Step Change scenario used as the basis for its 'Central case', which is consistent with the AER Guidance Note:

  'We adapt AEMO's forecasts of technology-induced drivers to develop forecasts for Essential Energy's service area which reflect the best publicly available information, are internally consistent and facilitate scenario analysis'[33]

- Essential Energy's current rooftop solar PV penetration level is 26% which, based on our experience, is around the level at which solar hosting capacity constraints start becoming more widespread leading to increases in rooftop PV tripping (curtailment) and customer complaints;
- It is reasonable to conclude that rooftop solar output creates the most immediate impact on hosting capacity, contributing to minimum system demand, overvoltages, and hosting capacity deterioration over time;
- Zepben (via Frontier Economics) has included what it refers to as favourable modelling assumptions, including 'a trend away from convenience charging and system wide levels of peak charging diversity occurring down into the distribution network';[34] and
- BESS growth is also expected to accelerate over the next RCP from a very low base, being paired with rooftop solar as unit prices continue to decline and as discussed below, in response to tariff signals.

[33] Frontier Economics 2022, 11.01 Forecasts of customer numbers, energy consumption and demand, page 22

[34] Zepben 2022, Essential Energy Hosting Capacity Report, page 9

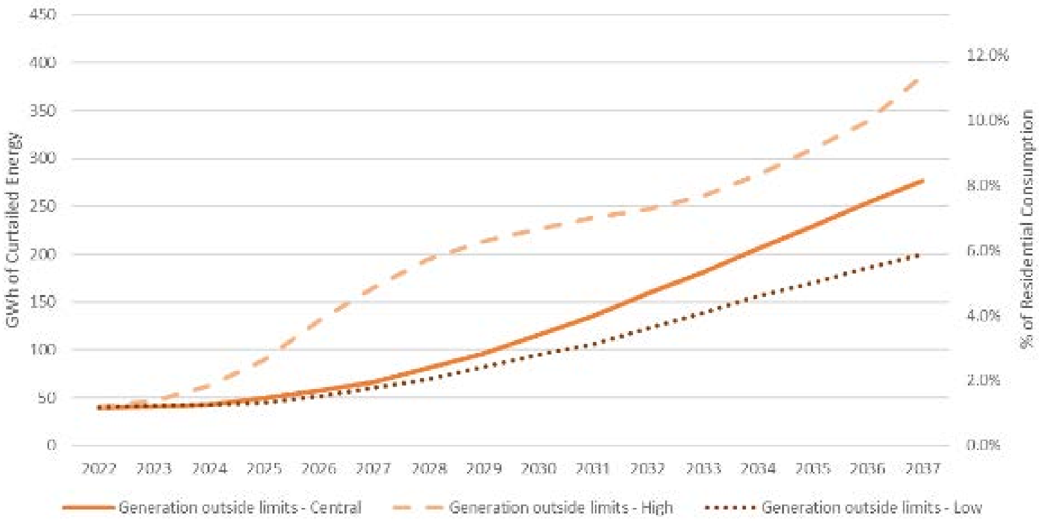
3.2.4 Derivation of a curtailment profile

Essential Energy's derivation of a curtailment profile

90. Figure 3.4 shows the results of Zepben's derivation of the curtailment of forecast CER generation over the study period. The Central forecast is based on the ISP Step change scenario, the Low forecast is based on the ISP Progressive change scenario, and the High forecast is based on the ISP Strong Electrification scenario.

91. According to the results, energy curtailed is forecast to more than double over the next RCP, albeit from a low base, to around 3.5% without intervention. With the High case energy curtailment is forecast to increase by 2029 to around 7% in the absence of any intervention.

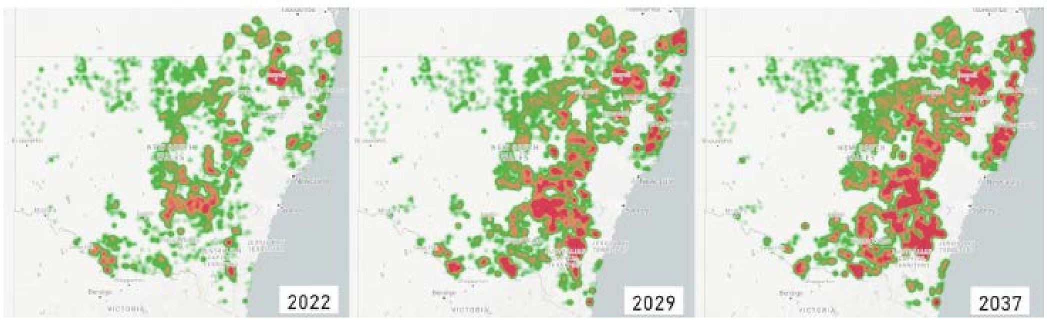
Figure 3.4: Zepben's forecast of generation curtailment under ISP 2022-based scenarios



Source: Essential Energy – 10.05.01.01 Draft Future Network Business Case – Baringa – Jan23-confidential, figure 22 Hosting Capacity Report, figure 22

92. Figure 3.5 shows the progression from localised over voltage events in 2022 to broad based over voltage events by 2037, according to the modelling.

Figure 3.5: Heatmap of increase in pre-intervention over voltage events over the study period



Source: Essential Energy – 10.05.01.01 Draft Future Network Business Case – Baringa – Jan23-confidential, figure 22 Hosting Capacity Report, figure 21

Our assessment of Essential Energy's forecast curtailment profile

The process for determining the curtailment profile is largely consistent with the AER's guidance note

93. The curtailment forecast is determined by aggregating the deterministic assessment of the energy flows outside of the voltage thresholds (216V to 253V) or reverse network flows above normal thermal limits over the year.

94. Given our earlier comments regarding the process for deriving the hosting capacity over the study period our primary concern remains that the curtailment energy may be overstated somewhat in the last 10 years of the study period due to the conservative overvoltage limit setting in the model (i.e. 253V).

A 1.5kW export limit is assumed to apply in the base case from 2030 and creates a major step change in curtailment energy

95. Currently Essential Energy's export limits are static export limits of 5kW for urban customers and 3kW for customers in rural areas.[35] Essential Energy has planned for these static limits to be reduced to 1.5kW from 2030 and to apply to all low voltage customers.[36]

96. If such a change was made, it would represent a material reduction from the current static export limits. As discussed in section 3.4.5, this assumption has the effect of causing a significant step change in the curtailment energy in the counterfactual. Essential's rationale for this change to its Connection Policy is that it is consistent with customers' preferences.

97. We note from Essential Energy's report on its customer and stakeholder engagement that with respect to the 'free export limit' of 1.5kW (i.e. the point beyond which customers will be charged for exporting from their CER) it states:[37]

> *'There was no clear finding on the free export limit from the customer forums. Stakeholders thought we should base this on the technical limits of the network.*
>
> *Our future network business case indicates that our network can accommodate 1.5 kilowatts (kW) of exports from each customer across our network on a postage stamp basis and this has been incorporated into this Proposal.*

98. While Essential states in its engagement document[38] that customers' preference was to apply export prices on a postage stamp basis (69%), this approach:

- Will have the effect of urban customers subsidising rural customers; and
- May result in an unnecessarily low static export limit given the uncertainties inherent in the hosting capacity modelling (i.e. the modelling results are based on input assumptions that are only conjectures about future customer behaviours and technologies and the interactions between them).

99. It is not clear whether stakeholders were made aware of these consequences and, if so, if this would have led them to change their responses. In any case it could be considered to conflict with the response that it should be set based on technical limits which inherently vary across the network. Moreover, the assumed reduction is not consistent with AER's guideline, which requires that the counterfactual is based on current policy settings.

100. We consider that Essential Energy has not adequately justified this assumed export limit reduction and that its analysis consequently overstates the benefits of DER.

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35 While Essential Energy has stated these limits, in its CBA model these are set at 6.62kW and 4.62kW respectively

36 Essential Energy- 7.01 DER Integration Strategy 2024-29, page 22

37 Essential Energy – 4.02 How engagement informed our proposal -Jan23 – Public, page 11

38 Essential Energy – 4.02 How engagement informed our proposal -Jan23 – Public, pages 48, 66

The impact of DER on curtailment changes over time

101. Zepben observes that the modelled increase in electricity demand from the uptake of EVs beyond 2030 will lead to local network areas experiencing an acceleration in voltage non-compliance due to widening swings in network demand. The dual trend of increasing peak generation from CER (during the day) and increasing local peak demand from EV charging (overnight) results from the analysis and provides a challenge for DNSPs to address without adequate visibility of their LV network (as discussed below)

Essential Energy has demonstrated that there is a reasonable need for investment in DER integration within the next RCP

102. The AER's Guidance Note requires the DNSP to identify a problem with integrating DER which requires investment in the next RCP (and possibly beyond).

103. Essential Energy in conjunction with its consultants has demonstrated an understanding of its network's ability to accommodate the forecast uptake of DER, as evidenced by its assessment of network hosting capacity and the consequent curtailment profile.

104. The assessment provides an estimate of the curtailment profile that, although overstated, nonetheless reasonably allows the conclusion that some interventions are required to at least maintain the current level of connection service during the next RCP. As discussed in section 3.4, Baringa (for Essential Energy) undertook a cost-benefit analysis (CBA) over a 20-year period. In our assessment of the CBA methodology and results, we comment on the inherent uncertainties with predicting the curtailment and alleviation profiles that far into the future.

3.3 Assessment of Essential Energy's proposed solutions

3.3.1 Proposed demand side solutions

What Essential Energy has considered

105. The model derives the solar hosting capacity benefit of the demand side interventions described in the table below.

Table 3.5: Identified demand side solutions

Intervention	Description
Innovative tariffs	New tariffs that are designed to influence customer export and consumption behaviour to help minimise PQ issues and increase network utilisation
Education	Teach customers about how they can help to minimise PQ issues and increase network utilisation
Flexible connection agreements	Incorporating dynamic operating envelopes (DOE)[39] or static export limits to manage demand and improve network utilisation

Sources: Essential Energy 2023, DER Integration Strategy, p14-15

39 DOE is a variable (dynamic) allocation of the available hosting capacity to individual or aggregate CER or connection points within a segment of the distr bution network in each time interval

Our assessment of Essential Energy's identified demand-side solutions

Network tariffs are a low cost means of integrating DER

106. Essential Energy currently has tariffs designed for retailers and aggregators, which comprise a time-of-use (TOU) tariff and a flat rate tariff. It proposes introducing a Sun Soaker two-way[40] default tariff for new smart meter customers in the next RCP. It includes:

- A charge for consumption from the grid based on peak pricing between 7am and 10am and between 3pm and 10pm; and
- A two-band charge for exports to the grid between 10am and 3pm (exports below 1.5kW are not charged) and a rebate for exports between 5pm and 8pm.

107. Essential Energy is currently trialling the Sun Soaker tariff and two other tariff components and consequently the results were not available for our review. Nonetheless, the proposed tariff structure is consistent with the objective of remediating customer consumption and CER export behaviour referred to in the AER's Guidance. Such tariffs should provide transparency to customers who are planning on investing or re-investing in DER. As noted by Essential Energy, the Solar Soaker and any other cost-reflective tariff requires significant penetration of smart meters to be effective (via retailers).

108. Baringa states that:[41]

> *'We used the the [stet] price signals from these innovative tariffs to estimate the change in customer behaviour (e.g. EV and battery charging during daytime hours) to shift consumption and 'soak up' a proportion of excess rooftop solar PV. We have incorporated this demand-side solution as part of our CBA to adjust for the impact of the price signals on the alleviation profile.'*

109. Essential Energy observes that the data from the trials 'may also prove useful for … facilitating engagement with energy service providers on a broader range of non-network solutions that are beginning to emerge as new technology platforms enable aggregation of flexible loads such as hot water, pool pumps, air conditioning, and EV chargers.' [42]

110. We concur with this observation and consider that 'orchestration' or coordination of behind-the-meter CER consumption and export with supply-side facilities such as community batteries and third-party aggregators (or VPPs[43]) will be an important factor in reducing the need for network augmentation to manage increasing CER penetration over time. Trials are underway in most Australian states[44] to build experience with DER integration, including tariff trials.

Customer education is also a low cost means of assisting with DER integration

111. We consider that it is reasonable for Essential Energy to invest in educating customers to consider such things as how and when they consume electricity and to right-size their rooftop solar to manage their electricity costs. We note that this intention aligns with the feedback from customers and stakeholders and the behavioural remediation objective outlined in the AER's Guidance Note.

Essential Energy considered three timing options for implementing advanced DOE. We consider that the option it has chosen (from 2033) is prudent

112. Essential Energy currently imposes static export limits '*based on maintaining integrity in all network conditions including during peak net export times (representing worst-case*

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40 Charge for both consumption and exports

41 Baringa 2023, Future Network Business Case, Table 1

42 Essential Energy, 7.01 DER Integration Strategy, page 19

43 A virtual power plant is an aggregation of DERs coordinated to deliver services for power system operations and electricity markets.

44 Refer to Figure 2, Alexander and Blaver 2021 Project Symphony: Vision and Impact Pathway

scenarios), which occur rarely.'[45] In addition to its current demand management techniques of controlled load, Essential Energy proposes investing in developing a 'basic' DOE capability and undertaking DOE trials in the next RCP.

113. The basic DOE capability is designed to address areas of the network where hosting capacity is most constrained and which Essential Energy claims can be developed with knowledge and systems available to Essential Energy now or which are readily obtainable.[46] However, as we have observed, Essential Energy nevertheless proposes to spend totex of $119m in the current period.

114. Essential Energy then proposes introducing advanced DOE, which requires a full network model, greater LV visibility, and enhanced ICT capability than required for implementing basic DOEs. This is not designated to commence until 2033.

115. DOEs will not increase the hosting capacity but rather allow maximum use of the existing hosting capacity (i.e. reducing curtailment events) by avoiding year round static export limits.

116. The CBA assumption is that the proportion of new connections adopting DOEs will increase from 5% in 2026 to 100% of new/upgraded systems by mid-2031. The apportionment of hosting capacity headroom is based on communicating allowable export to customers in 30-minute intervals, with initial DOEs based on typical days of voltage exceedance for CBA purposes. The upper DOE export limit is assumed to be 10kW for single-phase customers and 30kW for 3-phase customers.

117. These assumptions are reasonable, although the forecast ramp-up rate may be biased towards being optimistic and therefore exaggerating the benefit somewhat. Whilst the introduction of more cost-reflective pricing and education may encourage greater take-up of DOEs, other factors such as home energy management systems and the availability of demand/generation orchestration services from third parties may reduce the need for DOE.

118. These uncertainties are best addressed by sensitivity studies and deferring significant investments for as long as practicable. To this end, Essential Energy considered three options, with the only differenced being the timing of developing and implementing advanced DOEs:

1. Basic DOEs offered from 2026; advanced DOEs to be rolled-out from 2033
2. Basic DOEs offered from 2026; advanced DOEs offered from 2031
3. Basic DOEs offered from 2026; advanced DOEs offered from 2029.

