# Value Framework

**Supporting Document 5.1.5**

January 2024

SA Power Networks

Empowering South Australia

# Contents

# Glossary

| Acronym / term | Definition |
|---|---|
| **ABS** | Australian Bureau of Statistics |
| **AEMO** | Australian Energy Market Operator |
| **AER** | Australian Energy Regulator |
| **ALARP** | As low as reasonably practicable |
| **BAU** | Business as usual |
| **CAPEX** | Capital expenditure |
| **CECV** | Customer export curtailment value |
| **CER** | Customer energy resources |
| **CPI** | Consumer price index |
| **CSIRO** | Commonwealth Scientific and Industrial Research Organisation |
| **DF** | Disproportionality factor |
| **DNSP** | Distribution Network Service Provider |
| **EDC** | Electricity distribution code |
| **EPA** | Environment Protection Authority |
| **ESCoSA** | Essential Services Commission of SA |
| **FTE** | Full-time employee |
| **GHG** | Greenhouse gas emissions |
| **ICT** | Information and communication technology |
| **IT** | Information technology |
| **kWh** | Kilo-watt hours |
| **LRMC** | Long run marginal cost |
| **NEL** | National Energy Law |
| **NEM** | National Energy Market |
| **NEO** | National energy objective |
| **OH&S** | Occupational health and safety |
| **OMS** | Outage management system |
| **OPEX** | Operating expenditure |
| **OTR** | Office of the Technical Regulator |
| **PV** | Photo Voltaic |
| **SA POWER NETWORKS** | SA Power Networks |
| **SF6** | Sulphur hexafluoride |
| **SRMC** | Short run marginal cost |
| **SRMTMP** | Safety, reliability, maintenance and technical management plan |
| **VBDM** | Value based decision making |
| **VCR** | Value of customer reliability |
| **VSL** | Value statistical life |
| **VSLY** | Economic Value of a Statistical Life Year |
| **WACC** | Weighted average cost of capital |

# 1 Introduction

## 1.1 Purpose

The purpose of this value framework is to implement a common set of business wide value dimensions and underlying value metrics to quantify benefits and risks associated with proposed expenditures. Utilising a common set of values enhances our decision-making process by improving transparency and alignment between our investment decisions, goals and objectives. This enables us to assess and prioritise expenditures based upon their ability to contribute to business and customer outcomes.

## 1.2 Scope

Value based decision making (**VBDM**) is a best practice approach used in investment planning offering several benefits to our business and customers.

VBDM enhances transparency and line of sight between our organisational strategic focus areas and the valuation and management of enterprise risks by facilitating a clear understanding of how these risks are assessed and subsequently addressed. Additionally, VBDM enables the comparison of dissimilar investments using a standardised set of economic measures, ensuring a consistent and repeatable evaluation process. By considering the varying degrees of risk mitigation and the maximization of benefits relative to costs, our investments can be strategically prioritized and timed to achieve our desired objectives.

This Value Framework defines our organisational-wide value dimensions and underlying metrics used to quantify benefits. It also contributes to the description of attributes used in quantifying benefits associated with investments. As a critical document, the value of all investments that are being considered utilise this Framework to quantify the benefits of the proposed expenditure, ensuring a comprehensive and standardised approach.

This framework is implemented through various modelling tools across our business to forecast expenditures and associated benefits. Our forecasting structures and methodologies across the various expenditure areas guide the application of this Value Framework in investment analysis as shown in Figure 1-1.

**Figure 1-1: Expenditure forecasting framework**


## 1.3 Regulatory Requirements

The specification of this Value Framework is guided by the need to align with regulatory rules, guidelines and stakeholder expectations. In the regulatory context, the Value Framework supports the development of an efficient and prudent investment portfolio that maximises the benefits to customers.

Regulatory requirements which impact network and non-network investments are outlined in the following guidance notes published by the Australian Energy Regulator (**AER**):

- Industry Practice Application Note for Asset Replacement Planning;
- Customer Export Curtailment Value (**CECV**) Methodology;
- AER Note on Network Resilience;
- AER Regulatory Investment Test for Distribution and Application Guidelines; and

- Non-network ICT Capex Assessment Approach.

Guidance notes published by the AER are a key source of regulatory requirements for risk (benefit) modelling. Investment programs supported by modelling that are consistent with the approaches in the notes are therefore aligned to the requirements specified by the AER.

The notes list the following 'typical consequence areas' in modelling risk, as well as methodologies to estimate customer benefits against the costs of investments across the following areas:

- reliability and security;
- OH&S;
- environment;
- legislative and regulatory;
- financial;
- resilience;
- value of customer energy exports; and
- cybersecurity.

This Value Framework builds upon these typical consequence areas by providing further definitions and approaches to determine the values used within our investment analysis modelling.

## 1.4 Alignment to Strategic Objectives & Corporate Risk Management Framework

Our Corporate Risk Management Framework also plays a crucial role in facilitating a structured approach to understanding and addressing risks within our business. It involves qualitative analyses of risks across different levels, ranging from macro-level industry risks to micro-level business-wide and department-specific risks, providing a comprehensive perspective on potential threats that could impact our ability to achieve goals and objectives.

A key function of the Corporate Risk Management Framework is to enable effective prioritisation of business attention and resources. Given that not all risks carry the same significance, identifying and categorizing risks into various areas allows for the appropriate allocation of our efforts and resources based on their respective impacts on our operations, finances, and customer outcomes.

Once risks are understood and prioritized, the next step involves a systematic assessment of risks and benefits associated with investments in risk mitigation measures. This is where the Value Framework comes into play, complementing the Corporate Risk Management Framework. By providing a mechanism to quantify risks and evaluate potential benefits from risk management strategies, the Value Framework enables a cost-benefit analysis of various risk mitigation options. This, in turn, identifies investments that offer the most significant potential for risk reduction while minimizing the financial resources required. The synergy between these frameworks ensures a well-rounded and strategic approach to risk management within our business.

## 1.5 Principles in developing the Value Framework

This Value Framework defines the economic impacts (i.e. costs and benefits) to the community that are expected to arise from the occurrence of events (e.g. asset condition related failures, weather events, bushfires, security breaches, import and export constraints, etc) across different value dimensions. In estimating the economic impacts, it is important to systematically determine the appropriate economic value within each value dimension. Value metrics are assigned to each value dimension to determine the total economic impact.

### 1.5.1 Economic value

Value metrics are based on societal value which is considered appropriate as it is society that bears many of the consequences from harmful events. Societal value includes our customers who receive many of the benefits while also incurring the cost of network and non-network investment.

### 1.5.2 Range / Severity

The economic value of network events may have a range of different impact magnitudes across each of the value metrics. Depending on the value metric and the asset, the economic value is determined either using one of two methods:

1. Value Attribution; or
2. Value Scale.

#### *1.5.2.1 Value Attribution method*

The Value Attribution method applies a specific economic value associated with an outcome arising from an event. The Value Attribution approach is used when the economic impact of an event is determined by individual asset characteristics, such as unserved energy being determined by the average load an asset carries and the types of customers it services.

#### *1.5.2.2 Value Scale method*

The Value Scale method is a five-point severity scale of consequences which is drawn from our Risk Management Framework that utilises economic values assigned to each consequence severity level which are listed in Table 1-1 below.

**Table 1-1: Consequence severity scale**

| Consequence severity | Description |
|---|---|
| **Catastrophic** | The highest, most significant economic impact |
| **Major** | |
| **Moderate** | |
| **Minor** | |
| **Minimal** | The lowest, most insignificant economic impact |

The Value Scale approach is used where the economic impact varies between these defined levels e.g. safety consequences.

# 2 Value Dimensions and Value Metrics

## 2.1 Value Dimensions

Value Dimensions represent the categories into which our business outcomes and customer expectations can be assigned a value. This Value Framework defines 12 Value Dimensions into which economic value can be allocated. Figure 2-1 below lists these Value Dimensions and shows their alignment with our Corporate Risk Consequences and Strategic Focus Areas.

**Figure 2-1: Mapping Strategic Objectives, Enterprise Risks and Value Dimensions**

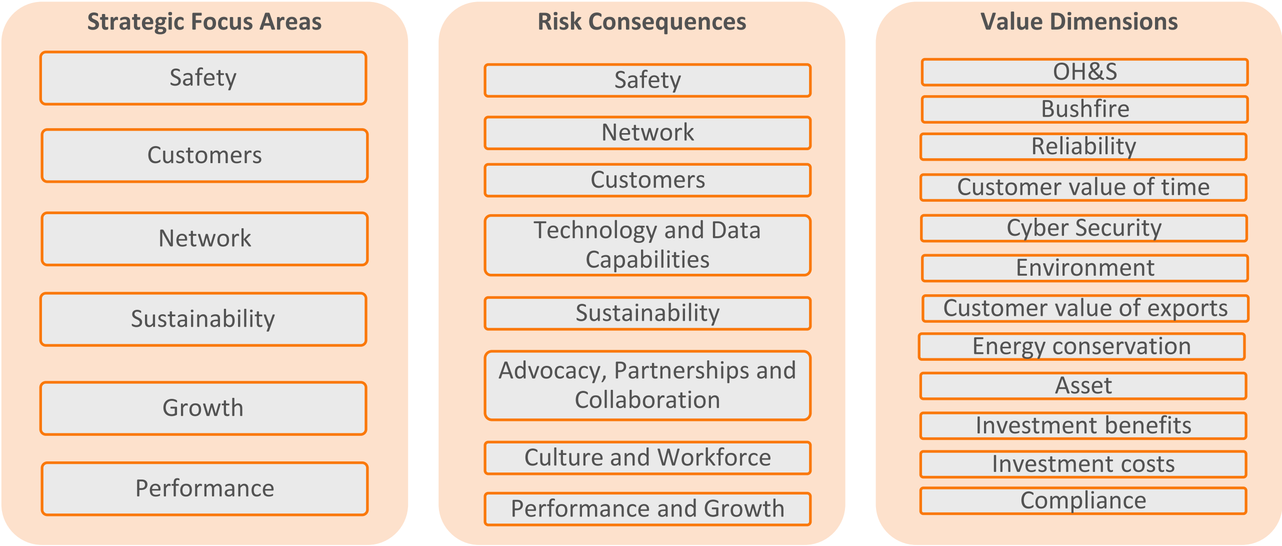



Table 2-1 presents an overview of the Value Dimensions and their intended scope.

