Opportunities for SAPS/Microgrids to Enhance Network Resilience

Presentation on the Final Report by CutlerMerz

ARENA Australian Government Australian Renewable Energy Agency

CutlerMerz

Energy Networks Australia

Agenda

- Introduction (10 min) — Dr Jill Cainey, ENA
- Community Perspective (10 min) — Dr Tricia Hiley, Reference Group
  - Mallacoota fire season 2019/20
- The project (40 min) — Melanie Koerner, CutlerMerz
  - Case Studies
  - Regulatory Review
  - Recommendations
- Q&A

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Introduction

Dr Jill Cainey, General Manager – Networks, ENA

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Community Perspective

Dr Tricia Hiley, Mallacoota resident & Reference Group member

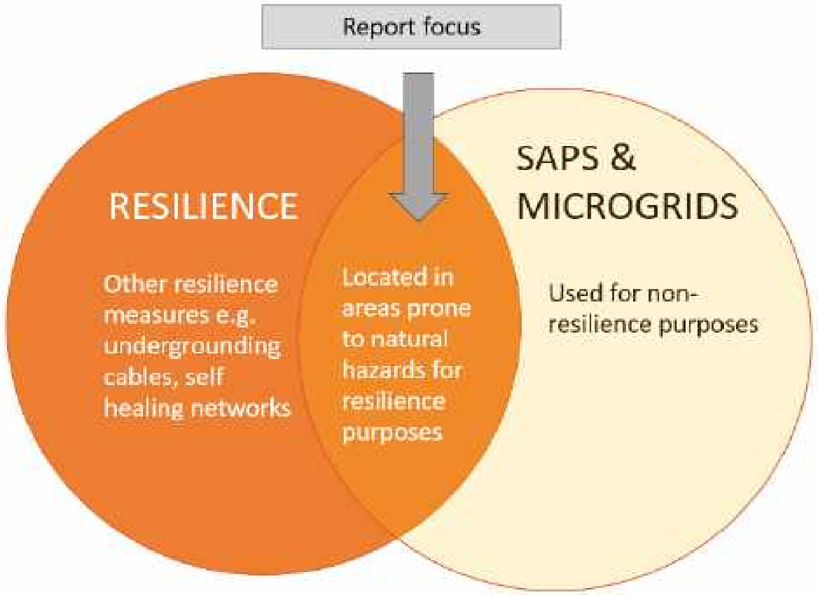


The Project

Melanie Koerner, Principal Consultant, CutlerMerz

Objective

1. Test the hypothesis that there is a **business case for investing in SAPS**, in some circumstances, **to enhance resilience** to natural hazard events
2. Assess the extent to which an increased frequency of natural hazard events under **climate change** projections is likely to materially improve the business case for investing in SAPS
3. Assess the extent to which the regulatory settings may provide **barriers or incentives for investment in SAPS for network resilience**



The outcome of the review will identify the need and urgency for changes in regulatory settings, and Market bodies / network service provider (NSP) practices to ensure resilience measures are adopted where there is a business case.

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Terminology

1. **Natural hazard events**: refers to naturally occurring physical phenomena including bushfires, floods, storms, cyclones, heatwaves, earthquakes and tsunamis, that disrupt and cause loss in society.
2. **Resilience**: the capacity of communities to prepare for, absorb and recover from natural hazard events and to learn, adapt and transform in ways that enhance these capacities in the face of future events.
3. **Stand-alone power systems**: an electricity supply arrangement which does not rely on physical connection to the national grid.
4. **Individual power systems**: refers to a subset of stand-alone power systems that supply electricity to a single customer.
5. **Islandable power systems**: refers to power systems that are connected to the electricity network but are capable of being islanded and of operating independently from the electricity network.

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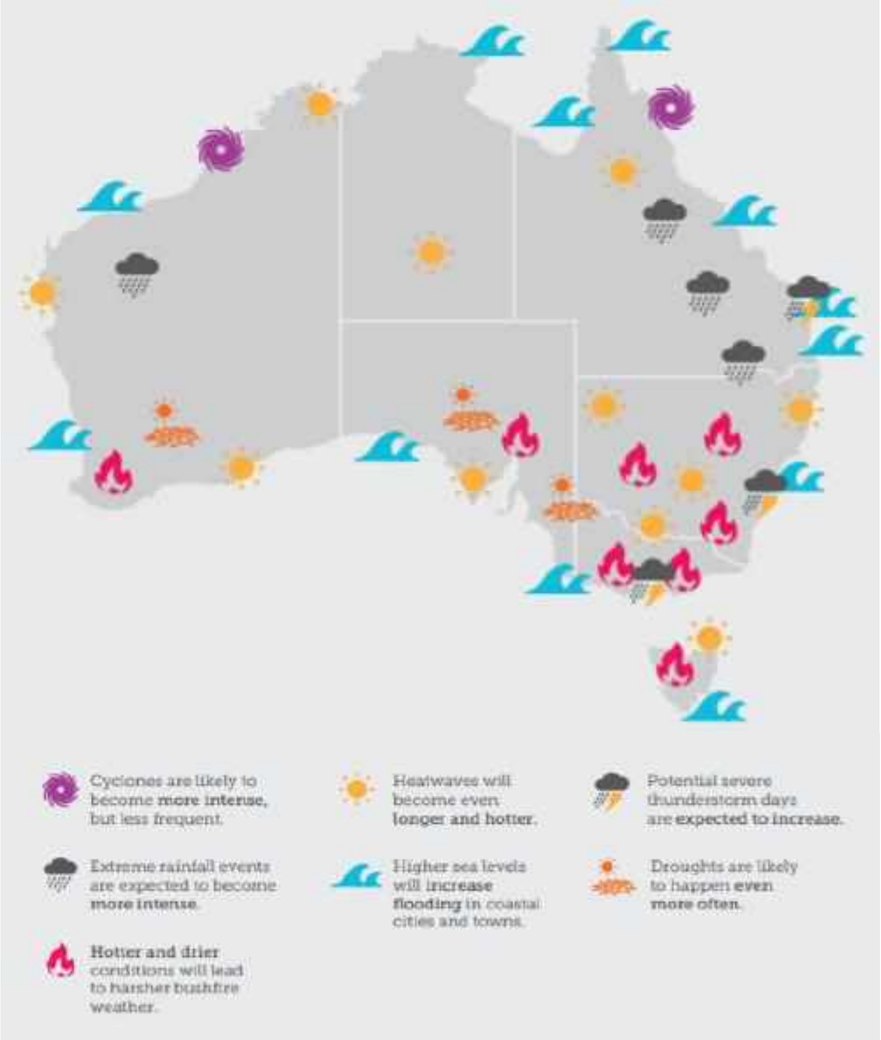
Context