119. Essential Energy proposes Option 1, which as shown in the cost-benefit analysis discussion below, is the cheapest option, is deliverable, and defers the majority of the required expenditure on a full roll-out until the next RCP. We consider this to be the prudent timing option.

3.3.2 Essential Energy's proposed supply side interventions

What Essential Energy has considered

120. Zepben's analysis for Essential Energy includes eight supply-side interventions to improve hosting capacity, as shown in the table below.

[45] Baringa 2023, Future Network Business Case, section 2.1.4

[46] Baringa 2023, Future Network Business Case, section 2.2.2.1

Table 3.6: Identified demand side solutions

Intervention	Description
LV reinforcement	Reconductor sections of LV network to increase thermal capacity by a minimum of 80%
HV reinforcement	Reconductor sections of HV network to increase thermal capacity by a minimum of 80%
Transformer upgrades	Replace distribution transformers with the next standard size that will increase the transformer capacity by at least 50%
OLTC distribution transformers	On-load Tap Changers were added to distribution transformers. These tap changers were configured to regulate to a 230v float voltage and implemented 'co-gen' Line Drop Compensation
Additional transformer	Add a transformer in a new location to split the original network section into two to increase overall capacity
Closed loop voltage control (CLVC)	Voltage measurements from the remote end of the LV feeder are used to inform the appropriate starting voltage for the ZS
Revised line drop compensation (LDC) settings	Set the OLTC at the start of the feeder to regulate based on a 'co-gen' LDC model, where the feeder starting point voltage is dropped as reverse power flows are detected, and increased as forward power flows are detected
Community BESS	Add community BESS to LV network sections

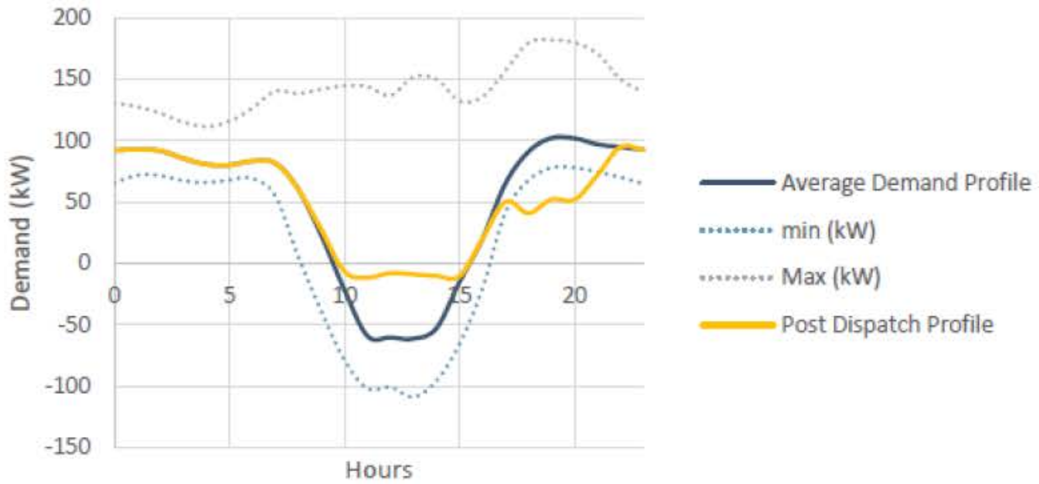
Source: Zepben 2022, Essential Energy Hosting Capacity Report, pp59-62

Our assessment of Essential Energy's identified supply-side solutions

Zepben's analysis provides reasonable input data for the cost-benefit analyses

121. Zepben identifies the intervention capacity benefits (in kW) for the supply-side interventions denoted above for eleven feeder section types. It also outlines the underlying assumptions. We consider that (i) the assumptions underpinning each supply-side intervention are sensible, and (ii) the supply-side interventions provide a good 'supply-side solutions toolbox' and the necessary information for Essential Energy to identify the economic and technical merit for the solutions for particular feeder types. For example, for the community BESS, Zepben includes the dispatch profile shown in the figure below.

Figure 3.6: Dispatch profile used for assessment of the community BESS solar enablement benefit



Source: Zepben 2023, Essential Energy Hosting Capacity Report, Figure 41

122. The inverter and energy storage size of the BESS was coordinated with Essential Energy's typical 315kVA substation. The BESS dispatch was pre-scheduled to charge during peak solar generation windows and discharge during the evening peak.

123. The results of Zepben's analysis indicate that:

- The benefits vary greatly depending on the application (e.g. CLVC benefits range from +55kW if applied to overhead commercial feeder section to 1.5kW for small rural dedicated overhead feeder sections)
- Revised LDC settings have minimal per network section kW boosting benefits for all of the 11 network section types modelled but improves outcomes for the entire feeder and therefore for many feeder sections and therefore for many hundreds of customers.

Only a subset of the supply-side interventions were economically viable

124. As discussed further in the cost-benefits analysis section below, whilst augmenting the network (e.g. with additional or upgraded transformers and conductors) directly improves the hosting capacity of local LV network, it is a relatively expensive option. As Essential Energy states:[47]

> *'However, given that power quality issues generally occur for only a few hours across a small number of days each year, it will require many customers in an area to be losing significant amounts of exports before an investment could be justified as prudent and efficient.'*

3.3.3 Essential Energy's proposed ICT and other enabling investments

What Essential Energy has considered

125. The table below summarises the ICT and data investments identified by Essential Energy to enable CER integration via its 'Network of the Future' strategy.

[47] Essential Energy 2023, 7.01 DER Integration Strategy 2024-29, page 23

Table 3.7: Essential Energy's proposed non-network ICT and data requirements to enable its 'Network of the Future' (viz. CER integration) solutions

Workstream	ICT solution/data requirement
Non-network capabilities – ICT and data	
LV visibility	Install 3,600 distribution transformer monitors (meters) Upgrade 400 feeders with MW and HV data Acquire/utilise AMI data (up to 30% coverage) Acquire solar irradiance data Upgrade Pi Historian database Additional NetVis licensing to enable LV analytics
DOE enabling	Interactive Geospatial Network maps with CER connectivity, capacity, and constraints (accessed via Customer Portal) Integration of connections management systems with hosting capacity and network (DERMS) systems. Build CER Register (Assess and uplift register) Distributed Energy Resource Management System (DERMS) Third Party API Builder and API Interchange (2030.5) Enterprise Data Platform with LV & Metering data, Climate (Realtime OT/IT data) to gain situational awareness of LV network performance. Hosting Capacity Model - Uplift State Estimation tool to include DoE Load profile management system Advanced analytics & data visualisation platform - LV Analytics
Improved connections	Uplift and integrate customer portal Improve back-office automation, compliance and exceptions
Improved network planning / operations	PowerOn Fusion (ADMS) planning tool (specifically for outage management) Network simulation and integrated network modelling tools Flexibility services: – CER Portfolio Management System – Automate non-network options assessment – Flexibility procurement platform – Third party services and billing – Settlement of flexibility services
Tariffs	Build Billing and Invoicing Platform to enable TOU tariffs
Additional staff	17 new FTEs are proposed to manage the new DER integration capability

Source: Baringa Tables 18 and 19

Our assessment of proposed ICT and other enabling investments

Increased visibility of the LV network is a necessary enabler of maximising DER export

126. Essential Energy propose improving its understanding of power flows and power quality metrics by:

- Installing 3,600 meters on existing distribution transformers (located on current and forecast constrained feeders);
- Acquire and utilising 30% network coverage of 5-minute advanced metering infrastructure (AMI) data by 2029 - ramping up over the course of the 2024-29 period to approximately 300,000 data points;
- Acquiring an unspecified volume of solar irradiance data; and

- Upgrading its Pi Historian database to capture SCADA data.

127. We are satisfied that adequate LV visibility is a necessary precursor to proactively identify looming LV network constraints (thermal of voltage), for developing and deploying cost-reflective tariffs and DOEs, and for LV planning (identifying the best solution from the 'toolbox' of potential interventions to address constraints).

128. It is also reasonable to assume that ICT investment to cope with the volume of AMI data that will need to be stored and analysed will be required in the next RCP.

129. However, Essential Energy has not adequately justified its target of 30% AMI data point coverage nor specified the volume of solar irradiance data it requires.

130. We remain concerned about the cost of its data acquisition program because:

- Whilst we consider it reasonable to target 20-25% data coverage to design/set transformer tapping, phase balancing, and DVMS, this level of coverage is only required for the feeders at which there are over-voltage constraints, not across the whole LV network. We consider that:
  - Essential Energy can leverage off its LV network modelling and any customer complaints to target the areas of the network with the highest levels of over-voltage and then secure the minimum LV visibility in those areas to identify the best solution(s)
  - A targeted approach is likely to maximise the cost-benefit of any intervention; and
- Similarly, targeted DOEs, which come after the other interventions in its hierarchy of interventions, do not need to be accurate, at least initially, to enable less curtailment of solar export

131. Therefore, at least for the duration of the next RCP, we do not consider that the ramp up to 30% coverage of all meters is required by the end of FY29.

The DOE, connections, and network planning/operations initiatives to support DER integration seem reasonable

132. Based on the descriptions provided and other DER integration expenditure proposals we are familiar with, the range of initiatives proposed appear to be reasonable. Baringa has included the costs in the CBA analysis and has identified the links of each of the projects to deliver the enabling capability to one or more of 16 possible benefit streams.

133. The timing of the delivery of benefits from the numerous enabling capabilities is staggered over an eight year period (FY23-FY30) which reflects the assumed establishment of the capabilities over time.

The majority of additional FTEs will be in place before the next RCP

134. [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

48 10.05.01.01 Draft Future Network Business Case - Baringa - Jan23 – Confidential, Table 20

138. [redacted]

[redacted] [redacted]

[redacted] [redacted]

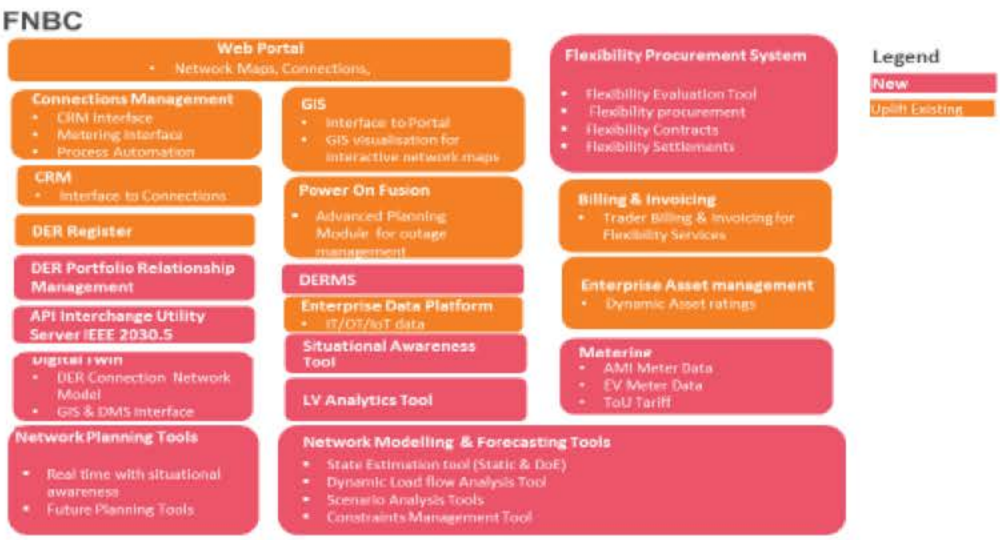
[redacted] [redacted]

[redacted] [redacted]

Essential Energy's proposed Non-network ICT expenditure is overstated

143. Essential Energy has estimated it will require [redacted] capex and [redacted] associated opex, for a total of [redacted] to undertake its proposed 'Future Network Business Case' (FNBC) ICT design and implementation activities in the next RCP, with the capex required for '*resources, infrastructure and initial software costs*.'[49] The figure below shows 'the scope of ICT system architecture impacts and changes that underpins Essential Energy's non-recurrent ICT cost estimates.'[50]

Figure 3.7: FNBC key system impacts underpinning Non-recurrent ICT cost estimate



Source: Extract from 10.05.01.01 Draft Future Network Business Case - Baringa - Jan23 – Confidential, Figure 35

144. We are generally supportive of Essential Energy's directional intent to further develop the key components of its CER integration initiatives (e.g. low voltage visibility and analytics, DOE, tariff development and improved network planning). However, we consider that its proposed CER-related ICT expenditure represents an excessive level of expenditure within the next RCP. We form this conclusion, based on the following considerations:

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49 Refer to Table 3.8

50 10.05.01.01 Draft Future Network Business Case - Baringa - Jan23 – Confidential, section D.3

- In section 3.4, we report our finding that Essential Energy's proposed CER program does not demonstrate a positive economic value, on our assessment of the information that it has presented. We consider that in part this results from an overstatement and front-loading of the proposed investment program, relative to realisable benefits. The proposed DER ICT is a significant cost item in this analysis.
- Essential Energy proposes to offer only 'basic' DOE until 2032, with 'advanced DOE' to be provided from 2033. From this perspective, heavy investment in ICT, most of which is proposed for 2025 and 2026, appears to be too long in advance of need. This is illustrated in Essential Energy's CBA,[51] where we observe a significant timing mismatch between proposed investment costs, and the assumed benefits;
- As is shown in Table 3.3, Essential Energy plans to spend [redacted] in the current RCP, including for network visibility and for technology and tariff trials. We would expect this to have already produced a CER platform that it can leverage off in the next RCP;
- The proposed ICT expenditure significantly exceeds that proposed by other DNSPs whose RPs are currently being assessed. For example, Endeavour Energy has proposed DER ICT of $5.0m[52] and Evoenergy has proposed $4.1m for '*IT systems for DOE/VPP integration*'. From inspection of its CBA, Ausgrid has proposed capex of $6.7m for DSC ICT capex and a further $4.7m for ICT capex for network visibility.

145. As discussed in section 4.5, whilst we are supportive of Essential Energy's intent to improve its CER connections process (including its web portal), we do not consider the initiative and the proposed [redacted] capex and [redacted] opex is justified. We note that Figure 3.7 identifies 'uplifting' the existing Web Portal, CRM, and Connections Management systems. Neither the Future Networks Business Case, DER Integration Strategy nor the Meter, Market and Customer Systems Investment Case clearly identify an interdependency between the Non-network ICT capex under the FNBC and the CRM and Portal initiative. We have therefore assumed that the required ICT capex (and opex) for the CRM and Portal initiative is wholly accounted for in the CRM and Portal project cost estimate, which we have assessed in section 4.5.