**Table 2-1: Value Dimensions and associated scope**

| Value Dimension | Scope |
|---|---|
| **OH&S** | Costs to workers, the public and the business associated with physical injuries sustained by persons because of network assets or network activities. |
| **Bushfire** | Costs associated with bushfires including loss of life, property, environment, and network assets. |
| **Reliability** | Costs incurred by customers for the network failing to provide them with electricity, such as via the failure of an asset or insufficient capacity being available. |
| **Customer value of time** | The value of the time that customers spend either accessing information in regard to our services. |
| **Cyber Security** | Costs associated with a cyber breach of our systems that relate to detection, notification and response to a breach, as well as direct business impacts in time lost without system access, and penalties imposed. |
| **Environment** | Costs associated with damage to the environment caused by network assets or network activities. This excludes the costs associated with network-initiated bushfires. |
| **Customer value of exports** | Value of exports from customer energy resources (**CER**), as per the AER methodology. This dimension only considers the value of customer energy exports that are permitted by the AER CECV methodology. |
| **Energy conservation** | The value associated with the reduction of appliance energy consumption due to a reduction in network voltage. |
| **Asset** | The direct financial costs to the network that occur as a result of an asset failure that are not included within any other value dimension (such as costs associated with unplanned response). |
| **Investment benefits** | Avoidable costs associated with replacing a degraded asset with a new equivalent or other benefits resulting from undertaking the investment (such as avoided maintenance) and time saved from assets being unavailable. |
| **Investment costs** | Actual expected costs associated with undertaking investments. These costs could be funded under network capex or opex. This category also considers avoided (current) and reduced (future) expenditures. |
| **Compliance** | Costs incurred for not complying with legal and/or regulatory obligations. |

## 2.2 Value metrics

Each Value Dimension contains several Value Metrics to which dollar values are assigned. For each Value Dimension, one or more underlying Value Metrics have been identified against which dollar values have been assigned. When the framework is applied, each applicable Value Metric is summated to determine the total value of a consequence/benefit associated with each Value Dimension. Table 2-2 presents an overview of the Value Dimensions and the Value Metrics.

**Table 2-2: Value Dimensions and their Value Metrics**

| Value Dimensions | | | Value Metrics | | |
|---|---|---|---|---|---|
| **OH&S** | Disability Weighted Value of Life / WHS Cost (including disproportionality factor) | Investigation costs | Litigation costs | | |
| **Bushfire** | Direct economic losses (property, livestock, agriculture) | | | | |
| **Reliability** | Unserved energy | Lost Embedded Generation | Investigation costs | Litigation costs | |
| **Customer value of time** | Customer productivity | | | | |
| **Cybersecurity** | Business Cyber recovery | Penalties | Business productivity loss | | |
| **Environment (non-bushfire)** | Remediation Costs | Greenhouse Gas Emissions | Penalties | Investigation costs | Litigation costs |
| **Customer value of exports** | Avoided distribution losses | FCAS benefits | Generator SRMC | Generator LRMC | |
| **Energy Conservation** | Avoided energy consumption | | | | |
| **Asset** | Reactive Replacement Premium | Asset Repairs | Investigation Costs | | |
| **Investment Benefits** | Avoided Opex | Opex reduction | Capex Avoidance | Capex reduction | Other benefits |
| **Investment Costs** | Activity Cost | Financing Rate | Investment Lifetime | Capex | Opex |
| **Compliance** | Penalties | | | | |

The following sections of this Value Framework detail each of the Value Dimensions and the Value Metrics shown above.

# 3 Financial value summary

The following section provides an overview of the financial value attribution methodology for each of the associated Value Dimensions underlying Value Metrics that are to be applied in our VBDM quantification models. Specific values for each metric are provided in Section 3.10.

## 3.1 OH&S

The Value Dimension of OH&S quantifies company, individual and community costs associated with injuries and fatalities caused by the failure of, or interaction with, network assets.

There are three value metrics for OH&S:

1. **Disability Weighted Value of Life / OHS costs (including disproportionality factors[1])** - represent society's willingness to pay to avoid serious injuries and/or fatalities and the cost to the network, individual and the community of minor injuries for which a value of life approach is not appropriate.
2. **Investigation costs** - represent the cost of carrying out investigations into the cause of the incident.
3. **Litigation costs** - represent the costs associated with any legal dealing resulting from the incident.

Each of the above value metrics are quantified using the Value Scale method which are listed below in Table 3-1.

**Table 3-1: OH&S value dimension**

| OH&S | Financial value calculations | | | | |
|---|---|---|---|---|---|
| | Value scale metrics | | | | |
| Rating of incident consequence | Minimal | Minor | Moderate | Major | Catastrophic |
| Measure of consequence of incident | Incident but no injury | Medical treatment only | Lost time injury | Permanent injury/work related illnesses to one or more persons | One or more fatalities. Multiple significant permanent injuries/work related illnesses |
| Disability Weighted Value of Life / OHS costs | Minimal | Minor | Moderate | Major | Catastrophic |
| Disproportionality factor | 3.2 | 3.9 | 4.6 | 5.3 | 6 |
| Investigation costs | Low | Low | Medium | High | High |
| Litigation costs | Very low | Low | Medium | High | Very high |

## 3.2 Bushfire

The bushfire value dimension quantifies direct economic losses, including structure replacement values, and agricultural/horticultural and livestock losses resulting from fires started by network asset failures.

One value metric is used for Bushfire:

1. **Property, lives and other direct costs –** represents direct losses due to a bushfire which are namely land damage, property damage, public injuries and fatalities. Note it does not include losses due to interruption of business activity or costs/losses due to the interruption of electricity supply.

The Property, lives and other direct costs metric is quantified using the Value Attribution method which is described below in Table 3-2.

[1] The Disproportionality factor is a multiplier applied to OH&S consequences to align with legal requirements to invest in consequence avoidance whenever costs are not grossly disproportionate to the risk reduction achieved.

**Table 3-2: Bushfire value dimension**

| Bush Fire | Financial value calculations |
|---|---|
| | **Value attribution metrics** |
| Property, lives and other direct costs | The value of Expected Bushfire Loss is summarised as a single value calculated for each asset unit in the network, based on the unique asset location using CSIRO modelling. The value for each asset is a weighted average of the expected economic loss for varying weather conditions considering both the likelihood of suppression and fire spread. |

## 3.3 Reliability

The Reliability Value Dimension quantifies costs associated with our network failing to transport electricity. This could be due to the failure of an asset, or lack of capacity within the network to accommodate electricity demand.

There are five value metrics for Reliability:

1. **Unserved energy** - represents the cost associated with a failure of the network to supply electricity.
2. **Lost large scale embedded generation** - represents the cost to the system of a loss of generation export from large-scale embedded generators registered with AEMO and semi-scheduled generators due to a failure of the network to transport electricity.
3. **Investigation costs -** represents the cost of carrying out investigations to determine the cause of the networks inability to transport electricity from generated to customers.
4. **Litigation costs** - represents the costs associated with any legal dealing resulting from the inability to transport electricity generated to customers.

The Reliability value metrics utilise both mix of Value Attribution and Value Scale methodologies which are briefly described in table 3-3 below.

**Table 3-3: Reliability value dimension**

| Reliability | Financial value calculations | | | | |
|---|---|---|---|---|---|
| | **Value attribution metrics** | | | | |
| Unserved energy | The value of Unserved Energy is summarised as a single value that is calculated for each asset in the network, based on the unique characteristics of each asset e.g. number of downstream customers, asset location etc. The value for each asset is a weighted average of the expected range of Reliability risks (such as duration and coincident failures). This differs to other value dimensions where values are calculated for multiple severity levels. The value of unserved energy is calculated using the AER's Values of Customer Reliability (VCR)[2]. | | | | |
| Lost large scale embedded generation | The value of the lost generation is calculated based on outage duration, annual generation and dispatch weighted NEM price. | | | | |
| | **Value scale metrics** | | | | |
| Rating of incident consequence | Minimal | Minor | Moderate | Major | Catastrophic |
| Measure of consequence of incident | < 2,000 customers without supply for < 12 hours | 10,000 customers without supply for < 24 hours | < 40,000 customers without supply for < 48 hours | > 40,000 customers without supply for > 48 hours | Adelaide CBD without supply for > 24 hours |
| Investigation costs | Low | Low | Medium | High | High |
| Litigation costs | Very low | Very low | Very low | Very low | Very low |

[2] AER VCRs are available via: [www.aer.gov.au/industry/registers/resources/reviews/values-customer-reliability], accessed 29 January 2024.

## 3.4 Customer value of time

The Customer value of time dimension refers to the benefit customers derive from reductions in time spent accessing information and/or support in relation to our services. The time saved may instead be used to undertake work or leisure activities from which customers derive value. Time saved typically arises from the automation of processes, consolidation of applications and reliability of ICT systems that avoid customer productivity loss due to an ICT outage.

There is one value metrics for Customer Value of Time:

1. **Customer value of time** – The value of customer time saved from accessing information and/or support in relation to our services.