Natural hazard events affect electricity network infrastructure leading to localised long duration outages:

- Strong winds directly bring down overhead lines and poles
- Fallen trees and debris cause damage to overhead lines and lift underground cables.
- Flooding inundates substations and underground assets, rendering them unusable.
- Bushfires burn through above-ground network assets.
- Networks are potentially a source of ignition for bushfires on extreme fire weather days

This year three cost pass through applications submitted to recover an unprecedented $42.67M from damage sustained from recent bushfire and severe weather events.



Source: Climate Council of Australia 2019 [Dangerous Summer: Escalating Bushfire, Heat and Drought Risk](), p. 6.

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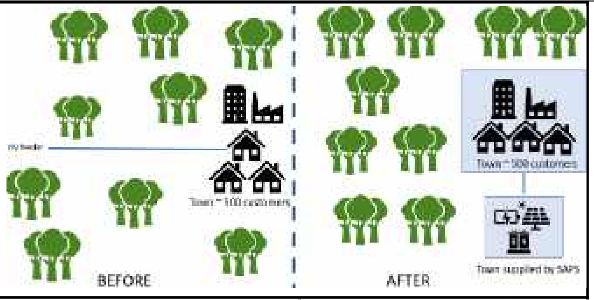
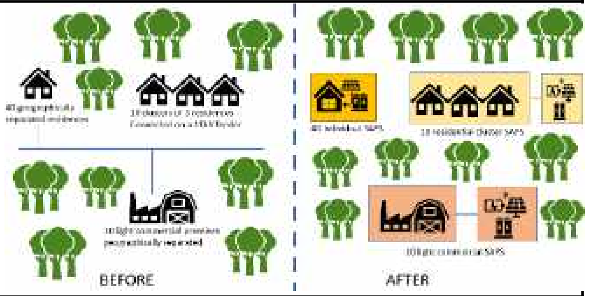
Objective

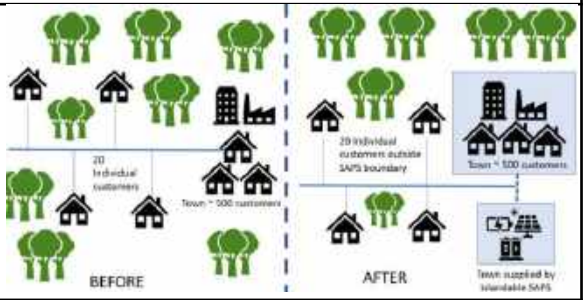
<u>Case Study 1</u>: Provision of an isolated SAPS to a remote town of approximately 500 customers, which is capable of supplying the township's entire demand. The township is then completely disconnected from the network.



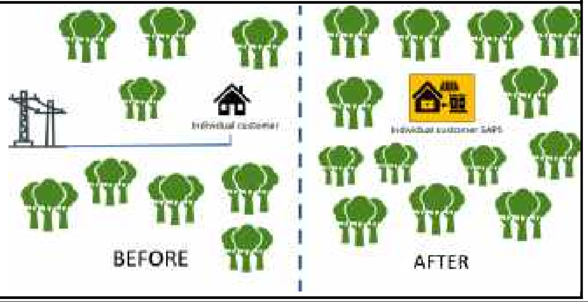
<u>Case Study 2:</u> Provision of **individual isolated SAPS** to 60 customers, which are capable of supplying the customers' entire demand. The customers are then completely disconnected from the network.



<u>Case Study 3</u>: Provision of an **islandable power system to a remote town** of approximately 500 customers which is capable of supplying around 45% of the township's demand. The township is ordinarily connected to the network and only becomes islanded during an outage.



<u>Case Study 4</u>: Provision of a **SAPS to one remote customer** in a remote area (with a dedicated 5km feeder), capable of supplying the customer's entire demand. The customer is then completely disconnected from the network.



