



REPORT 1 OF 5

# Future Customer & Societal Objectives

AUGUST 2025

Project Sponsors:



© Commonwealth Scientific and Industrial Research Organisation 2025. To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO.

#### *Important disclaimer*

CSIRO advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, CSIRO (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

CSIRO is committed to providing web accessible content wherever possible. If you are having difficulties with accessing this document, please contact [csiro.au/contact](https://csiro.au/contact).

#### **Prepared for:**



#### **What is CSIRO?**

The Commonwealth Scientific and Industrial Research Organisation is Australia's national science agency, conducting applied research across key sectors to drive national impact.

#### **Citation:**

Energy Catalyst, Report 1 of 5: Future Customer & Societal Objectives v1.1, AR-PST (Australian Research in Power Systems Transition) Stage 4 Topic 7, prepared for CSIRO, August 2025.



Energy Catalyst Disclaimer: The information contained in this publication comprises general statements. No claim to represent the official policy of CSIRO, AEMO or any other third party is made. The reader is advised and acknowledges that the information contained may be incomplete and/or unsuitable for use in specific situations. Therefore, no reliance or actions must be made on the information contained without seeking independent expert professional, scientific and technical advice. To the extent permitted by law, CSIRO and Energy Catalyst (including their employees and consultants) exclude all liability to any person or entity for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information, material, errors and/or omissions contained therein.

## *Navigating to 2035 en route to 2050*

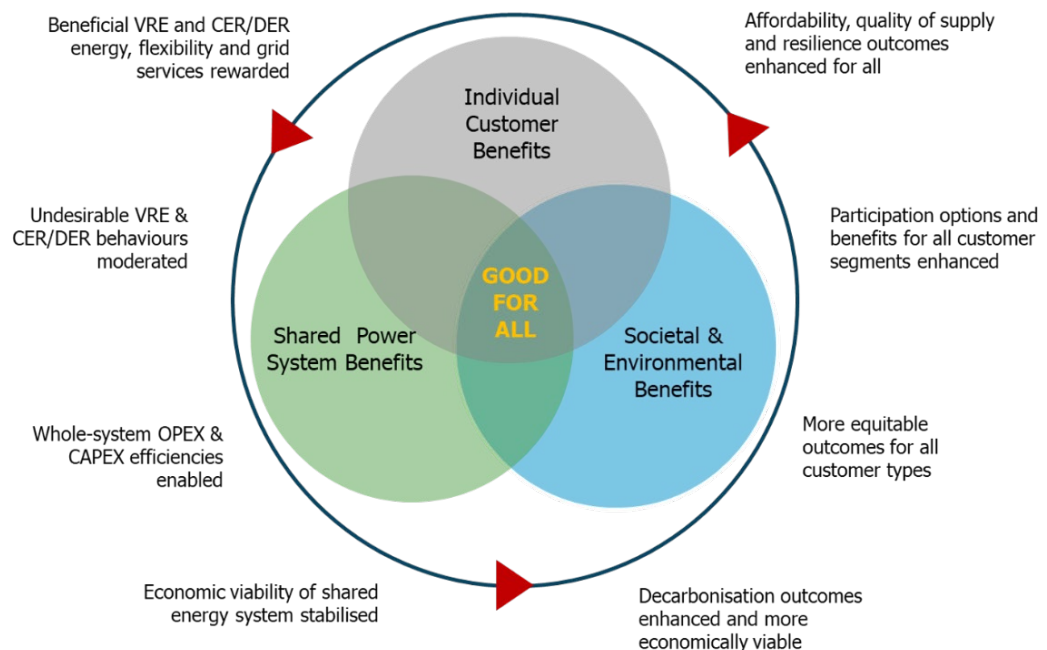
Electricity systems exist to serve humanity. And as these critical systems move into their second century they are facing profound change. At the same time, customer and societal expectations are also evolving, in some cases dramatically. As Australia considers the type of power systems it will need for the rest of 21<sup>st</sup> century, this global meta-analysis of diverse customer and policymaker perspectives identified eight future objectives. While each jurisdiction – and each customer – will weight these differently, they provide valuable perspective on the trade-off choices that will need to be collectively weighed to achieve a ‘balanced scorecard’ of outcomes for society.

| Report Development Team |                 |
|-------------------------|-----------------|
| Lead Author             | Matthew Bird    |
| Key Technical Advisor   | Dr Jeffrey Taft |
| Contributing Authors    | Mark Paterson   |
|                         | Thomas Prisk    |
| Support Staff           | Eduardo Ariztia |
|                         | Jenny Mistry    |

## Executive Summary

This report identifies eight Future Customer and Societal Objectives derived from a metanalysis of diverse Australian and global sources. While customers and policy makers articulate a wide range of perspectives, often using different language and points of emphasis, the research also found a level of convergence on the following desirable attributes: Dependable, Affordable, Sustainable, Equitable, Empowering, Expandable, Adaptable, and Beneficial.

While there are commonalities with some more traditional power system objectives of the last century, for example as expressed in Australia's National Electricity Objective (NEO), the expanded set of eight objectives reflect a clear shift away from assumptions of passive energy consumption toward a more engaged and participatory energy future.



*A proactive, human-centred approach to transition design for Australia's grids has the potential to deliver a more balanced scorecard of outcomes for all customers.*

The eight objectives were derived from a synthesis of over 50 sources across academia, industry and customer advocates to ensure the consideration of Australia grid transformation pathways was grounded in a strong focus on the people that the system exists to serve. And increasingly, as many customers enjoy greater optionality – and even the prospect, no matter how remote, of 'leaving the grid' – there is a sense that after 100-years of unchallenged dominance that the sector may now be witnessing the gradual maturing of 'product substitution' risk.

These shifts demand foresight and realism about the type of power system Australia needs to develop over the next decade, namely one that embraces flexibility, mutually-beneficial participation and more inclusive governance. While the report does not prescribe specific reforms, it does provide a practical framework to guide system actors in navigating competing priorities, stakeholder expectations, and emerging customer and societal risks.

The report is structured to build a logical and contextual foundation before presenting its core findings. [Chapter 1](#) sets out the purpose, context, and rationale, explaining that power systems must increasingly reflect evolving societal values and customer needs. [Chapter 2](#) describes the report's development approach and wide-ranging literature review, and [Chapter 3](#) introduces the eight Future Customer and Societal Objectives, each framed as essential design considerations. [Chapter 4](#) explores how trust and social licence intersect with these objectives, positioning them as preconditions for participation and power system legitimacy. Finally, [Chapter 5](#) discusses the role of system design in managing trade-offs between competing objectives, emphasising the need for strategic foresight and a genuinely human-centred orientation.

In summary, the eight objectives offer a 'first principles' lens through which future trade-offs and investments may be evaluated. They represent both an opportunity and a responsibility: to ensure that the energy transition remains grounded in the lived experience of consumers and aligned with broader societal values.

## Table of Contents

|   |           |
|---|-----------|
| <b>Executive Summary.....</b>   | <b>4</b>  |
| <b>Table of Figures.....</b>  | <b>8</b>  |
| <b>List of Acronyms.....</b>  | <b>9</b>  |
| <b>1 Report Purpose, Context &amp; Rationale .....</b>  | <b>10</b> |
| 1.1 Purpose.....  | 10        |
| 1.2 National Context .....  | 10        |
| 1.3 Practical Rationale .....   | 11        |
| <b>2 Report Development Approach &amp; Limitations.....</b>   | <b>14</b> |
| 2.1 Philosophy .....  | 14        |
| 2.2 Development Methodology .....   | 15        |
| 2.3 Inherent Limitations & Constraints .....  | 16        |
| 2.4 Accessing the Reference Set & Providing Feedback .....  | 17        |
| <b>3 Future Customer &amp; Societal Objectives .....</b>  | <b>19</b> |
| 3.1 DEPENDABLE: Safe, secure, adequate, reliable and resilient .....  | 20        |
| 3.2 AFFORDABLE: Efficient and cost-effective .....  | 21        |
| 3.3 SUSTAINABLE: Enables 2030 and 2050 Decarbonisation Goals.....   | 23        |
| 3.4 EQUITABLE: Broad accessibility of benefits and the fair sharing of costs....  | 24        |
| 3.5 EMPOWERING: Advances customer and community agency, optionality,<br>and customisation .....                           | 25        |
| 3.6 EXPANDABLE: Enables electrification of transport, building services and<br>industrial processes .....                 | 26        |
| 3.7 ADAPTABLE: Flexible and adaptive to change, including technological,<br>regulatory and business model innovation..... | 28        |
| 3.8 Beneficial: Socially trusted, public good/benefits, commercially investable<br>and financeable.....                   | 29        |

|    |  |    |
|----|--|----|
| 4  | Trust & Social Licence: The relationship with the eight objectives | 30 |
| 5  | Future System Design: Informing better trade-off choices .....     | 31 |
| 6  | Conclusion.....  | 35 |
| 7  | References .....   | 36 |
|    | Appendix A: Detailed overview of the source material .....         | 50 |
|    | Appendix B: Principles, Methodologies & Acknowledgements.....      | 78 |
| B1 | Guiding Principles .....   | 78 |
| B2 | Integrated Disciplines & Tools.....                                | 79 |
| B3 | Acknowledgements & Foundational Sources.....                       | 83 |

## Table of Figures

|   |    |
|---|----|
| Figure 1: This report is part of an integrated set of five reports designed to support a systems-based approach to Australia's grid transformation..... | 11 |
| Figure 2: The study identified eight customer and societal objectives for future power systems....  | 16 |
| Figure 3: Consumer likelihood of identifying as under financial pressure, per income bracket.....   | 21 |
| Figure 4: Consumer-perceived value for money across different services. ....  | 21 |
| Figure 5: Mapping of objectives through the structural and component choices. ....  | 31 |
| Figure 6 – Tracing System Qualities to Properties to Components .....   | 33 |
| Figure 7 – Example Mapping of Structural interventions to qualities and properties .....  | 34 |



## List of Acronyms

|        |  |
|--------|--|
| AR-PST | Australian Research in Power System Transition               |
| ACOSS  | Australian Council of Social Service                         |
| AER    | Australian Energy Regulator                                  |
| CER    | Consumer Energy Resources                                    |
| CSIRO  | Commonwealth Scientific and Industrial Research Organisation |
| DER    | Distributed Energy Resources                                 |
| DNSP   | Distribution Network Service Provider                        |
| DSO    | Distribution System Operator                                 |
| EC     | Energy Catalyst  |
| ECA    | Energy Consumers Australia                                   |
| ENA    | Energy Networks Australia                                    |
| ESB    | Energy Security Board  |
| EV     | Electric Vehicle   |
| FFRC   | Finland Futures Research Centre                              |
| IEA    | International Energy Agency                                  |
| NEM    | National Electricity Market                                  |
| NEO    | National Electricity Objective                               |
| NREL   | National Renewable Energy Laboratory (US)                    |
| PEI    | Pacific Energy Institute                                     |
| PSA    | Power Systems Architecture                                   |
| RACE   | Reliable, Affordable, Clean Energy                           |
| TDC    | Transmission – Distribution Coordination                     |
| UoM    | University of Melbourne                                      |
| US DOE | United States Department of Energy                           |
| VRE    | Variable Renewable Energy                                    |

# 1 Report Purpose, Context & Rationale

## 1.1 Purpose

Electric power systems exist to serve individuals, families, businesses, institutions and whole societies. Individually and collectively, humans provide the fundamental reason our power system exists and the priorities it must serve.

The legacy power systems of the last century are now being transformed to meet the needs of the remainder of the 21st century. In this context, evaluating the range and priority of future system capabilities required is simply impossible without a holistic consideration of evolving customer and societal objectives. Doing so is key to answering key strategic questions such as:

*What do our citizens and policy makers expect from our future power systems?*

*How might societal expectations continue to change as new technologies and business models evolve and alternative options expand?*

*As significant elements of our legacy grids are approaching end of life, what type of future power system do we need to create to best meet societal needs and sustain the highest possible level of customer retention?*

Therefore, this report provides a synthesis of customer and societal objectives for future power systems as derived from a wide range of Australian and global literature. While further work will be required, its findings are illustrative of how our relationship with, and increasingly diverse expectations of, electric power systems are fundamentally transforming. Collaborative engagements and careful trade-off choices will be required to sustain trust, make efficient investment choices and mitigate the risk of stranded investments.

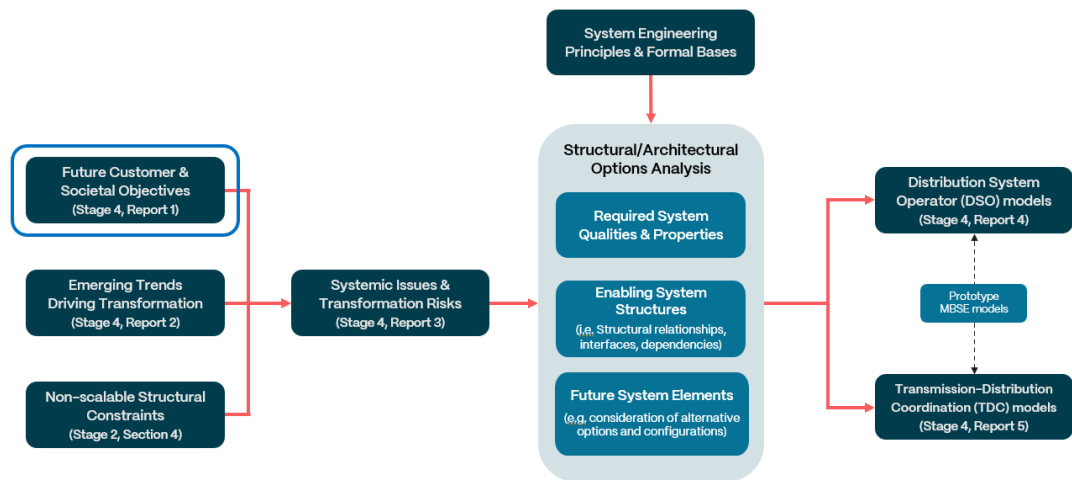
## 1.2 National Context

Electricity systems are some of the largest and most complex systems ever created by humans. Following decades of comparatively slow change, these critical societal systems are now experiencing a scale of structural transformation not seen since the dawn of electrification.

On numerous metrics Australia's NEM is leading the way in navigating this complex and multi-faceted transformation. In this context, several formal initiatives<sup>1</sup> are currently reviewing key elements of the 'as built' NEM and each of these processes are expected to add value within their respective remits in the near to medium-term. It is likely that the recommendations of each of these initiatives will also have near, medium and long-term structural or 'architectural' implications that may benefit from a common set of reference materials.

---

<sup>1</sup>For example, the National Consumer Energy Resources Roadmap, the Review of Market Settings in the National Electricity Market and the recently completed CER Data Exchange Industry Co-Design.



*Figure 1: This report is one of five which, as a reference set, are designed to support an integrative approach to Australia's power system transformation*

To help support such a foundation, this document is part of an integrated set of five reports developed under the Australian Research – Power System Transformation (AR-PST) initiative sponsored by Australia's national science agency CSIRO and in collaboration with the Australian Energy Market Operator (AEMO). This reference set consists of the following reports:

- **Report 1:** Future Customer & Societal Objectives
- **Report 2:** Emerging Trends Driving Transformation
- **Report 3:** Systemic Issues & Transformation Risks
- **Report 4:** Distribution System Operator (DSO) Models
- **Report 5:** Transmission-Distribution Coordination (TDC)

Informed by Design Thinking, this first report explored customer and societal objectives for our future power systems. This focus underpinned the development of the entire reference set and encouraged an overarching perspective that placed human and societal interests at the centre of the development process. While more can always be done, and it must, this constructively challenged the application of technical, structural and other analyses employed to constantly recalibrate against supporting the achievement of diverse human and societal interests.