Program management costs appear high but not unreasonably so for a complex project

146. Essential Energy has allowed Project management capex of [redacted][53] to undertake change management, business analysis, functional leads, training, consulting, expenses.[54] This represents 13% of the total project cost. In our experience, this is somewhat higher than we would expect, particularly given that 10% of the project cost is for data acquisition, which should require minimal 'project management'. Nonetheless, the following factors indicate that the project management estimate is not unreasonably high:

- As evidenced in Figure 3.7 (which is just an extract of the full diagram in the FNBC document), the project is reasonably complex, which increases project management costs;
- The Networks of the Future initiative, as planned, will run over 5 years, which also tends to increase project management costs;
- Essential Energy appears to be relying on at least some consulting services, which are typically more expensive than internal resources.

147. However, as discussed in section 3.4.5, we consider that the program as a whole proposed by Essential Energy may not be economically justified. In this case a pro-rated reduction in the proposed Project management capex would be warranted.

51 See section 3.4

52 Endeavour Energy RP Attachment 10.450, DER integration strategy, table 25

53 Based on deducting [redacted] m for the Non-network ICT from the total amount of [redacted] shown in Table 4.2

54 Refer to Table 4.2

Corporate overheads should not be included in the forecast

148. Essential Energy has allowed [redacted] opex for Corporate overhead for 'ICT define, support, and operate costs.' Our understanding is that only direct costs should be incorporated in project level costing to avoid duplication.

3.4 Assessment of Essential Energy's cost-benefit analysis

149. In this section we assess the CER cost benefit analysis (CBA) model that Essential Energy provided and which we understand was developed with assistance from its partner, Baringa.[55] Essential Energy presents this analysis in seeking to justify its proposed CER program on economic grounds, including its preferred option.

3.4.1 AER base case guidance

150. Consistent with the RIT-D guidelines, the AER expects DNSPs to define a BAU base case against which to measure the net economic benefit of options. The BAU base case should have the following characteristics:[56]

- DNSP continues its BAU activities which are 'ongoing, economically prudent activities that occur in the absence of a credible option being implemented';
- Comprises BAU operating expenditure associated with voltage management which are already in place;
- Allow for inverter systems to trip at times where DER exports exceed hosting capacity; and
- Incorporate export curtailment assumptions based on existing static export limits.

151. The preferred option should be that which maximises the net economic benefit across the NEM, with the base case representing the best option if there is no option that yields a net economic benefit.

3.4.2 Essential Energy's CBA modelling

Model overview

152. Essential's CBA model provides a NPV comprised of the separate PVs of benefit and cost streams over a 20-year analysis period, from 2024 to 2043.

153. Cost inputs to the model are imported from a separate model. For the period 2025-29 they sum to [redacted], which is close (but not identical) to the values presented in the Baringa report and referenced in Table 3.8 below.[57] We consider that the cost values in the CBA model are sufficiently close to those in Essential Energy's regulatory proposal documentation, as to be usable in considering the regulatory proposal.

Costs

154. In the CBA model, the costs are disaggregated as follows:

- 'Bundle 1-3 capex' and 'Bundle 1-3 Opex
  - Bundle 1-3 capex comprises what are described as 'Capex', Net Vis Capex and PM capex

55 10.05.01.02 Future Network CBA. V8.0, 25/01/2023

56 AER 2022, DER integration expenditure guidance note, Section 3.2.3

57 Each of the component costs is also close but not identical to those shown in Table 3.7 and comparison of the relevant amounts confirms that the CBA model includes corporate and network overhead costs as part of the assumed opex, which is consistent with descriptions in the model.

  - Bundle 1-3 opex comprises what are described as non-network, network overhead and corporate overhead; and
- Bundle 4 opex, which comprises only network and corporate overhead.

155. The model includes lower and upper bound cost assumptions, of -25% and +70% respectively.

Benefits

156. Benefit inputs to the model comprise:

- ZSS hosting capacity by ZSS for each year, as calculated from Zepben's modelling;
- PV forecasts by MW capacity, for each ZSS; and
- CECV values, with one of two arrays of data selectable: AER (OGW) values or HK (Houston Kemp) values.

Scenarios, sensitivity analysis capability and key model outputs

157. The model results are calculated for low, medium and high demand scenarios and present PV results separately for:

- DOE benefits (CECV);
- DOE and network visibility benefits (non-CECV);
- Network intervention benefits;
- Tariff benefits;
- Bundle 1-4 capex and opex;
- Network capex; and
- Total NPV.

158. This allows network benefits to be assessed against network costs, and DOE benefits to be assessed against DOE costs.[58]

159. The model has inherently useful sensitivity capability, with key selectable inputs that are useful for this purpose being:

- Selection of CECV (as above);
- Selection of intervention 'option', noting that these are essentially defined by the years in which development costs are incurred, DOE trial starts and full DOE starts;
- The imposition of hard export limits at stages 2 and 3, and the year in which they occur; and
- Assumptions regarding uptake of BESS and EVs by customers with PV.

Our assessment of the CBA model capability

Model is fit for purpose

160. We consider that the model is conceptually sound as a means of calculating the NPV of the proposed DER program, for testing the sensitivity of those assumptions to key parameters and for defining and selecting reasonable options.

3.4.3 Expenditure forecasts in the CBA model

Essential Energy's expenditure forecast

161. The summary of the scope and forecast expenditure for 'Option 1' is shown in Table 3.8.

58 NPVs calculated in the model do not include the tariff benefit, which is assumed for both the counterfactual and factual and is therefore cancelled out.

Table 3.8: High level scope and expenditure forecast for the next RCP for preferred CER Option 1 (real FY24)[59]

Category		Scope		FY25-FY29 ($m)
Network capex		Network augex for CER integration[60]	CLVC and LDC Limited LV network augex	[redacted]
Non-network capex	Non-recurrent ICT	ICT design and delivery	Resources Infrastructure Initial software costs	[redacted]
		Program management	Project management Change management Business analysis Functional leads Training, consulting, expenses	
	Network visibility	LV metering and data	Distribution Metering for targeted sites Data upgrades for targeted feeders	[redacted]
Opex	Non-Network	Data acquisition and licences	AMI data Solar irradiance data EdgeElectron licences NetVis licences	[redacted]
Opex	Network overhead	Network Ops System Control Network Connections Primary Systems Network Planning Network Dev Network Performance Regulatory Customer Services	New/incremental FTE Resources to enable new capabilities (e.g. detailed LV forecasting, TOU tariff design)	[redacted]
Opex	Corporate overhead	ICT define, support, and operate costs	Program/project 'Define Phase' Costs Incremental and ongoing data/compute/SaaS plus FTE support	[redacted]
Total				[redacted]

Source: Based on Baringa 2023, Future Network Business Case, Tables 28 and 29

162. The cost forecast methodology is summarised in Table 3.9.

59 We note that figures vary between Essential Energy's documents – we have typically referred to its 'core' documents (e.g. RP, Future Network Business Case) and referenced sources accordingly; from Essential Energy's response to an Information Request, the SCS non-recurrent ICT capex allocation for the Network of the Future Strategy is [redacted] (refer to *1 Essential Energy – EMCa Followup Non-Recurrent ICT Projects – Confidential*, page 1). We infer that this is the line item in Table 3.8 described as *Non-recurrent ICT / ICT design and delivery* and presume therefore that the difference between this figure and [redacted] referred to in this table, is the Program Management component. We also note a further ICT line item of [redacted], for *Corporate Overhead*.

60 Baringa states that the forecast only included AUGEX where primary and positive business case based on improved CER exports (e.g. CECV) could be determined.

Table 3.9: Summary of Essential Energy/Baringa cost forecast methodology

Estimate stage	Key activities	
Scope definition	Essential Energy and Baringa developed and agreed a cost plan that defined the scope of inputs, timeframes, and responsibilities Baringa mapped all FNBC Use Cases and proposed network interventions against the regulatory cost categories reported in the RINs	
Estimation	Network capex	Costs based on standard unit rates, volumetrics, and coverage (e.g. design and build)
	Non-recurrent ICT	Costs inclusive of relevant resource and cost categories (e.g. software, licencing, Cloud) and utilising standard rate cards/cost calculators
	Program management	Proposed by Baringa to deliver the non-recurrent ICT program based on Baringa's experience
	Non-network	Costs included estimates for data acquisition (e.g. AMI) and licencing based on existing or known rates as well as incremental FTE costs for delivering new capabilities (e.g. planning engineers) based on standard labour rates.
	Network overhead	
	Corporate overhead opex	
	Non-network opex	Baringa developed a model for proportional leasing of BESS based on its experience
Forecast and validation	Forecasts developed (i.e. cognisant of timeframes) with initial validation by Essential Energy cost owners Baringa and Essential Energy reviewed each other's forecast, including review of cost estimates against similar programs and activities within recent DNSP reset submissions. Final review, validation and 'sign-off' for cost estimates was undertaken by Essential Energy	
Finalisation	Relatively minor amendments were made as the CBA model and regulatory submission was developed to reflect appropriate financial treatment; remove duplicate costs, and ensure consistency	

Source: Baringa 2023 Future Network Business Case, Table 27

EMCa's assessment of the expenditure forecasts

Essential Energy's cost estimating methodology is reasonable

163. Essential Energy has well-defined scopes, recent historical unit costs, and/or other accessible cost benchmarks for several cost estimate elements. For example:

- Essential Energy's BAU network capex programs and projects (including remedial PQ work) should provide a sound basis for the unit cost estimates;
- Similarly, unit costs for network visibility capex (distribution transformer metering and data upgrades for targeted feeders) should be well-known from BAU work and/or validated by vendors; and
- Putting aside the issue of the volume of AMI data that is reasonably required, the unit cost of AMI data was based on quotes from the data owners.

164. This approach is consistent with good industry practice for projects in this stage of their development lifecycle.

165. Non-recurrent ICT design and delivery costs are typically challenging to accurately forecast due to issues with scope and integration. Figures 35 and 36 in Baringa's report illustrate:

- The complexity and broad scope of the ICT architectural changes and additions; and

- That some thought has been put into defining the architecture/scope of work but it remains conceptual and therefore subject to change over the project lifecycle.

Confidence in the expenditure forecast would have benefited from third party review

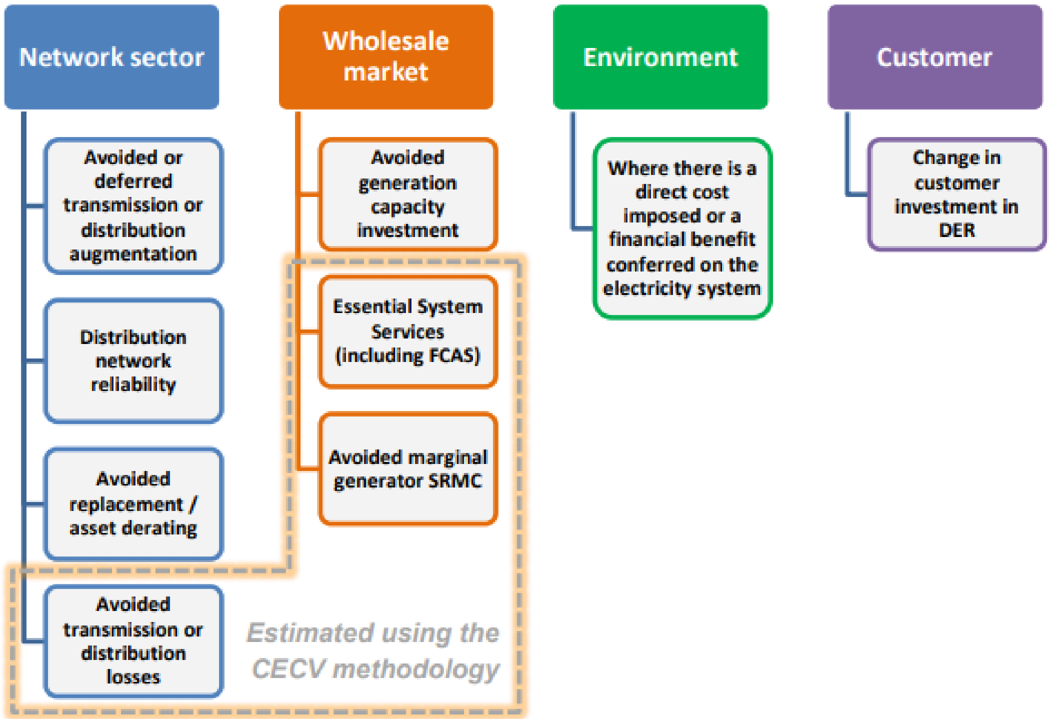
166. Whilst the forecasting methodology is sound in most respects, we consider that greater confidence in the cost estimates would have been achieved with evidence of review by at least one third party. This is particularly the case with ICT & Program management [redacted] capex in the next RCP), and corporate overheads ([redacted] opex in the next RCP).

3.4.4 Benefits in the CBA model

AER identified benefit categories and CECV

167. Figure 3.8 illustrates the AER's assessment of the DER value streams for consideration by DNSPs in their derivation of their DER integration strategies and investment plans. The diagram also shows the value streams included in the AER's customer export curtailment value (CECV).

Figure 3.8: AER benefit categories summary



Source: Baringa 2023, Future Networks Business Case, Figure 7

168. The CECV methodology estimates the DER value streams and DNSPs are expected to apply the CECV to the value streams denoted above and estimate the others.[61] The AER Guidance Note provides guidance to the DNSPs on valuing all of the benefit streams in the figure above and we use this guidance as our reference for assessing Essential Energy's benefit estimation methodology.