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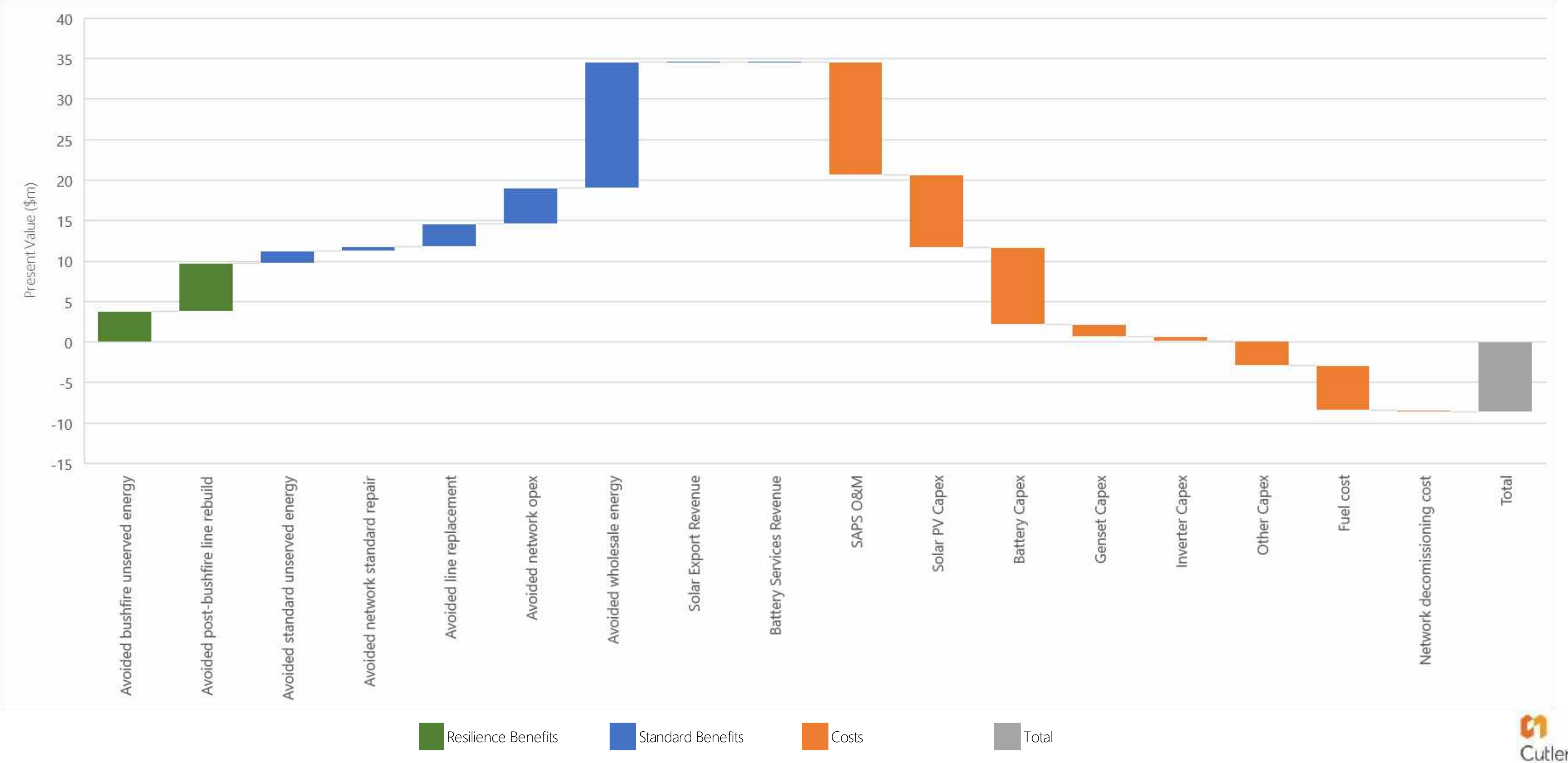
Case Study 1: Isolated remote town SAPS



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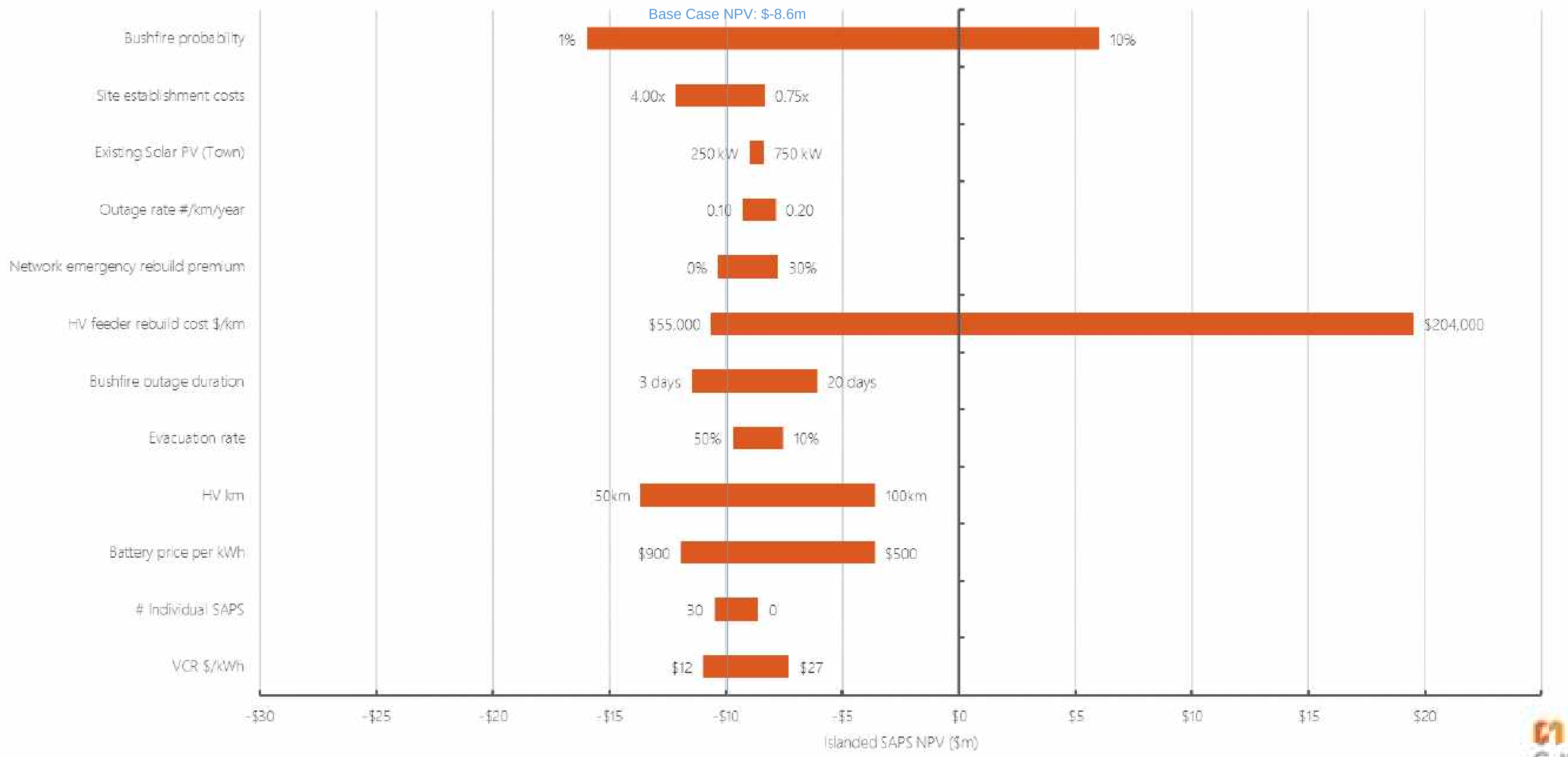
Case Study 1: Isolated remote town SAPS



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The economics of resilience-based SAPS

Islanding remote towns

1. The **business case for islanding remote towns** appears to generally be **negative**. Only very remote, small population towns with existing unreliable power supply and feeders that are nearing the end of their useful asset life would justify investing in an islanded SAPS.
2. However, if the **probability of a major natural hazard event** impacting a town in any given year **increases to 8%** or more, then there is likely to be a **compelling resilience-based business case** for provisioning some remote towns with resilience-based SAPS.
3. Climate change projections suggest that it is plausible that the probability of a bushfire event impacting a town in bushfire prone areas will increase **beyond 8% before 2050**.