### 1.3 Practical Rationale

Customers in almost every part of the economy have never enjoyed more choice and decision-making power. Digital technologies, market platforms and business model innovations are expanding options for all types of customers, whether residential, commercial or industrial.

Often referred to as the *Age of the Customer* is also called the *Age of Disruption* for good reason. Accelerated by evolving customer expectations, technologies and business models, many long-standing sectors and incumbent corporations have found their familiar twentieth century context transform unrecognisably over a comparatively short period.

While the electricity sector has several unique features, it is important to recognise that no sector is immune to these wider societal currents. For example, no longer content to simply be passive consumers, millions of citizens and businesses are now driving the transformation, with many becoming investor-participants in their own energy future and an entirely separate demographic to those consumers who will probably never want to be 'active' energy consumers. According to most scenarios, what was historically called the 'demand side' is likely to become where a large proportion of the energy resources available to Australia's power systems are located.

Both lived experience and the extensive academic literature illustrate the diverse nature of sectoral disruptions across banking, telecommunications, transport, media, entertainment, accommodation – the list goes on.

While analogies from other sectors may be of illustrative value, they rarely apply directly to a sector such as the electric power sector with all its unique characteristics. For all the differences, however, several commonalities repeatedly manifest across the wide range of transformational and disruptive forces. These are summarised below.

1. **Disruption starts small.** Disruptive forces initially impact only the edges of a system. Their initial impacts are small and are largely ignored as posing any significant threat by incumbents. The gradual erosion of customer loyalty and increasing options for 'product substitution' are largely dismissed as peripheral – often until it's too late.
2. **Customers drive disruption.** The driving force of disruption is customers, not technology. New technologies and business models enable and accelerate disruption, but the critical driver is the human aspiration for better solutions to the specific needs faced and key objectives pursued.
3. **Negative impacts vary.** Not all disruption results in the substantive destruction of a sector and its incumbent entities. Often it has the more subtle but significant impact of eroding the economic vitality of a sector. For example, railways were once one of the most lucrative and prestigious sectors to be employed in.
4. **Disruption impacts regulation.** Incumbents often assume that regulatory mechanisms will shield them from disruptive forces. While this may slow the full impact for a time, history demonstrates that even entrenched regulatory systems themselves face disruption where customer and societal aspirations diverge from the solutions provided by incumbents.
5. **Customer-focus is key to surviving and thriving.** The history of disruption is not encouraging for incumbents. What can be learned is that one of the most vital aspects of navigating disruptive forces is deep customer focus. That is, getting very close to what diverse customers value today, building deep capability to anticipate how customer objectives are likely to evolve in the future, and forging the sectoral architecture and capability to enable timely adaptation and response. Some important aspects of this consideration also include the varying levels of risk appetite and market proficiency that different customers have.

In summary, for much of the last century customers had few alternatives for meeting the bulk of their electricity needs other than the commodity service provided by large-scale grids. Unlike most other sectors, the risk of 'product substitution' for electricity incumbents was almost non-existent. Despite recognising the scale of change unfolding, it is perhaps natural for many in the sector to assume the status quo of the last century will continue substantively unchanged well into the future. In a highly risk averse sector, it is unlikely that such assumptions would be acceptable in any other sphere of activity.

Without assuming exact parallels to other industries, the scale of disruptive forces eroding sectors once thought unassailable, growing concerns over energy affordability and the accelerating 'democratisation' of new energy technologies all provide signals that should not be ignored. As noted above, one of the few means for an incumbent sector to successfully navigate such complex transformations is to focus intently on understanding and serving customer and societal needs and objectives, both in the present and well into the future.

*Consumers will have much more skin in the game and will be looking for returns.*

*That's right, returns.*

*Let's just say over the next 10 – 15 years that five million Australian households each spend around \$50,000 on a combination of things like buying an EV, adding batteries or rooftop solar and changing over from gas appliances to electric ones.*

*That's actually a pretty conservative estimate. But it's no small thing. All of those households doing that represents a \$250 billion investment in assets underpinning the future energy system.*

Gavin Dufty,  
St Vincent de Paul

## 2 Report Development Approach & Limitations

### 2.1 Philosophy

The set of reports has been developed through the lens of Design Thinking and underpinned by Systems Engineering, Systems Architecture and related disciplines. In doing so, it attempts to take a longer view of whole-system transformation relevant to the NEM and the increasingly critical role of DSO models for achieving the key objective of the federal National CER Roadmap initiative [1].

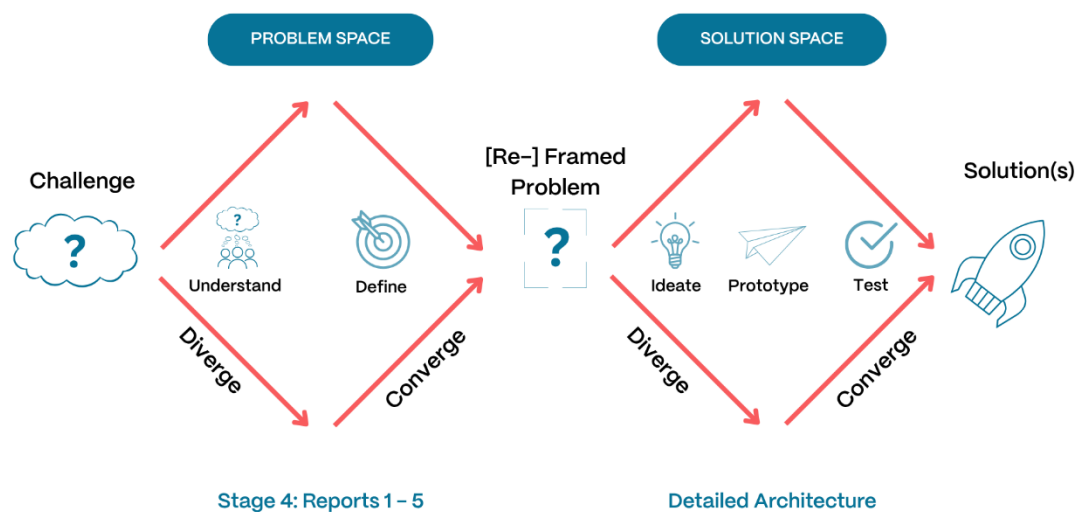


Figure 2: The reference set of five reports applies a Design Thinking approach to whole-system transformation underpinned by Systems Engineering and related disciplines

As noted previously, the reference set is designed to underpin a subsequent Detailed Architecture process that provides an integrated approach for navigating Australia's timely and efficient deployment of DSO and TDC models (i.e. 'solution space'). As illustrated in Figure 2 above, the five reports developed in AR-PST Stage 4 evaluate the divergent global and Australian content relevant to each of the topics covered (i.e. 'problem space'). This enables a rigorous, objective and traceable means for reporting and converging on the most critical issues that must be addressed to develop future-ready solutions enabled by constructive multi-stakeholder collaboration.

The Power Systems Architecture (PSA) discipline is fundamentally stakeholder- and user-centric. As illustrated in Figure 1 (above), this report functions as an important foundational input to a structured process for developing an architectural model of the power system and its transformation, a process informed and guided by PSA principles.

## 2.2 Development Methodology

The report was developed based on a wide-ranging literature review of over fifty (50) primary sources from customer advocates, academia, and industry, originating from Australia, North America, the United Kingdom and the European Union (refer [Appendix A](#)). These sources were shortlisted from a larger selection of potential materials to ensure diversity of representation, content relevance and future orientation.

Guided by the principles and methodologies outlined in [Appendix B](#), the process moved through the following steps, giving particular attention to:

- Ensuring the ‘voice of the customer’, as represented in the literature, directly informed how each objective was characterised.
- Providing a range of perspectives spanning a diversity of policy makers and customer types (residential, commercial and industrial).
- Ensuring each objective is as distinct as possible (while recognising that some overlap is unavoidable).
- In seeking to fairly report the findings, no opinion is offered on the appropriateness or otherwise of the objectives, nor of their priority with reference to the other objectives.

Regarding limitations in the available source material and the analytic process, the following observations are made:

- There is extensive discussion in the global literature about both the varied technical options relevant to future power systems and the nearer-term expectations of customers and society. By contrast, the availability of sources that explicitly explore future customer and societal objectives for the power system is limited.
- Noting the above point, having selected the material that was of greatest relevance to the topic, the development process required a significant level of inferential reasoning to derive future-oriented implications relevant to customer and societal objectives.
- In addition, there was a comparative scarcity of discussion on first order qualities such as the safe, secure, adequate, reliable, and resilient supply of electricity. This may best be explained by the fact that they are considered intrinsic to power system operations and therefore assumed as a given in any future power system.
- The eight objectives identified are not proposed as either exhaustive or equally relevant in every location.

In summary, while further work will be required, the report findings illustrate how our collective relationship with, and increasingly diverse expectations of, electric power systems are transforming fundamentally. The design of our future power systems will require collaborative engagements and careful trade-off choices to sustain trust, foster social licence, mitigate the risk of stranded investments and deliver the benefits customers and society need.



Figure 3: The study identified eight customer and societal objectives for future power systems.

## 2.3 Inherent Limitations & Constraints

Given the wide-ranging nature of the reference set, the following points highlight limitations that are inherent to any such analysis. They should therefore be noted in the interpretation and application of this report subject to the formal disclaimers provided above.

- The five reports have been developed as an integrated reference set which, by definition, covers an extremely wide range of complex topics. This necessarily means that none of these topics have been treated exhaustively.
- As a reference set, it is anticipated that most readers will refer to particular content on an 'as needs' basis. Therefore, each of the five reports is designed to stand alone which has required some repetition of key unifying themes and concepts.



- The reference set focuses on several emerging areas of consideration and is designed to assist navigation of the 'emerging future' over the next decade and beyond. It is therefore a consolidation of the development team's understanding at the time of publishing and will likely benefit from a comprehensive update on at least a bi-annual basis.
- While a range of tools and models are employed as a basis for reasoning about how the power system and its wider societal context may evolve, it is recognised that reality is far more complex than any model or archetype can ultimately represent.
- Recognising the inherent complexity of the topics explored, the diversity of perspectives and terminology, and the many thousands of pages of global content that is more or less relevant, the following points should be noted:
  - The reference set is inherently explorative and spans numerous overlapping topics and developments, many of which are yet to mature to a point of industry consensus, either in Australia or globally.
  - Therefore, it is inevitable, expected and healthy that different readers will draw different conclusions on some or several of the topics addressed.
  - Particular content will mean more to some system actors and/or those with particular discipline expertise than others. The standpoint of the reader and the time horizon they are primarily focused on will likely influence how the desirability or otherwise of particular content is evaluated.
  - Accurately predicting the future and/or foreseeing all eventualities is impossible. Therefore, it is anticipated that some of the content contained in this reference set will prove to be incorrect. For that reason, stakeholder feedback is strongly encouraged and a formal mechanism to do so is provided below.
  - In summary, the information contained in the reference set comprises general statements based on research. No claim to represent the official policy of CSIRO, AEMO or any other third party is made.
- Finally, while each of the five reports are designed to stand alone, they are best employed as an integrated set of reference material. Reports 3, 4 & 5 in particular should be read with reference to each other.

## 2.4 Accessing the Reference Set & Providing Feedback

The Energy Catalyst team deeply values excellence and humility. We believe that true leaders in times of transformational change do not overestimate their own knowledge. On the contrary, they foster and contribute to an ecosystem of diverse perspectives which enables shared understanding and mutual progress – even where differences remain.

This reference set is developed from a perspective that values exploration, discovery and convergence based on shared learning. Others will have important insights that the development team has not considered, and we would like to hear them. As noted earlier, as realists we also anticipate that some of the content contained will ultimately prove to be incorrect.

The full reference set of reports is available free for download at [energycatalyst.au/futuregrid](https://energycatalyst.au/futuregrid) or by scanning the following QR code.

Constructive stakeholder feedback is also strongly encouraged, and a formal mechanism is also provided for each report at the same location. Thank you in advance for your collaboration.



### 3 Future Customer & Societal Objectives

Humans provide the fundamental reason our power system exists and the priorities it must serve. If this is true, it is impossible to consider the required capabilities of our future power systems without a holistic consideration of customer and societal objectives.

In the context of global power system transformations, a set of eight future customer and societal objectives emerged from the Australian and global literature. Like the diversity of society itself, the objectives are analogous to an intricate tapestry and involve varying levels of interdependence. For example, pursuing a deeper and more rapid decarbonisation of the power system (Sustainable) may result in power quality and system security risks (Dependable) and escalated system costs (Affordable).

A consolidated summary of the eight future customer and societal objectives is provided below.

|                    |  |
|--------------------|--|
| <b>DEPENDABLE</b>  | Safe, secure, adequate, reliable and resilient   |
| <b>AFFORDABLE</b>  | Efficient and cost-effective   |
| <b>SUSTAINABLE</b> | Enables 2030 and 2050 decarbonisation goals  |
| <b>EQUITABLE</b>   | Broad accessibility of benefits and the fair sharing of costs                                      |
| <b>EMPOWERING</b>  | Advances customer and community agency, optionality, and customisation                             |
| <b>EXPANDABLE</b>  | Enables electrification of transport, building services and industrial processes                   |
| <b>ADAPTABLE</b>   | Flexible and adaptive to change, including technological, regulatory and business model innovation |
| <b>BENEFICIAL</b>  | Socially trusted, public good/benefits, commercially investable and financeable                    |

More expansive than conventional sets of objectives, these eight objectives provide a more holistic, nuanced and future-facing set of insights relevant to a bi-directional and participative electricity future. As such, they highlight the expanding diversity of customer and societal expectations and the need for collaborative prioritisation and trade-off choices.

Each of these eight future customer and societal objectives are summarised below together with a selection of quotations from the literature reviewed. A more detailed overview of the underpinning source material is also provided in [Appendix A](#). Based on the analysis, several cross-cutting observations can be made:

### 3.1 DEPENDABLE: Safe, secure, adequate, reliable and resilient

An almost universal emphasis in the literature is that dependable electricity systems will remain essential to all modern societies. As lifestyles, commerce, industry and a range of enabling infrastructures (internet, water, banking, telecommunications, etc) are increasingly electrified, the critical importance of dependable power systems continues to expand. The sources also maintain that electricity systems must continue to be considered an essential service into the future even as the potential for customer agency and autonomy.

As an essential service, ultimate responsibility for a dependable power system will continue to reside with governments. Numerous discussions in the literature note that improving reliability, resilience, and restoration time should be prioritised for customer benefit (refer to [References 8.1](#)). This potential increases as the power system becomes more automated, digitised, coordinated, and decentralised. At the same time, it is also recognised that digitalisation also introduces new challenges and vulnerabilities, such as data privacy and cyber-security, which must be addressed to ensure a safe and secure system.