Essential Energy's benefit categories and estimation method

169. In Table 3.10 we summarise Essential Energy's benefit estimation methodologies.

[61] AER 2022, DER integration expenditure guidance note, Table 3.2

Table 3.10: Essential Energy/Baringa benefit estimation methodology

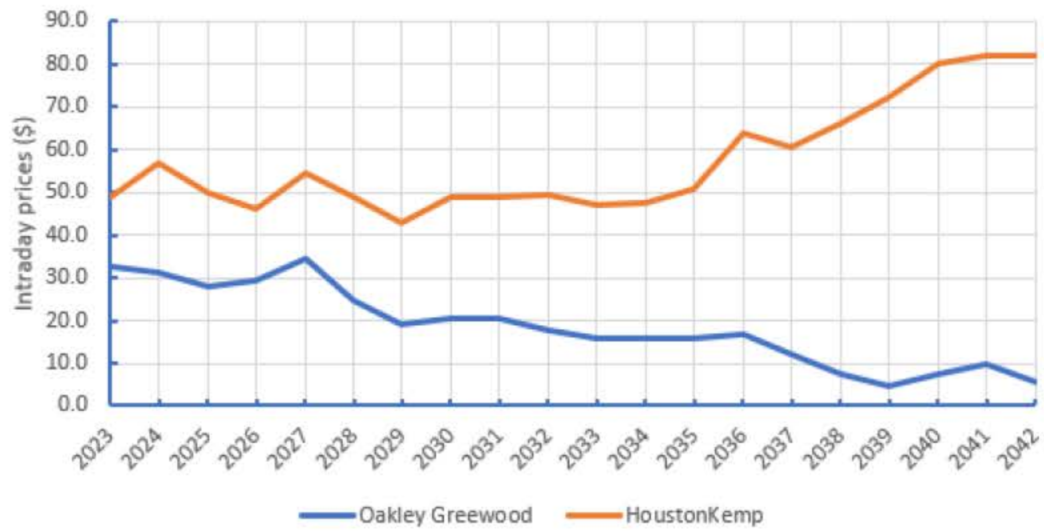
Benefit category	Baringa estimation methodology
Avoided marginal generator SRMC	CECV*
Avoided generator capacity investment	CECV* (which excludes this benefit)
Essential System Services	Not captured in the CECV
Avoided/deferred augmentation	Captured in CBA model
Avoided replacement/asset derating	Excluded from the CBA model
Reduced line losses	CECV*
Improved reliability	Included in community BESS intervention only
Environmental	Excluded from CBA model but implicitly included in wholesale benefits
Change in CER investment	Excluded from the CBA model
Intangible (other benefits)	Excluded from the CBA model

*Source: based on Baringa 2023 Future Network Business Case, Table 7; * Baringa states that it uses an alternative CECV than provided by the AER.*

Essential Energy uses an alternative CECV methodology

170. The AER's CECV was based on analysis by Oakley Greenwood however Essential Energy has relied upon an alternative CECV derived from a methodology developed by HoustonKemp. Oakley Greenwood uses the draft ISP 2022 as its source for capacity mix, while HoustonKemp derives its own capacity mix from a Long-Term investment plan model.[62] The figure below shows the difference in intraday prices derived from application by Essential Energy of the respective CECV methodologies.

Figure 3.9: Oakley Greenwood and HoustonKemp CECV outputs (intraday prices 10am-5pm)



Source: Based on Baringa 2023 Future Network Business Case, Table 22

171. Baringa observes that the AER provides the option for DNSPs to commission their own avoided generation investment benefit estimates but Baringa considers that:[63]

62 Baringa 2023 Future Network Business Case, Appendix C.2.1

63 Baringa 2023 Future Network Business Case, Appendix C.2.1

'…combining avoided generation SRMC and avoided generation investment estimates from different sources would be problematic because it combines different 'states of the world'. In particular, the generation capacity mix projections under Oakley Greenwood and HoustonKemp's estimates appear to be fundamentally different.'

172. Baringa concludes that Oakley Greenwood's exclusion of avoided generator investment benefits understates the true benefits of avoided DER export curtailment.

173. It is obvious from the figure above that application of the HoustonKemp CECV rather than the Oakley Greenwood derived values has a major impact on the value ascribed to benefits. Also that the values diverge most significantly twelve to twenty years out, such that a reliance on the HoustonKemp values to achieve a positive NPV raises significant option value and regret considerations around justification for proposed CER investment in the next five years for benefits that are mostly assumed to arise around a decade later.

174. We note that in Oakley Greenwood's final report to the AER it responds to the ENA/HoustonKemp submission to the AER's draft CECV Methodology report. In its response it concludes that (among other things) *'…the shortcoming in HoustonKemp modelling, as discussed above, was the use of a demonstrably unrealistic alleviation profile.*'[64] It essentially rejects the HoustonKemp CECV methodology.

175. In our assessment we have considered the potential outcome of the CBA analysis with the AER/Oakley Greenwood CECV estimates. We also analyse the extent to which the timing of benefits in Essential Energy's CBA provides insights into the justification for the timing of the proposed investment.

Essential Energy's non-CECV benefits

176. Baringa's report maps the candidate project groupings and underlying projects to 16 benefit categories- one is CECV and the rest are non-CECV benefits categories. The assumed financial year in which the benefits will start is also provided for each project. The four key groups of benefit capabilities are:[65]

- DOE and Network Visibility – 20 projects;
- Improved Connections, CER, and Asset Management – 3 projects;
- Improved Network Planning, Utilisation and Operations – 7 projects; and
- Innovative tariffs – 1 project.

177. We discuss our assessment of the non-CECV benefits in section 3.4.5.

3.4.5 Assessment of CBA model results and sensitivities

Sensitivity to CECV assumptions

Essential Energy's proposed CER investment, and the DOE component in particular, have a negative NPV when the AER CECV is applied

178. The CBA model allows a toggle between using the AER (OGW) CECVs and the Houston Kemp values.

179. As we show in Table 3.11, with the OGW values the PV of the avoided curtailment would be $103m, compared with the value of $219m in the model under the HK CECV assumption that Essential has relied on. With the AER values, the NPV of the proposed DER program is negative. The timing of the path towards the positive NPV that Essential Energy has proposed is further illustrated in Table 3.15, showing that the positive eventual NPV as presented depends entirely on the assumed benefits in years 16 to 20 of the analysis period. The timing of the path towards the positive NPV that Essential has proposed is

65 Baringa 2023 Future Network Business Case, Appendix C.3

further illustrated in Table 3.15, showing that the positive eventual NPV as presented depends entirely on the assumed benefits in years 16 to 20 of the analysis period.

Table 3.11: Present value and NPV overall results from CBA model dependent on CECV values ($m)

Summary Present value	Houston Kemp CECV	AER (Oakley Greenwood) CECV
Total DOE (CECV)	$219	$103
Total DOE and Net Vis (non CECV)	$124	$124
Total Network Intervention Benefit	$113	$52
Total Tariff Benefit Calc	$17	$7
Total Benefits	**$456**	**$279**
Total Bundle 1 - 4 Capex	-$91	-$91
Total Bundle 1 - 4 Opex	-$170	-$170
Total network Capex	-$37	-$25
Total Costs	**-$298**	**-$286**
Total NPV	**$159**	**-$7**

Source: EMCa analysis from Essential Energy CBA model, option 1 with central demand scenario and medium cost assumptions. (Note that the exclusion of Total Tariff Benefit Calc from the summation of total benefits is as per Essential's model.)

180. Further inspection of the results shows that the network intervention solution is positive, with a PV benefit of $51.7m against a PV cost of $24.9m (with the AER CECV assumptions) , whereas the DOE interventions have a significantly negative NPV under this CECV and contribute only around one-third of the claimed aggregate positive NPV under the Houston Kemp CECV assumptions.

Table 3.12: Present value and NPV for DOE interventions only ($m)

PV and NPV for DOE	Houston Kemp CECV	AER (Oakley Greenwood) CECV
Total DOE (CECV)	$219	$103
Total DOE and Net Vis (non CECV)	$124	$124
Total Benefits	**$343**	**$227**
Total Bundle 1 - 4 Capex	-$91	-$91
Total Bundle 1 - 4 Opex	-$170	-$170
Total Costs	**-$261**	**-$261**
Total NPV	**$82**	**-$34**

Source: EMCa analysis from Essential Energy CBA model, option 1 with central demand scenario and medium cost assumptions

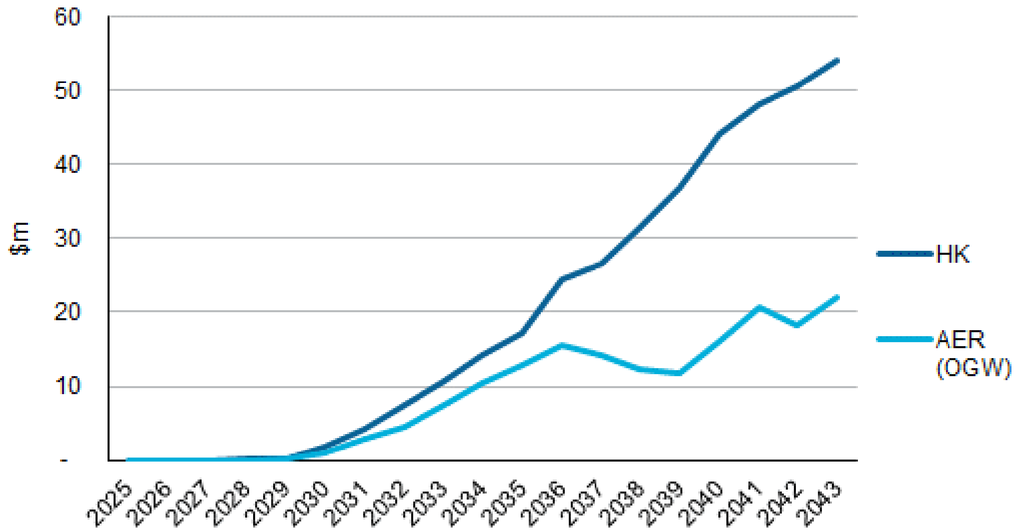
The HK CECVs drive Essential Energy's claimed NPV based on a high and continuing increase in CECV-related benefits assumed to be derived in the later stages of the 20-year analysis period, from the proposed near-term investment

181. We further inspected the impact of the alternative CECVs. As we show in Table 3.11, while the alternative value that Essential has used shows a similar profile up to around 2035, the impact of the respective values diverges significantly after that. It is clear from this that the much higher Houston Kemp CECV values from 2035 to 2043 are what drives the large difference in the assumed benefits of the DOE program.

182. Considerations of option value and potential 'regret' suggest a need for extreme caution in anchoring an investment over the next five years on assumptions that this investment is

required in order to achieve this high and increasing level of benefits, in a period that is 10 to 20 years into the future.

Figure 3.10: Annual value of avoided curtailment: Comparison between assumed HK and AER/OGW CECV



Source: EMCa analysis from Essential Energy CBA model, option 1 with central demand scenario and medium cost assumptions

Impact of assumed reduction in static export limit

The assumed need to impose a static export limit of 1.5kW from 2030, in the absence of DOE, is almost entirely responsible for the levels of curtailment that DOE is then assumed to avoid

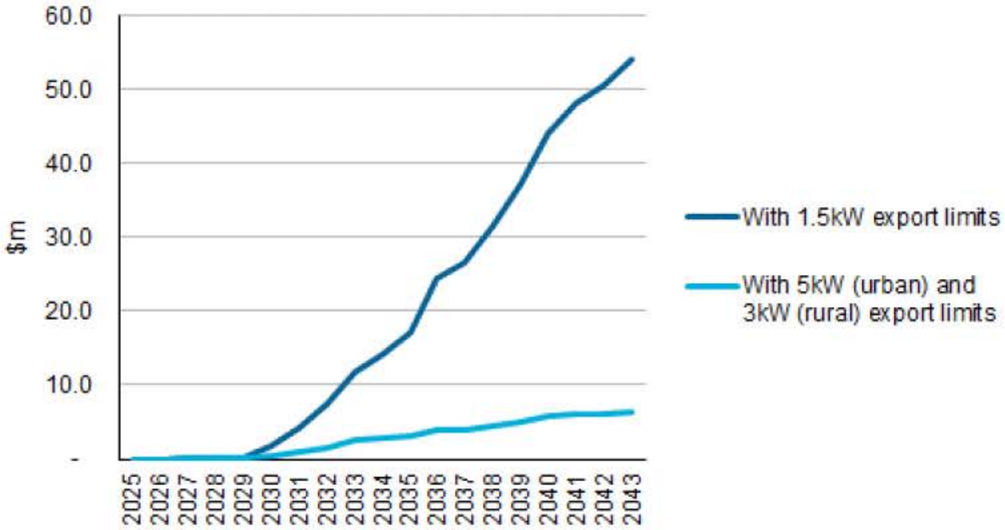
183. We next investigated the extent to which the assumed reduction in the static export limit (from 2030) is driving the assumed benefits from reduced curtailment.

184. In its counterfactual, Essential Energy assumes that it would need to impose a static 1.5kW export limit in 2030. Its counterfactual level of curtailment is therefore measured on this basis and the model calculates 'avoided curtailment' as a benefit relative to this.

185. We modified the model to impose a 5kW urban and 3kW rural static export limit, in line with Essential Energy's apparent current requirement for new PV customers. This in effect shows something closer to the 'inherent' curtailment that would occur due to over-voltage and applies a counterfactual that reflects Essential Energy's current policy settings, as required by the AER guideline. As shown in Figure 3.11, this shows that the claimed avoided curtailment benefits are almost entirely a function of the assumed imposition of a reduction in the static export limit (to 1.5kW) in 2030.

186. If the counterfactual case is respecified based on current policy settings (i.e. with the current static export limits of 5kW and 3kW), then the NPV of the DER program is negative $35m with the HK CECVs and negative $96m with the AER CECVs.

Figure 3.11: Annual value of avoided curtailment: Impact of imposing 1.5kW static export limit



Source: EMCa analysis from Essential Energy CBA model, option 1 with central demand scenario and medium cost assumptions. HK CECV assumptions. Static export limit modified to 5kW urban and 3kW rural for stages 2 and 3

187. The impact of the assumed reduction in the static export limit is further illustrated in Table 3.13, which shows the contributions to the NPV of the proposed DER program of the curtailment benefit before and after the assumed imposition of this reduced limit.

Table 3.13: Contribution of assumed curtailment benefit to NPV (based on Houston Kemp CECV values) ($m)

Timeframe considered	Contribution to PV
Before stage 3 export limit	18.7
After stage 3 export limit	200.5
TOTAL contribution of curtailment benefit to NPV	**219.2**

Source: EMCa analysis from Essential Energy CBA model, option 1 with central demand scenario and medium cost assumptions. HK CECV assumptions.

Orchestrated uptake of BESS, charging of EVs and solar soak hot water heating will reduce customer exports and, with targeted measures, may obviate the need for reduced static export limits

188. We understand the 'equity' rationale that underlies policies to impose static export limits, and also the rationale that underlies preferrable mechanisms allowing for dynamic export curtailment. However, the CBA reveals the crucial importance of the assumption that imposing a static limit of 1.5kW from 2030 is the only reasonable counterfactual that is available and hence the need to be able to demonstrate its necessity as the basis from which to compare the proposed DER program.

189. For consideration, we observe the assumptions in Essentials' CBA regarding significant uptake of consumer BESS and EVs. In conjunction with another of Essential Energy's proposed policies for 'solar soak', each of these has the potential to increasingly absorb PV 'spill' that is currently exported. Though we have not had the chance to fully verify this, it appears that this absorption of what would otherwise result in exports is catered for in the model and we assume that this contributes to the lower level of curtailment when the static export limits are not reduced to 1.5kW. We also stress tested the model workings in this regard by effectively removing binding of the static export constraints (which we did by increasing them to 20kW) and the modelled amount of curtailment fell further, to amounts of only a few hundred thousand dollars per year.

190. While reinterpretation of the results of the CBA can be taken as implying less favourable economics than Essential Energy has proposed for the DOE component of its DER program, it also provides guidance on the merits of pursuing means of minimising exports, to consumers' advantage, based on orchestration of the BESS, charging of EVs and solar soak 'hot water' that it is assumed consumers will increasingly adopt.