The Customer value of time metric is quantified using a Value Attribution methodology which is described in table 3-4 below.

**Table 3-4: Customer value of time value dimension**

| Financial | Financial value calculations |
|---|---|
| **Value attribution metric** | |
| Efficiency benefit | • Reduction of time spent by customers accessing information provided by our various systems and interaction processes (e.g. handling or mitigating the need for enquiries such as in relation to planned outages) due to either system efficiency improvements or a reduction in the number of customers requiring access to such systems because of pro-active information provision on items like planned or unplanned outages. |

## 3.5 Cyber Security

The cybersecurity value dimension quantifies the expected costs and penalties associated with a cyber breach of our systems.

**Table 3-5: Cyber Security value dimension**

| Financial | Financial value calculations |
|---|---|
| **Value attribution metrics** | |
| **Business recovery cost** | • Estimated cost of recovering from a cyber breach, including investigation of the incident, public relations and rectification to systems, data and processes. |
| **Penalties** | • The penalty associated with a breach of the Privacy Legislation Amendment, described as a 'serious or repeated breach of privacy'. |
| **Business productivity loss** | • The loss of business functionality or access to a significant portion of our core IT systems following a cyber breach event. |

## 3.6 Environment (non-bushfire)

The value dimension of Environment (non-bushfire) quantifies the cost of damage to the environment caused by the failure of network assets.

There are five value metrics for environment:

1. **Remediation costs** - represent costs incurred by the network to return the environment to its pre-asset failure state.
2. **Greenhouse gas emissions** - represents the cost to society of the emission of gasses that may contribute to climate change and is valued pursuant to the National Electricity Objective.

3. **Penalties -** represent fines that could be levied by regulators or other bodies for allowing the damage to the environment to occur.
4. **Investigation costs –** represent the costs of carrying out investigations into the cause of the incident.
5. **Litigation costs -** represent the costs associated with any legal dealing resulting from the incident.

The Environment (non-bushfire) value metrics use both Value Attribution and Value Scale methodologies which, described in Table 3-6 below.

**Table 3-6: Environment (non-bushfire) value dimension**

| Environment (non-bushfire) | Financial value calculations | | | | |
|---|---|---|---|---|---|
| | **Value attribution metrics** | | | | |
| Remediation costs | This value metric incorporates costs incurred to clean-up environmental damage. This is limited to the clean-up of oil but may be expanded over time to include other materials that require clean-up. Oil clean-up costs are related to the quantity of oil spilled.<br>The total cost for each severity level is as follows: Cleanup cost = Oil Capacity (Litres) × % lost to environment × Cleanup Cost per Litre | | | | |
| Greenhouse gas emissions | This metric values greenhouse gas (GHG) emissions in quantifying the value of contributing to meeting emissions reduction targets of participating jurisdictions pursuant to the NEO. GHG emissions result in societal costs due to their contribution to climate change. Value attribution is based on a price of AUD$65.47) per tonne of C02 with an indexation of 4.5% per annum until 2040.[3] This represents SA POWER NETWORKS's placeholder approach, pending a Value of Emissions Reduction being determined by Australian governments. | | | | |
| | **Value scale metrics** | | | | |
| Rating of incident consequence | Minimal | Minor | Moderate | Major | Catastrophic |
| Measure of consequence of incident | Value attribution < $5000. Negligible damage that is contained on-site. | Value attribution < $20,000. Minimal damage to the environment and small clean-up. | Value attribution < $100,000. | Value attribution > $100,000 | Long term environmental impacts. Permanent and irreparable damage |
| Penalties | Very low | Very low | Low | Medium | High |
| Investigation costs | Low | Low | Medium | Medium | High |
| Litigation costs | Very low | Low | Medium | High | High |

## 3.7 Customer Value of Exports

The Customer Value of Exports dimension reflects the value associated with avoided export curtailment (also known as alleviated export curtailment).

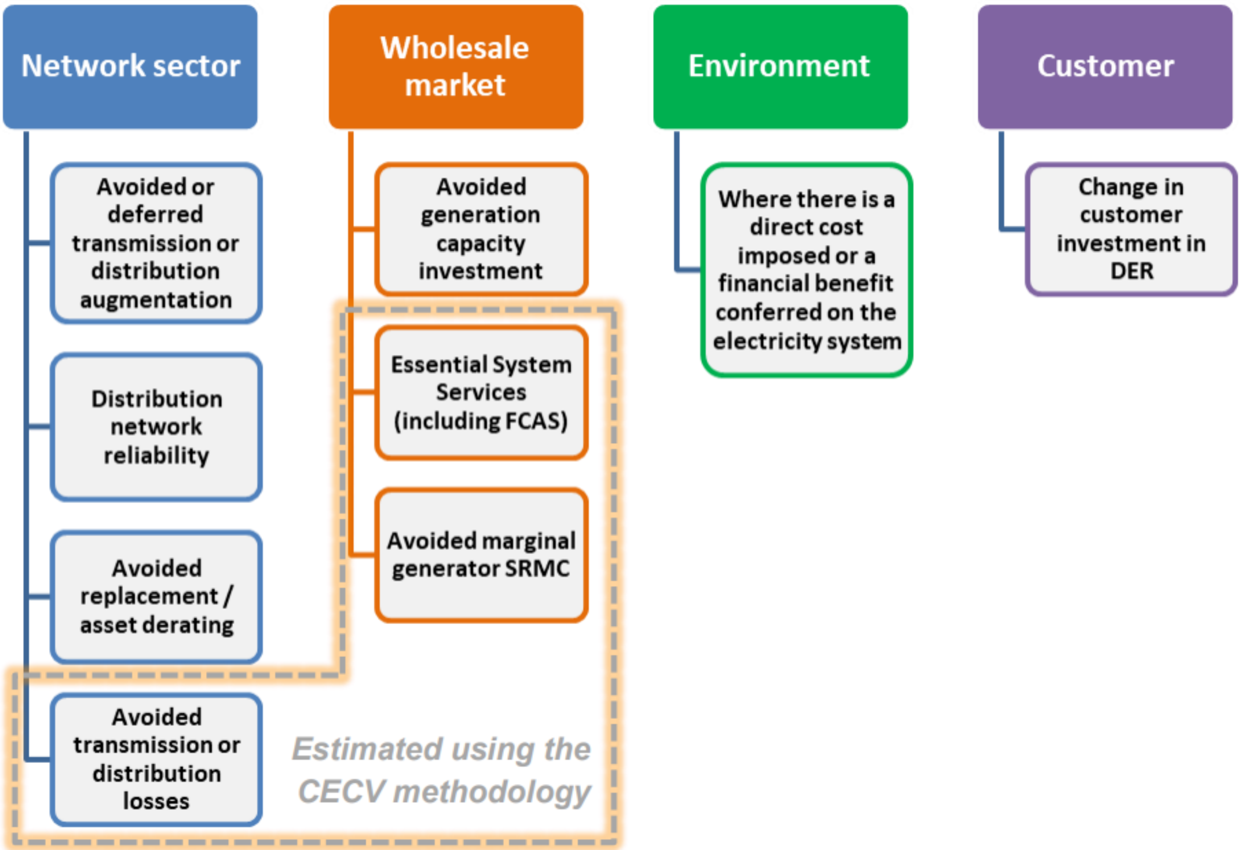
This has been quantified in accordance with the AER's Customer Export Curtailment Value methodology[4] which utilises CECVs to reflect the costs all customers face when energy exports on the distribution network are curtailed.

It is important to note that the AER CECV methodology only provides values for a subset of the known benefits associated with alleviated export curtailment. These benefits and those quantified by the AER's CECV methodology are shown in Figure 3-1 below.

[3] SA Power Networks, *'Shadow carbon price for valuing emissions reduction benefits*', 26 April 2023, p. 3.

[4] AER, *'Final customer export curtailment value methodology – June 2022'*, available via: [www.aer.gov.au/industry/registers/resources/guidelines/customer-export-curtailment-value-methodology/final-decision], accessed 29 January 2024.

**Figure 3-1: DER value streams provided by AER guidance[5]**




The AER CECV methodology does not preclude DNSPs from quantifying the other benefits identified in the AER's CECV methodology, such as avoided generation capacity investment costs.

We engaged economic consultants, Houston Kemp, who have quantified the value of avoided generation capacity investment costs using whole of National Electricity Market (**NEM**) modelling[6]. This modelling applies with/without analysis of a forecast alleviation of export curtailment resulting from our proposed investment program. These avoided generation capacity investment values are added on top of the AER's CECVs for inclusion in cost-benefit modelling.

In summary, the Customer Value of Exports dimension contains two value metrics which are the:

1. **AER CECV –** reflects the FCAS, avoided transmission or distribution losses and avoided marginal generator SRMC costs; and
2. **Avoided generation capacity investment CECV** – reflects the avoided or deferred generator LRMC.

Note that the two metrics above are combined into a single modified CECV for use in our modelling.

**Figure 3-7: Customer value of exports value dimension**

| Financial | Financial value calculations |
| --- | --- |
| | **Value attribution metrics** |
| Alleviated export curtailment benefits | • AER CECV: Values are taken from the AER's CECV values available via the AER website.<br>• Avoided generation investment LRMC: Values associated with our investment programs alleviated curtailment are calculated by economic consultants HoustonKemp. |

[5] Sourced from AER *'Final CECV methodology – Explanatory statement'* p. 8. Available via [www.aer.gov.au/documents/aer-explanatory-statement-final-customer-export-curtailment-value-methodology-june-2022], accessed 29 January 2024.

[6] See document: 5.7.13 - Houston Kemp Avoided Generation Investment Report - Consultant Report

## 3.8 Energy Conservation

The Energy Conservation Value Dimension refers to the financial saving customers may derive from reductions in the amount of electricity that various appliances may consume when average voltage levels on the network are lowered.