*Energy is an essential service; the energy system exists to support the community and is not an end in itself.*

[ACOSS, AiG, EEC and Property Council of Australia – Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources, December 2024](#)

*Consumers expect leadership and transparency. The participants wanted government in control of the transition, not industry. They expected government to provide clear, consistent and timely information, and create regulations to protect them.*

[Energy Consumers Australia – PowerUp: Consumer Voices in the Energy Transition, July 2024](#)

### 3.2 AFFORDABLE: Efficient and cost-effective

Affordability is recognised in the literature as a critical priority with significant scope for improvement in the future power system. As a baseline, Energy Consumers Australia's 2022 [Energy Consumer Sentiment Survey](#) indicates consumer likelihood of identifying as under financial pressure per income bracket (Figure 3) and the value for money of electricity services as second lowest across all services assessed (Figure 4). Various sources also highlighted that many emerging features of the future power system are tightly coupled with affordability, such as automation, demand-side flexibility, cost-reflective tariffs, unbundling of energy services, energy efficiency.

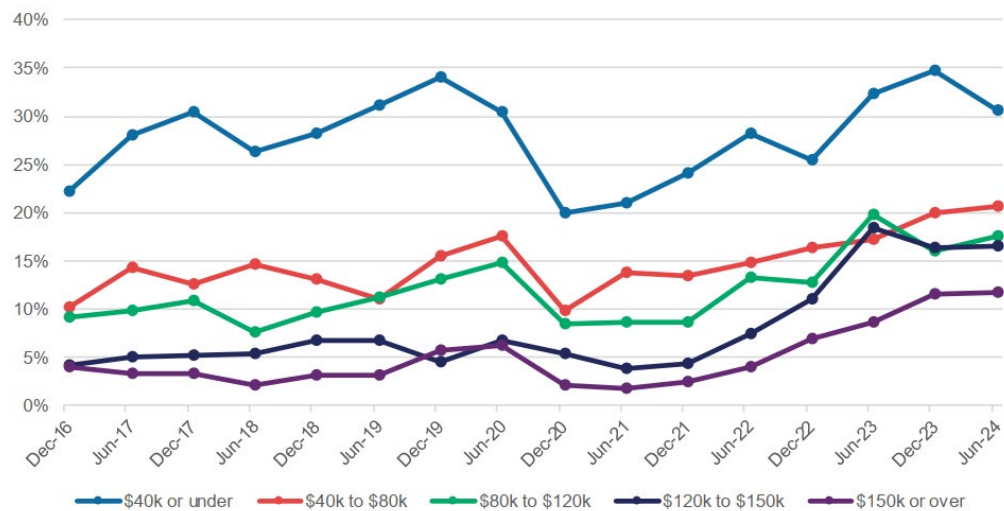


Figure 4: Consumer likelihood of identifying as under financial pressure, per income bracket.

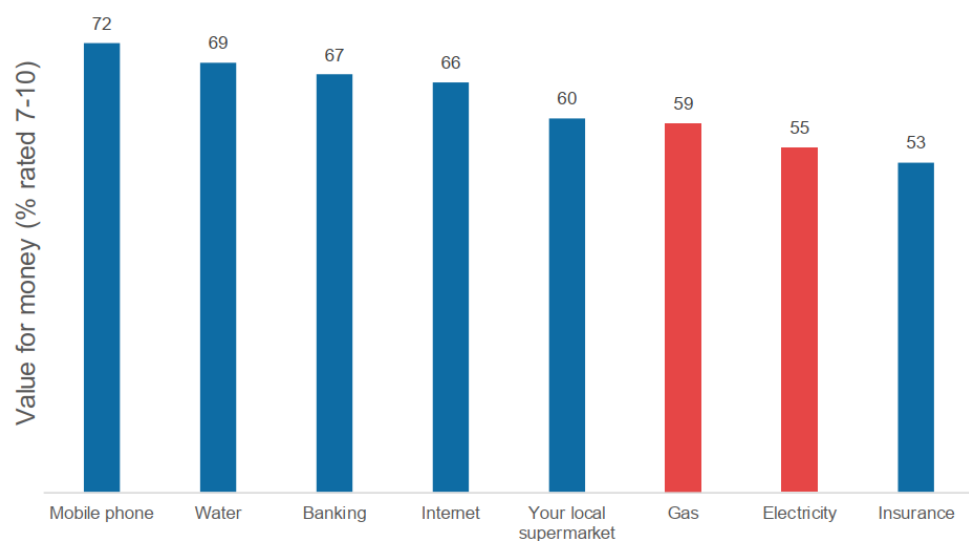


Figure 5: Consumer-perceived value for money across different services.

Efficient investment in utility-scale infrastructure and utilisation of existing transmission and distribution were also raised across multiple sources as a key determinant of affordability for customers that will continue to require rigorous attention. Some sources discussed the need for customer's perception of value of their energy services to better align with the costs they incur, and similarly, that customers are confident that competition and cooperation across the supply chain are resulting in increased affordability.

*There is a well-known and widely accepted correlation between income and the energy divide... low-income households are consistently paying a greater portion of their income on energy than their higher earning counterparts. Results from December 2023 indicate that for the lowest income households (below \$20,000/year), energy costs represent 13.6% of their total income, an increase of 1.2% compared to December 2022. This is over five times more than the proportion of income spent on energy by the highest earning group.*

[Energy Consumers Australia – Understanding the Energy Divide \(Explainer\), December 2023](#)

*Our failure to fully harness the power of demand-side action needlessly locks us into higher future energy costs and emissions, while failing to serve the interests of either individual energy users or the community as a whole.*

[ACOSS, AiG, EEC and Property Council of Australia – Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources, December 2024](#)

*For the past 20 years, economic regulators of the energy market have told consumers to shop around for a better energy deal if they are not happy or if they are concerned their bills are too high. As far as consumers are concerned, the 'system' has said to them: It's your risk. You manage it.*

[Monash University \(R. Ben-David\) – Minimising Consumer Harm for a Successful Energy Transition, Presentation to IPART's 30th Anniversary Conference, November 2022](#)

### 3.3 SUSTAINABLE: Enables 2030 and 2050 Decarbonisation Goals

Policy makers and customers expect power systems to actively transition toward a greater reliance on renewable energy-based electricity generation. At the same time, recent geopolitical conflict, cost-of-living pressures and energy price rises have heightened the debate in various parts of the world about the perceived conflict between affordability and decarbonisation.

Customers broadly support the need for the power system to decarbonise and are motivated to adapt their energy use accordingly, particularly where financial benefits accrue. As such, enabling customers to conveniently choose to procure their electricity from sustainable and affordable sources is a common theme in the literature, as is energy efficiency and energy productivity. Further, a sizeable proportion of customers have or will invest in their own on-site renewable energy resources in the form of rooftop solar which simultaneously achieves their highest reported objective of reducing electricity costs while also allowing them to contribute to a more sustainable power system.

Additional themes that emerge from the literature are the need for environmentally responsible construction (and decommissioning) of energy infrastructure and components, and the customer expectation for clear, transparent, and accountable reporting on the environmental impact of their own choices and those of their providers.

*Many of us do not know what meeting Australia's 2030 decarbonisation targets means for us, or what we need to do because we haven't been 'told straight' what the plan is. An overarching narrative, with the aim of bringing us all together under a unifying vision, is sorely needed from governments and industry. This needs to happen soon because in the absence of a cohesive story, we're all facing a deluge of misinformation that's costing many people money as well as their goodwill.*

[Energy Consumers Australia – Three Year Plan 2025–2028, 2025](#)

*Demand-side actions – such as energy efficiency and demand flexibility – are essential to achieving emissions reduction targets and can save billions of dollars in energy bills and investment through right-sizing investment in new infrastructure. Current governance arrangements fail to seize these opportunities, needlessly locking us into higher costs and emissions.*

[ACOSS, AiG, EEC and Property Council of Australia – Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources, December 2024](#)

### 3.4 EQUITABLE: Broad accessibility of benefits and the fair sharing of costs

Ensuring equitable outcomes in a rapidly changing power system presented as another key priority for customer advocates. Several sources identified the need to ensure the benefits of a future modernised power system are distributed fairly across all customers, such that those with limited access to new energy products and services do not incur a disproportionate share of the costs of operating that system. Fit-for-purpose consumer protections featured in the literature as an important mechanism to ensure those participants in the power system with limited access are not disadvantaged. This includes shielding consumers from undue complexity and decision fatigue, particularly for those without the resources or desire to actively manage energy decisions across multiple time horizons.

Another emerging challenge identified is minimising complexity and providing relevant information on offerings in a clear and concise manner. As the customer base diversifies, and energy products and services proliferate, it is important that all customers, regardless of their experience or knowledge, have easy and simple information and fair access to platforms and product/service offerings most suited to their circumstances. This may include personalised and accessible quantitative data to inform decision making.

*Consumers expect fairness... they expect government to distribute benefits and burdens fairly – not equally – across the community. They do not want to pay more than their fair share, but do not want vulnerable people left behind. Most would change their behaviour if compensation was fair, and benefits are transparent.*

[Energy Consumers Australia, PowerUp: Consumer Voices in the Energy Transition, Jul. 2024](#)

*If EVs demand a significant capital upgrade to the distribution network or an extensive roll-out of charging stations, should those costs be recovered from all consumers or only from the owners of EVs?*

[R. Ben-David, What if the Consumer Energy Market Were Based on Reality Rather Than Assumptions?, Monash Business School, Monash University, Melbourne, Australia, Jul. 2024](#)



### 3.5 EMPOWERING: Advances customer and community agency, optionality, and customisation

As power systems evolve and customers diversify in their preferences and priorities, facilitating customer and community agency will be a key challenge, opportunity and priority. The design of new energy products and services and emerging technologies will need to carefully consider how they can empower customers to make informed choices, while at the same time does not overwhelm them with micro-decisions that impact their lifestyle or business operations. This will require human-centred design and continuous feedback from their customer base as has been demonstrated by other sectors.

It was also noted across various sources that empowerment includes:

- Simple and intuitive platforms and user-interfaces for interacting with energy products and services, including presentation of key data for decision making
- The ability to configure technologies, products and services to align with user and household preferences, routines and expectations
- Enabling customers to easily compare offerings across competing providers and platforms, and
- To retain simple no-frills arrangements should customers choose to do so.

Similarly, sources suggested that communities will also have increasing optionality for meeting their energy needs, such as community batteries, virtual power plants, co-located small-scale generation and storage facilities, but will require the regulatory environment and policy settings to enable such solutions. The literature also observed that advancing customer agency will require all stakeholders, including government bodies, businesses, and individuals, to have an agreed and coherent understanding of what customer agency and empowerment are, and to embed that in relevant policy and regulation.

*With a policy focus on households and small businesses, Australia could turbocharge the energy transition and show the rest of the world the way out of the climate crisis.*

[V. L. McLeod, Developing Policy for Australia's Clean Energy Transition Using a Systems Thinking Approach: Consumer and Distributed Energy Resource Integration Case Study, RACE for 2030, Jul. 2024](#)

*Herein lies the central dilemma for economic regulation during the energy transition. If customers have not successfully navigated a market constructed around one decision variable, how can they be expected to navigate a labyrinthine market involving all the decision variables...?*

[R. Ben-David, Minimising Consumer Harm for a Successful Energy Transition, Presentation to IPART's 30th Anniversary Conference, Monash University, Nov. 17, 2022](#)

### 3.6 EXPANDABLE: Enables electrification of transport, building services and industrial processes

With the current and projected scale of new energy technology deployment and the electrification of transport and industrial processes in Australia, an expandable power system is critical. Expandability in this context refers to the power system's capacity to accommodate significant increases in electricity demand arising from the electrification of sectors traditionally reliant on fossil fuels, including transport, buildings, and industrial processes.

The literature affirmed that efficient supply-side investment in utility-scale generation, transmission and storage will be required to meet this objective. However, sources also identified the need to promote load flexibility for supply and demand balancing with much larger penetrations of VRE, supported by the strategic integration of energy storage across all levels of the power system and to moderate utility scale investment and avoid over-build.

*Technical standards for hardware enable informed and competitive consumer choice to more interoperable and easily accessible product and services options.*

[Energy Consumers Australia – Social License for DER Control FINAL v2.0, December 2020](#)

*While the challenge of integrating DERs is currently driving up the cost of transforming the electricity grid, with proper policy design and implementation, they can also be an economic solution.*

[RACE for 2030 – Developing Policy for Australia's Clean Energy Transition Using a Systems Thinking Approach: Consumer and Distributed Energy Resource Integration Case Study, July 2024](#)

*Our failure to fully harness the power of demand-side action needlessly locks us into higher future energy costs and emissions, while failing to serve the interests of either individual energy users or the community as a whole.*

[ACOSS, AiG, EEC and Property Council of Australia – Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources, December 2024](#)

In parallel, sources asserted the need for customer and industry facing energy product and service offerings and platforms to mutually benefit consumers and the operation of the power system. The literature pointed to managed EV charging as an example of an opportunity to enhance the orderly expansion of the power system through temporal and spatial load diversification, on the condition that offerings mutually benefit customers and the operation of the power system.

Other factors influencing expandability in the literature include: operational scalability, data and communications infrastructure (and cyber security), and new and improved consumer-based appliances and other products with integrated energy management such as time-shifting load.

These elements support the electrification of buildings and industrial processes by enabling intelligent control, optimisation, and integration of new, high-demand loads into a significantly expanded grid environment.

### 3.7 ADAPTABLE: Flexible and adaptive to change, including technological, regulatory and business model innovation

Adaptability in the power system refers to its capacity to respond to and accommodate change across multiple dimensions, without compromising system performance, security, or customer outcomes. These dimensions include time itself, emergency/unplanned scenarios, technological advancements, shifts in regulatory frameworks, and evolving business models.

The literature reflected on the necessity of effective regulation, standards and policies that promote a highly interoperable and coordinated power system. This power system should be adaptable to simultaneously accommodate a diverse range of business models, products, platforms and services while maintaining the security and stability of the system. From this, customers will be enabled to adopt new and innovative energy products and services offerings and new technologies as they emerge. This will be coupled with improved coordination across previously siloed regulatory domains, which will shortlist this range of offerings down to a navigable breadth for customers.

In addition, enabling customer churn through an adaptable system will support customer-centred business model and product innovation through competition. Sources also noted 'least regrets' decisions that enable the power system to be resilient to broad range of plausible futures can reduce the risk of stranded assets and other costs involved with the transition. Similarly, staged implementation of reforms to the power system that consider the long-term effects on optionality for customers was recommended. This was reinforced by suggestions that staged implementation of reforms could be supported by modular, place-based initiatives such as Local Renewable Energy Zones (LREZs).

Initiatives such as these could allow for targeted and transparent experimentation without holding broader reform hostage to single points of contention.

*Consumers need the big picture. The participants wanted a clear roadmap of the transition that they can understand – timelines, end goals, their role and when/where they will see benefits for their households and communities.*

[Energy Consumers Australia – PowerUp: Consumer Voices in the Energy Transition, July 2024](#)

*All reforms must not be held up by the most contentious single issues. Proposals should be modular and, with triaging of proposals agreed, action should be taken to deliver agreed modules, rather than waiting for the complete set of proposals being agreed where significant dependencies and trade-offs are not present.*

[Utility Week \(E. Brown, M. Frerk, R. Hey, L. Sandys, S. Steer, and A. Whitehead\) – Addressing Waste and Inefficiencies: Delivering Customer, Cost, Carbon and Connections Dividends, 2024](#)

### 3.8 BENEFICIAL: Socially trusted, public good/benefits, commercially investable and financeable.

As power systems transform from hundreds of merchant resources to millions of merchant and privately owned resources, beneficial opportunities for participation and third-party orchestration are widely recognised as key to modern power systems. However, the literature emphasised that without social licence for control of privately owned assets, participation in such programs will be reduced, and potential cost-saving benefits to the system forgone. Specifically, customer-facing actors such as aggregators and retailers will need to manage concerns around loss of control, data security, privacy, and disruption to daily routines to be granted the social licence to operate these assets.