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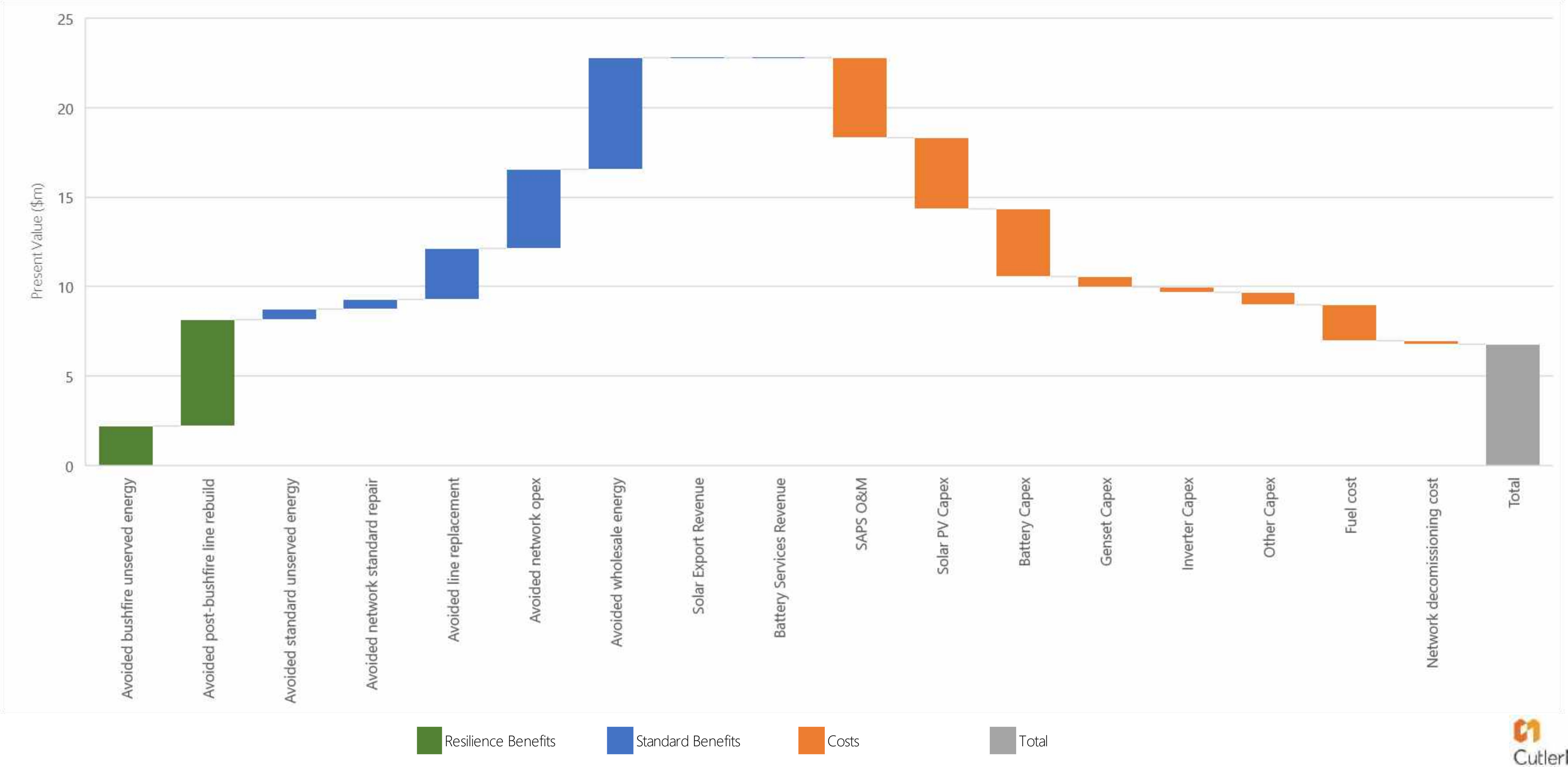
Case Study 2: Individual Power Systems