There is one financial value metric for the Energy Conservation Dimension:

1. **Avoided energy consumption** – represents the savings customers derive from lower electricity consumption.

The avoided energy consumption value metric utilises a Value Attribution methodology.

**Table 3-8: Energy conservation value dimension**

| Financial | Financial value calculations |
|---|---|
| **Value attribution metrics** | |
| Avoided energy consumption | • Avoided energy consumption: value customers will receive determined by multiplying the amount of energy consumption reduction achieved against the South Australian Default Market Offer[7]. |

## 3.9 Asset

The Value Dimension of Asset quantifies direct financial costs to the business occurring as a result of an asset failure that are not included in other value dimensions (i.e. excluding environmental clean-up and fines, etc.). There are four value metrics for financial:

1. **Reactive replacement premium** - represents the additional costs incurred to replace an asset reactively after a failure relative to a planned replacement, including overtime costs and productivity costs due to diverting resources from other tasks and an inability to efficiently schedule the work.
2. **Asset repairs (linear assets only)** - represents the cost of repairing assets after failure and only applies to linear assets due to their repairability.
3. **Investigation costs** - represents the cost of investigating the cause of consequences after-the-fact.
4. **Property damage** - represents the replacement or repair cost of property damaged or destroyed by the asset failure (excluding damage due to fire or environmental damage caused by the asset failure).

The Asset value dimension metrics utilise both value attribution and scale methods, described in table 3-9 below.

**Table 3-9: Asset value dimension**

| Financial | Financial value calculations |
|---|---|
| **Value attribution metrics** | |
| Reactive replacement premium | Reasonable estimate of the costs if it can be calculated for an asset class. If not, the planned replacement unit rate is uplifted by a fixed amount representing the cost to respond to the asset failure[8]. |
| Asset repairs | Current unit rates for repairs. If unit rates are not available, the rate should be calculated from a sample of recent historic repairs. |
| Property damage | Property damage costs are calculated for each asset class based on historic data. |
| **Value scale metrics** | |

[7] AER, *'Default market offer price determination 2022-23 – Final Determination 26 May 2022'*, available via: [https://www.aer.gov.au/documents/aer-final-determination-default-market-offer-prices-2022-23-26-may-2022], accessed 29 January 2024.

[8] Refer section 4.9.1

| Rating of incident consequence | Minimal | Minor | Moderate | Major | Catastrophic |
|---|---|---|---|---|---|
| Measure of consequence of incident | Cost < $100k | < $500k | < $2m | < $10m | > $10m |
| Investigation costs (only applied when no other consequences are incurred) | Low | Medium | Medium | High | High |

Some financial costs to the network are excluded to avoid double counting such as payments related to regulatory incentive schemes.

## 3.10 Compliance

As a requirement of its South Australian Distribution Licence, SA Power Networks is required to prepare and comply with a safety, reliability, maintenance and technical management plan (**SRMTMP**) dealing with matters prescribed by regulation. This comprehensive document lays out the safety and technical compliance management strategy agreed between the South Australian Technical Regulator and SA Power Networks. This document includes description of the major risk areas and the management framework explaining the basic approach and philosophy for mitigating those risks.

SA Power Networks considers that compliance with obligations is a requirement, and that a do-nothing approach to compliance requirements is not credible nor acceptable. However, not all compliance obligations are set based on the same criteria. For instance, some obligations require best endeavours to comply whereas other obligations require more strict compliance.

The cost of the most efficient option to achieve compliance needs to be determined so that the expenditure can be prioritised. The nature of compliance required (e.g. best endeavours), together with the costs of achieving compliance can then be considered together to determine the timeframe over which the expenditure will be incurred (as it is prioritised against other investment prioritises).

Table 3-10 contains examples of compliance requirements as related to network investment.

**Table 3-10: Examples of compliance matters for which the value dimension can apply**

| Compliance matter | Details of compliance required | Nature of compliance required | How compliance is monitored | How is non-compliance dealt with |
|---|---|---|---|---|
| **Network reliability standards** | Electricity Distribution Code (EDC/13) set targets for reliability, network restoration and minimising interruptions. | Best endeavours (EDC/13 Section 2.2) | SA Power Networks is to report how it has applied best endeavours if performance fails to meet the standards . | Step 1 - ESCoSA could request a plan from us to remedy within specified timeframe, the non-compliance<br>Step 2 -potential to cancel our licence. |
| **Vegetation clearances** | Electricity (Principles of Vegetation Clearance) Regulations 2021. | Duty to take reasonable steps to comply. The Electricity Act requires SA Power Networks to take reasonable step to keep vegetation clear of powerlines s55) and if this occurs, SA Power Networks is not liable for any damage cause by interaction between our powerlines and vegetation (eg interruption to supply, bushfire start etc) | Internal audits, external audits and audits by OTR. Must report on compliance annually to OTR and ESCoSA. | Step 1 - Technical Regulator issues direction to comply with the Regulation.<br>Step 2 - potential to cancel our licence. |

| | | | | |
|---|---|---|---|---|
| **Clearance to ground, clearance to structure** | Electricity (General) Regulations 2012. Parts 10 and 13 (Table 1, 2, 3 and 4). | Requirements relate to safety clearances for aerial line being designed, install, operated and maintained. | SA Power Networks has a programme to identify aerial lines that do not meet the clearance requirements set out in the Regulation (visual inspections). Contact with powerlines are reported to the Office of the Technical Regulator (OTR). | Rectified when identified. Legal liability if not rectified within a reasonable timeframe. Maximum penalty $250k (The Act s60). |
| **Compliance with standards (Electricity (General) Regulations)-** | Requires electricity infrastructure to be designed, installed, operated, and maintained to be safe for the electrical service conditions and the physical environment in which they operate. | Must maintain and operate infrastructure in accordance with the applicable standards when designed. | Routine inspections and patrols, and incident investigations. | Rectified when identified. Legal liability if not rectified within a reasonable timeframe. Maximum penalty $250k (The Act s60) If ongoing non-compliance potential for forfeit of Distribution License. |
| **Earthing and electrical protection Electricity (General) Regulations)** | Earthing and electrical protection systems must be designed, installed, operated and maintained to safely manage abnormal electricity network conditions likely to significantly increase the risk of personal injury or significant property damage. | Must maintain and operate infrastructure in accordance with the applicable standards when designed. | Routine inspections and patrols, and incident investigations. | Rectified when identified. Legal liability if not rectified within a reasonable timeframe. Maximum penalty $250k (The Act s60) If ongoing non-compliance potential for forfeit of Distribution License. |
| **Safety, reliability, maintenance, and technical management plan** | How we operate, design install, operate and maintain the distribution system to achieve QoS, safety outcomes (See Technical Regulations s72). | The Act requires us to comply with the SRMTMP as approved by the Technical Regulator. | SRTMP details items that are monitored etc to ensure compliance. | Rectified when identified. Legal liability if not rectified within a reasonable timeframe. Maximum penalty $250k (The Act s60) If ongoing non-compliance potential for forfeit of Distribution License. |

# 4 Basis of Financial Values

## 4.1 OH&S

The OH&S value dimension quantifies company, individual, and community costs associated with injuries and fatalities caused by the failure of, or interaction with, network assets.

Three components apply specifically to OH&S:

1. **Disability Weighted Value of Life** is an estimate of the value that society places on reducing the risk of dying or to avoid serious injuries and/or fatalities.
2. **OHS cost** represents the cost to the network, individual and the community of minor injuries for which a value of life approach is not appropriate.
3. **Disproportionality factor** is a multiplier applied to OH&S consequences to align with legal requirements to invest in consequence avoidance whenever costs are not grossly disproportionate to the risk reduction achieved.

The value of OH&S risk is calculated for five severity levels using the value metrics above. When this metric is used, model framework documents define and calculate the probability of each severity occurring for each failure mode, which is outside of the scope of the value framework.

The consequence value for OH&S risks is calculated across a severity scale, with five values ranging from Minimal to Catastrophic. The first four severity levels use the disability weighted value of life approach while the minimal severity level uses an OHS cost approach. The OHS cost approach is used because the value of life approach is too coarse to apply to very low severity injuries. The proposed values are presented in the table below. Sources for the individual values are discussed in the following sub-sections.

**Table 4-1: OH&S consequence values**

| Scale | Description | Value Metric Assumption | Calculation assumption | Value (2020/21) | Value June 2022[9] | Average of peers[10] |
|---|---|---|---|---|---|---|
| **Minimal** | Low level injury/symptoms requiring first aid only | Minor injury requiring limited treatment.<br>Valued using SafeWork Australia short term absence cost. | OHS Cost (Short term absence) | $4,876 | $5,246 | $2,612 |
| **Minor** | Non-permanent injuries/work related illnesses requiring medical treatment | Temporary injury that limits the victim's quality of life for 1 year.<br>Valued using VSLY multiplied by the weighting for a minor injury (e.g. nerve damage, sprain, dislocation). | VSLY * 0.07 | $15,190 | $16,344 | $39,257 |
| **Moderate** | Significant non-permanent injury/work related illnesses requiring emergency surgery or hospitalisation for more than 7 days | Temporary injury that limits the victim's quality of life for 1 year.<br>Valued using VSLY multiplied by the weighting for a bone fracture of a major bone (e.g. femur, pelvis). | VSLY * 0.25 | $54,250 | $58,370 | $276,212 |

[9] 2020/21 figures have been escalated to June 2022 dollars in alignment with CPI between December 2020 and June 2022.