All parties will need to build trust by emphasising customer agency in the design of their platforms and systems and in their engagement with customers. Promoting and educating customers on the societal good that comes from enrolling their assets in programs that support the efficient operation of the power system will also be important. Finally, sources concluded that the degree to which customer voice, concerns, and lived experience are reflected in customer facing product and service offerings will be the degree to which social licence is obtained, which will in turn impact the success of such programs.

*Exposing consumers to risks they are not well-equipped to understand endangers their confidence in the system of markets and regulation that places them in that situation. In the decades ahead, such actions will imperil their confidence in the energy transition.*

[R. Ben-David, Minimising Consumer Harm for a Successful Energy Transition, Presentation to IPART's 30th Anniversary Conference, Monash University, Nov. 17, 2022](#)

*Consumers will have much more skin in the game and will be looking for returns. That's right, returns. Let's just say over the next 10 – 15 years that five million Australian households each spend around \$50,000 on a combination of things like buying an EV, adding batteries or rooftop solar and changing over from gas appliances to electric ones. That's actually a pretty conservative estimate. But it's no small thing. All of those households doing that represents a \$250 billion investment in assets underpinning the future energy system.*

[Energy Consumers Australia \(Gavin Dufty\) – Consumers are investors too – where's their return?, March 2024](#)

## 4 Trust & Social Licence: The relationship with the eight objectives

Building and maintaining trust and social licence is foundational to achieving all eight Customer and Societal Objectives. As the energy transition accelerates, households are increasingly expected to participate in more complex systems of energy production, management, and trade. However, consumers do not automatically offer trust to new systems, actors or mechanisms that facilitate that participation. Further, their ongoing trust is easily eroded by the perception that the 'system' is not aligned with their interests or that participation involves too much friction or complexity.

Trust is earned through transparency, fairness, simplicity, and demonstrable good faith. It is shaped not only by system behaviour but also by the degree of meaningful agency consumers feel they have. A growing paradox emerges: while enhancing agency is often promoted as a pathway to beneficial customer engagement, if not well supported, it can create complexity, decision fatigue, and a sense of burden—undermining the very trust it seeks to build.

Social licence, in turn, is not simply about willingness to invest in CER or participate in flexible demand programs—it is about confidence that such engagement will be safe, fair, and beneficial. For example, consumer discomfort around energy data—especially concerns around profit-motivated third-party control or algorithmic misuse—has reduced willingness to enrol in grid services. Without robust protections, consent mechanisms, and accountability, trust falters.

The implications are significant. Where it is absent or undermined, key transition tools such as demand flexibility and orchestration risk failure.

Importantly, trust must also be cultivated at the whole-system level, not just with customer-facing service providers. A consistent theme across the literature is the lack of a clear, cohesive national narrative for the transition. In the absence of leadership, transparency, and unified direction, misinformation takes root and legitimacy erodes. The public increasingly expects government—not just industry—to provide clarity, coordination, and confidence.

Ultimately, trust and social licence are not peripheral—they are the pre-conditions upon which successful system reform depends. Trust is the currency of participation – where trust is present, supported by clear choices, guidance, and reciprocity, participation and engagement increases. In this context, all eight objectives in this report are shaped to varying degrees by the issue of trust and social license. To highlight just two examples:

- A dependable energy system requires not just resilience, but public confidence in the institutions who determine where and how that resilience is facilitated.
- Affordability depends not only on prices, but on perceived fairness and value.

Where consumers feel exploited, confused, or left behind, trust collapses—and with it, the foundation for a successful energy transition.

## 5 Future System Design: Informing better trade-off choices

Australia's energy transition will necessarily involve a myriad of trade-off decisions across technical, regulatory, economic and societal domains. Industry engagement with trade-off choices has typically been contained within the former three domains, and less so within the societal domain. This is understandable given the difficulty of evaluating system and component-level design choices against customer and societal objectives in a defensible way. To address this, the power system architecture discipline provides a helpful distinction between system properties and system qualities:

- **Qualities** are system-level outcomes that emerge from the interaction of system properties. Examples include reliable, safe, sustainable, and flexible. They are derived from objectives such as the eight customer and societal objectives identified in this report. A single quality may map to several objectives. They describe observable characteristics from the perspective of end-users of the system.
- **Properties** arise from structural and component choices that together yield system qualities. Examples include:
  - Degree of decentralisation (e.g., distributed vs. central control)
  - Openness (e.g., ability for third parties to access system data)
  - Modularity (e.g., separable system components)
  - Layering (e.g., autonomy within operating zones)

Properties describe characteristics from the perspective of operators and solution developers.

Mapping system qualities to properties allows system architects to make explicit and traceable the relationships between structural interventions and system objectives, as shown in Figure 5 and implicit in Figure 1. The strength of correlation between the two is a measure of how well proposed architectural features meet the essential human-centred 'first principles' requirements for power systems.

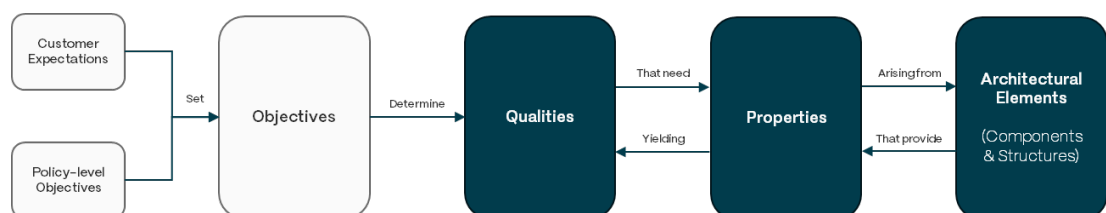


Figure 6: Mapping of objectives through the structural and component choices.

This quality–property mapping is powerful because it decouples future system design decisions from only focusing on technical or performance objectives, and allows stakeholders to explore multiple architectural paths toward the same societal goals.

This helps inform trade–off decisions by:

### **1. Allowing Structured Evaluation of Alternatives**

The architectural discipline enhances clarity about what can and cannot be achieved from a given configuration. For example, if a system needs to be resilient (a quality derived from the objective of dependable), architecture helps determine which combinations of properties (e.g., decentralisation, modular control, redundancy) are more likely to produce that outcome—without overbuilding.

### **2. Avoiding Unintended Consequences**

By making explicit which qualities depend on which structural properties, the architectural approach helps avoid poor trade–offs. For instance, improving "visibility" (a quality) might seem like a good idea, but achieving it by centralising all telemetry could reduce expandability and adaptability (other qualities), especially as CER/DER grows.

### **3. Societal Preference Mapping**

Architectural thinking enables the alignment of societal values with technical configurations. For example, if communities value autonomy and privacy, then a centralised optimisation model—even if technically efficient—may be rejected unless the architecture allows for local autonomy while preserving overall system coordination (via layering, interoperability, and modularity).

In the context of this work, such considerations are germane to structural discussions in Report 4 (Distribution System Operator Models) and Report 5 (Transmission–Distribution Coordination). Importantly, as shown in Figure 6, this process is iterative and should consider existing technical and other constraints.



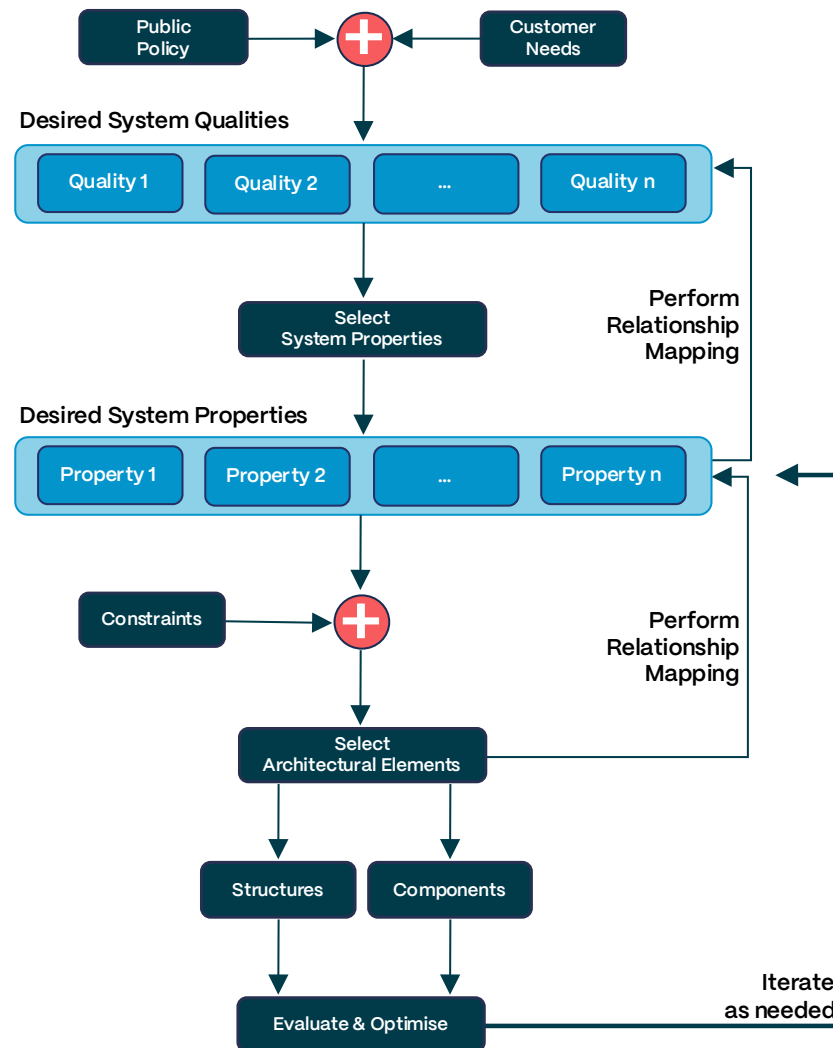


Figure 7 – Tracing System Qualities to Properties to Components

## Case Study: "Power of Choice" Reforms

The Power of Choice (PoC) reforms aimed to empower consumers through competitive metering arrangements. These policy formulations were aligned with customer and societal preferences (qualities) and implemented by structural interventions (properties). However, many would argue that the reforms encountered several key failings, many of which can be traced back to not properly understanding cascading effects of quality and interrelated property trade-off decisions due to inadequate architectural foresight. The following table identifies key structural interventions from the PoC reforms (properties), an assessment of the likely desired qualities, and the results of the trade-offs associated with these decisions. It is provided as an illustrative

example of the relationship between system qualities, properties and structural interventions, and not as an exhaustive critique of historical decisions.

| Structural Intervention             | Desired System Qualities        | Trade-off Decision  | De-prioritised Qualities | Detrimental Implications for System Properties   |
|-------------------------------------|---------------------------------|---|--------------------------|--|
| Retailer control over metering      | Customisable, Flexible, Useable | Prioritise market competition (retailers controlling metering) over systemic integration of metering data | Secure, Scalable         | Metering data became siloed, access was inconsistent, DNSPs lacked reliable, timely visibility into low-voltage networks—undermining operational efficiency and CER integration, leading to fragmented Responsibility & Compromised Operational Coordination |
| Quarantined meter data              | Customisable, Useable           | Smart meters primarily serve consumer billing and retail functions, not system operations                 | Reliable, Safe           | Meter design and rollout neglected telemetry standards (e.g. real-time voltage data), making them inadequate for grid visibility or dynamic hosting capacity management  |
| Market-led Roll-out and Placement   | Deployable, Fair                | Market-led rollout (retail-driven) rather than a coordinated, universal deployment                        | Efficient, Scalable      | Deployment lagged, especially in areas of low commercial return, data on constrained network segments unavailable to DNSPs   |
| Flexibility for Solution Developers | Flexible, Modular               | Prioritised retail innovation and vendor freedom over open interoperability                               | Scalable, Interoperable, | Inconsistent data formats and protocols made it difficult to integrate meter data into broader digital energy infrastructure or support DNSP needs   |

*Figure 8 – Example Mapping of Structural interventions to qualities and properties*

In summary, tracing structural interventions to system-level objectives via desired system qualities and properties provides a robust process for making informed trade-off decisions. An insufficient understanding of end-to-end impacts can lead to unintended consequences that are detrimental at a system-level even where structural interventions are well-intentioned and target desirable system qualities.

## 6 Conclusion

The transformation of Australia's power system is fundamentally a societal endeavour. It is being driven not solely by technological advancement or regulatory change, but by a decisive shift in customer expectations, social values, and the evolving role of communities within the energy system. This report articulates eight Future Customer and Societal Objectives—Dependable, Affordable, Sustainable, Equitable, Empowering, Expandable, Adaptable, and Beneficial—that collectively define the essential characteristics of a future power system that is fit for purpose.

These objectives emerge from the recognition that the power system exists to serve people. It is their expectations, preferences, and participation that should increasingly shape the contours of the system's architecture. Households, businesses, and communities are no longer just consumers—they are investors, operators, and co-designers. Whether through rooftop solar, electric vehicles, or demand-side technologies, millions are making decisions that actively influence system performance and direction. In this context, the legitimacy of system decisions rests not only on engineering excellence or economic efficiency, but on social licence, transparency, and perceived fairness.

Importantly, the eight objectives are not discrete technical targets but interconnected and interdependent social outcomes. They reflect a multi-dimensional understanding of value—where affordability cannot come at the cost of trust, and where sustainability must be achieved alongside equity and expandability. They also highlight the tension between expanding choice and the responsibility to protect vulnerable customers from complexity and disadvantage. Designing a power system that reconciles these competing pressures requires a new kind of systems thinking—one that rigorously traces structural interventions back to outcomes aligned with diverse customer and with societal preferences.

Architectural tools and frameworks, as discussed throughout the report, offer a structured means of navigating these trade-offs. By distinguishing between structural system properties and emergent system qualities, stakeholders are better equipped to trace how design decisions impact customer outcomes. This approach enables alignment between policy, investment, and governance with the evolving priorities of society. It also allows for more resilient system pathways that preserve optionality, minimise lock-in, and support continuous adaptation.

Ultimately, the challenge is not just to build a power system that works, but one that is worthy of public trust, capable of delivering social benefit, and inclusive of the many futures Australians wish to shape. The objectives outlined in this report serve not as a checklist, but as a shared foundation from which system custodians can evaluate decisions, resolve tensions, and design a system transformation that is not only technically sound but socially anchored.