The economics of network intervention

CBA model analysis suggests that a level of network intervention will continue to be a prudent response to increasing CER over the next regulatory period

191. Essential Energy's CBA modelling indicates that network augmentations at the level that it has proposed, remain a prudent economic response within the next regulatory period. In Table 3.14, we show the NPV of this intervention 'stand-alone'. We observe that the model has a means of 'optimising' the level of prudent network investment based on the assumed benefit, therefore when we reduce the CECV the model indicates a reduced requirement for network capex. However, the NPV is nevertheless positive with a benefit cost ratio of over 2.0.

192. At some point we expect that non-network interventions will more fully supersede network solutions, however Essential's CBA suggests that low-cost and targeted network solutions are a viable option in the meantime. Essential's proposal is based on not introducing full DOE until 2033, and its CBA supports its proposition that a prudent level of network intervention will be required to accommodate CER in the next regulatory period. However, the modelling also indicates, with application of the AER CECV values, that this prudent level is likely less than Essential has proposed.

Table 3.14: PV of costs and benefits of network intervention ($m)

Intervention	Houston Kemp CECV	AER (Oakley Greenwood) CECV
Total Network Intervention Benefit	$113	$52
Total network Capex	-$37	-$25
Total NPV	**$76**	**$27**

Source: EMCa analysis from Essential Energy CBA model, option 1 with central demand scenario and medium cost assumptions.

The value of network visibility

Essential Energy's model indicates value in continuing to enhance and to harness the value of increasing network visibility. This benefit is not dependent on assumptions regarding distant future values of the CECV and is realisable over the next 10 years.

193. In its CBA, a PV of $124m is attributed to what are described as non-CECV DOE and network visibility benefits. [redacted] of benefits (not present-valued) are assumed to accrue within the next regulatory period, and these far exceed the value avoided curtailment benefits within this period (and which total only [redacted]). The major component of assumed benefit is deferred augex, which is estimated in the model to total [redacted] in the ten years from 2025 to 2034.

194. While we have no direct means of verifying the benefit estimates, we consider them to be reasonable.

195. We are not aware of a means within the model itself to extract a definitive estimate of the NPV of 'network visibility' alone. However, based in information that we can observe in the model, we consider it likely that a CER initiative focused primarily on continuing a level of investment in harnessing the value of increasing network visibility, may be found to be a prudent and viable component of a CER program over the next regulatory period.

Overall NPV profile

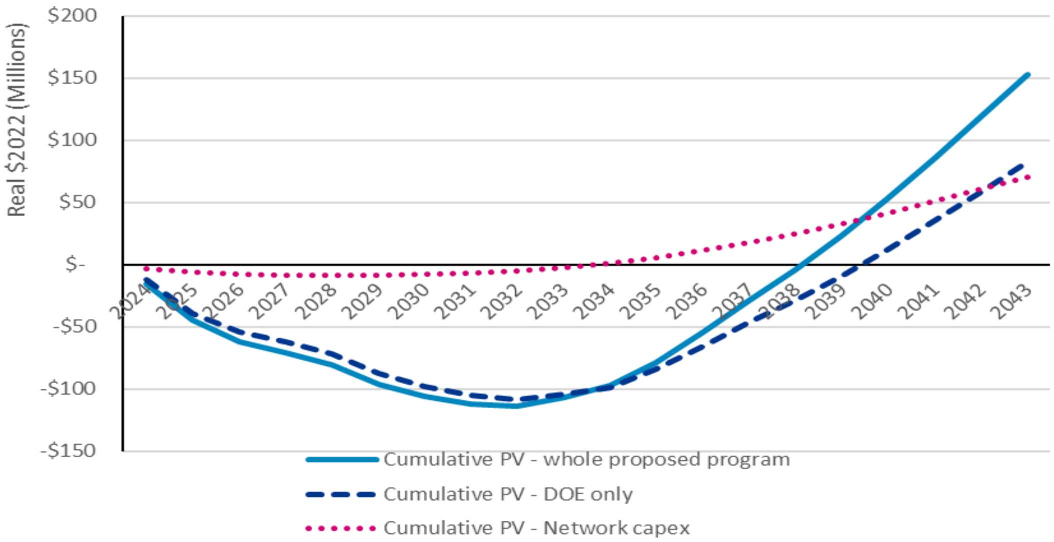
While the overall NPV with Essential Energy's assumptions, is positive, this arises only because of an assumed significant increase in benefits 16 to 20 years out. And around 50% of the NPV is contributed by network augmentation, rather than DOE

196. In Figure 3.12 we show the cumulative project NPV. This traces the net benefits of the proposed project, annually discounted to present values. The end point ($159m, excluding the 'tariff' benefit) is the project NPV as proposed from Essential Energy's CBA.

197. As can be seen, the project accumulates a negative NPV for around 15 years before becoming positive for the final 5 years based (as shown above) on Essential Energy's assumed rapid increase in CECV value in the early 2040s.

198. We have also plotted on this graph the DOE and the network intervention components of the proposed CER program. An interpretation of this is that there is relatively low potential regret from the network component, which is far less negative than the DOE component and becomes positive by shortly after the next regulatory period. On the other hand, the DOE component relies totally on assumed high avoided curtailment values in the early 2040s, to justify the expenditure that is proposed over the next two regulatory periods.

Figure 3.12: Cumulative 'earn' of NPV of proposed DER program



Source: EMCa analysis from Essential Energy CBA model, option 1 with central demand scenario and medium cost assumptions.

199. The timing of the path towards the positive NPV that Essential has proposed is further illustrated in Table 3.15, showing that the positive eventual NPV as presented depends entirely on the assumed benefits in years 16 to 20 of the analysis period.

Table 3.15: NPV (based on Houston Kemp CECV), disaggregated by period[66]

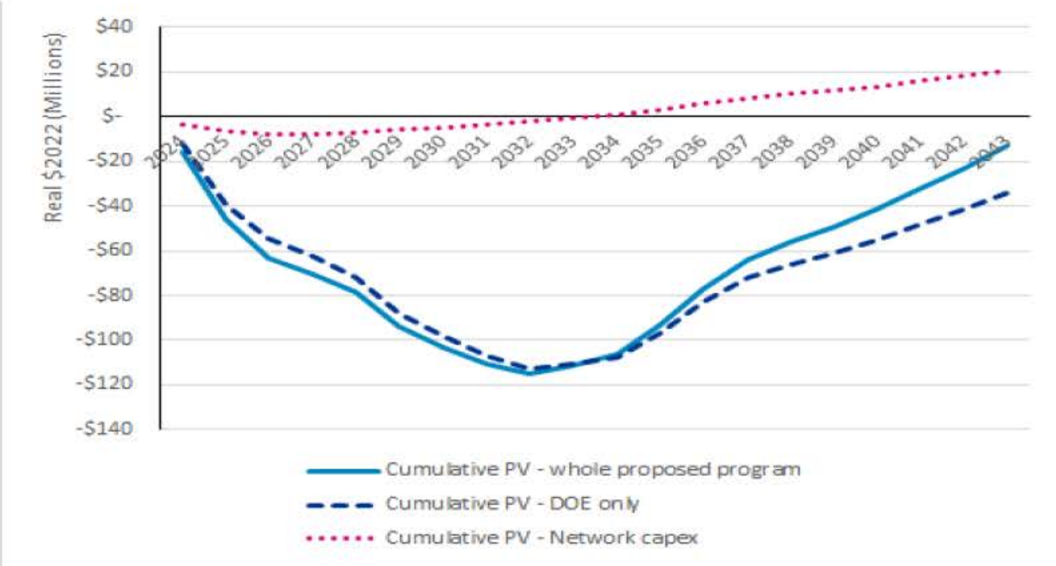
Indicative impact (by period):	$m (PV)
years 1 to 10	-107.0
years 11 to 15	102.7
years 16 to 20	156.7
Full period NPV	**152.4**

Source: EMCa analysis from Essential Energy's CBA model.

The NPV is negative with the AER's CECV values. And the long period over which it is significantly negative illustrates the level of regret that would arise if the year 15 to 20 assumed increase in benefits does not materialise.

200. In Figure 3.13, we present the equivalent time-profile of the NPV, with the AER/OGW values used for the CECV. As presented earlier, the NPV is negative overall and for the DOE component of the program, but positive for the network component.[67]

Figure 3.13: Cumulative 'earn' of NPV of proposed DER program, with AER CECV values



Source: Insert-source-details

3.4.6 Conclusions from our assessment of Essential Energy's CBA

Essential's positive economic case depends on adopting Houston Kemp's CECV values and assuming that a static 1.5kW export limit is required from 2030. We consider both assumptions to be questionable

201. The CBA illustrates the extent to which the proposed investment in the next regulatory period is dependent on assumptions that this investment is necessary in order to achieve what are presented as significant benefits in years around 2038 to 2044; that is, 16 to 20 years hence. In Essential Energy's CBA, these benefits are boosted by an assumed significant increase in CECV values at this time, and which are inherent in the Houston Kemp values that Essential Energy has used.

66 This differs from the NPV of $159m presented in Table 3.10, because an 'LV intervention CBA' benefit of [redacted] is excluded. The time accumulation of this amount is not derivable as the NPV is entered directly in Essential Energy's CBA model.

67 Noting that this is a lower network capex component than Essential Energy has proposed.

202. We find that the net benefits are also significantly boosted by Essential's assumption that the counterfactual will require it to impose a 1.5kW static export limit from 2030. The need for this is not evident from the model, which indicates relatively low levels of curtailment in the 2030s if the static export limits are not reduced.

A continuing level of prudent and targeted network augmentation is justified in the next regulatory period

203. The CBA model indicates that continuing targeted network investment will continue to represent a prudent means of addressing DER-related issues where and when they arise and provides a positive economic value in its own right. However, with appropriate assumptions, the model indicates that a lower level of such investment is warranted than Essential has proposed

Prudent and targeted investment in increasing network visibility may also be justified

204. While not definitive, there are also indications in the model that warrant further consideration of prudent and well-targeted investment and ongoing expenditure aimed at increasing the level of network visibility and harnessing the information obtained.

Essential Energy's proposed investment and operational expenditure in the next period is excessive and too early, relative to the benefits it is intended to bring

205. On balance, we consider that a reasonable interpretation of the CBA is that the level of proposed CER expenditure proposed for the next regulatory period is not warranted. In CBA terms, there is too large a time lag between the proposed investment and the assumed benefits. We consider that the proposed investment is higher than is necessary, and too early, for what is described only as a 'trial' until 2033. This exposes the program as currently proposed to a high risk of regret if it transpires that a different, better or lower cost solution would have achieved the eventual need when it becomes significant later next decade, or if the assumed increasing need at that time does not materialise.

206. While time is required to establish capability, to test services and to engage with customers, elements of a CER program are also relatively flexible. In particular, the ability to harness base levels of information to provide new services, to test and then deploy those services and new technologies as they become available, speaks to the advantages of agility and deferral of investment until as close as possible to the time when it is needed.

3.5 Our findings and implications

3.5.1 Summary of our findings

Essential's model for derivation of hosting capacity is fit for purpose

207. We were provided with a detailed description of the development of the hosting capacity model, including data acquisition, model development and validation; base case validation, and the hosting capacity analysis itself. The validation was undertaken by the University of Melbourne.

The hosting capacity modelling shows that overvoltage limits will be reached within the next RCP for all feeder types but thermal limits are likely to be a longer term issue

208. Two feeder types dominate Essential's network configuration, with 65% of the feeders either small rural dedicated or shared overhead feeders. According to the hosting capacity modelling results, these have the lowest average hosting capacity and their limits will be reached within the next RCP.

209. From the modelling, it is likely that unconstrained charging of EVs would (if it were to occur) lead to much higher numbers of constrained feeders over time, particularly in the outer years of the study period.

Essential proposes an additional 17 FTEs to manage CER integration which we consider to be excessive, noting that most are planned to be added in the current RCP

210. We do not consider that the scope of work that we consider to be justified in the next RCP for CER integration will require the size of the team proposed by Essential.

We consider that the trigger point for over-voltage is set too low for inverters installed since 2020 and for replacement inverters

211. Essential Energy's volt-watt overvoltage settings are appropriate for inverters installed before 2021, however the model appears to trip inverters installed since the revised version technical standard at the same voltage level, which is a conservative assumption and leads to an overstatement of the curtailment frequency and energy.

Essential's positive economic case depends on adopting Houston Kemp's CECV values and assuming that a static 1.5kW export limit is required from 2030.

212. We consider both of Essential's assumptions to be questionable. The Houston Kemp CECV provides significantly higher estimation of benefits than the AER's guideline value and bestows significant and highly uncertain continuing increases in such values 15 to 20 years hence.

213. Essential Energy's assumed blanket 1.5kW export limit from solar inverters from 2030 onwards drives a significant assumed benefit from DOE then avoiding the levels of curtailment that it would otherwise cause. The assumed need for this limit is not evident from the CBA model nor Zepben's hosting capacity analysis, which indicates relatively low levels of curtailment in the 2030s if the static export limits are not reduced.

A continuing level of prudent and targeted network augmentation is justified in the next regulatory period

214. The CBA model indicates that continuing targeted network investment will continue to represent a prudent means of addressing DER-related issues where and when they arise and provides a positive economic value in its own right. However, with appropriate assumptions, the model indicates that a lower level of such investment is warranted than Essential has proposed.

Prudent and targeted investment in increasing network visibility may also be justified

215. The CBA model indicates that prudent and well-targeted investment and ongoing expenditure aimed at increasing the level of network visibility and harnessing the information obtained is likely to be warranted.

216. The extent of data required to enable investment decisions to manage hosting capacity is likely to be less than Essential Energy has proposed.

The non-network ICT and Program management allowances are overstated

217. We consider the full scope of the proposed Network of the Future initiative, including ICT and program management costs, is excessive given the status of Essential Energy's program on the pathway to 'advanced' DOE in the early 2030s. We consider that a more targeted program will better meet DER facilitation objectives without an unnecessary cost burden to consumers.

3.5.2 Implications of our findings for proposed expenditure

218. We consider that a lesser amount of investment, involving a lower cost trial and elements of Essential's proposed program, would likely meet the requirements of the NER.

219. In considering Essential Energy's proposed levels of expenditure within the next five years, we consider that there is significant potential for investment regret if it transpires that a different, better or lower cost solution or combination of solutions would have achieved the eventual need to the extent that such need becomes significant later next decade, or if the assumed increasing need at that time does not materialise. In particular, we consider that the proposed investment in DER ICT 'Network of the Future' expenditure is overstated, and we assess an adjustment for this in section 4.9.2.

4 REVIEW OF NON-RECURRENT ICT EXPENDITURE

Essential Energy has proposed non-recurrent ICT capex of $64.3m, comprising nine projects. We review [redacted] of this, being cyber security-related projects, in a separate report. We reviewed the proposed Network of the Future ICT project in section 3.3.3 and one project (data centre consolidation) completes a project currently in progress and we consider that it is warranted on this basis. We review each of the other projects in this section.