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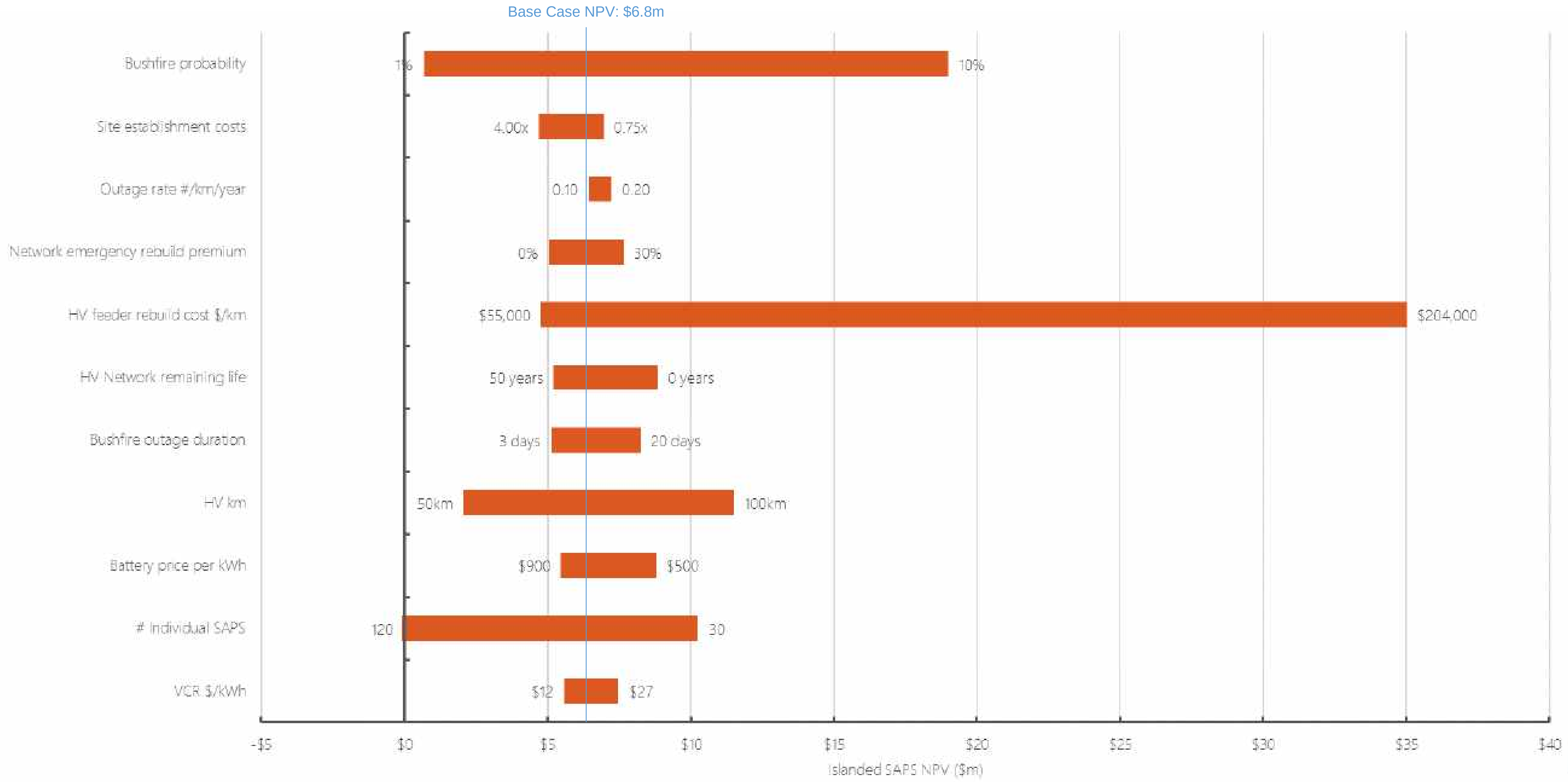
Case Study 2: Individual Power Systems



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The economics of resilience-based SAPS

Individual power systems

1. The business case for providing individual SAPS to a reduced number of single customers tends to produce a higher economic benefit, even without considering resilience benefits
2. The consideration of resilience benefits may enable additional candidates for individual SAPS to be identified.

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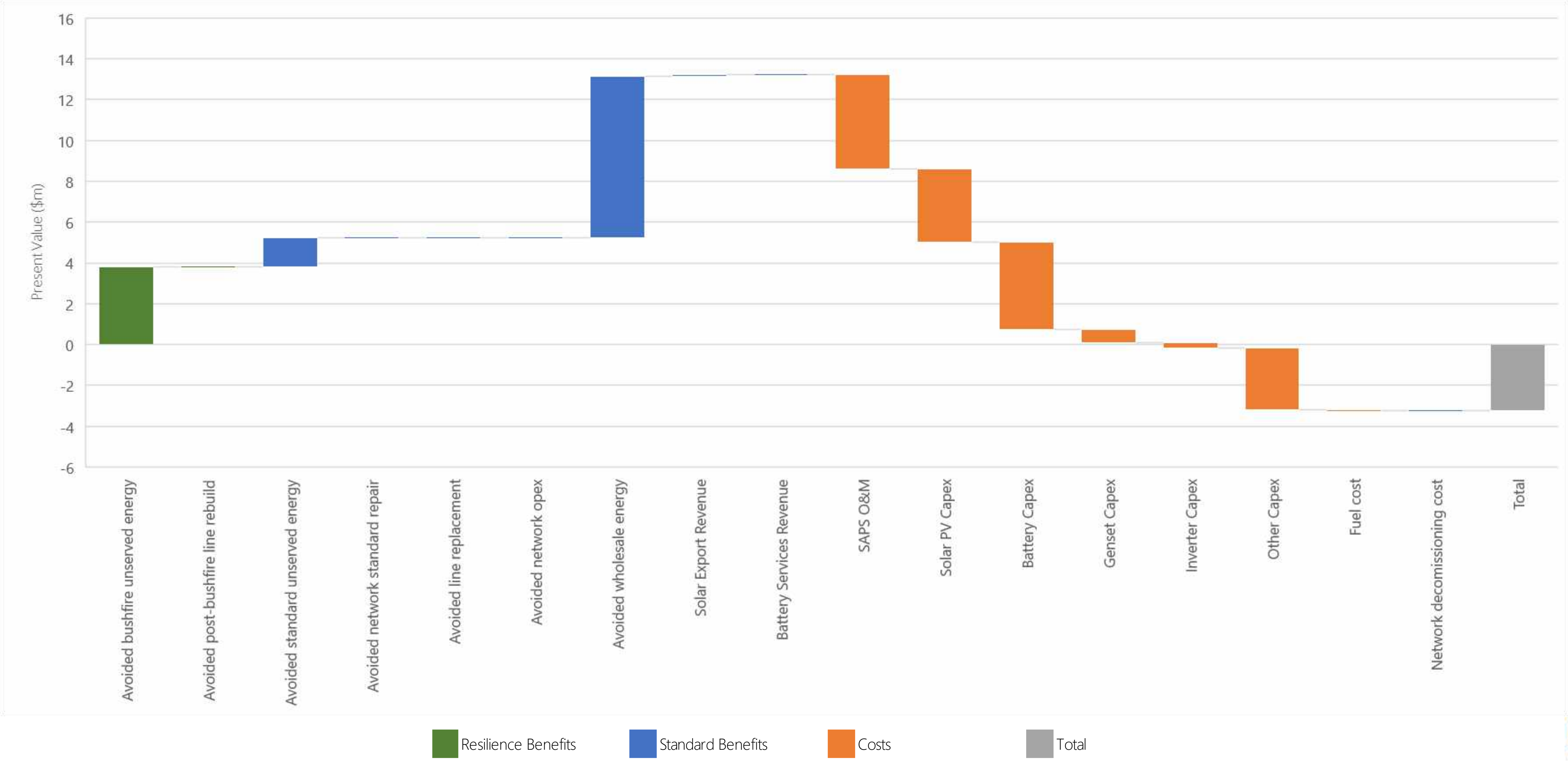
Case Study 3: Islandable Power System to Remote Town