## 7 References

- World Energy Council, *World Energy Trilemma Framework*, 2025. [Online]. Available: [World Energy Trilemma Index | World Energy Council](#)
- CSIRO, *The Energy Trilemma – What Matters the Most to Consumers?*, April 2019. [Online]. Available: <https://www.csiro.au/-/media/EF/Files/Energise-insights/Insight-40-Energy-Trilemma.pdf>
- B. Mawhood and N. Sutherland, *Tackling the Energy Trilemma*, House of Commons Library, UK Parliament, March 2023. [Online]. Available: [Tackling the energy trilemma – House of Commons Library](#)

*Note: References grouped under the relevant Future Customer and Societal Objective heading that they support.*

### 7.1 Dependable

- ENA and CSIRO, *Electricity Network Transformation Roadmap – Interim Program Report*, 2015. [Online]. Available: <https://www.energynetworks.com.au/resources/reports/electricity-network-transformation-roadmap-interim-program-report-summary/>.
- P. De Martini and A. De Martini, *Customer Load Management: Evolution & Revolution*, Pacific Energy Institute, Dec. 2021. [Online]. Available: <https://pacificenergyinstitute.org/wp-content/uploads/2021/12/PEI-Customer-Load-Management-Evolution-Revolution-12.29.21.pdf>.
- ACOSS and TEC, *ourPower: A Vision for Clean, Affordable, Dependable Energy for All*, Feb. 2022. [Online]. Available: <https://ourpower.org.au/wp-content/uploads/2022/02/ourPower-Booklet.pdf>.
- Energy Consumers Australia, *Strategic Plan 2021–2024*. [Online]. Available: <https://energyconsumersaustralia.com.au/wp-content/uploads/Energy-Consumers-Australia-Strategic-Plan-2021-2024.pdf>.
- D. R. Ben-David, *Response to Consultation on Two-Sided Markets*, Monash Business School, Oct. 2020. [Online]. Available: [https://www.monash.edu/\\_data/assets/pdf\\_file/0006/2380785/Ron-Ben-David-Response-to-Consultation-on-Post-2025-19-October-2020.pdf](https://www.monash.edu/_data/assets/pdf_file/0006/2380785/Ron-Ben-David-Response-to-Consultation-on-Post-2025-19-October-2020.pdf).
- Victoria DEWLP, *Victorian Neighbourhood Battery Initiative Consultation Paper*, March 2021.
- U.S. Department of Energy, *A National Roadmap for Grid-Interactive Efficient Buildings*. [Online]. Available: <https://www.energy.gov/eere/articles/does-national-roadmap-grid-interactive-efficient-buildings>.

- ACOSS, Ai Group, Energy Efficiency Council, and Property Council of Australia, *Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources*, Dec. 2024. [Online]. Available: <https://www.eec.org.au/uploads/Projects/Demanding%20better%20-%20A%20reform%20agenda.pdf>.
- Energy Consumers Australia and The Insight Centre, *PowerUp: Consumer Voices in the Energy Transition*, Jul. 2024. [Online]. Available: <https://energyconsumersaustralia.com.au/publications/powerup-consumer-voices-energy-transition>.

## 7.2 Affordable

- Energy Charter, *Maturity Model*, Mar. 2020. [Online]. Available: <https://www.theenergycharter.com.au/wp-content/uploads/2020/06/Energy-Charter-Maturity-Model-March-2020.pdf>.
- ACOSS, Ai Group, Energy Efficiency Council, and Property Council of Australia, *Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources*, Dec. 2024. [Online]. Available: <https://www.eec.org.au/uploads/Projects/Demanding%20better%20-%20A%20reform%20agenda.pdf>.
- R. Ben-David, "Minimising consumer harm for a successful energy transition," presented at IPART's 30th Anniversary Conference, Sydney, Australia, Nov. 17, 2022. [Online]. Available: [https://www.ipart.nsw.gov.au/sites/default/files/cm9\\_documents/Ron-Ben-David-Minimising-Consumer-Harm-IPART-30-year-conference-%2817-November-2022%29.PDF](https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Ron-Ben-David-Minimising-Consumer-Harm-IPART-30-year-conference-%2817-November-2022%29.PDF).
- ENA and CSIRO, *Electricity Network Transformation Roadmap – Interim Program Report*, 2015. [Online]. Available: <https://www.energynetworks.com.au/resources/reports/electricity-network-transformation-roadmap-interim-program-report-summary/>
- U.S. Department of Energy, *A National Roadmap for Grid-Interactive Efficient Buildings*. [Online]. Available: <https://www.energy.gov/eere/articles/does-national-roadmap-grid-interactive-efficient-buildings>.
- M. Roberts, et al., *H4 Opportunity Assessment: Rewarding flexible demand: Customer friendly cost reflective tariffs and incentives – Final Report*, RACE for 2030 CRC, Nov. 2021. [Online]. Available: <https://www.ceem.unsw.edu.au/sites/default/files/documents/H4-OA-final-report-17.11.21.pdf>.
- Energy Consumers Australia, *Submission: AER's Issues Paper on the Retailer Authorisation & Exemptions Review*, Jul. 2022. [Online]. Available:

<https://www.aer.gov.au/documents/energy-consumers-australia-submission-aers-issues-paper-retailer-authorisation-and-exemptions-review-28-june-2022>.

- Energy Consumers Australia, *Draft Consumer Vulnerability Strategy*. March 2022. [Online]. Available: <https://energyconsumersaustralia.com.au/publications/submission-on-the-aer-draft-consumer-vulnerability-strategy>.
- Energy Consumers Australia, *Energy Consumer Sentiment Survey: Household Topline Results*, Oct. 2022. [Online]. Available: <https://energyconsumersaustralia.com.au/sites/default/files/wp-documents/ECBS-W13a-Oct22-Household-Toplines.pdf>
- S. Heinonen and J. Karjalainen, *Electrification in Peer-to-Peer Society: A New Narrative for Sustainable Futures*, Finland Futures Research Centre (FFRC), FFRC Publications 1/2019, Helsinki, Finland, 2019. [Online]. Available: [https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication\\_1-2019-rev.pdf](https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication_1-2019-rev.pdf).
- Energy Consumers Australia, *Foresighting Forum 2021: System Design Webinar: Your Questions Answered*, Sep. 2021. [Online]. Available: <https://energyconsumersaustralia.com.au/news/foresighting-forum-2021-system-design-webinar-your-questions-answered>.
- P. De Martini and A. De Martini, *Customer Load Management: Evolution & Revolution*, Pacific Energy Institute, Dec. 2021. [Online]. Available: <https://pacificenergyinstitute.org/wp-content/uploads/2021/12/PEI-Customer-Load-Management-Evolution-Revolution-12.29.21.pdf>.
- UPowr, *Customer Segmentation Research and Design for Orchestration Programs*. Australian Renewable Energy Agency (ARENA), Apr. 2021. [Online]. Available: <https://arena.gov.au/assets/2021/07/upowr-customer-segmentation-research-and-design-for-orchestration-programs.pdf>.
- Energy Consumers Australia, *Understanding the Energy Divide*, December 2023. [Online]. Available: <https://energyconsumersaustralia.com.au/our-work/research/understanding-the-energy-divide>.

### 7.3 Sustainable

- Energy Consumers Australia, *Three Year Plan 2025–2028*. [Online]. Available: <https://energyconsumersaustralia.com.au/about-us/three-year-plan-25-28>.
- ACOSS, Ai Group, Energy Efficiency Council, and Property Council of Australia, *Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources*, Dec. 2024. [Online]. Available: <https://www.eec.org.au/uploads/Projects/Demanding%20better%20-%20A%20reform%20agenda.pdf>.

- ACOSS and TEC, *ourPower: A Vision for Clean, Affordable, Dependable Energy for All*, Feb. 2022. [Online]. Available: <https://ourpower.org.au/wp-content/uploads/2022/02/ourPower-Booklet.pdf>.
- M. Roberts, et al., *H4 Opportunity Assessment: Rewarding flexible demand: Customer friendly cost reflective tariffs and incentives – Final Report*, RACE for 2030 CRC, Nov. 2021. [Online]. Available: <https://www.ceem.unsw.edu.au/sites/default/files/documents/H4-OA-final-report-17.11.21.pdf>.
- S. Heinonen and J. Karjalainen, *Electrification in Peer-to-Peer Society: A New Narrative for Sustainable Futures*, Finland Futures Research Centre (FFRC), FFRC Publications 1/2019, Helsinki, Finland, 2019. [Online]. Available: [https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication\\_1-2019-rev.pdf](https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication_1-2019-rev.pdf).
- UPowr, *Customer Segmentation Research and Design for Orchestration Programs*. Australian Renewable Energy Agency (ARENA), Apr. 2021. [Online]. Available: <https://arena.gov.au/assets/2021/07/upowr-customer-segmentation-research-and-design-for-orchestration-programs.pdf>
- P. S. Lavieri and G. J. M. Oliveira, *Electric Vehicle Charging Consumer Survey: Insights Report*. C4NET, Feb. 2022. [Online]. Available: <https://c4net.com.au/wp-content/uploads/2022/02/Survey-Insights-Electric-Vehicle-Charging-Preferences-of-Australian-Consumers.pdf>.
- E. R. Frederiks, K. Stenner, and E. V. Hobman, "Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour," *Renewable and Sustainable Energy Reviews*, vol. 41, pp. 1385–1394, Jan. 2015. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S1364032114007990>.
- CSIRO and Energy Networks Association, *Customer-Centric Networks*, 2015. [Online]. Available: [https://www.energynetworks.com.au/assets/uploads/roadmap\\_interim\\_report\\_final.pdf](https://www.energynetworks.com.au/assets/uploads/roadmap_interim_report_final.pdf)
- ACOSS, *New Energy Compact: Consultation Draft 5.0*, Dec. 2020. [Online]. Available: [https://www.acoss.org.au/wp-content/uploads/2021/02/NEC\\_Consultation-Draft-V.5-04122020.pdf](https://www.acoss.org.au/wp-content/uploads/2021/02/NEC_Consultation-Draft-V.5-04122020.pdf).
- World Economic Forum and Boston Consulting Group, *The Net-Zero Challenge: Fast-Forward to Decisive Climate Action*. [Online]. Available: [https://www3.weforum.org/docs/WEF\\_The\\_Net\\_Zero\\_Challenge.pdf](https://www3.weforum.org/docs/WEF_The_Net_Zero_Challenge.pdf)
- International Energy Agency, *Net Zero by 2050: A Roadmap for the Global Energy Sector*, revised ed., Oct. 2021. [Online]. Available: <https://www.iea.org/reports/net-zero-by-2050>.

## 7.4 Equitable

- R. Ben-David, "Minimising consumer harm for a successful energy transition," presented at IPART's 30th Anniversary Conference, Sydney, Australia, Nov. 17, 2022. [Online]. Available: [https://www.ipart.nsw.gov.au/sites/default/files/cm9\\_documents/Ron-Ben-David-Minimising-Consumer-Harm-IPART-30-year-conference-%2817-November-2022%29.PDF](https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Ron-Ben-David-Minimising-Consumer-Harm-IPART-30-year-conference-%2817-November-2022%29.PDF).
- Energy Consumers Australia and The Insight Centre, *PowerUp: Consumer Voices in the Energy Transition*, Jul. 2024. [Online]. Available: <https://energyconsumersaustralia.com.au/publications/powerup-consumer-voices-energy-transition>.
- R. Ben-David, *What if the Consumer Energy Market Were Based on Reality Rather Than Assumptions?*, Monash Business School, Monash University, Melbourne, Australia, Jul. 2024. [Online]. Available: [https://www.monash.edu/\\_data/assets/pdf\\_file/0007/3733441/Ron-Ben-David-What-if-the-consumer-energy-market-were-based-on-reality-rather-than-assumptions-July-2024.pdf](https://www.monash.edu/_data/assets/pdf_file/0007/3733441/Ron-Ben-David-What-if-the-consumer-energy-market-were-based-on-reality-rather-than-assumptions-July-2024.pdf).
- ACOSS and TEC, *ourPower: A Vision for Clean, Affordable, Dependable Energy for All*, Feb. 2022. [Online]. Available: <https://ourpower.org.au/wp-content/uploads/2022/02/ourPower-Booklet.pdf>.
- Energy Consumers Australia, *Strategic Plan 2021–2024*. [Online]. Available: <https://energyconsumersaustralia.com.au/wp-content/uploads/Energy-Consumers-Australia-Strategic-Plan-2021-2024.pdf>.
- D. R. Ben-David, *Response to Consultation on Two-Sided Markets*, Monash Business School, Oct. 2020. [Online]. Available: [https://www.monash.edu/\\_data/assets/pdf\\_file/0006/2380785/Ron-Ben-David-Response-to-Consultation-on-Post-2025-19-October-2020.pdf](https://www.monash.edu/_data/assets/pdf_file/0006/2380785/Ron-Ben-David-Response-to-Consultation-on-Post-2025-19-October-2020.pdf).
- M. Roberts, et al., *H4 Opportunity Assessment: Rewarding flexible demand: Customer friendly cost reflective tariffs and incentives – Final Report*, RACE for 2030 CRC, Nov. 2021. [Online]. Available: <https://www.ceem.unsw.edu.au/sites/default/files/documents/H4-OA-final-report-17.11.21.pdf>.
- Energy Consumers Australia, *Submission: AER's Issues Paper on the Retailer Authorisation & Exemptions Review*, Jul. 2022. [Online]. Available: <https://www.aer.gov.au/documents/energy-consumers-australia-submission-aers-issues-paper-retailer-authorisation-and-exemptions-review-28-june-2022>.
- Energy Consumers Australia, *Draft Consumer Vulnerability Strategy*. March 2022. [Online]. Available: <https://energyconsumersaustralia.com.au/publications/submission-on-the-aer-draft-consumer-vulnerability-strategy>



- S. Heinonen and J. Karjalainen, *Electrification in Peer-to-Peer Society: A New Narrative for Sustainable Futures*, Finland Futures Research Centre (FFRC), FFRC Publications 1/2019, Helsinki, Finland, 2019. [Online]. Available: [https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication\\_1-2019-rev.pdf](https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication_1-2019-rev.pdf).
- Energy Consumers Australia, *Foresighting Forum 2021: System Design Webinar: Your Questions Answered!*, Sep. 2021. [Online]. Available: <https://energyconsumersaustralia.com.au/news/foresighting-forum-2021-system-design-webinar-your-questions-answered>.
- UPowr, *Customer Segmentation Research and Design for Orchestration Programs*. Australian Renewable Energy Agency (ARENA), Apr. 2021. [Online]. Available: <https://arena.gov.au/assets/2021/07/upowr-customer-segmentation-research-and-design-for-orchestration-programs.pdf>
- ACOSS, *New Energy Compact: Consultation Draft 5.0*, Dec. 2020. [Online]. Available: [https://www.acoss.org.au/wp-content/uploads/2021/02/NEC\\_Consultation-Draft-V.5-04122020.pdf](https://www.acoss.org.au/wp-content/uploads/2021/02/NEC_Consultation-Draft-V.5-04122020.pdf).
- Energy Consumers Australia, *Social Licence for Control of Distributed Energy Resources: Final Report*, CutlerMerz Pty Ltd, Dec. 2020. [Online]. Available: <https://energyconsumersaustralia.com.au/our-work/research/social-licence-for-control-of-distributed-energy-resources>.
- Energy Security Board (ESB), *Customer Insights Collaboration: Synthesis From Workshop 2*, Jun. 2022. [Online]. Available: <https://www.datocms-assets.com/32572/1657176767-esb-ssg-release-2.pdf>.

## 7.5 Empowering

- ACOSS, Ai Group, Energy Efficiency Council, and Property Council of Australia, *Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources*, Dec. 2024. [Online]. Available: <https://www.eec.org.au/uploads/Projects/Demanding%20better%20-%20A%20reform%20agenda.pdf>.
- V. L. McLeod, *Developing Policy for Australia's Clean Energy Transition Using a Systems Thinking Approach: Consumer and Distributed Energy Resource Integration Case Study*, RACE for 2030 Cooperative Research Centre, Jul. 2024. [Online]. Available: [https://www.racefor2030.com.au/content/uploads/21.E2.A.0189-Final-Report\\_Dec-2022.pdf](https://www.racefor2030.com.au/content/uploads/21.E2.A.0189-Final-Report_Dec-2022.pdf).
- R. Ben-David, "Minimising consumer harm for a successful energy transition," presented at IPART's 30th Anniversary Conference, Sydney, Australia, Nov. 17, 2022. [Online]. Available: [https://www.ipart.nsw.gov.au/sites/default/files/cm9\\_documents/Ron-Ben-David-Minimising-Consumer-Harm-IPART-30-year-conference-%2817-November-2022%29.PDF](https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Ron-Ben-David-Minimising-Consumer-Harm-IPART-30-year-conference-%2817-November-2022%29.PDF).