Essential Energy has not presented a positive business case for its proposed CRM and Portal project and, as discussed in section 3.3.3, we consider that it has overstated the investment that is warranted for its Network of the Future ICT project. We consider that Essential Energy has adequately justified the remaining projects.

Based on these findings, we consider that a prudent level of capex would be $18.8m less than Essential Energy has proposed. We estimate that a SaaS opex reduction associated with the adjusted projects, would total $34.1m.[68]

4.1 What Essential Energy has proposed

4.1.1 Overview and summary of proposed expenditure and scope of our assessment

Overview of proposed expenditure

220. Essential Energy has proposed ICT capex of $199m, within which it has proposed $64.3m of non-recurrent ICT capex and $134.6m of non-recurrent ICT project opex, as shown in Table 3.1.

Table 4.1: Essential Energy proposed non-recurrent ICT capex and opex - $million, real FY2024

Description	2025	2026	2027	2028	2029	Total
Non-recurrent ICT capex	21.9	14.0	8.8	8.9	10.8	**64.3**
Non-recurrent ICT opex	31.4	40.5	41.8	16.5	4.4	**134.6**
Total	**53.3**	**54.6**	**50.6**	**25.3**	**15.2**	**198.9**

Source: Essential Energy Att. 10.07 ICT Business Plan, Table 4

221. The scope of our review in this section covers Essential Energy's proposed non recurrent ICT capex forecast; however, where ICT opex is associated with a program that we have reviewed, then any consequences for ICT opex would also need to be taken into account to the extent that they are explicitly proposed (e.g. as opex step changes) or are implicit in the expenditure allowances relevant to AER's determination.

222. Essential Energy has not proposed an opex step change related to the non-recurrent ICT projects.

68 These adjustments exclude any adjustments to proposed cyber security ICT, and which is covered in our separate report.

Initiatives reviewed in this section and cross-referenced initiatives reviewed elsewhere

223. The proposed non-recurrent ICT capex includes nine distinct initiatives (as Essential Energy refers to them). Our assessment of the capex for six of the nine initiatives is provided in this section 4, with the other three initiatives being as follows:[69]

- Network of the Future Strategy ([redacted] SCS only non-recurrent capex and [redacted] associated ICT opex) – assessment is provided in section 3.3.3 of this report;[70]
- Cyber Security Resilience Program ([redacted] capex and [redacted] associated ICT opex) – assessment is provided in a standalone report; and
- Data centre consolidation ([redacted] capex and [redacted] opex) – we have not assessed this project because it is a continuation of a project approved in the current RCP with expenditure in FY25 only in the next RCP.

4.1.2 Summary of the basis for Essential Energy's proposed expenditure

224. Figure 4.1 shows the expenditure profile for non-recurrent projects, split into opex and capex.

225. The average annual non-recurrent totex in the next RCP is approximately 15% lower than the actual and forecast totex in the current RCP. Notably, totex is dominated by opex in the next RCP, reflecting:

- Essential Energy's progression from on-premise systems to off-premise/cloud hosted systems; and
- The IFRS[71] requirement that cloud computing investments (SaaS[72]) must be expensed (opex), noting that the current RCP expenditure is based on the preceding accounting treatment (i.e. SaaS opex was capitalised).

Figure 4.1: ICT non-recurrent expenditure profile (real $m 2024)

Source: Source: Essential Energy response to EMCa meeting follow-up Non-recurrent ICT Projects

226. The projects/programs that Essential Energy classify as including non-recurrent capex are shown in Table 4.2.

69 Refer to Table 4.2

70 The Network of the Future Strategy is Essential Energy's DER integration program. While we have assessed this program in section 3.3.3, as a non-recurrent ICT program we have considered an adjustment based on our findings, in section 4.9.2.

71 International Financial Reporting Standards

72 Software as a Service

Table 4.2: Projects/programs comprising Essential Energy's non-recurrent capex ($m FY24, SCS only)

ICT program	Capex						Opex						TOTEX
	25	26	27	28	29	TOT	25	26	27	28	29	TOT	
ERP Payroll and RTA	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Spatial network management upgrade	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Network of the future strategy	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Advance DMS upgrade	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Mobile WFM system upgrade	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Market system, network billing & meter data	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Customer strategy - CRM and portal	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Cyber security resilience program	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Data centre consolidation	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
TOTAL	21.9	14.0	8.8	8.9	10.8	64.3	31.4	40.6	41.7	16.4	4.4	134.6	198.9

Source: 1 Essential Energy - EMCa Followup Non-recurrent ICT Projects - Confidential

4.2 Our assessment approach and context

4.2.1 Our assessment approach

227. Our assessment approach is based on assessing Essential Energy's proposed non-recurrent ICT capex against the following project dimensions:[73]

- Regulatory expectation – the business case (or equivalent, cognisant of the project development lifecycle) meets regulatory requirements set out in the NER and AER guidelines;
- Strategic alignment – the business case is aligned to the ICT strategy/strategic priorities;
- Cost estimation methodology – the derivation of the project cost estimates is based on a methodology that is likely to lead to a prudent and efficient delivered project cost, including a cross-check with dependent, inter-dependent or related projects to ensure there is no duplication of expenditure;
- Deliverability – the project and/or program of work is likely to be deliverable at an efficient cost, including understanding critical path inter-dependencies with other projects; and
- Customer engagement – the business case project demonstrates how the aligns to customer expectations, with evidence of customer engagement.

228. We have focussed our attention on the three projects (or 'initiatives' as Essential Energy refers to them) with the highest totex that are in scope for this section of the report. We have also assessed three of the remaining four initiatives, presenting our assessment in less detail. We have not assessed the seventh initiative - Data Centre Consolidation – because it

73 We would normally consider benchmarking in our reviews of ICT expenditure, however this is not helpful in assessing non-recurrent ICT project or even programs of work due to the diverse timelines on which non-recurrent ICT operate

is an approved project which commenced in the current RCP and is scheduled to be completed in FY25 at a cost of [redacted] totex in the next RCP.

4.2.2 Relevant context: AER Guidelines

229. The AER's Non-network ICT capex assessment approach[74] provides the following guidance on its approach to assessing non-recurrent ICT projects as part of its reviews of NSPs five-year revenue forecasts. We provide excerpts from this guideline in Figure 4.2.

Figure 4.2: Excerpts from AER guideline on assessment of non-network ICT

Maintaining existing services, functionalities, capability and/or market benefits

'Given that these expenditures are related to maintaining existing service, we note that it will not always be the case that the investment will have a positive NPV. As such, it is reasonable to choose the least negative NPV option from a range of feasible options including the counterfactual. For such investments, we consider that they should be justified on the basis of the business case, where the business case considers possible multiple timing and scope options of the investments (to demonstrate prudency) and options for alternative systems and service providers (to demonstrate efficiency). The assessment methodology would also give regard to the past expenditure in this subcategory.'

Complying with new / altered regulatory obligations / requirements

'It is likely that for such investments, the costs will exceed the measurable benefits and as such, the least cost option will likely be reasonably acceptable in regard to the NER expenditure criteria. Therefore the assessment of these expenditures is similar to subcategory one. Should there be options to achieve compliance through the use of external service provides, the costs and merits of these should be compared.'

New or expanded ICT capability, functions and services

'We consider that these expenditures require justification through demonstrating benefits exceed costs (positive NPV). We will make our assessment therefore through assessing the cost-benefit analysis. Where benefits exceed costs consideration should also be given to self-funding of the investment.

For each subcategory of non-recurrent expenditure, we note that there may be cases where the highest NPV option is not chosen. In these cases, where either the chosen option achieves benefits that are qualitative or intangible, we would expect evidence to support the qualitative assumptions. We consider the evidence provided must be commensurate with the cost difference between the chosen and highest NPV option.

We also note that where non-recurrent projects either lead to or become recurrent expenditures in the future, this needs to be identified in the supporting business case and accounted for in any financial analysis undertaken to support the investment.'

230. Our assessment is based on these guidelines, in particular, the need to identify where, and the extent to which, proposed expenditure is to provide new or expanded capability and the need for economic justification of such expenditure.

74 AER, Non-network ICT capex assessment approach, Nov 2019, pages 11-12

4.3 Assessment of Essential Energy's investment framework

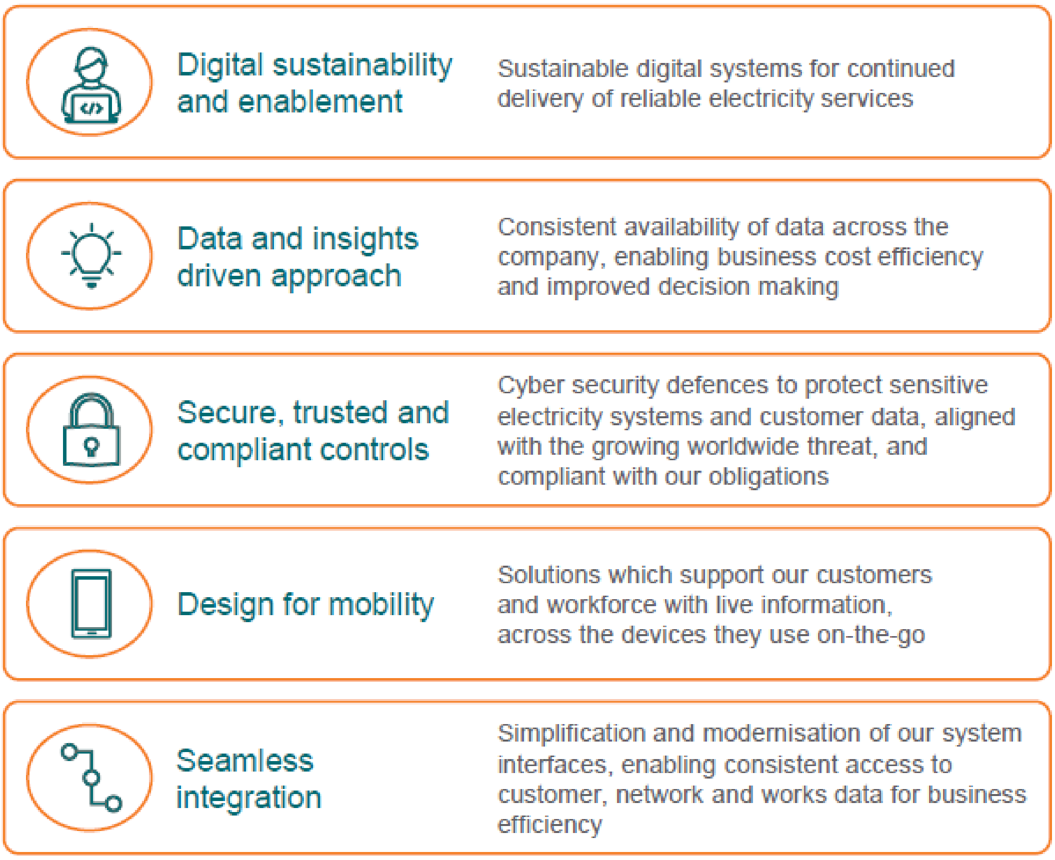
Essential Energy's ICT strategy

Essential Energy's digital strategic priorities provide an appropriate reference for the proposed initiatives

231. Essential Energy's five strategic priorities shown in the figure below are common within the industry, as NSPs seek to leverage investments in ICT to improve overall productivity, improve cyber security resilience, and improve decision-making through greater access to and analysis of multiple data forms.

232. Each of the Investment cases that we have access to include a section on Corporate strategic alignment. We have reviewed the propositions and are satisfied that the cases for action align with Essential Energy's themes.

Figure 4.3: Essential Energy's digital strategic priorities



Source: Essential Energy on-site presentation, slide 142

Links between strategic priorities and the ICT program for the next RCP are logical

233. Essential Energy has provided the key investments aligned with each of the five strategic priorities as well as the initiatives completed/underway in the current RCP.[75]

234. Based on our experience and the information provided, the sequencing of the initiatives are logical and sensible progressions from what Essential Energy refers to as 'Investments for the Future' in the current RCP to 'Systems Sustainability' and 'Customer Service' (enhancement) in the next RCP.

[75] Essential Energy Att 10.07 ICT Business Plan – Jan 23 – Confidential, pages 5-7

4.3.2 Cost estimation methodology

235. Essential Energy has included high level comments regarding its cost forecasting methodology in the individual Investment Cases (aka preliminary business cases) provided for the major non-recurrent expenditure. The common estimating methods deployed are:

- Industry analysis, historical expenditure, and cost planning using standard labour rates;
- Validation of cost estimates through consultation with industry peer businesses and advisors for the major equivalent scopes of work (e.g. MDM, MI, NBM, CRM projects); and
- Focus on using 'as-a-service' (aaS)[76] market provisioned solutions.

236. We note that Essential Energy's governance process includes refining the preliminary business cases that have been provided in support of its RP to derive the final business case, with costs informed by formal market procurement of systems and services.

237. With the exception of Essential Energy's focus on aaS services, which have cost advantages and disadvantages over time and therefore require careful consideration, we consider that its cost forecasting methodology is adequate for the preliminary business cases.

4.4 Assessment of proposed Market Systems, Network Billing and Meter data project

4.4.1 Initiative overview

238. Essential Energy proposes totex of [redacted] capex and [redacted] opex) to perform 'generational replacement' of its five systems:[77]

- In-house developed EDDiS Meter Data Management (MDM) system, which works with the CIS to process market transactions and serves as the meter data repository and management system;
- Hansen 'PeacePlus' Customer Information System (CIS);
- Hansen Market Interactions (MI) capabilities including 'Gatekeeper' and 'Market Solution' systems, which provide transaction management, interfacing with the NEM; and
- Energetiq Network Billing Management (NBM) system, which generates network billing for Retailers.

239. The replacement work is scheduled to be completed within FY27 after commencing at the start of the next RCP.

240. In the investment Case, the replacement of these systems is referred to as Stage 1 of a two-stage initiative. Stage 2 delivers a Customer Relationship Management (CRM) system and Customer Online Portal (COP or Portal). We assess Stage 2 in section 4.5.

241. Essential Energy has positioned this Stage 1 initiative as entirely for maintaining existing services, functionalities, capability and/or market benefits (i.e. with reference to the AER's classification of non-recurrent ICT projects).

[76] E.g. Software as a Service, Platform as a Service, Infrastructure as a Service

[77] Essential Energy, Att 10.07.01 Meter, Market and Customer Systems Investment Case – Jan23 – Confidential, pages 8-11

4.4.2 Essential Energy's case for change

242. In this subsection we consider the drivers for investment and whether Essential Energy has presented a compelling case for undertaking the designated non-recurrent ICT expenditure in the next RCP.

Essential Energy undertook life extension upgrades in the current RCP but the systems are or will be out of vendor support in the next RCP

243. The CIS and EDDiS are Essential Energy's primary systems for managing market data and coordinating market transactions. As such they are critical business systems.