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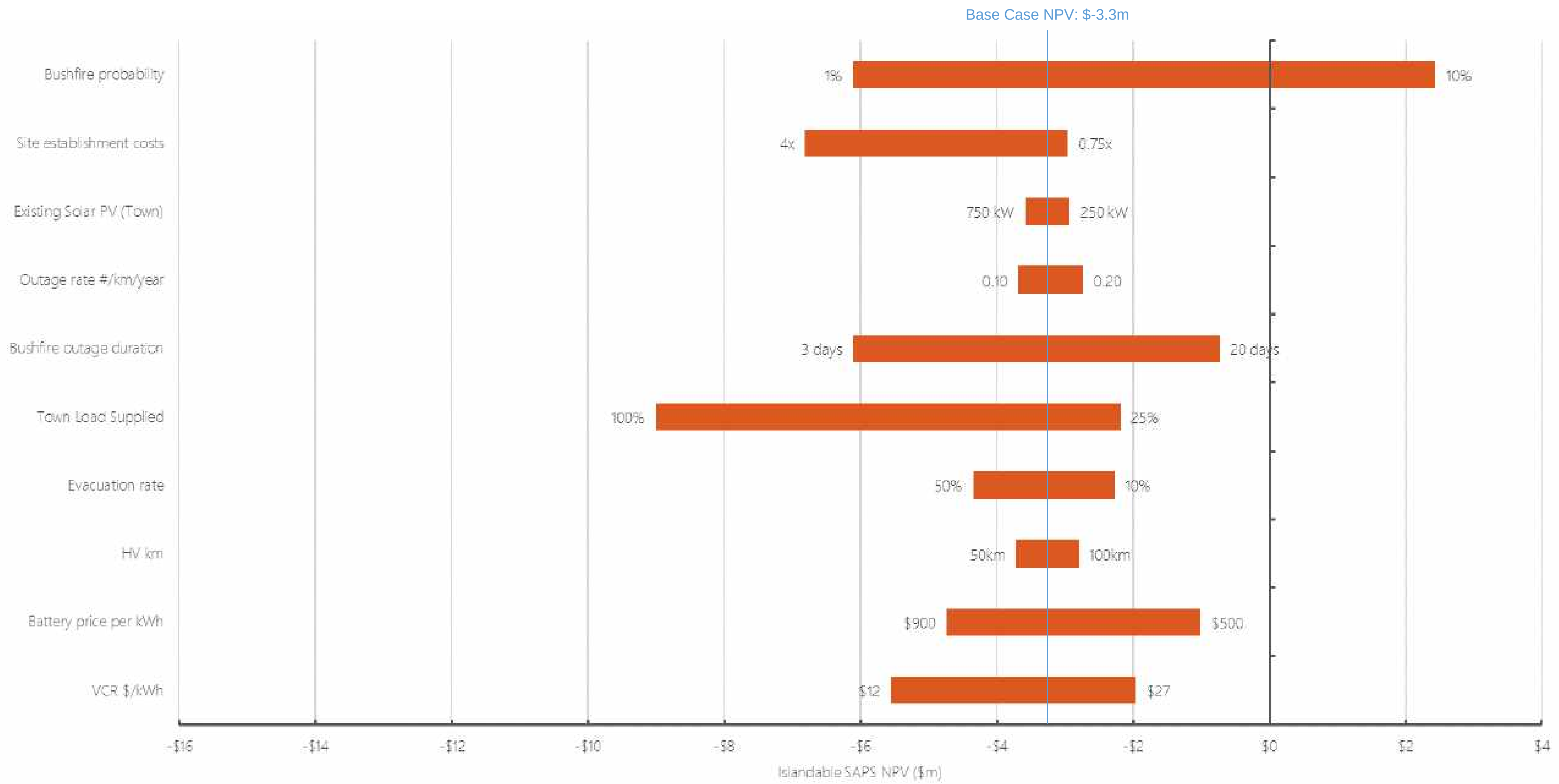
Case Study 3: Islandable Power System to Remote Town



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The economics of resilience-based SAPS

Islandable power systems in remote towns

1. The **business case for an islandable power system** is negative with a similar NPV to Case Study 1. While there are lower costs due to smaller systems, the benefits of avoided network O&M and rebuild are not realised.
2. There may be a **potential implementation mechanism** whereby a town may be provisioned with an islandable SAPS and then **transitioned to an islanded SAPS** at the end of the network asset's life or after the network asset is destroyed by a natural hazard event.