- P. De Martini and A. De Martini, *Customer Load Management: Evolution & Revolution*, Pacific Energy Institute, Dec. 2021. [Online]. Available: <https://pacificenergyinstitute.org/wp-content/uploads/2021/12/PEI-Customer-Load-Management-Evolution-Revolution-12.29.21.pdf>.
- ACOSS and TEC, *ourPower: A Vision for Clean, Affordable, Dependable Energy for All*, Feb. 2022. [Online]. Available: <https://ourpower.org.au/wp-content/uploads/2022/02/ourPower-Booklet.pdf>.
- Energy Consumers Australia, *Strategic Plan 2021–2024*. [Online]. Available: <https://energyconsumersaustralia.com.au/wp-content/uploads/Energy-Consumers-Australia-Strategic-Plan-2021-2024.pdf>.
- R. Ben-David, *Response to Consultation on Two-Sided Markets*, Monash Business School, Oct. 2020. [Online]. Available: [https://www.monash.edu/\\_data/assets/pdf\\_file/0006/2380785/Ron-Ben-David-Response-to-Consultation-on-Post-2025-19-October-2020.pdf](https://www.monash.edu/_data/assets/pdf_file/0006/2380785/Ron-Ben-David-Response-to-Consultation-on-Post-2025-19-October-2020.pdf).
- U.S. Department of Energy, *A National Roadmap for Grid-Interactive Efficient Buildings*. [Online]. Available: <https://www.energy.gov/eere/articles/does-national-roadmap-grid-interactive-efficient-buildings>.
- M. Roberts, et al., *H4 Opportunity Assessment: Rewarding flexible demand: Customer friendly cost reflective tariffs and incentives – Final Report*, RACE for 2030 CRC, Nov. 2021. [Online]. Available: <https://www.ceem.unsw.edu.au/sites/default/files/documents/H4-OA-final-report-17.11.21.pdf>.
- Energy Consumers Australia, *Submission: AER's Issues Paper on the Retailer Authorisation & Exemptions Review*, Jul. 2022. [Online]. Available: <https://www.aer.gov.au/documents/energy-consumers-australia-submission-aers-issues-paper-retailer-authorisation-and-exemptions-review-28-june-2022>.
- Energy Consumers Australia, *Draft Consumer Vulnerability Strategy*. March 2022. [Online]. Available: <https://energyconsumersaustralia.com.au/publications/submission-on-the-aer-draft-consumer-vulnerability-strategy>.
- Energy Consumers Australia, *Energy Consumer Sentiment Survey: Household Topline Results*, Oct. 2022. [Online]. Available: <https://energyconsumersaustralia.com.au/sites/default/files/wp-documents/ECBS-W13a-Oct22-Household-Toplines.pdf>.
- S. Heinonen and J. Karjalainen, *Electrification in Peer-to-Peer Society: A New Narrative for Sustainable Futures*, Finland Futures Research Centre (FFRC), FFRC Publications 1/2019, Helsinki, Finland, 2019. [Online]. Available: [https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication\\_1-2019-rev.pdf](https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication_1-2019-rev.pdf).
- Energy Consumers Australia, *Foresighting Forum 2021: System Design Final Report: Your Questions Answered!*, Sep. 2021. [Online]. Available:

<https://energyconsumersaustralia.com.au/news/foresighting-forum-2021-system-design-webinar-your-questions-answered>.

- UPower, *Customer Segmentation Research and Design for Orchestration Programs*. Australian Renewable Energy Agency (ARENA), Apr. 2021. [Online]. Available: <https://arena.gov.au/assets/2021/07/upowr-customer-segmentation-research-and-design-for-orchestration-programs.pdf>
- P. S. Lavieri and G. J. M. Oliveira, *Electric Vehicle Charging Consumer Survey: Insights Report*. C4NET, Feb. 2022. [Online]. Available: <https://c4net.com.au/wp-content/uploads/2022/02/Survey-Insights-Electric-Vehicle-Charging-Preferences-of-Australian-Consumers.pdf>.
- CSIRO and Energy Networks Association, *Customer-Centric Networks*, 2015. [Online]. Available: [https://www.energynetworks.com.au/assets/uploads/roadmap\\_interim\\_report\\_final.pdf](https://www.energynetworks.com.au/assets/uploads/roadmap_interim_report_final.pdf).
- Energy Security Board (ESB), *Customer Insights Collaboration: Workshop 3 Summary*, May 2022. [Online]. Available: [https://www.datocms-assets.com/32572/1673496508-1656654591-esb\\_customer-insights-collaboration\\_synthesis-from-workshop-3.pdf](https://www.datocms-assets.com/32572/1673496508-1656654591-esb_customer-insights-collaboration_synthesis-from-workshop-3.pdf).
- Energy Consumers Australia and Forethought, *A Future Energy Vision: Consumer Expectations Research*, Feb. 2020. [Online]. Available: <https://energyconsumersaustralia.com.au/our-work/research/consumer-values-expectations-needs>.
- F. Calabria and L. Tremaine, *Origin Energy – Our Strategy*, Origin Energy, Mar. 2022. [Online]. Available: <https://www.originenergy.com.au/about/investors-media/origin-ceo-frank-calabria-and-origin-cfo-lawrie-tremaine-present-origins-strategy-refresh/>.
- N. Fromer and S. Griffith, *Caltech Energy 10: How do we cut US global warming gas emissions in half by 2030?*, California Institute of Technology, Jun. 2022. [Online]. Available: <https://www.caltech.edu/about/news/ce10-energy-global-warming-solutions>.
- ARENA and ThinkPlace, *Demand Response Customer Insights Report*, May 2018. [Online]. Available: <https://arena.gov.au/assets/2018/08/demand-response-consumer-insights-report.pdf>.

## 7.6 Expandable

- Energy Consumers Australia and CutlerMerz Pty Ltd, *Social Licence for Control of Distributed Energy Resources: Final Report*, version 2.0, Dec. 2020. [Online]. Available: <https://energyconsumersaustralia.com.au/our-work/research/social-licence-for-control-of-distributed-energy-resources>.
- V. L. McLeod, *Developing Policy for Australia's Clean Energy Transition Using a Systems Thinking Approach: Consumer and Distributed Energy Resource Integration Case Study*, RACE for 2030 Cooperative Research Centre, Jul. 2024. [Online]. Available:

[https://www.racefor2030.com.au/content/uploads/21.E2.A.0189-Final-Report\\_Dec-2022.pdf](https://www.racefor2030.com.au/content/uploads/21.E2.A.0189-Final-Report_Dec-2022.pdf).

- ACOSS, Ai Group, Energy Efficiency Council, and Property Council of Australia, *Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources*, Dec. 2024. [Online]. Available: <https://www.eec.org.au/uploads/Projects/Demanding%20better%20-%20A%20reform%20agenda.pdf>.
- Energy Consumers Australia, *Strategic Plan 2021–2024*. [Online]. Available: <https://energyconsumersaustralia.com.au/wp-content/uploads/Energy-Consumers-Australia-Strategic-Plan-2021-2024.pdf>.
- U.S. Department of Energy, *A National Roadmap for Grid-Interactive Efficient Buildings*. [Online]. Available: <https://www.energy.gov/eere/articles/does-national-roadmap-grid-interactive-efficient-buildings>.
- M. Roberts, et al., *H4 Opportunity Assessment: Rewarding flexible demand: Customer friendly cost reflective tariffs and incentives – Final Report*, RACE for 2030 CRC, Nov. 2021. [Online]. Available: <https://www.ceem.unsw.edu.au/sites/default/files/documents/H4-OA-final-report-17.11.21.pdf>.
- Energy Consumers Australia, *Draft Consumer Vulnerability Strategy*. March 2022. [Online]. Available: <https://energyconsumersaustralia.com.au/publications/submission-on-the-aer-draft-consumer-vulnerability-strategy>
- S. Heinonen and J. Karjalainen, *Electrification in Peer-to-Peer Society: A New Narrative for Sustainable Futures*, Finland Futures Research Centre (FFRC), FFRC Publications 1/2019, Helsinki, Finland, 2019. [Online]. Available: [https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication\\_1-2019-rev.pdf](https://www.utupub.fi/bitstream/handle/10024/160647/FFRC-publication_1-2019-rev.pdf).
- Energy Consumers Australia, *Foresighting Forum 2021: System Design Webinar: Your Questions Answered!*, Sep. 2021. [Online]. Available: <https://energyconsumersaustralia.com.au/news/foresighting-forum-2021-system-design-webinar-your-questions-answered>.
- P. S. Lavieri and G. J. M. Oliveira, *Electric Vehicle Charging Consumer Survey: Insights Report*. C4NET, Feb. 2022. [Online]. Available: <https://c4net.com.au/wp-content/uploads/2022/02/Survey-Insights-Electric-Vehicle-Charging-Preferences-of-Australian-Consumers.pdf>.

## 7.7 Adaptable

- R. Ben-David, *Submission to the Select Committee on Energy Planning and Regulation in Australia*, Monash Business School, Monash University, Melbourne, Australia, Oct. 2024. [Online]. Available: [https://www.monash.edu/\\_data/assets/pdf\\_file/0008/3813155/Ron-Ben-David-Submission-to-the-Select-Committee-on-Energy-Planning-and-Regulation-in-Australia-28-October-2024.pdf](https://www.monash.edu/_data/assets/pdf_file/0008/3813155/Ron-Ben-David-Submission-to-the-Select-Committee-on-Energy-Planning-and-Regulation-in-Australia-28-October-2024.pdf).

- V. L. McLeod, *Developing Policy for Australia's Clean Energy Transition Using a Systems Thinking Approach: Consumer and Distributed Energy Resource Integration Case Study*, RACE for 2030 Cooperative Research Centre, Jul. 2024. [Online]. Available: [https://www.racefor2030.com.au/content/uploads/21.E2.A.0189-Final-Report\\_Dec-2022.pdf](https://www.racefor2030.com.au/content/uploads/21.E2.A.0189-Final-Report_Dec-2022.pdf).
- Energy Consumers Australia and The Insight Centre, *PowerUp: Consumer Voices in the Energy Transition*, Jul. 2024. [Online]. Available: <https://energyconsumersaustralia.com.au/publications/powerup-consumer-voices-energy-transition>.
- E. Brown, M. Frerk, R. Hey, L. Sandys, S. Steer, and A. Whitehead, *Addressing Waste and Inefficiencies: Delivering Customer, Cost, Carbon and Connections Dividends*, Utility Week Forum, Oct. 2024. [Online]. Available: <https://event.utilityweek.co.uk/forum24/agenda>
- ACOSS and TEC, *ourPower: A Vision for Clean, Affordable, Dependable Energy for All*, Feb. 2022. [Online]. Available: <https://ourpower.org.au/wp-content/uploads/2022/02/ourPower-Booklet.pdf>.
- U.S. Department of Energy, *A National Roadmap for Grid-Interactive Efficient Buildings*. [Online]. Available: <https://www.energy.gov/eere/articles/does-national-roadmap-grid-interactive-efficient-buildings>.
- M. Roberts, et al., *H4 Opportunity Assessment: Rewarding flexible demand: Customer friendly cost reflective tariffs and incentives – Final Report*, RACE for 2030 CRC, Nov. 2021. [Online]. Available: <https://www.ceem.unsw.edu.au/sites/default/files/documents/H4-OA-final-report-1711.21.pdf>.
- Energy Consumers Australia, *Social Licence for Control of Distributed Energy Resources: Final Report*, CutlerMerz Pty Ltd, Dec. 2020. [Online]. Available: <https://energyconsumersaustralia.com.au/our-work/research/social-licence-for-control-of-distributed-energy-resources>.
- Energy Security Board (ESB), *Customer Insights Collaboration: Workshop 3 Summary*, May 2022. [Online]. Available: [https://www.datocms-assets.com/32572/1673496508-1656654591-esb\\_customer-insights-collaboration\\_synthesis-from-workshop-3.pdf](https://www.datocms-assets.com/32572/1673496508-1656654591-esb_customer-insights-collaboration_synthesis-from-workshop-3.pdf).

## 7.8 Beneficial

- R. Ben-David, "Minimising consumer harm for a successful energy transition," presented at IPART's 30th Anniversary Conference, Sydney, Australia, Nov. 17, 2022. [Online]. Available: [https://www.ipart.nsw.gov.au/sites/default/files/cm9\\_documents/Ron-Ben-David-Minimising-Consumer-Harm-IPART-30-year-conference-%2817-November-2022%29.PDF](https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Ron-Ben-David-Minimising-Consumer-Harm-IPART-30-year-conference-%2817-November-2022%29.PDF).
- Energy Consumers Australia, "Consumers are investors too – where's their return?," Energy Consumers Australia, Mar. 19, 2024. [Online]. Available:

<https://energyconsumersaustralia.com.au/news/consumers-are-investors-too-where-their-return>

- P. De Martini and A. De Martini, *Customer Load Management: Evolution & Revolution*, Pacific Energy Institute, Dec. 2021. [Online]. Available: <https://pacificenergyinstitute.org/wp-content/uploads/2021/12/PEI-Customer-Load-Management-Evolution-Revolution-12.29.21.pdf>.
- U.S. Department of Energy, *A National Roadmap for Grid-Interactive Efficient Buildings*. [Online]. Available: <https://www.energy.gov/eere/articles/does-national-roadmap-grid-interactive-efficient-buildings>.
- M. Roberts, et al., *H4 Opportunity Assessment: Rewarding flexible demand: Customer friendly cost reflective tariffs and incentives – Final Report*, RACE for 2030 CRC, Nov. 2021. [Online]. Available: <https://www.ceem.unsw.edu.au/sites/default/files/documents/H4-OA-final-report-17.11.21.pdf>.
- Energy Consumers Australia, *Foresighting Forum 2021: System Design Webinar: Your Questions Answered*, Sep. 2021. [Online]. Available: <https://energyconsumersaustralia.com.au/news/foresighting-forum-2021-system-design-webinar-your-questions-answered>.
- UPowr, *Customer Segmentation Research and Design for Orchestration Programs*. Australian Renewable Energy Agency (ARENA), Apr. 2021. [Online]. Available: <https://arena.gov.au/assets/2021/07/upowr-customer-segmentation-research-and-design-for-orchestration-programs.pdf>
- CSIRO and Energy Networks Association, *Customer-Centric Networks*, 2015. [Online]. Available: [https://www.energynetworks.com.au/assets/uploads/roadmap\\_interim\\_report\\_final.pdf](https://www.energynetworks.com.au/assets/uploads/roadmap_interim_report_final.pdf).
- Energy Consumers Australia, *Social Licence for Control of Distributed Energy Resources: Final Report*, CutlerMerz Pty Ltd, Dec. 2020. [Online]. Available: <https://energyconsumersaustralia.com.au/our-work/research/social-licence-for-control-of-distributed-energy-resources>.