- The CIS was implemented in 2001 and was updated with bespoke customisation to achieve mandatory compliance with the 5 Minute Settlements & Customer Switching obligations.[78] Whilst the operational life has been extended, it remains '*a superseded legacy Hansen product, operating under a vendor extended support agreement through to June 2025, with extension options concluding in June 2027'*[79]*;*
- The EDDiS MDM system was developed in-house and has also been extended in the current RCP to comply with the 5 Minute Settlements & Customer Switching obligations. However, its programming environment is now well outside of Microsoft support;
- The NBM system was deployed by Essential Energy in the 2000s and works with the CIS to generate network billing via a customised interface; and
- The MI capabilities are closely integrated with the companion Hansen CIS system.

244. In addition to the system supportability and sustainability issues summarised above, Essential Energy identifies manual handling of tariff changes as an impediment to implementing new tariffs (as referred to in section 3) and with market volatility (retailer churn) and throughput issues.

245. Essential Energy presents a risk assessment, identifying four sources of risk[80] and ranking each of them as High. Based on the description of the risks and the analysis of the likelihood and consequences presented we consider the High overall risk by 2027 or thereabouts as a reasonable assessment.

246. Due to technical obsolescence, close integration of the five systems, and reliance on manual processing, Essential Energy argues that it needs to transition the five products (each of which are critical to market operations) by 2027 at the latest.

247. In our experience it is good industry practice to seek to extend the life of products through technical upgrades and by contracting for extended vendor support to defer the major cost and business disruption associated with major upgrades/replacement. Based on the information provided, Essential Energy has done this.

248. On the other hand, it is not good industry practice to allow the commercial and operational risks associated with technical debt in core systems to accumulate to excessive levels.

249. We therefore conclude that Essential Energy has made a sound case to undertake major upgrades or replacements of the five products within the next RCP.

4.4.3 Essential Energy's Options analysis

250. Essential Energy considers three stage 1 + stage 2 options in addition to the Base Case to address the risks:

- Base Case - continue to operate with minimal incremental investment;
- Option 1 – Integrated meter, market and network billing system, and customer system (**preferred**);

[78] MSATS CATS and NEM B2B (cl 7.17.4(g); NER 6.5.7(a)(2) and 6.5.7(a)(3)

[79] Essential Energy, Att 10.07.01 Meter, Market and Customer Systems Investment Case – Jan23 – Confidential, page 8

[80] Market non-compliance, Cyber security, Inability to support new market obligations, Customer responsiveness risk

- Option 2 - Integrated meter and market and network billing system, with a separate customer system; and
- Option 3 – Separate market and customer systems with redeveloped meter data system.

251. In this sub-section we only consider the Stage 1 costs and benefits. Stage 2 (CRM and Portal enhancements) are considered in section 4.5.

Essential Energy reasonably concludes that the Base case is not technically viable

252. It is reasonable to conclude that the software for the five systems would not be able to be modified indefinitely to ensure continued compliance with the market rules. Residual supportability and sustainability risks would remain 'High'. Furthermore, there are dependencies with Essential Energy's planned tariff reforms, as discussed in section 3, which would be unable to be implemented or would require some form of workaround.

The cost benefit analysis assumptions are reasonable

253. Essential Energy's assumptions for Options 1 and 2 are the same and are summarised as follows:[81]

- The existing MDM, MI, CIS and NBM systems will continue operating with current business processes until transition to the new solution in FY27;
- The solutions will be selected via a market evaluation and formal procurement process; and
- The initiative will be delivered as a coordinated project comprising two primary delivery stages with Stage 1: Meter, Market and Network Billing implemented by Dec 2026, and Stage 2: CRM and Portal implemented by Oct 2027.

254. For Option 3, the net costs are higher than for Options1/2 despite lower SaaS fees[82] due to the extra duration and effort associated with (i) planning for and procurement of additional MDM software development services, and (ii) higher re-development complexity and higher integration and testing complexity.

255. We consider the assumptions to be reasonable.

Options 1 and 2 share advantages over Option 3

256. The scope of Stage 1 Options 1 and 2 are the same and involve replacing the MDM, MI, CIS and NBM systems with an integrated commercial solution. Options 1/2 address the business drivers and has an NPC that is commensurate with Option 3, as shown in Table 4.3.

257. Options 1/2 benefits are derived from the following financial and non-financial sources:[83]

- Financial sources:
  - avoided hosting and support charges for existing legacy CIS, MI and NBM systems, quantified at
  - avoided manual processing of meter exchanges
  - Avoided manual configuration of new tariffs
  - reduced support effort for the legacy MDM system; and
- Non-financial sources
  - ability to enable higher levels of market volatility, including through the introduction of new tariffs
  - risk mitigation benefits.

[81] Essential Energy, Att 10.07.01 Meter, Market and Customer Systems Investment Case – Jan23 – Confidential, page 25

[82] Due to the insourcing of EDDiS MDM support

[83] Essential Energy, Att 10.07.01 Meter, Market and Customer Systems Investment Case – Jan23 – Confidential, page 26

258. Option 3 also results in the replacement of the MI, CIS and NBM systems, but the legacy EDDiS MDM will be redeveloped using a modern software programming platform rather than as part of an integrated solution. Option 3 will also address the business drivers..

259. Option 3 financial and non-financial benefits are essentially the same as Options 1/2 with the exception of the reduced support effort for the legacy MDM system.

260. Option 3 is assessed as having a much higher initiative-level delivery risk than Options 1/2 because *'[u]nlike Options 1 and 2 risks associated MDM implementation [sic] remain very high, due to the custom redevelopment of a complex system and the need for extensive systems integration and testing.'*[84]

261. We are satisfied that Stage 1 Option 1 or 2 is likely to present the lowest delivery risk for replacement of the MDM, MI, CIS and NBM systems.

Stage 1 Options 1/2 are identified by Essential Energy as 100% maintaining service levels

262. We consider that it is reasonable to classify Stage 1 Options 1/2 as a non-recurrent ICT initiative for maintaining service levels.

263. With reference to the AER's non-network ICT capex assessment approach, the selected option should have the lowest NPC of the viable solutions considered. The table below summarises the comparative NPC for Stage 1 only (i.e. no CRM or Portal). We would have expected the integrated solution (i.e. options 1/2) solution to have a lower NPC than option 3, however in the costings that Essential Energy provided this has higher ongoing opex which, in NPC terms, slightly exceeds the lower capex. Nevertheless, in NPC terms the two options are materially equivalent.

Table 4.3: Stage 1 options - NPV analysis - $million, real FY2024

Description	Capex (in next RCP)	Opex (in next RCP)	NPC (11 years to 2035)
Base Case (Stage 1)	[redacted]	[redacted]	86.13
Option 1/2 (Stage 1)	[redacted]	[redacted]	105.97
Option 3 (Stage 1)	[redacted]	[redacted]	105.17

Source: EMCa's analysis using Essential Energy – Business Case Meter Market and Customer NPV Model – 20230421-Confidential

Essential Energy's selection of Option 1 is likely to be the prudent selection

264. Notwithstanding that Stage 1 Options 1 and 2 involve the same scope - replacing the existing MDM, MI, CIS and NBM capabilities with a modern integrated solution – this approach is the logical choice for following reasons:

- Essential Energy has taken reasonable steps to extend the useful life of the systems;
- The timing of the replacement work to conclude within the next RCP is appropriate;
- It is likely to be deliverable within the nominated timing;
- It aligns with Essential Energy's strategic priorities;
- It provides a platform to support the efficient introduction of new tariff structures;
- It provides a platform for improving customer service which is stage 2 of the Initiative and is discussed in the following section; and

265. Whilst the NPC for Option 1/2 is 0.7% higher than for Option 3 (Stage 1), this is not sufficient for us to conclude that Option 3 is superior to Option 1/2 (Stage 1).

84 Essential Energy, Att 10.07.01 Meter, Market and Customer Systems Investment Case – Jan23 – Confidential, page 39

4.5 Assessment of proposed Customer strategy – CRM and Portal project

4.5.1 Initiative overview

266. This initiative is presented by Essential Energy as Stage 2 of the MDM, MI, CIS and NBM systems lifecycle replacement discussed in the preceding section. It leverages the proposed new platform to provide customer relationship management (CRM) and customer online portal (COP) capabilities to improve customer service.

267. The estimated capex for this project in the next RCP is [redacted], which is an order of magnitude less than the estimated opex of [redacted]. Essential Energy has assessed the scope of work as comprising 20% maintaining the current level of service and 80% of the proposed investment for new and expanded ICT capability.

4.5.2 Essential Energy's case for change

The reported customer service improvement requirements are familiar within the industry

268. Essential Energy reports that during consultation in 2021 and 2022, its customers and stakeholders identified the need for improved customer service practices. In summary, what is sought includes:[85]

- *'A "single customer view" with a common datastore, avoiding the need for customers to "tell us twice";*
- *Timely, proactive and tailored information on network service status, planned and unplanned outages, and estimated times of recovery (ETRs);*
- *Efficient contact, enquiry and issue management;*
- *Ability to interact through a choice of channels, including an online portal with mobile enablement; and*
- *The ability for large customers and other stakeholders (including councils) to define specific contacts for individual locations or divisions within their organisational structure*.'

269. Essential Energy has provided a detailed description of the feedback in its Investment Case and we consider that the summary above is a fair representation of the (reported) feedback.[86]

270. In our experience, the features of customer service expressed by Essential Energy's customers and stakeholders is very similar to the feedback from customers and stakeholders in most jurisdictions in Australia.

4.5.3 Essential Energy's Options analysis

271. Essential Energy presents three options for introducing enhanced CRM and COP capabilities, in each case leveraging off the three options discussed in the preceding section:

- Option 1: Integrated meter, market and customer system and leverage the new solution to also provide CRM and COP capability (recommended);
- Option 2: Integrated meter, market and customer system with separate CRM and COP capability; and
- Option 3: Replace the existing MI, CIS and NBM platform with a modern solution; rebuild the in-house MDM system; deploy separate CRM and COP capability.

85 Essential Energy, Att 10.07.01 Meter, Market and Customer Systems Investment Case – Jan23 – Confidential, page 5

86 Essential Energy, Att 10.07.01 Meter, Market and Customer Systems Investment Case – Jan23 – Confidential, pages 13-18

Option 3 remains the most expensive option when the customer service enhancements are included and offers no advantages over Option 1

272. Stage 1 Option 3 was assessed as the least-preferred, technically viable option in the preceding section and adding Stage 2 does not change this conclusion. Based on Essential Energy's cost estimate, it is 16% ([redacted] more expensive to deliver the CRM and COP solutions as a separate capability (i.e. compared to Option 1).

Option 2 is more expensive than Option 1 when the customer service enhancements are included and offers no advantage over Option 1

273. Whilst Stage 1 Options 1 and 2 were the same in terms of cost and benefits, the approach for Option 2 to deliver the customer service improvements is the same as for Option 3 and therefore it also is 16% ([redacted]) more expensive than the integrated approach per Option 1.

The NPVs (or net present costs in this case) are close, but it is reasonable to conclude that Option 1 is preferred

274. Essential Energy derived an NPV of -$82.35m over an 11-year study period for the recommended Option 1 (stage 1 + stage 2), which is $3.68m (4.5%) less costly (in Net Present Cost terms) than Option 2 and $3.28m (3.8%) less costly than Option 3. In other words, the differences are small given the likely accuracy range of the costs and benefits. The closeness of the results is unlikely to change with sensitivity analyses. Combining this more favourable economic cost with the qualitative and delivery risk benefits of Option 1 resolves our view that Option 1 would be the preferred choice.

Option 1 Stage 2 is 80% attributable as an expansion of capability, but Essential Energy has not demonstrated that it has a positive NPV

275. The AER ICT expenditure assessment guidelines require that non-recurrent ICT projects which improve service capability should be demonstrated to have a positive NPV.

276. We viewed the component of Essential Energy's CBA that covers Option 1 Stage 2 only and which comprises the CRM and portal. Essential Energy states that 20% of the cost required to maintain service and 80% provides an 'expansion' of service capability.

277. Essential Energy has identified benefits from Option 1 overall, however these comprise avoided charges from its legacy systems. Therefore, the benefits represent savings against its Stage 1 legacy replacement. Essential Energy has not identified any benefits which could reasonably be considered to accrue to its 'Stage 2' expansion of capability. On this basis, therefore, the proposed Stage 2 component (capex and opex) of this project does not meet AER's criteria because it does not have a positive NPV.

4.6 Assessment of proposed ERP Payroll and RTA project

4.6.1 Initiative overview

278. Essential Energy proposes [redacted] totex ([redacted] capex and [redacted] opex) on upgrading its Enterprise Resource Planning (ERP) Payroll and Rostering and Time Attendance (RTA) systems by migrating to the Oracle ERP/HCM[87] Payroll and RTA solution.

Essential Energy's case for change

279. In the current RCP, Essential Energy's legacy Oracle Peoplesoft ERP system was integrated with its Oracle Cloud ERP/HCM solution '*to provide continued interim Payroll and RTA capability as the Oracle Cloud suite is yet to offer payroll functionality configured and certified for use in Australia…By the end of the coming regulatory period (FY29), the Oracle Peoplesoft system will have been in place for 26 years. With the shifting focus towards the*

87 Human capital management

new generation Oracle Cloud ERP suite, further legislative changes in the coming RCP may not be directly accommodated or practical in the incumbent ageing system.''[88]

280. Essential Energy's risk analysis identifies one 'High' inherent risk (New payroll/super/tax obligations) and two 'Medium' risks.

4.6.2 Options analysis

281. This business case considers two options in addition to the Base Case:

- Base Case: continue to operate the existing systems, with minimal incremental investment; defer replacement until the following RCP;
- Option 1: migrate the existing Payroll and RTA solution to the Oracle ERP/HCM equivalents (*recommended*); this option finalises the transition away from the ageing Oracle Peoplesoft ERP; and
- Option 2: migrate to a 'best of breed' solution integrated with the Oracle Cloud ERP/HCM.

Option 1 presents the lowest cost estimate and highest NPV

282. The Base Case cost estimate of [redacted] totex comprises:

- Incremental cost of Oracle on-demand hosting (PaaS) commencing in FY29 (opex) for the continued use of the Oracle Peoplesoft HCM Payroll and RTA functions;
- Peoplesoft instance is already hosted within the Oracle's Cloud environment;
- An allowance for interim Peoplesoft changes in FY28 and FY29 (opex) based on Essential Energy's similar experience with the Single Touch Payroll changes in the current RCP;[89] and
- Cost of upgrading Peoplesoft and the RTA (capex and opex) – as for Option 1 but deferred five years.

283. The Option 1 cost estimate of [redacted] totex comprises of:

- Initial opex in FY27-FY28;
- Ongoing opex (SaaS charges) to support the Payroll and RTA systems from FY28; and
- Capex to establish the Payroll and RTA systems in FY27-FY28.