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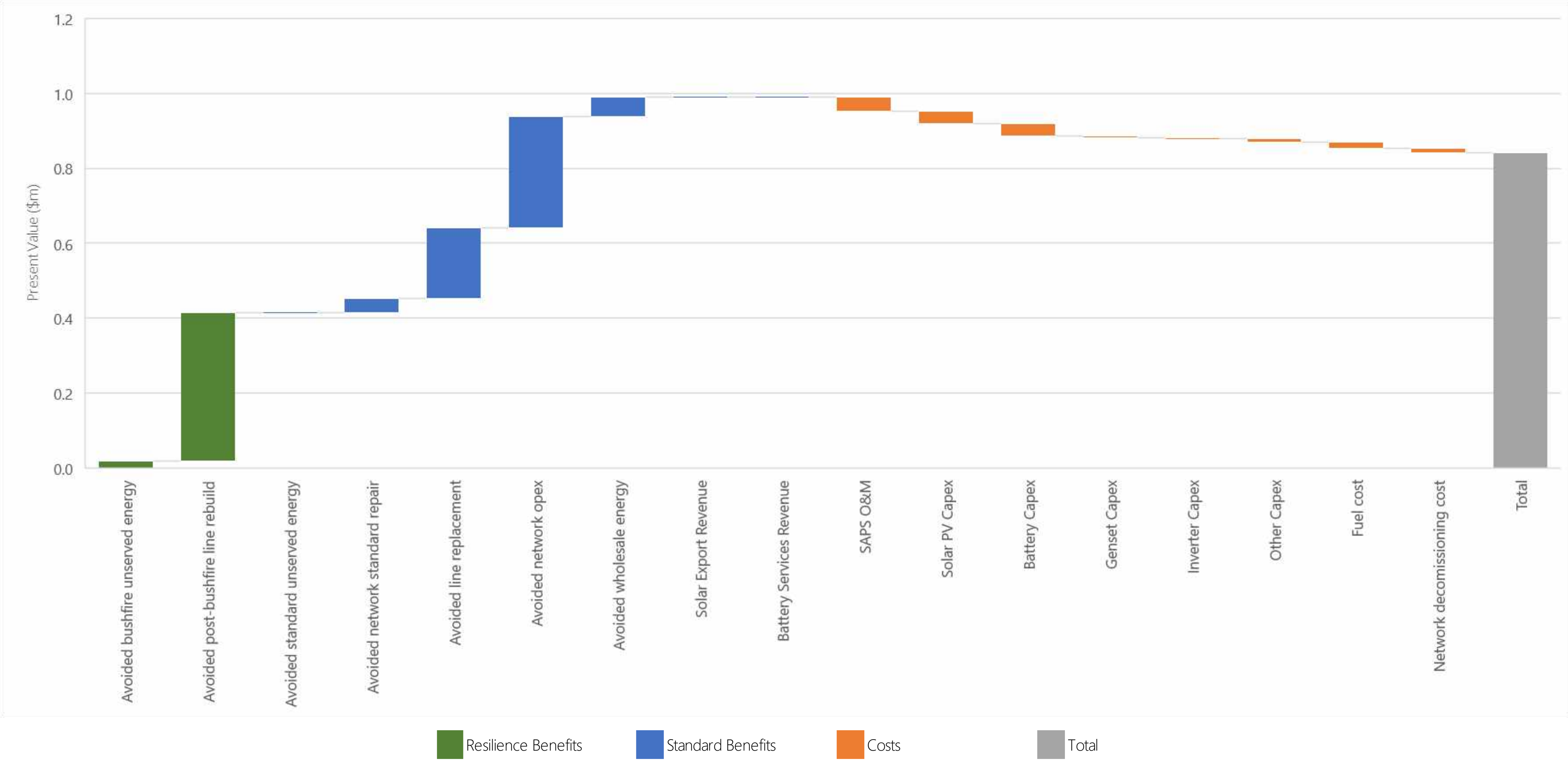
Case Study 4: Individual Remote SAPS



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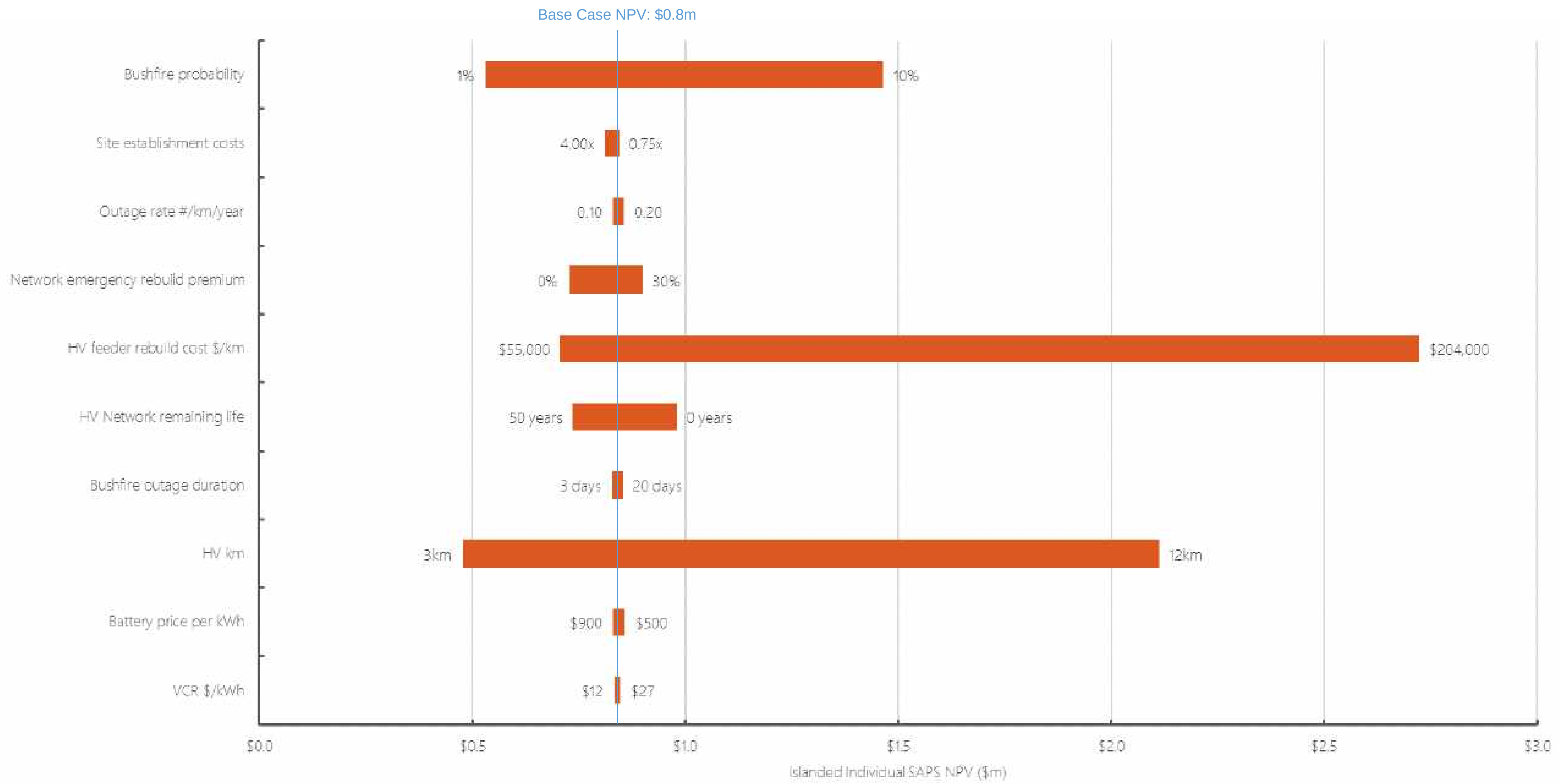
Case Study 4: Individual Remote SAPS



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The economics of resilience-based SAPS

Individual Remote SAPS

1. The **business case for individual remote SAPS** at the end of a 5km feeder is positive, even without considering resilience benefits.
2. Resilience benefits make up approximately 50% of the overall benefits implying that there are likely an increased number of individual customers that could be provisioned with a remote SAPS where resilience benefits are considered.