## 7.9 Other

- P. De Martini, et al., *Sourcing Distributed Energy Resources for Distribution Grid Services*, U.S. Department of Energy, Office of Electricity, Dec. 2024. [Online]. Available: <https://www.energy.gov/sites/default/files/2024-12/Sourcing%20DER%20for%20Dist%20Services%20final%2012.17.24.pdf>.
- Energy Networks Association, *Primacy Rules for ESO/DNO Coordination – Increment 2*, Open Networks Programme, version 1.0, Oct. 2024. [Online]. Available: <https://www.energynetworks.org/assets/images/primacy-rules-for-eso-dno-coordination-increment-2-v1.0-published.pdf>.

- WSP, Imperial College London Consultants, and National Grid, *Dissemination of Project Findings: Final Dissemination Webinar*, Energy System Operator (ESO), Jul. 2024.
- M. Otte, et al., *Aggregators in Digitalised Power Systems: How can Aggregators Improve the TSO-DSO-Customer Coordination in Digitalised Power Systems?*, ISGAN Working Group 6, Jul. 2024. [Online]. Available: [https://www.iea-isgan.org/wp-content/uploads/2024/07/ISGAN\\_Aggregator\\_final.pdf](https://www.iea-isgan.org/wp-content/uploads/2024/07/ISGAN_Aggregator_final.pdf).
- L. Thompson, *Transmission-Distribution Coordination Working Group: IESO-Administered Markets Communication Interfaces*, Independent Electricity System Operator (IESO), Ontario, Canada, Apr. 2024. [Online]. Available: <https://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/Engagement-Updates/ieso-engagement-updates-April-2024.pdf>.
- J. W. and L. Schmitt, *Future Control Room Architectures for Grid and Market Integrated Operation*, Axual and Digital4Grids, Jan. 2025.
- N. Omran and A. Golriz, *T-D Coordination to Support Reliable Performance of BPS with DER Integration*, Independent Electricity System Operator (IESO), Ontario, Canada, Dec. 2023. [Online]. Available: <https://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/tdwg/TDWG-20231214-T-D-Coordination-to-Support-Reliable-Performance-of-BPS-with-DER-Integration.pdf>.
- B. Herndler, et al., *Flexibility Harvesting and Its Impact on Stakeholder Interaction*, ISGAN Working Group 6, Dec. 2022. [Online]. Available: [https://www.iea-isgan.org/flexibility-harvesting-and-its-impact-on-stakeholder-interaction\\_key-messages/](https://www.iea-isgan.org/flexibility-harvesting-and-its-impact-on-stakeholder-interaction_key-messages/)
- Stokes, et al., *Flexibility Markets: Development and Implementation – TSO-DSO Coordination: The UK Case*, ISGAN Annex 9, Energy Systems Catapult, Mar. 2022. [Online]. Available: <https://www.iea-isgan.org/wp-content/uploads/2022/06/ISGAN-TSO-DSO-InsightReport-2022.pdf>.
- P. De Martini, S. Patel, and D. Kathan, *TSO-DSO-Aggregator Market and Operational Coordination Requirements*, U.S. Department of Energy, Office of Electricity, Apr. 2024. [Online]. Available: [https://www.energy.gov/sites/default/files/2024-07/47990\\_DOE\\_OE\\_TDC\\_Project\\_Coordination\\_Platform\\_v9\\_RELEASE\\_508.pdf](https://www.energy.gov/sites/default/files/2024-07/47990_DOE_OE_TDC_Project_Coordination_Platform_v9_RELEASE_508.pdf).
- G. Morch, et al., "Architectures for Optimised Interaction Between TSOs and DSOs: Compliance With The Present Practice, Regulation And Roadmaps," in Proc. 25th Int. Conf. on Electricity Distribution (CIRED), Madrid, Spain, Jun. 2019.
- GridWise Architecture Council, *A Practical Introduction to Common Grid Architecture Techniques*, Pacific Northwest National Laboratory (PNNL), Apr. 2024. [Online]. Available: [https://gridwiseac.org/wp-content/uploads/PNNL-35073\\_2024\\_GridArchitecture\\_White-Paper-PAL-final.pdf](https://gridwiseac.org/wp-content/uploads/PNNL-35073_2024_GridArchitecture_White-Paper-PAL-final.pdf).
- International Renewable Energy Agency (IRENA), *Innovation Landscape Brief: Future Role of Distribution System Operators*, Abu Dhabi, UAE, 2019. [Online]. Available: <https://www.irena.org/->



[/media/Files/IRENA/Agency/Publication/2019/Feb/IRENA\\_Landscape\\_Future\\_DSOs\\_2019.pdf?la=en&hash=EDEBEDD537DE4ED1D716F4342F2D55D890EA5B9](/media/Files/IRENA/Agency/Publication/2019/Feb/IRENA_Landscape_Future_DSOs_2019.pdf?la=en&hash=EDEBEDD537DE4ED1D716F4342F2D55D890EA5B9)

- ANederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), "Common Information Model Ontology Class Library," [Online]. Available: [https://ontology.tno.nl/IEC\\_CIM/](https://ontology.tno.nl/IEC_CIM/)
- F. Marten, et al., "CIM CGMES–extensions for the TSO–DSO data exchange in the EU–project 'TDX–ASSIST'," presented at the ETG Congress 2019, Kassel, Germany, Oct. 2019. [Online]. Available: <https://publica.fraunhofer.de/bitstreams/1724ce77-b639-4e2e-b114-e018df1b1cb4/download>
- BRIDGE Regulation and Data Management Working Groups, *BRIDGE TSO–DSO Coordination Report*, European Union Horizon 2020, Dec. 2019. [Online]. Available: [https://h2020-bridge.eu/wp-content/uploads/2020/01/D3.12.f\\_BRIDGE-TSO-DSO-Coordination-report.pdf](https://h2020-bridge.eu/wp-content/uploads/2020/01/D3.12.f_BRIDGE-TSO-DSO-Coordination-report.pdf).
- Think Human, *Future Network Deep Dive Report – SA Power Networks*, SA Power Networks, 2018. [Online]. Available: [https://ehq-production-australia.s3.ap-southeast-2.amazonaws.com/df7eb8ff09fb4d6ea16497fbd6b0ec6c661ccbf7/documents/attachments/000/083/130/original/SAPN\\_DeepDive\\_Future\\_Network\\_2\\_FINAL\\_REPORT.pdf](https://ehq-production-australia.s3.ap-southeast-2.amazonaws.com/df7eb8ff09fb4d6ea16497fbd6b0ec6c661ccbf7/documents/attachments/000/083/130/original/SAPN_DeepDive_Future_Network_2_FINAL_REPORT.pdf)
- T. Mai, et al., *Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States*, National Renewable Energy Laboratory (NREL), Golden, CO, USA, 2018. [Online]. Available: <https://www.nrel.gov/docs/fy18osti/71500.pdf>.
- M. Finch, *Futures of Heat, Light, and Power: Scenarios for the Australian Energy Sector in 2050*, Energy Consumers Australia, Feb. 2020. [Online]. Available: <https://energyconsumersaustralia.com.au/news/foresighting-forum-2020-publications-and-resources>
- Energy Security Board (ESB), *Customer Insights Collaboration: Synthesis From Workshop 2*, Jun. 2022. [Online]. Available: <https://www.datocms-assets.com/32572/1657176767-esb-ssg-release-2.pdf>.
- R. Ford and J. Hardy, "Are we seeing clearly? The need for aligned vision and supporting strategies to deliver net-zero electricity systems," *Energy Policy*, vol. 147, Jan. 2020. [Online]. Available: <https://ideas.repec.org/a/eee/enepol/v147y2020ics0301421520306157.html>
- J. Webb, R. Wade, S. Tingey, and M. Gill, *What is "Local"? Conceptualising local energy in the UK energy system*, *EnergyREV*, Feb. 2022. [Online]. Available: [https://www.energyrev.org.uk/media/1915/energyrev\\_what-is-local\\_final\\_202202.pdf](https://www.energyrev.org.uk/media/1915/energyrev_what-is-local_final_202202.pdf)
- Energy Consumers Australia, *Energy Consumer Sentiment Survey: Household Topline Results*, Oct. 2022. [Online]. Available: <https://energyconsumersaustralia.com.au/sites/default/files/wp-documents/ECBS-W13a-Oct22-Household-Toplines.pdf>



- S. Hall, et al., *Doing business model innovation for sustainability transitions — Bringing in strategic foresight and human centred design*, *Energy Research & Social Science*, vol. 90, p. 102685, Aug. 2022. [Online]. Available: <https://doi.org/10.1016/j.erss.2022.102685>.
- S. Hall, et al., *Matching consumer segments to innovative utility business models*, *Nature Energy*, vol. 6, no. 1, pp. 337–338, Jan. 2021. [Online]. Available: [https://www.researchgate.net/publication/348834704\\_Matching\\_consumer\\_segments\\_to\\_innovative\\_utility\\_business\\_models](https://www.researchgate.net/publication/348834704_Matching_consumer_segments_to_innovative_utility_business_models)
- S. Adams, et.al., *Social License to Automate: Emerging Approaches to Demand Side Management*, Users TCP Task 1 Report, Oct. 2021. [Online]. Available: <https://doi.org/10.47568/4XR122>.
- Energy Consumers Australia, *Three Year Plan 2025–2028*, Sydney, Australia, 2025. [Online]. Available: <https://www.energyconsumersaustralia.com.au>
- Energy Consumers Australia, *Understanding the Energy Divide – Explainer*, Dec. 2023. [Online]. Available: <https://www.energyconsumersaustralia.com.au>
- Energy Consumers Australia, *PowerUp: Consumer Voices in the Energy Transition*, Jul. 2024. [Online]. Available: <https://www.energyconsumersaustralia.com.au>

## Appendix A: Detailed overview of the source material

The following tables provide a summary of the underpinning Australian and global literature from which the eight future objectives are derived. Note that each entry may be applicable to several objectives, but for simplicity has only been listed against one objective. For consistency, each excerpt has been reframed to read as a future oriented objective. In many cases, the future objective has been inferred from current or nearer-term priorities described in the source content that are applicable to longer-term objectives for the power system.

| a. DEPENDABLE: Safe, secure, adequate, reliable, and resilient                                |  |
|---|--|
| Source  | Stated or Inferred Objectives (Future Tense)   |
| 2022-06 ECA --<br>Energy Consumer<br>Sentiment Survey --<br>Small Business                    | Small businesses are satisfied with their interaction and experience of the power system across the following areas: provision of electricity, customer service, billing platforms and arrangements, value for money, time to restore following outages, advances in technology, future reliability, ability to access information and tools, ability to make choices, confidence in the market, and dispute resolution.   |
| 2022-04 ESB --<br>Customer Insights<br>Collaboration<br>Workshop 2 --<br>Exploring the issues | Data regarding the customers' energy usage patterns and interfacing with energy management platforms is carefully, privately, and securely collected. This data is readily and easily accessible and interpretable for customers, such that customers are meaningfully informed and able to and feel confident making decisions which will positively impact both themselves and the collective society.   |
| 2022-02 Our Power – A<br>vision for clean,<br>affordable, dependable<br>energy for all        | <p>Ensure that the energy system can operate safely and securely regardless of how energy is produced. Engage with people and communities on investment and services so that energy is delivered in line with expectations, particularly when it comes to price, reliability and resilience.</p> <p>Improve the resilience of people, communities, businesses and institutions as well as the energy system to manage the increasing frequency and intensity of severe weather events as well as</p> |

|  |  |
|--|--|
|  | <p>cybersecurity and other unforeseeable or 'black swan' events such as Covid-19.</p> <p>Develop metrics for resilience, especially relating to localised long duration outages caused by severe weather events. Ensure the transparency of reliability, security and resilience data to inform decision-making and efficient investment.</p> <p>Strong and well-supported regulators to work with people, communities and energy participants to design, implement and oversee affordable, clean dependable energy.</p>                       |
| 2021-10 ECA – Strategic Plan 2021-2024                   | <p>Consumers experience cheaper and more reliable electricity supply from a modern power system that incorporates hardware and software that increases the speed and breadth of communication, artificial intelligences that delivers improved optimisation and responsiveness, monitoring and data that make delivering electricity more efficient.</p> <p>Households and small businesses benefit from a modernised system that can reduce the frequency and duration of power outages and restore service faster when outages do occur.</p> |
| 2021-01 ECA – Future Energy Vision Research – Households | <p>Technology enables customers to automate when things turn on and off to save energy and money.</p>  |
| 2020-11 ACOSS – New Energy Compact Consultation Draft 5  | <p>Consumers can depend on energy system resilience and efficiency across the supply chain, efficient energy use and new technologies and services are promoted for the benefit of people and the environment.</p>   |
| 2020-11 ACOSS – New Energy Compact Consultation Draft 5  | <p>The power system is flexible, innovative, responsive, and based on consumers' expectations.</p>   |
| 2020-05 Monash – Ron Ben-David on Two Sided Markets      | <p>Energy is provided to customers as an essential service. Similar to other essential services, the provision is reliable, sustainable, and affordable, and enabled by effective policy.</p>  |

|   |   |
|---|---|
| 2019-10 FFRC --<br>Electrification in a<br>Peer-to-Peer Society | Energy is perceived as ubiquitous and abundant by participants in the energy system, which changes how they use energy personally, what business models arise, and how the system is coordinated. |
| 2015-12 CSIRO & ENA -<br>- Customer-centric<br>Networks         | Customer's value electricity solutions that provide secure and reliable electricity, given their dependence on increasingly automated and digitised economy and lifestyle                         |

| b. AFFORDABLE: Efficient and cost-effective                                   |   |
|---|---|
| Source  | Stated or Inferred Objectives (Future Tense)  |
| 2022-03 ECA – Feedback on the Draft AER Consumer Vulnerability Strategy       | Rigorous attention is paid to ensure there is efficient investment and effectively utilising the capacity of the transmission and distribution networks as part of a collective commitment to improve affordability for consumers.  |
| 2022-03 ECA – Feedback on the Draft AER Consumer Vulnerability Strategy       | The overall cost to serve is minimised through an effective balancing of energy products and services affordability and consumer protections.   |
| 2022-02 Our Power – A vision for clean, affordable, dependable energy for all | <p>Ensure that investment in, and the operation of, the energy system is economically efficient and avoids wasting money and resources. There should be fair and efficient allocation of costs, which should be borne first by the beneficiaries of the energy transition. There should be fair allocation of risks, which should be borne by those who are best able to manage and mitigate them in the interests of energy users.</p> <p>Ensure that the energy system can operate safely and securely regardless of how energy is produced. Engage with people and communities on investment and services so that energy is delivered in line with expectations, particularly when it comes to price, reliability and resilience.</p> <p>Improve the resilience of people, communities, businesses and institutions as well as the energy system to manage the increasing frequency and intensity of severe weather events as well as cybersecurity and other unforeseeable or 'black swan' events such as Covid-19. Provide incentives and prioritise energy solutions relating to energy demand including energy efficiency.</p> <p>Improve the utilisation of existing generation and network infrastructure.</p> |