[10] SA Power Networks sought external advice regarding the values in use by other DNSPs. The values are the average of the corresponding severity levels in use by ten Australian DNSPs.

| | | | | | | |
|---|---|---|---|---|---|---|
| **Major** | Permanent injury/work related illnesses to one or more persons | Severe injury that permanently reduces the victim's quality of life. Valued using VSL multiplied by the weighting for an arm/leg amputation. | VSL * 0.3 | $1,500,000 | $1,613,908 | $1,766,579 |
| **Catastrophic** | One or more fatalities. Multiple significant permanent injuries/work related illnesses | Fatality or severe injury that prevents the victim from working for the rest of their life. Valued using VSL. | VSL * 1 | $5,000,000 | $5,379,693 | $5,513,315 |

For forecasts, each OH&S severity level value can be inflated using a Wage Price Index forecast. This should be higher than the inflation forecast and result in an increase in real terms over the forecast period.

### 4.1.1 Disability Weighted Value of Life

The Disability Weighted Value of Life is used for the severity levels of Catastrophic through Minimal. This approach values the loss of quality of life (disability weightings), using an estimate of societal willingness to pay (value of statistical life).

Value of Statistical Life (**VSL**) values are published by the Federal Government Department of Prime Minister and Cabinet (The Office of Impact Analysis) in the Value of Statistical Life guidance note.[11]

Two VSL values are available, a whole of life value VSL and an annual value VSL year or VSLY. VSL is appropriate for fatalities and permanent injuries that have a lifelong impact on the victim. VSLY can be used for temporary impairment.

The VSL or VSLY values are appropriate for total incapacitation where the victim has no quality of life. For injuries below the most severe level, some quality of life will be retained. To account for this, a disability weighting can be used. The Best Practice Regulation Guidance Note refers to a source for disability weightings, The Burden of Disease and Injury in Australia (Mathers et al 1999) from the Australian Institute of Health and Welfare.

- For major injuries, the weighting foot and leg amputations of 0.3 is used. As this is a permanent injury, the full VSL value is used.
- Moderate and minor injuries are temporary, so the single year VSLY value is used. For moderate injuries, a disability weighting of 0.25 was selected. This value is within range of several broken bone values, such as vertebra (0.266), pelvis (0.247) and patella, tibia or fibula (0.271).
- For minor injuries the weighting of 0.07 was selected. This is based on the values for nerve damage (0.064), sprains (0.064) and dislocation (0.074).

The Best Practice Regulation Guidance Note is updated annually to escalate the values of VSL and VSLY. The escalation approach is to use the Wage Price Index, which is typically higher than the rate of inflation. Forecasts of VSL and VSLY should use the same approach. If a forecast for the Wage Price Index is not available, a historic average growth rate is used. The Australian Bureau of Statistics (**ABS**) data on the Wage Price Index is available via the ABS website[12].

[11] Department of the Prime Minister and Cabinet – The Office of Impact Analysis, *'Value of statistical life guidance note 2023'*, available via: [www.pmc.gov.au/resource-centre/regulation/best-practice-regulation-guidance-note-value-statistical-life], last accessed 29 January 2024.

[12] Australian Bureau of Statistics - Wage Price Index, available via: [www.abs.gov.au/statistics/economy/price-indexes-and-inflation/wage-price-index-australia/latest-release#data-download], accessed 29 January 2024.

### 4.1.2 OHS Cost

For low severity OH&S consequences, an alternate approach has been used. The value of life approach was determined to be too coarse to apply to these very low severity injuries.

Estimates for costs of minor injuries are available from SafeWork Australia. The values were developed for 2012-13 and require escalation to be comparable with the other values used for OH&S.[13]

The costs considered by SafeWork Australia are:

- Direct costs
  - Workers' compensation premiums paid by employers;
  - Payments to injured or incapacitated workers from workers' compensation jurisdictions;
- Indirect costs
  - lost productivity;
  - loss of current and future earnings; and
  - lost potential output and the cost of providing social welfare programs for injured or incapacitated workers.

The report also provides estimates for higher severity injuries. The values are comparable to those calculated using the VSL approach. The VSL approach is more widely used in the electricity sector and uses more up-to-date information so is the preferred source for all but low severity OH&S consequences.

For alignment with the VSL source, the SafeWork Australia values are escalated using the ABS Wage Price Index[14].

Using the series 'Quarterly Index; Total hourly rates of pay excluding bonuses ; Australia ; Private and Public; All industries', the index value was 115.5 at June 2013 and was 134.1 at June 2020 (the VSL values were published August 2020). The escalation factor from the published OHS cost is 1.16.

The SafeWork Australia report (see page 26, Table 1.9) puts the value of a minor injury at $4,200 in 2012-13, which equates to a 2020 value of $4,876.

### 4.1.3 Disproportionality factors

The application of AS 5577 Electricity Network OH&S Management Systems in managing OH&S risks associated with the operation of an electricity network is a mandated requirement in SA. The standard requires network OH&S risks to be eliminated, and if this is not reasonably practicable, then to be reduced to as low as reasonably practicable (**ALARP**). A common approach applied within the industry to determine whether ALARP has been achieved is to determine whether the cost of reducing the risk is grossly disproportionate to the quantified OH&S benefits gained.

Guidance from the Health OH&S Executive (UK) suggests that a DF between 2 and 10 can be used. Higher values are used for situations where extensive harm is possible if the risk event were to occur. The application of the DF allows for the model to prioritise investment to meet community expectations that the organisation should invest a greater multiple to reduce some risks as compared to others.

---

[13] Safe Work Australia, 'The cost of Work-related Injury and Illness for Australian Employers, Workers and the Community 2012-13', available at: [www.safeworkaustralia.gov.au/system/files/documents/1702/cost-of-work-related-injury-and-disease-2012-13.docx.pdf], last accessed 29 January 2024.

[14] ABS, *'Wage Price Index, Australia*', available via: [www.abs.gov.au/statistics/economy/price-indexes-and-inflation/wage-price-index-australia/latest-release#data-download], accessed 29 January 2024.

The AER has provided guidance on acceptable DFs for regulatory purposes in the draft and final determinations. In particular, the AER stated the following in its Final Determination for SA Power Networks[15]:

> *The disproportionality factor is an index used to represent an organisations' appetite to spend more than the calculated value of the OH&S risk to reduce that risk. It is usually multiplied by the average value of consequence to ensure that any uncertainty is accounted for. In previous decision and the repex guidance note, we have relied on values between 3 (workers) to 6 (public). The use of values beyond those are likely to overestimate the expenditure required.*

The application of a Disproportionality Factors (**DFs**) to the consequence value represents an organisation's appetite to spend more than the value of the OH&S risk avoided to reduce the risk. Escalating DFs based on the severity of the OH&S consequence reflects expectations that more investment should be made to prevent serious injuries than minor injuries.

The escalating DF can be in alignment with the AER guidance if the weighted average of the DFs is less than (and preferably as close as possible to) the guidance values.

**Table 4-2: Disproportionality factors**

| Severity Level | Disproportionality Factor |
|---|---|
| **Minimal** | 3.2 |
| **Minor** | 3.9 |
| **Moderate** | 4.6 |
| **Major** | 5.3 |
| **Catastrophic** | **6** |

## 4.2 Bushfire

The Bushfire value dimension quantifies losses, both property and lives, as a result of fires started by the failure of network assets.

The risk value for fire is derived from SA Power Networks' bushfire risk modelling conducted by CSIRO. The model calculates the consequence across a range of bushfire weather conditions and a large number of fire start locations across the state, (500 metre grid across all medium and high bushfire risk areas).

Based on CSIRO bushfire simulation, the economic costs associated with each bushfire simulation is determined. Exposure data has been developed in the form of geographic maps of land and property values. The severity of the bushfire hazard, across the geographic extent of each event footprint, is then assessed against these exposure data sets to calculate the overall economic loss of each simulated fire event.

## 4.3 Reliability

The Reliability value dimension quantifies costs associated with the network failing to provide its primary objective, to transport electricity from sources to loads.

Two values apply specifically to Reliability:

1. Unserved energy; and
2. Lost large scale embedded generation.

[15] AER, *'Final Decision SA Power Networks Distribution Determination 2020 to 2025 Attachment 5 Capital expenditure'*, June 2020, p. 28.

The value of Reliability risk is summarised as a single value that is calculated for each asset in the network, on the basis of the unique characteristics of each asset. The value for each asset is a weighted average of the expected range of Reliability risks (such as duration and coincident failures).

### 4.3.1 Unserved energy

SA Power Networks quantifies the value associated with a loss of supply based upon the value of the unserved energy which is valued using the AER's VCRs.

Unserved energy is valued using the following equation:

$$Value\ of\ Unserved\ Energy = Outage\ Duration \times \sum_{i=1}^{I}(Load\ Impacted_i \times VCR_i)$$

The outage duration is measured in hours and reflects the average duration of the outage for the affected customers. Due to the staged nature of restoration, the actual duration for individual customers may be higher or lower than this duration value.

The term in brackets calculates the hourly cost of the unserved energy for each customer type. Customer types may have different VCRs which are calculated separately and summed.

Sources for the three components of the equation are discussed below.

#### *4.3.1.1 Value of Customer Reliability*

VCRs are expressed in $/kWh terms and published annually by the AER.[16] Each annual update includes a spreadsheet of appendices containing VCR values for a range of customer types.

- Residential loads: the SA value in Table 1-1 can be used. If the specific climate zone for the customer is known the more detailed values in Table 1-2 should be used instead.
- Business loads: the values in Table 1-3 and 1-4 should be used.

#### *4.3.1.2 Outage Duration*

Outage duration is estimated from our historical Outage Management System (OMS) data. The OMS data is filtered so that only relevant outages are included (dependant on the programs requirements), and an average duration calculated for each asset class and asset failure mode. It is noted that an assets' geographic location will also contribute to the consideration of outage duration. Where available, this information will also be used to determine outage duration.