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Regulatory Barriers: Summary of Findings

1. **No positive requirement** under the existing framework for NSPs to invest in resilience
2. Overall, current regulatory arrangements place **greater emphasis on managing network resilience through recovery measures** (such as via insurance or the cost pass through mechanism) than mitigating impacts of, or absorbing impacts from, natural hazard events.
3. All NSPs have a **legal obligation** (under various state-based legislation enforcing AS5577) to manage safety risks including protection from ignition of fires by electricity networks and **safety aspects arising from the loss of electricity supply.**
4. However, the extent to which NSPs consider resilience measures in terms of mitigating or absorbing these impacts varies. The **consideration of the role of SAPS in a safety context has to date, not been categorically considered**.
5. The **regulatory framework for SAPS is an area that is still evolving** via AEMC proposed rule changes related to SAPS which address several key barriers. The proposed changes are unlikely to address resilience related barriers.
6. Several areas of the **regulatory framework** are **potentially constraining** the ability of NSPs to enhance resilience to natural hazard events including lack industry agreement on:
   - **Valuing reliable supply** of electricity following a long duration localised outage; and
   - **Assigning probabilities** to the frequency of occurrence of natural hazard events.

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Recommendation 1: Engagement on Resilience

DNSPs to proactively engage with their customers and customer advocacy groups to better understand customer expectations, priorities and value placed on resilience-based SAPS.

The engagement should seek to determine the level of customer support for proactive investment by DNSPs in resilience.

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Recommendation 2: Resilience Rule Change

Where customer support is achieved and/or where other stakeholders (e.g. customer advocacy groups) separately identify customer value for network investment in resilience, then there may be a strong case for a rule change request to be submitted. Any such rule change should require, inter alia, an explanation of the distinction between resilience and reliability, and the relevance of resilience to the NEO.

Any rule change request should consider the following elements:

- A definition of resilience
- A requirement for the AER to create a resilience guideline including:
  - A risk assessment framework: we expect that this will be forthcoming in 2021 via the ESCI project. This will include probabilistic treatment of individual severe weather events, and potentially an alternative approach for compound severe weather events.
  - Changes to the AER's VCR framework to recognise the costs of long duration but localised outages, potentially including social costs based on recent Australian data.
- Changes to the STPIS Beta 2.5 methodology to reflect the increasing number and severity of MEDs.
- Changes to chapter 6 related to forecast capex and opex to require DNSPs to "maintain the reliability, security and resilience of the distribution system through the supply of standard control services" (6.5.7(a)(3)(iv)).
- Changes to broaden the considerations that a DNSP is able to consider in determining whether to transition existing customers to a SAPS to include improved resilience.
- Consideration of the impact of a resilience requirement on other incentives (e.g. CESS and EBSS).
- Consideration of any impacts on jurisdictional reliability standards.

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Recommendation 3: Natural hazard management (resilience) plans

The development of natural hazard management (resilience) plans, which may include bushfire management plans and/or other natural hazards such as cyclones (as appropriate), setting out:

- Specific activities, including capital expenditure programs and operational or maintenance expenditure programs undertaken to reduce the risk of a network asset igniting a bushfire
- Specific activities including capital expenditure programs and operational or maintenance expenditure programs undertaken to reduce the impact of any natural hazard on the network asset (which may include replacing the asset with SAPS)
- Capacity to manage and respond to natural hazard events through appropriate emergency response programs, customer information systems, public communications strategies and resourcing levels.

In preparing natural hazard management plans, as set out in AS5577, NSPs should also engage with state governments and emergency services to clearly set out responsibilities for emergency supply of power immediately following an emergency event.

Further investigation may also be required to determine whether emergency systems and SAPS standards should be set at a national or state level.

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Recommendations for Further Work

1. **Deep dive case study:** An in-depth case study should be carried out based on an actual town recently impacted by a natural hazard event (such as Mallacoota or Bawley Point) to better understand:
    - Financial modelling implications under the AEMC's proposed third-party ownership of the generation component of SAPS installations
    - Network configuration requirements and what control systems would need to be put in place
    - The customer value of reliable power during and immediately following natural hazard events
    - The community views on the design parameters for an islandable SAPS, including consideration of the number of types of facilities where a resilient power supply is highly desirable.
    - The community willingness/ability to reduce demand below normal levels after a natural hazard event
    - The relative risks and benefits of a diesel supplied SAPS or solar/battery supplied SAPS, including consideration of diesel transport and long-term diesel use after a natural hazard event

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Recommendations for Further Work

2. **Resilience-based SAPS study:** A technical study should be undertaken aimed at mitigating potential technical issues for islandable SAPS including, but not limited to, consideration of:
    - How behind the meter DER interacts with SAPS, including consideration of efficiently and safely isolating any premises within the SAPS impacted by the natural hazard event.
    - Expanding on the work undertaken by Horizon Power's Onslow Renewable Energy Pilot to examine the ability of inverters in behind the meter DER to operate independently or participate after an outage, including consideration as to how EVs with V2G may contribute, investigation into appropriate network and SAPS configurations and control system requirements, and how SAPS may impact the value of customer DER through increased curtailment.

3. **National potential for resilience-based SAPS study:** An in-depth study should be conducted aimed at identifying the potential for resilience-based SAPS across Australia, including in areas prone to natural hazard events to identify total costs and benefits of a SAPS-based approach.

4. **Network resilience measures feasibility study:** A study should be undertaken which identifies a broader suite of resilience measures (not necessarily related to DER) and the relevant applications (i.e. where business cases are likely to be positive). This may include consideration of undergrounding, automation to restore supply, and diversification of feeder locations (where more than one feeder supplies an area) to provide a more holistic framework of measures for managing network resilience.

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Q&A

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