284. Option 2 addresses the business drivers and mitigates the inherent risks similar to Option 1 but introduces additional independent systems and integrations, with associated service fees and support costs.[90] The Option 2 cost estimate is [redacted] totex.

285. We consider the cost estimates and timing to be reasonable.

Benefits derive from avoided hosting costs

286. Essential Energy identifies avoided hosting and support charges from its existing Peoplesoft System as the only source of benefits. For Options 1 and 2 the benefits accrue from 2029 onwards (i.e. to the end of the 15 year study period). The same benefits accrue for the Base Case but not until 2034.

287. We consider that the assumed quantum and timing of the benefits to be reasonable.

Option 1 is identified by Essential Energy as 100% maintaining service levels

288. We consider that it is reasonable to classify Option 1 as a non-recurrent ICT initiative for maintaining service levels. With reference to the AER's non-network ICT capex assessment

88 Essential Energy, Att. 10.07.03 Payroll and RTA Investment Case – Jan23-Confidential, p5

89 Essential Energy, Att. 10.07.03 Payroll and RTA Investment Case – Jan23-Confidential, page 10

90 Essential Energy, Att. 10.07.03 Payroll and RTA Investment Case – Jan23-Confidential, page 16

approach, the selected option should have the lowest NPV of the viable solutions considered. The table below summarises the comparative NPVs for the three options.

Table 4.4: Results of Essential Energy's cost benefit analysis - $million, real FY2024

Description	NPV	Totex
Base Case	-9.05	[redacted]
Option 1: migrate Oracle Peoplesoft Payroll and RTA systems leveraging Oracle Cloud ERP	-7.94	[redacted]
Option 2: replace Payroll and RTA systems with best of breed solutions integrated with the Oracle Cloud ERP	-9.47	[redacted]

Source: Essential Energy – Business Case Payroll and RTA NPV Model – 20230421-Confidential

Essential Energy's selection of Option 1 is likely to be the prudent selection

289. Option 1 is the logical choice for the following reasons:

- Essential Energy has taken reasonable steps to extend the useful life of the Payroll and RTA systems;
- It addresses the identified risks at the least cost, which is consistent with the AER guidelines for non-recurrent non-network ICT investments that are aimed at maintaining current levels of service/functionality;
- The timing of the replacement work to conclude by FY29 is appropriate and it is likely to be deliverable by that time
  - Essential Energy may choose to defer at least some of the expenditure into the following RCP if the identified risks do not manifest by or near the end of the next RCP; and
- It aligns with Essential Energy's strategic priorities.

4.7 Assessment of other non-recurrent ICT Projects

What Essential Energy has proposed

290. Excluding the Cyber security, Network of the Future, and Data Centre Consolidation initiatives, another three non-recurrent ICT initiatives are planned to commence in the next RCP with an estimated combined capex of [redacted] and [redacted] opex.

The initiatives are designated as 100% for maintaining services

291. Essential Energy has positioned each of the initiatives as maintaining current capabilities and functions. We consider that the classification is reasonable for these initiatives. In accordance with the AER's Non-network ICT capex assessment approach, we have checked in each case whether (i) Essential Energy has considered credible options, (ii) whether Essential Energy's CBA analysis is credible, and (iii) that it has selected the least-cost option (and if not, why not).

Spatial Network Management Upgrade

292. Essential Energy uses the GE Smallworld GIS and invested in the current RCP to extend its life after initially intending to replace/upgrade it the current RCO. It intends to '*renew the GIS for long term sustainability, with enhanced integration which will include the new Oracle Cloud Enterprise Asset Management (EAM) system and the upgraded GE PowerOn Advanced Distribution Management System (ADMS). This renewal may take the form of a*

product upgrade to the latest GE Smallworld version, or transition to other competing product(s). [91]

293. The estimated capex is [redacted] and the estimated opex is [redacted] over the next RCP.

294. In addition to avoiding the elevated risk of operating with reduced support for the Smallworld version for what is a critical business application, Essential Energy outlines compliance risks, productivity opportunities, and business process improvements in its Investment Case.

295. Three options are considered in the Investment Case:

- Base Case - defers replacement until the following RCP;
- Option 1. Lifecycle systems renewal – upgrade the GE Smallworld GIS (*recommended*); and
- Option 2. Lifecycle systems renewal – implement new 'best of breed' spatial solutions.

296. Essential Energy's cost-benefit analysis leads to an NPV of -$6.26m for Option 1, which represents a lower Net Present Cost (NPC) than the Base Case and a significantly higher NPV than for Option 2. We have reviewed the other qualitative advantages and disadvantages of the three options and consider that Essential Energy has selected the prudent Option.

Advanced Distribution Management System Upgrade

297. Essential Energy is migrating from the GE "PowerOn Fusion" ADMS platform to GE's "PowerOn Advantage ADMS product in the current RCP. It proposes a 'mid-life' upgrade in FY28 for an estimated capital cost of [redacted] and associated opex of [redacted] which will (i) renew the underlying technology layers for ongoing supportability, and (ii) support integration and management of DER. Essential Energy has also identified that the upgraded ADMS will enable process efficiencies through new or improved integration to its GIS, Market Systems, EAM, and Pi Historian.[92]

298. Three options are considered in the Investment Case:

- Base Case – defer the upgrade/replacement of the ADMS until the following RCP and operate the existing system with minimal investment;
- Option 1 – upgrade the ADMS (*recommended*); and
- Option 2 – Migrate to a new ADMS.

299. Essential Energy's cost-benefit analysis leads to an NPV of -$5.94m for Option 1, which is higher than the NPV for the Base Case and significantly higher NPC than for Option 2. We have reviewed the other qualitative advantages and disadvantages of the three options and consider that Essential Energy has selected the prudent option and that the cost is a reasonable estimate.

Mobile Work Force Management Systems Upgrade

300. Essential Energy proposes capex of [redacted] and opex of [redacted] to undertake a 'mid-life upgrade' of its Mobile WFM system *'to ensure the ongoing sustainability of these workforce management systems into the 2030s*.'[93] Essential Energy positions the initiative as a risk mitigation investment to ensure the ongoing operability, security and supportability of the system. It has also identified productivity improvement opportunities once the new EAM system and Depot Queue[94] systems are commissioned.

301. Three options are considered in the Investment Case:

[91] Essential Energy, Att. 10.07.05 Spatial Network management Upgrade Investment Case – Jan23-Confidential, page 2

[92] Essential Energy, Att. 10.07.04 ADMS Upgrade Investment Case – Jan23-Confidential, page 2

[93] Essential Energy, Att. 10.07.06 ADMS Upgrade Investment Case – Jan23-Confidential, page 2

[94] A improved work packaging, allocation and progress tracking initiative

- Base Case – defer upgrade/replacement until the following RCP and operate the existing system with minimal investment;
- Option 1 – upgrade the Mobile WFM system (recommended); and
- Option 2 – Mobile WFM replacement.

302. Essential Energy's cost-benefit analysis leads to an NPV of -$3.53m for Option 1, which higher than the NPV for the Base Case and significantly higher than for Option 2. We have reviewed the other qualitative advantages and disadvantages of the three options and consider that Essential Energy has selected the prudent option and that the cost is a reasonable estimate.

4.8 Deliverability risk

4.8.1 Program delivery risk

The delivery performance in the current RCP and the reduced forecast spend in the next RCP indicates manageable deliverability risk

303. Essential Energy's overall ICT program expenditure trend is down from an actual/expected $303.6m in the current RCP to $278.1m in the next RCP, or -8%. As discussed above, the proposed non-recurrent totex in the next RCP is 15% lower than the actual/expected non-recurrent totex in the current RCP.

304. Essential Energy has advised that it experienced higher 'source costs' (particularly skilled labour) in the current RCP compared to its forecast. This contributed to it spending more than the AER's allowance of $286.5m (SCS), however Essential Energy maintains that it will largely deliver on the planned projects.

305. We asked Essential Energy for evidence of its current period performance and were provided with post-implementation review summaries for the top 10 projects (by expenditure). As to be expected, there are some under-budget and over-budget projects but the overall cost variance is negligible at 2%. Schedule performance was also sound.

Essential Energy's roadmap shows that most initiatives are scheduled to be completed by FY28

306. Essential Energy's roadmap for its non-recurrent initiatives is shown in the figure below. It reveals both the timing of the initiatives earmarked for the next RCP (sorted according to Essential Energy's five ICT 'functional segments' in the first column) and the initiatives undertaken in the current RCP with expenditure in FY23 and/or FY24.

307. We observe that:

- Most projects are due to be completed by FY28 allowing some time for slippage, and generally reflecting the expenditure profile in Figure 4.1 which tapers off in the latter two years of the next RCP;
- It does not reveal critical path dependencies – we consider this issue separately; and
- With the exception of cyber security, there are no 'back-to-back' continuation projects.

[redacted]

The ICT Business Plan does not include an assessment of delivery risk

308. We would normally expect the overarching ICT strategy or plan to include at least a summary of its risk analysis and controls for ensuring the program of work is deliverable at an efficient cost in addition to the risk analysis supporting the case for investment. However, such a risk analysis was not provided in Essential Energy's ICT Business Plan which appears to be the logical vehicle for such analysis.

4.8.2 Initiative-level delivery risk

309. The Investment Cases for the initiatives in the next RCP which we have access to include a project delivery risk assessment for each option. For each of the preferred options, the residual risk is rated as moderate or low due to the nominated controls. We are satisfied that at the initiative level the controls are likely to be effective.

310. For reasons discussed above we consider that the ICT program of non-recurrent initiatives in the next RCP is likely to be deliverable at an efficient cost.

4.9 Our findings and implications

4.9.1 Summary of our findings[95]

Essential Energy has not demonstrated that its proposed Customer Strategy – CRM and Portal project has a positive business case

311. The AER ICT expenditure assessment guidelines require that non-recurrent ICT projects which improve service capability should be demonstrated to have a positive NPV.

312. Whilst Essential has selected what we consider to be the best option of those considered, it has not identified any benefits arising from the expansion of capability from the CRM and Portal project, which is referred to as 'Stage 2' of a wider project. On this basis, this 'Stage 2' project does not meet AER's criteria.

95 As previously indicated, our review of the proposed cyber security project is contained in a separate report

313. We therefore consider that the [redacted] capex and [redacted] SaaS opex for this initiative is not likely to satisfy the capex and opex criteria, respectively.

314. We expect based on the qualitative information provided by Essential about the proposed project that there are quantifiable benefits that could be determined, but Essential Energy has not presented these quantified results.

The Network of the Future initiative is assessed in section 3 of this report, where we find that the level of proposed expenditure is not justified

315. In section 3 we note that Essential Energy proposes [redacted] non-network CER ICT capex (and [redacted] opex) to support its Network of the Future initiative. While we consider that some investment in CER-related ICT is warranted, as discussed in section 3.3.3, we consider that Essential Energy has not justified the level of expenditure that it has proposed, or its timing early in the next RCP.

The projects designated to maintain the current level of service/functionality are aligned to the AER's guidelines

316. Five of the projects within the scope of this assessment are to upgrade or replace systems that are at the point in their lifecycle where the risk-cost of retaining the current version out-weighs the total cost of the proposed replacement. In most cases the timing coincides with the cessation of vendor support for the product itself or the platform on which the application/system resides.

317. We are also satisfied that Essential has taken all reasonable steps to extend the life of the systems in the current RCP or will do through to the proposed upgrade/transition date.

318. The proposed 'maintain service' projects all align with Essential's ICT priorities which are themselves familiar within the industry.

319. Essential has provided cost-benefit analyses to support the selection of the preferred option. In each case the selected option addresses the identified risks at the least cost, which is consistent with the AER guidelines for non-recurrent non-network ICT investments that are aimed at maintaining current levels of service/functionality.

320. The timing of the investments which are all designated to conclude within the next RCP is defensible and the work is likely to be deliverable at an efficient cost, although we note that Essential Energy may choose to defer at least some of the expenditure into the following RCP if the identified risks do not manifest by or near the end of the next RCP as envisioned.

The data centre consolidation project should be completed

321. Data Centre consolidation is a continuation project that is approved and which we have not reviewed. The initiative is scheduled to be completed in the first year of the next RCP for an estimated capex of [redacted] and opex of [redacted].

4.9.2 Implications of our findings for proposed expenditure

Alternative forecast adjustments

Customer strategy – CRM and portal is not justified

322. For the projects within scope we consider that Essential Energy has not sufficiently justified the proposed [redacted] capex for the Customer Strategy – CRM and Portal. This would imply that the [redacted] of SaaS opex associated with this project is therefore also not required.

The level of proposed expenditure on CER / Network of the Future non-network ICT capex is not justified

323. Consistent with our assessment of Essential Energy's proposed CER program in section 3, we consider that the proposed CER-related ICT capex of [redacted], and associated SaaS opex of [redacted] is not justified. However, we expect that Essential Energy will need to

continue to invest in some CER-related ICT over the next RCP, as it continues its journey towards being able to offer advanced dynamic services in the 2030s, when it expects these to be warranted.

324. From the information provided, we are not able to define what a smaller-scale ICT project should be but taking account of the levels of investment proposed by other DNSPs currently under review, we consider that it is likely to be 50% of the currently proposed amount, and possibly less. This would therefore reduce the proposed capex allowance by [redacted] and would imply an associated reduction of [redacted] in SaaS opex.

Aggregate impact

Other than for cyber security, we propose an alternative non-recurrent capex forecast that is $18.8m less than what Essential Energy has proposed

325. From Essential Energy's proposed non-recurrent ICT capex of $64.3m, and associated opex of $134.6m, we propose the following adjustments would provide for a reasonable allowance for the projects considered in this report:

- A reduction of [redacted] capex (and associated SaaS opex of [redacted] for the proposed Customer Strategy – CRM and Portal project; and
- A reduction of [redacted] capex (and [redacted] SaaS opex) for the proposed Network of the Future project.

326. The SaaS opex associated with the adjustments to the two projects above totals [redacted].

327. Our assessment of proposed ICT cyber security expenditure of [redacted] capex (and associated SaaS opex of [redacted]) is discussed in our separate report, which also identifies any assessed adjustments to Essential Energy's proposal.

Annual adjustments

328. To the extent that AER adopts our proposed adjustments to Essential Energy's proposed ICT, the relevant annual expenditure for the two relevant projects above is contained in Table 4.2.

Balance of proposed non-recurrent ICT expenditure is reasonable

329. Excluding the proposed cyber security expenditure, we consider that balance of the in-scope capex of [redacted] (and [redacted] of associated SaaS opex) represents a prudent level of expenditure which Essential Energy has adequately justified.

No non-recurrent ICT-related opex step change

330. Essential Energy did not propose an opex step change within the scope of our ICT assessment. The SaaS opex implications referred to in the current section may need to be taken into account in considering any step change that Essential Energy subsequently proposes.