Where OMS data is insufficient to calculate a reasonable average duration, data from similar assets and outage causes is used.

For forecasts, the outage duration value does not change over time. Exceptions are made if there is an anticipated change in how the network or the organisation will respond to outages e.g. specific programs aimed at reducing restoration times.

#### *4.3.1.3 Load Impacted*

Load impacted is the expected quantum of kWh of energy interrupted per hour. For simplicity, this is calculated as annual consumption (measured in kWh) of the affected customers divided by the number of hours in a year (8,760 for non-leap years).

[16] The AER's VCRs are available via the AER website [www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/values-of-customer-reliability], last accessed 2 January 2024.

The customers that will be affected by an outage caused by the failure of each network asset is estimated from a network model. Typically, an asset failure that causes an outage will result in a loss of supply for all customers located in the same protection zone.

The annual consumption for each customer identified as impacted is taken from the relevant SA Power Networks IT system that contains this data. The most recent year of consumption is used.

Where customers have distributed energy resources (e.g. rooftop solar PV), the metered consumption data will underestimate the actual underlying consumption. Because a network outage will cause the embedded generator to shut down, it is the customer's underlying consumption that is affected, not only the portion seen in the metering data. An estimate of internal embedded generator use leveraging known embedded generation capacity at each customer is added to the customer's annual consumption for the purposes of calculating load impacted by outages.

For forecasts, in an ideal model the load impacted will change over time to reflect electricity consumption forecasts for the affected area (including average customer load growth and growth in the number of customers) and changes in protection zone coverage over time. However, in a practical sense this may not be feasible in which case the load impacted should remain constant over time.

### 4.3.2 Lost large scale embedded generation

When a network outage occurs, embedded generators may be disconnected from the NEM. This may require more costly forms of generation to be dispatched, increasing total system costs.

For the purposes of this value metric, only large-scale embedded generation that is registered with the Australian Energy Market Operator (**AEMO**) and semi-scheduled is to be considered.

The value of the lost generation is calculated using the formula below:

$$\begin{aligned} &Value\ of\ Embedded\ Generation \\ &\quad = Outage\ Duration \times \frac{Annual\ Generation}{8{,}760} \times Dispatch\ Weighted\ NEM\ price \end{aligned}$$

The first term is the same as is used for the Unserved Energy calculation, the second term is the average output of any large-scale embedded generators affected by the outage and the final term is a proxy for the cost of dispatching alternate sources of generation. The dispatch weighting reflects the typical dispatch profile of the type of generator affected (i.e. a solar output profile).

For forecasts, the lost embedded generation value can be escalated using a consumer price index (**CPI**) forecast or held constant in real terms. For simplicity, the addition of new embedded generators can be ignored unless there is a specific project requirement for a new generator to be included in the assessment.

## 4.4 Customer value of time

Time spent by customers accessing our systems is time which could be used to perform other activities from which customers derive benefits e.g. work or leisure. Activities undertaken to either reduce time spent accessing systems therefore drives customer value as they can pursue these other activities.

The customer value of time benefit is derived using the following equation:

$$\begin{aligned} &Customer\ Value\ of\ Time\ Benefit = \\ &number\ of\ impacted\ customers \times average\ time\ spent\ accessing\ systems \times Wage\ Price\ Index \end{aligned}$$ [17]

[17] ABS, *'Wage Price Index, Australia'*, available via: [www.abs.gov.au/statistics/economy/price-indexes-and-inflation/wage-price-index-australia], accessed 29 January 2024.

The first term reflects the number of customers spending time accessing information or services, the second term reflects the average amount of time customers spend accessing our systems or information, the final term serves as a proxy as to what our customers time is worth through reference the ABS wage price index for South Australia.

## 4.5 Cybersecurity

The cybersecurity value dimension is estimated as the average cost of a cyber breach and the risk cost avoidance of a cyber event. There are three value metrics for cybersecurity which are included in the calculation of total cyber security benefits.

### 4.5.1 Business recovery cost

Business recovery cost is estimated based on:

- revealed average costs of historical minor breaches; or
- forecast costs for potential major breaches that reflect a conservative buildup of expected costs, benchmarked against publicly available revealed expenditure from actual cyber security events within Australia and internationally.

### 4.5.2 Penalties

The penalty associated with a 'serious or repeated breach of privacy' under the Privacy Legislation Amendment[18] is the greater of:

- A$50 million;
- three times the value of any benefit obtained through contravention; or
- if the value of the benefit obtained cannot be determined, 30% of a company's domestic turnover in the "breach turnover period".

### 4.5.3 Business productivity loss

When ICT systems are unable to be used because of a major cyber event, the loss of our business productivity is a quantifiable measure of additional cost which we incur.

Business productivity loss is estimated using the following equation:

$$\text{Business productivity loss} =$$

$$\text{Number of impacted staff} \times \text{Number of days impacted} \times \%\text{ productivity lost per day} \times \text{Average wage cost per hour.}$$

## 4.6 Environment (non-bushfire)

The Environment (non-bushfire) value dimension quantifies the cost of damage to the environment caused by the failure of network assets.

There are three value metrics that apply to Environment:

1. **Clean-up costs** represent costs incurred by the network to return the environment to its pre-asset failure state.

[18] Australian Government, *'Privacy Legislation Amendment'*, available via:[www.legislation.gov.au/Details/C2022A00083], accessed 28 January 2024.

2. **Greenhouse gas emissions** represent the cost to society of the emission of gasses that may contribute to climate change and obligations to meet legislated emissions reductions targets under the National Energy Objective.
3. **Fines and penalties** represent fines that could be levied by regulators or other bodies for allowing the damage to the environment to occur.

Environment costs may be incurred without the functional failure of an asset. This includes when an asset has defects that cause the leaking of liquids or gasses into the environment. Replacing the asset will address the defect and reduce the annual environment cost to zero.

Environment costs are also incurred when an asset fails and the failure mode results in some or all of the stored liquid or gas being released into the environment.

### 4.6.1 Clean-up Costs

This value metric incorporates direct costs incurred by SA Power Networks to clean-up environmental damage. This is limited to clean-up of oil but may be expanded over time to include other materials that require clean-up.

Oil clean-up costs are related to the quantity of oil spilled. This is the same value as used for the Fines and Penalties value metric.

Severity levels relate to the percentage of the oil in the asset that escapes into the environment. The total cost for each severity level is as follows:

$$Cleanup\ cost\ =\ Oil\ Capacity(Litres)\ \times\ \%\ lost\ to\ environment\ \times\ Cleanup\ Cost\ per\ Litre$$

The oil capacity is unique to each asset. The percentage of oil lost to the environment will depend on the failure mode and the presence of preventative equipment, such as bunding. SA Power Networks should determine appropriate severity levels based on the failure modes being modelled.

The clean-up cost per litre will be calculated from historic SA Power Networks data for oil clean-ups, adjusted for the litres of oil that was lost from the asset.

For leaking assets that have not failed, the clean-up cost is incurred annually, but the Oil Capacity (Litres) parameter is replaced with 'Annual Leakage Losses (Litres)'. For forecasts, reactive replacement premiums can be inflated using a network cost growth rate that is consistent with other forecasts and/or parameters used for regulatory forecasting purposes.

### 4.6.2 Greenhouse Gas Emissions

This value metric places a value on greenhouse gas (GHG) emissions. GHG emissions result in societal costs due to their contribution to climate change.

Greenhouse gas (**GHG**) emissions can be valued using carbon prices, which are expressed in $/kg of carbon emitted. Gasses other than carbon dioxide can be converted to a carbon-dioxide equivalent (**CO2-e**) using an appropriate conversion factor. Conversion factors are sourced from the Australian Government Department of Climate Change, Energy, the Environment and water.[19]

The NEL and NER currently only expressly permit the use of emissions pricing in cases where actual costs are incurred by a network business. As SA Power Networks is currently not required to pay for emissions of GHG, this value metric cannot be used in most cases for regulatory modelling.

[19] Available via [www.industry.gov.au], accessed 29 January 2024.

However, many stakeholders place a value on GHG emissions and would encourage investments to minimise such emissions, as confirmed by SA POWER NETWORKS's Customer Values Research which seeks to understand customer's willingness to pay for network investments to minimise emissions.

Changes to the National Electricity Objective (**NEO**) in the NEL are currently being progressed by energy ministers, which would introduce an emissions reduction objective within the broader economic efficiency umbrella of the NEO. These changes, if enacted, would likely lead to the Australian Energy Regulator (**AER**) needing to update its guidance on benefit valuations (e.g. in the RIT-D guidance). In the meantime, SA Power Networks intends to investigate approaches to valuing carbon emissions in monetary terms as an input to its regulatory business cases.

The main GHG that may be released by network assets is SF6[20], which is used as an insulator in switchgear. From the source above, 1kg of SF6 gas is equivalent to 22,800kg of CO2.

There is in general no penalty associated with the release of SF6, but networks recognise that the release of this gas should be discouraged and that this needs to be incorporated into risk modelling to ensure replacement of assets that could release SF6 is appropriately prioritised. For this reason, several networks have included the equivalent carbon price of SF6 as a risk in repex modelling. The value of other GHGs have not yet been included in our asset replacement modelling.

We are considering our intended approaches to valuing emissions reduction. We are aware of two prices that could potentially be used:

- EU Emissions Trading System prices, quoted in Euros and converted to Australian dollars. The EU scheme is one of the most well-established carbon pricing schemes and has high trading volumes and interacts with other international carbon pricing schemes so is an appropriate international price for carbon.[21]
- Australian Carbon Credit Units prices, published by the Clean Energy Regulator represent a local price for carbon. The market is shallow compared to international markets and prices are in part determined by government policy, which does not currently require most emitters to participate in the market.[22]

As of June 2023, the most recent prices are ~€95.17 (~AUD$155.71) per ton for EU ETS credits and AUD$38.750 per tonne for ACCUs. For forecasts, the carbon price can be inflated using a CPI forecast or held constant in real terms. If a carbon price forecast is available that should be used instead.

### 4.6.3 Environmental Compliance Fines and Penalties

Environment Protection Act 1993 (the Act) provides the regulatory framework to protect South Australia's environment. Under Section 104A of the Act, the Environment Protection Authority (EPA) can seek civil penalty from an alleged offender as a negotiated civil penalty (generally low level, contraventions) or as a 'court imposed civil penalty'.

Under the Environment Protection Act 1993 and the maximum penalty amount for causing environmental nuisances is $15,000 whereas causing material environmental harm can potentially lead to a maximum penalty of $500,000. The maximum penalty for breaching an issued site remediation order under the Act is $120,000.[23]

---

[20] Sulphur hexafluoride (also known as SF6).

[21] Historical and current prices can be accessed at: [www.ember-climate.org/data/carbon-price-viewer], accessed 29 January 2024.

[22] Prices are available in the Australian Government's Clean Energy Regulator's *'Quarterly Carbon Market Report'* available at: [www.cleanenergyregulator.gov.au/csf/market-information/Pages/quarterly-Market-report.aspx], accessed 29 January 2024.

[23] The penalty calculation methodology is contained in the South Australian Environment Protection Authorities *' Policy for calculation of civil penalties under the Environment Protection Act 1993 and associated legislation',* available via [https://www.epa.sa.gov.au/business_and_industry/civil-penalty-calculation-policy], accessed 29 January 2024.

For simplicity of implementation, the Fines and Penalties component of Environmental will use the Penalties Value Metric (refer section 4.12).

## 4.7 Customer value of exports

To value the alleviation of export curtailment, we employ a methodology consistent with the 'self-selection of half hourly values' approach described in the AER Final CECV methodology Explanatory Statement[24].

To do this, we forecast the kWh quantum of additional export enabled (known as alleviated curtailment) by each proposed investment for every half hour period across the investment time horizon. The quantum of alleviated curtailment for each half hour period is then multiplied against the respective CECV for each half hour period across the time horizon to quantify the total benefit attributable from the CECV.

We also add generation capacity investment costs to the AER CECV to form a modified CECV. These generation capacity investment costs have been quantified by economic consultants Houston Kemp through the use of NEM modelling with and without the alleviation of export curtailment to identify changes in generation capacity investment. Further detail on this modelling is provided in Houston Kemps Avoided generation capacity investment report[25].

$$\text{Value of Alleviated Curtailment } = \sum_{\text{i}=1}^{\text{I}} \left(\text{Half Hourly Alleviated Curtailment}_{\text{ i}} \times \text{ Half Hourly CECV}_{\text{i}}\right)$$

## 4.8 Energy Conservation

To the quantify the benefit customers receive from energy conservation as a result of average network voltage reduction, we estimate the average dollar value of the energy saved per impacted customer for each Volt of average network voltage reduction. To do this, we have adapted the methodology used in a study undertaken by the Victorian Department of Energy, Environment and Climate Action[26] to account for the different mix of appliance types in South Australia which is further explained in document 5.7.6 Business case – Network Visibility.

To quantify the energy conservation benefit customers receive as a result of average network voltage reduction, the following equation is used:

$$\begin{aligned} &Energy\ Conservation\ Benefit \\ &\quad = Energy\ reduction\ percentage\ acheived \times number\ of\ customers\ impacted \\ &\quad \times average\ annual\ customer\ consumption \\ &\quad \times South\ Australian\ Default\ Market\ Offer\ price\ per\ kWh \end{aligned}$$

The first term is the percentage of energy reduction achieved due to a reduction in average network voltage, the second term is the number of customers who are impacted by the average reduced network voltage, the third term is the average annual customer consumption before voltage reduction occurred, and the final term is the AER's default market offer price[27].

---

[24] AER, *'Final CECV methodology - Explanatory Statement - June 2022'*, available via: [https://www.aer.gov.au/documents/aer-explanatory-statement-final-customer-export-curtailment-value-methodology-june-2022], accessed 29 January 2024.

[25] Document 5.7.13 Avoided generation capacity investment report.

[26] Department of Energy, Environment and Climate Action, Voltage Management in Distribution Networks, Directions Paper, 2023.

[27] AER, 'Default market offer price determination 2022-23 – Final Determination 26 May 2022', available via: [https://www.aer.gov.au/documents/aer-final-determination-default-market-offer-prices-2022-23-26-may-2022], accessed 29 January 2024.

## 4.9 Asset

The Asset value dimension quantifies direct costs to the network that occur as a result of an asset failure that is not included within any other value dimension (i.e. excluding environmental clean-up and fines, etc.).

There are three value metrics that specifically apply to Asset:

1. **Reactive replacement premium** represents the additional costs incurred to replace an asset reactively after a failure relative to a planned replacement, including overtime costs and productivity costs due to diverting resources from other tasks.
2. **Asset repairs** represents the cost of repairing assets after failure.
3. **Property damage** represents the replacement or repair cost of property damaged or destroyed by the asset that failed (excluding damage due to a fire caused by the asset failure).

Some financial costs to the network are excluded to avoid double counting. This includes payments related to regulatory incentive schemes.

The value of Asset risk is made up of multiple components, some of which are closely linked to other value dimensions (for example, litigation costs are higher for severe fires compared to minor fires). Most of the individual value metrics are calculated for five severity levels, with the remainder having a single fixed value (such as the reactive replacement premium, which can be assumed a single value that is independent of the failure mode or any other consequences). For those with multiple severity levels, the model framework defines/calculates the probability of each severity occurring.

### 4.9.1 Reactive Replacement Premium

The reactive replacement premium is based on the additional costs incurred to replace failed assets reactively. This considers:

- after hour call-outs and overtime rates payable and stand down rates;
- productivity loss due to diverting staff from planned works;
- allocation of the annual cost of retaining on-call or reserve staff for emergency response; and
- allocation of the cost of equipment and spare parts kept at depots for emergency response.

Where a reasonable estimate of the above costs can be calculated for an asset class, this is used.

When an estimate cannot be determined for an asset class, a default value of 15 labour hours is used. This is based on the following assumptions:

- rescheduling interrupted task(s) (3 hours);
- make safe current task and return (4 hours - 2 hour for crew of 2);
- travel and investigate failure prior to repair / replacement (6 hours – 3 hours for crew of 2); and
- loss efficiency on interrupted task (2 hours – 1 hour for crew of 2).

For forecasts, reactive replacement premiums can be escalated using a network cost growth rate consistent with other forecasts and/or parameters used for regulatory forecasting purposes (i.e. labour rate escalation).

### 4.9.2 Asset Repairs

Repair costs for assets are based on current unit rates for repairs of the particular asset. Where unit rates are not available, the rate is calculated from a sample of recent historic repairs.

Rates may differ by asset types, voltage and location subject to data availability. For forecasts, asset repair costs can be inflated using a network cost growth rate that is consistent with other forecasts and/or parameters used for regulatory forecasting purposes.

### 4.9.3 Property Damage

Property damage costs cover damage to both network and non-network assets and other property caused by the failure of a network asset, excluding damage caused by fires which is calculated separately in the fire value dimension.

Property damage costs are calculated for each asset class based on historic data. For forecasts, property damage costs can be inflated using a CPI forecast or held constant in real terms. If network assets are included within the damage costs and are significant, a network cost growth rate is used instead.

## 4.10 Investigation Costs

Investigation costs represent the cost of investigating the root-cause of an event after it has occurred. The value of these costs can be categorised into three levels of investigation based on the resources involved, and the extent of the investigation.

**Table 4-3: Investigation Costs**

| Level | Typical Event | Value 2020-21 | Value June 2022[28] | Average of peers[29] |
|---|---|---|---|---|
| **Low** | Internal investigation conducted as part of BAU operations | $5,000 | $5,380 | $4,462 |
| **Medium** | Internal investigation with support of external advisor | $50,000 | $53,797 | $47,455 |
| **High** | Independent external investigation | $200,000 | $215,188 | $263,200 |

For forecasts, investigation costs can be escalated using a CPI forecast or held constant in real terms.

## 4.11 Litigation Costs

Litigation costs cover the cost of legal representation, court fees and the possible awarding of costs against SA Power Networks due to any litigation triggered by an asset failure.

Reparation payments that may be awarded against SA Power Networks following litigation are presumed to convert societal risks incurred into financial costs. As such, these risks are already included within other value metrics so are excluded from the litigation costs value metric to avoid double counting. For example, if a court orders payments to a person severely injured by a failed network asset, the financial payment received by the victim would only offset some of the personal costs already incurred (and already counted in total risk by the OH&S value metrics) by the individual due to being injured.

Litigation costs are estimated for different consequence severities.

[28] 2020/21 figures have been escalated to June 2022 dollars in alignment with the CPI increase between December 2020 and June 2022.

[29] Ibid 5.

**Table 4-4: Litigation Costs**

| Level | Typical Event | Value per event 2020-21 | Value June 2022[30] | Average of peers[31] |
|---|---|---|---|---|
| **Very low** | Forced outage, short duration interruption. Litigation or dispute unlikely. Briefing to regulator, government. | $0 | $0 | $1,028 |
| **Low** | Minor injury or property damage. Non litigated dispute or negotiation. | $15,000 | $16,139 | $19,189 |
| **Medium** | Serious Injury. Up to 1 year litigation. | $100,000 | $107,594 | $62,282 |
| **High** | Fatality. Up to 3 years litigation. | $1,000,000 | $1,075,939 | $989,653 |
| **Very high** | Catastrophic Bushfire Event, Multiple Fatality due to negligence, Major system disturbance. More than 3 years of litigation. | $10,000,000 | $10,759,386 | $10,541,515 |

## 4.12 Legal and Regulatory Compliance Fines and Penalties

The Penalties value metric reflects the costs of penalties / fines levied on the business, generally associated with not meeting legal or regulatory obligations.

Costs associated with penalties are estimated for different consequence severities as shown in Table 4-5.

**Table 4-5: Penalty costs**

| Level | Typical Event | Value per event 2020-21 | Value June 2022[32] | Average of peers[33] |
|---|---|---|---|---|
| **Very low** | Customer complaints. | $0 | $0 | $0 |
| **Low** | Information or briefing to regulator. Fines unlikely. | $5,000 | $5,380 | $6,392 |
| **Medium** | Negotiation with regulator (minor litigation). Voluntary amendments to practises. Potential fines up to $100k. | $50,000 | $53,797 | $53,701 |
| **High** | Direction from regulator to amend practices. Potential fines up to $500k. | $500,000 | $537,969 | $504,765 |
| **Very high** | Licence restrictions | $2,000,000 | $2,151,877 | $1,678,937 |

## 4.13 Investment Benefits

The value dimension of investment benefits quantifies avoidable costs associated with replacing a degraded network or non-network asset with a new equivalent or other benefits resulting from undertaking the investment.

There are three value metrics for benefits:

1. avoided opex;
2. cost reduction; and
3. other benefits.

The value of benefits is summarised as a single value that is calculated for each asset unit, based on the unique characteristics of each asset unit.

[30] 2020/21 figures have been escalated to June 2022 dollars in alignment with the CPI increase between December 2020 and June 2022

[31] Ibid 5

[32] 2020/21 figures have been escalated to June 2022 dollars in alignment with increase in ABS CPI between December 2020 and June 2022.

[33] Ibid 5.

### 4.13.1 Avoided Opex

OPEX avoidance represents the reduction, or avoidance, of future increases in OPEX. These increases arise from factors such as increases in demand for services, input costs, or assets being run beyond their conditional lives. It is important to note that avoided OPEX relates are costs which are not presently incurred.

For network assets, avoided OPEX is the avoided future annual OPEX (e.g. maintenance, etc.) costs associated with network assets after a degraded unit is replaced with a brand-new equivalent. This also extends to non-network assets where replacement of ageing property and fleet assets results in opex savings associated with ongoing maintenance and time saved when assets are unavailable during maintenance. This could also be considered a productivity improvement.

Avoided OPEX is equal to the difference in future OPEX between a degraded asset and a new replacement asset. In many instances, the OPEX for a new asset is zero (for example, pole inspections and maintenance is typically zero for the first 15 years of life).

$$Avoided\ Opex = Opex_{Condition=i} - Opex_{Condition=0}$$

The value of future OPEX is calculated based on historical actual expenditure at the asset class level, with similar condition parameters. For simplicity, OPEX may be at a low rate below a certain condition/age and at a higher rate above that condition/age. The rates across both time periods should still be derived from historical data. For forecasts, the value of avoided OPEX are inflated using SA POWER NETWORKS's internal operating cost adjustment factors.

Avoided OPEX may also occur from the minimisation or reduction of costs to meet additional demand for services. For example, increases in process efficiencies through investments in ICT could reduce the number of additional FTE's required to meet increasing call centre demand.

### 4.13.2 Opex reduction

Opex reduction represents the direct tangible benefit associated with reducing the cost of service as a result of the investment made. Cost reductions are generally related to opex related benefits of a recurrent nature made by investing in a program which consolidates particular applications or services. The value of reduced opex can be quantified as:

$$Reduced\ Opex = Opex_{Condition=i} - Opex_{Condition=0}$$

The value of OPEX is calculated from historical actual expenditure at the asset class level, with condition as a parameter. For simplicity, OPEX may be at a low rate below a certain condition/age and at a higher rate above that condition/age. The rates across both time periods should still be derived from historical data.

### 4.13.3 Other Benefits

Other benefits represent a broad range of benefits across network and non-network activities that may be, for example, due to technological improvements or opportunities to augment the network during replacement at low incremental cost.

Other benefits are to be determined/calculated on a case-by-case basis as appropriate for individual asset replacement projects.

## 4.14 Investment Costs

The value dimension of investment costs quantifies the actual expected costs associated with undertaking the investment. These costs could be funded under network and non-network capital expenditure (CAPEX) or operational expenditure (OPEX).

There are three value metrics for investment costs, which are used together to calculate the annualised cost of the investment (this calculation is outside the scope of the value framework):

1. **Activity Cost** represents the CAPEX and OPEX cost of replacing/refurbishing/other activity applied to an asset under normal circumstances.
2. **Financing Rate** represents the annual cost to SA Power Networks of financing the investment, measured as a percentage of the replacement cost.
3. **Investment Lifetime** represents the length of time the activity applied to the asset is expected to remain useful for.

The value of investment costs is summarised as a single value that is calculated for each asset unit in the network and non-network assets, based on the unique characteristics of each asset unit. This differs to other value dimensions where values are calculated for multiple severity levels.

### 4.14.1 Activity Cost

Activity costs should be based on current unit rates for each activity that can be applied to an asset. Some activity types, such as repairs will only be applicable for a sub-set of asset/sub-asset classes. If unit rates are not available, the rate should be calculated from a sample of recent historic activities. Some of the key asset related activity types are provided in the table below.

**Table 4-6: Activity and associated expenditure type details**

| Activity Type | Spend type | Description |
|---|---|---|
| **Asset Repair (Corrective Maintenance)** | OPEX | All work associated with correcting defects that have not yet resulted in an asset 'breakdown'. Corrective maintenance is undertaken when assets fail to meet the threshold criteria set to enable it to remain in working order until the next planned maintenance cycle. These tasks are generally driven from the results of the inspection, testing and condition monitoring process. |
| **Asset Replacement Planned** | CAPEX | Work associated with replacing an asset with a new one under normal conditions |
| **Asset Replacement Reactive** | CAPEX | Work associated with replacing an asset with a new one under emergency conditions. |
| **Asset Refurbishment (Life Extension)** | CAPEX | Work associated with refurbishing and/or extending the life of an asset |
| **Asset Planned Maintenance (e.g. Asset Inspection)** | OPEX | Work associated with undertaking planned assessment of asset condition. This category includes testing and measurement and all routine visual inspection tasks designed to identify corrective issues and are carried out in a repetitive manner. |
| **Asset Preventative Maintenance** | OPEX | Asset treatments undertaken generally in conjunction with inspection, testing and condition monitoring (i.e. Planned Maintenance) and includes activities such as lubrication and exercising of moving parts. |
| **Asset Re-inspection** | OPEX | Work associated with undertaking a planned maintenance activity with a reduced period than would be expected by the wider population of assets |
| **Asset Removal** | OPEX | Work associated with the removal of an asset or assets that are no longer required on the network. |
| **Vegetation Maintenance** | OPEX | SA POWER NETWORKS's largest maintenance activity which includes identifying, scoping and undertaking proactive vegetation cutting to maintain safety clearances from electrical assets. |

| | | |
|---|---|---|
| **Asset Modifications / Design Changes** | OPEX / CAPEX | Minor changes to the design of equipment to maintain or improve functionality. |
| **Asset Damage due to third party** | OPEX | All work associated with equipment that has ceased to perform its intended function due to factors beyond the equipment's design capability (e.g. digging into underground cables or a car hitting a pole causing equipment malfunction). These failures cannot be managed through normal maintenance activities and may be carried out under emergency conditions. |
| **Asset Damage due to Nature Induced Breakdowns** | OPEX | All work associated with equipment that has ceased to perform its intended function due to factors beyond the equipment's design capability (e.g. animals causing equipment malfunction or lightning strikes). These failures cannot be managed through normal maintenance activities and may be carried out under emergency conditions. |
| **Asset Fault and Emergency Breakdown** | OPEX | All work associated with equipment that has ceased to perform its intended function (excluding nature induced breakdown and repairs due to third party damage). |
| **Non-Direct Maintenance** | OPEX | Work associated with enabling plant, tools and equipment that is used to support the delivery of the different maintenance activities defined above to perform their respective functions appropriately. |

For the purpose of forecasting, activity costs can be inflated using a network cost growth rate that is consistent with other forecasts and/or parameters used for regulatory forecasting purposes. If available, different escalation rates can be applied to the materials, labour and other cost components as appropriate.

### 4.14.2 Financing Rate

The financing rate is the annual cost of the funds required for investment in the activity.

Our Weighted Average Cost of Capital (WACC) should be used as the financing rate, or more specifically the Real Vanilla WACC. For regulatory risk modelling the WACC forecast should be the same forecast included in the regulatory submission. For other modelling the WACC forecast should be from the most recent regulatory determination.

The annual financing cost is the activity cost multiplied by the financing rate.

### 4.14.3 Investment Lifetime

Investment lifetime is the length of time the activity applied to the asset is expected to remain useful for.

For an asset replacement activity, this is the expected length of time the replacement asset will remain in service for. This aligns to our standard asset lives and reflect historical data (adjusted for technological/material improvements) for existing assets[34].

For refurbishment/repair activities the investment lifetime is based on the life extension of the overall asset or the length of time until the activity is required to be repeated. This aligns with our historic data for similar activities undertaken historically.

[34] Our asset lives are calculated by fitting a normal distribution, calibrated by asset class age profiles and observed failures.