|  |  |
|--|--|
|  | <p>Enable energy management technology and behaviour that enhances outcomes for energy users and reduces the costs of the energy system.</p> <p>Develop metrics for resilience, especially relating to localised long duration outages caused by severe weather events. Ensure the transparency of reliability, security and resilience data to inform decision-making and efficient investment.</p> <p>Strong and well-supported regulators to work with people, communities and energy participants to design, implement and oversee affordable, clean dependable energy.</p>  |
| 2021-12 Race for 2030<br>– Tariffs for Rewarding Flexible Demand | <p>Customer friendly cost reflective tariffs and incentives enhance flexibility of household electricity use and generation, resulting in increased capacity for renewable generation and reduced costs for consumers, while still maintaining affordability for high cost-to-serve locations.</p> <p>Incentives are appropriately designed around household diversity, abilities, opportunities and values and availability of controllable discretionary loads to time-shift via automation or otherwise.</p>  |
| 2021-10 ECA –<br>Strategic Plan 2021–2024                        | <p>Consumers can rely on having affordable energy for comfortable homes and competitive businesses.</p> <p>Greater automation offers stress-free and seamless time-shifting in ways that consumers barely notice, leading to lower bills.</p> <p>Demand side solutions moderate investment in new bulk generation and storage, backed by a robust understanding of consumers.</p> <p>Consumers experience cheaper and more reliable electricity supply from a modern power system that incorporates hardware and software that increases the speed and breadth of communication, artificial intelligences that delivers improved optimisation and responsiveness, monitoring and data that make delivering electricity more efficient.</p> |

|   |   |
|---|---|
| <p>2021-01 ECA – Future Energy Vision Research – Households</p> | <p>Energy is affordable: household consumers are satisfied that what they are being is fair and reasonable and represents value for money.</p> <p>Technology enables customers to automate when things turn on and off to save energy and money.</p>  |
| <p>2020-09 Energy Charter – Maturity Model</p>                  | <p>Energy companies improve energy affordability for customers to the point that customers consider energy to be good value, and there is significant evidence supporting this collective customer sentiment.</p> <p>Investment decisions are demonstrably optimised for the benefit of the customers by the given company, which is working cooperatively across the supply chain.</p> |
| <p>2020-05 Monash – Ron Ben-David on Two Sided Markets</p>      | <p>Efficient allocation (or rationing) of services, including reliability of electricity supply, to the parties who attach the greatest value to those services, reduces the cost of electricity for all consumers.</p>   |
| <p>2015-12 CSIRO &amp; ENA – Customer-centric Networks</p>      | <p>Customers are offered value options allowing them to trade off electricity service featuresv that were previously standardised, in exchange for a financial benefit, such as being more responsible for their own reliability of supply (by choosing to install on-site energy storage, for example).</p>  |

| c. SUSTAINABLE: Enables 2030 and 2050 decarbonisation goals                   |  |
|---|--|
| Source  | Stated or Inferred Objectives (Future Tense)   |
| 2022-02 Our Power – A vision for clean, affordable, dependable energy for all | <p>Energy sources that negatively impact the health and wellbeing of people and communities are avoided and as are those detrimental to the environment in their production and use (including global heating, coal dust, diesel particulates, noxious fumes from burning coal and gas, wood smoke, and groundwater pollution)</p> <p>Incentivise energy solutions that improve the health and well-being of people – for example, by improving the energy efficiency and energy productivity of homes, hospitals, schools, offices and other workplaces.</p> <p>Implement policies and strategies in line with the transition to net zero emissions by a date consistent with the scientific evidence to limit global warming to 1.5 degrees, including incentives to decarbonise, prioritising investment in zero-emissions technology and deploying clean energy production.</p> <p>Be transparent and accountable in reporting on environmental performance.</p> <p>Ensure people, businesses and communities can play a role in the transition to zero-carbon energy.</p> <p>Build and dispose of energy infrastructure and components in a socially responsible and environmentally sustainable way.</p> |
| 2021-01 ECA – Future Energy Vision Research – Households                      | Customers can choose to source their electricity from sustainable sources at cheaper prices.   |
|   | Energy is clean: energy comes from sustainable carbon-free energy sources.   |
| 2020-11 ACOSS – New Energy Compact Consultation Draft 5                       | Consumers assume a shared responsibility for the power system to achieve Net Zero Emissions through the sustainable production and use of energy.  |



| c. SUSTAINABLE: Enables 2030 and 2050 decarbonisation goals  |  |
|--|--|
| Source   | Stated or Inferred Objectives (Future Tense)   |
| World Economic Forum and Boston Consulting Group – The Net Zero Challenge: Fast-Forward to Decisive Climate Action, 2020 | The energy system is built on long-term decarbonisation certainty. Investors are confident, public-private partnerships have matured, and capital flows towards net-zero technologies at unprecedented scale. Businesses compete to reduce emissions and motivated by consistent policy signals and international alignment. Markets reward decarbonisation, and the societal case for climate action is no longer debated but embodied in new infrastructure projects, supply chains, and cultural norms.   |
| International Energy Agency – Net Zero by 2050: A Roadmap for the Global Energy Sector, October 2021                     | Governments, citizens, and businesses are unified in their efforts to decarbonise the energy system. There is universal access to clean electricity, air pollution has dropped significantly, and a majority of global car sales are for electric vehicles. Advanced economies have phased out coal-fired power generation, and solar and wind dominate electricity generation. Again, renewables and clean energy account for a majority of global generation capacity. All new buildings are zero-carbon-ready and energy efficient, and non-energy industries have broadly adopted low-emissions production technologies. The energy transition has not only met climate targets—it has delivered economic growth, new job creation, and improved public health and environmental outcomes. |

| d. <b>EQUITABLE: Broad access to benefits and the fair sharing of costs</b>                      |   |
|--|---|
| Source   | Stated or Inferred Objectives (Future Tense)  |
| 2022-06 ICL – Applying strategic foresight and human centred design to business model innovation | Business models are aligned with what consumers find desirable, as uncovered by human-centred design.   |
| 2022-06 ECA – A fit-for-purpose consumer agency and protection                                   | <p>Consumer protection and rights are comprehensively covered by consumer law and aligned with the two-way dynamic functioning of the power system.</p> <p>Consumers have universal access to free and independent dispute resolution whatever their arrangements for consuming and producing electricity.</p>  |
| 2022-04 ESB – Customer Insights Collaboration Workshop 2 – Exploring the issues                  | <p>Energy companies develop equitable and productive automation processes that reduce costs for customers and businesses and enable customers' agency and reduce barriers to entry. These automation processes are collaboratively developed in parallel with relevant hardware to ensure coherent and modular implementation and integration of interoperability practices and standards.</p> <p>Landlords are incentivised to install/provide flexible DER/demand response technologies on their properties to enable increased access for tenants to meaningfully participate in energy markets and demand response incentive programs. Effective processes are in place to ensure both landlord and tenant benefit from the use and consistent maintenance of the technologies.</p> |
| 2022-02 Our Power – A vision for clean, affordable, dependable energy for all                    | <p>Ensure energy rules, policies and measures are designed to enable access to clean, affordable, dependable energy for everyone.</p> <p>Ensure energy rules, policies and measures do not disadvantage people if they cannot or do not want to participate in new energy products and services. Be honest, ethical and transparent to build trust. Understand and engage with people, businesses and communities to meet their needs, provide real choices and improve</p>   |

|   |  |
|---|--|
|   | <p>outcomes. Provide education to inform and support people to access and manage energy to meet their needs. Enable real choice and decision-making by ensuring options and tools are ethical, clear, transparent, learnable, in plain language and accessible. Enable people, businesses and communities to contribute to society, economic development and a sustainable environment. Give energy users control over how their data is used and shared in a way that is consistent with community expectations as well as privacy and other legal frameworks. Ensure energy service platforms are open and people can move between them without being locked in, to support innovation and provide real choices. Implement human-centred co-design processes when developing new policy, regulation, services and products, to ensure diversity of energy users views and needs. Ensure adequate protections are in place to enable full participation in the energy system. Ensure that people understand their responsibilities and the impacts on others of their energy choices.</p> |
| 2021-12 Race for 2030 – Tariffs for Rewarding Flexible Demand | <p>Energy service providers have considered approaches to vulnerable customers and design flexibility schemes such that they are not disadvantaged or adversely impacted.</p>  |
| 2021-10 ECA – Strategic Plan 2021-2024                        | <p>Consumers participate in demand-side decision-making in ways that prioritise reward over punishment, and which do not ask them to trade-off core needs, such as being warm in winter and cool in summer. Utilities also benefit, enjoying improved security, reduced peak loads, increased integration of renewables, and lower operational costs.</p> <p>Energy services are individualised, and accessing electricity as an essential service is no longer provided as one-size-fits-all. A least-cost future energy system is enabled by providing genuine choices and control to households and small businesses, who have a range of motivations, abilities and opportunities to contribute to, and benefit from, technologies, new energy services and markets.</p>   |

|  |  |
|--|--|
| 2021-05 US DOE – A National Roadmap for Grid-Interactive Efficient Buildings       | The building design and construction industry have deep expertise in energy and incorporate relevant technologies and design tools into projects, maximising customer choice, smart building capability, customer convenience, control and safety.   |
| 2021-01 ECA – Future Energy Vision Research – Households                           | <p>Energy is inclusive: Household consumers are empowered by readily available information about the energy system and their choices.</p> <p>Customers on limited incomes have access to assistance or subsidies to pay for their energy use.</p> <p>Energy is affordable: household consumers are satisfied that what they are being is fair and reasonable and represents value for money.</p>   |
| 2020-12 ECA – Social License for DER Control FINAL v2.0                            | DER control programs equitably distribute net private benefit to ensure that consumers that do not have the ability to install DER (such as renters, or households living in dwellings without access to adequate roof space) are still able to participate.   |
| 2020-05 Monash – Ron Ben-David on Two Sided Markets                                | There is an increase in fairness, through the elimination of cross-subsidies and prohibitions that protect consumers from certain types of conduct that harm effective competition   |
| 2019-10 FFRC – Electrification in a Peer-to-Peer Society                           | Engaging with energy is readily understandable to modern consumers as it is conceptually similar to other existing familiar peer-to-peer exchange platforms like social media, and shares many of the same features (self-organisation, absence of traditional hierarchies and social structures, open collaboration, self-expression, bottom-up creativity).  |
| 2022-11 R. Ben-David – Minimising Consumer Harm for a Successful Energy Transition | Regulatory frameworks are designed with the cognitive and time-based limitations faced by consumers in mind, rather than assuming fair outcomes are enabled by full engagement as a default requirement. The regulation is oriented toward protecting consumers from undue complexity and decision fatigue, recognising that most households do not have the ability or desire to continuously manage dynamic pricing, variable products, or |

|   |   |
|---|---|
|   | <p>energy risk on a multi time scale basis. Consumers do not feel that complexity is a barrier to participation, or that successful interaction with the power system requires them to navigate overwhelming optionality.</p>   |
| <p>2023-12 Energy Consumers Australia – Understanding the Energy Divide – Explainer</p> | <p>The energy system ensures that complexity does not act as a barrier to fair participation, particularly for those already facing social or financial disadvantage. Systems are simplified and coordinated to ensure that all consumers, regardless of technical knowledge or time, can navigate their energy choices with confidence and ease.</p> <p>Market actors demonstrate proactive efforts to minimise ‘confusopoly’ effects, by streamlining interactions across retailers, installers, tradespeople, and technology providers. Information and support are intuitive for people not familiar with the industry, and there is no requirement for consumers to actively manage multiple energy-related decisions and contracts in real time.</p> <p>Special attention is given to protecting vulnerable households, recognising that those most affected by rising energy costs and inefficient housing generally have the least capacity to absorb such impacts.</p> |

| E. EMPOWERING: Advances Customer and Community Agency, Optionality, and Customisation |  |
|---|--|
| Source  | Stated Or Inferred Objectives (Future Tense)   |
| 2022-06 ECA – A fit-for-purpose consumer agency and protection                        | <p>Consumer agency is enshrined in the regulation of the power system.</p> <p>Business models arise from out of familiarity with how energy services are bought – starting with consumers' diverse needs and preferences including: convenience, minimising entities consumers contract with, shared services such as local storage and bulk hot water, pricing optionality so consumers can manage their own risk.</p>  |
| 2022-03 ECA – Feedback on the Draft AER Consumer Vulnerability Strategy               | <p>Energy companies enable potential and existing customers to make informed tariff and consumption choices. Suppliers provide consumers with information, services, and/or tools that help customers:</p> <ol style="list-style-type: none"> <li>1 Understand the key features of the product/service offering, including any charges, fees, and associated payments</li> <li>2 Make informed choices about how they manage their costs and consumption, including when and how much energy they consume, and other significant relevant quantified factors, such as efficiency and flexibility.</li> </ol> <p>Further, energy companies provide consumers with clear and accessible information that helps them understand that they can switch their current product/service offering and supplier.</p> <p>Customer agency goes beyond simply regulating suppliers and the information they need to provide, and transitions to considering what is needed for consumer decision making and building customer confidence and trust. Revised energy market structures provide a wide range of competitive, affordable, and accessible options for consumers.</p> |

|   |  |
|---|--|
| <p>2021-12 RACE for 2030<br/>– Tariffs for Rewarding Flexible Demand</p>                        | <p>Incentives are appropriately designed around household diversity, abilities, opportunities and values and availability of controllable discretionary loads to time-shift via automation or otherwise.</p> <p>Consumers are comfortable with using enabling technologies to manage flexible loads, such as inputting default energy use priorities and choices for autonomous management, integrating smart appliances into home energy setup, and remote activation of discretionary loads.</p> <p>Consumers use advanced but simple monitoring tools that provide visualisation of energy use (and/or generation) which support households in understanding the energy use and costs of their appliances and in assessing the impact of load-shifting.</p> |
| <p>2021-10 ECA –<br/>Strategic Plan 2021–<br/>2024</p>  | <p>Demand side solutions moderate investment in new bulk generation and storage, backed by a robust understanding of consumers.</p> <p>Advanced metering makes consumption more transparent, allowing consumers who wish to do so to be more actively involved in the energy market.</p> <p>User-friendly phone apps can make real-time decision making around energy consumption as quick and easy as checking your bank balance or arranging a date.</p>   |
| <p>2021-09 ECA –<br/>Foresighting Forum –<br/>System Design Webinar</p>                         | <p>Consumers are granted autonomy as to the degree of participation and the decisions they make about supporting grid objectives.</p> <p>People and communities are empowered to implement local solutions to their energy needs.</p>  |
| <p>2021-05 US DOE – A<br/>National Roadmap for<br/>Grid-Interactive<br/>Efficient Buildings</p> | <p>Customers understand and are compelled to adoption by the value proposition of Grid-Interactive Efficient Buildings as capital costs decrease and maintenance requirements are better understood.</p> <p>Customers understand and are comfortable with the risks of investment in Grid-Interactive Efficient Buildings and participation in the greater energy system through a mature familiarity with technologies assisted by broad dissemination of relevant information that supports decision making.</p>   |

|  |   |
|--|---|
|  | Federal, state, and local codes and regulations regarding energy devices and systems are aligned and consistent, decreasing Grid-Interactive Efficient Building project costs and complexity.   |
| 2020-09 ICL – The need for aligned vision and supporting strategies to deliver NZE grids | The vast majority of customers are engaging effectively in demand side management programs. This mass participation is enabled by appropriately designed markets and technical infrastructures (e.g., smart meters and batteries) to deliver demand side management without the loss of individual comfort or experience or societal benefits.  |
| 2020-05 Monash – Ron Ben-David on Two Sided Markets                                      | Consumers can efficiently, and with minimal pressure, process the choices they face, and feel confident in making the decision that is best for their personal circumstances that balances societal needs. The degree to which customers monitor electricity prices and decide how or when to participate is entirely based on their preferences of engagement frequency and intensity, rather than limited by the service or product offering of the businesses and technologies with which they are interacting.  |
| 2019-10 FFRC – Electrification in a Peer-to-Peer Society                                 | The energy system is democratized as users are empowered to realise their personal and societal ambitions for energy, aided by the ability to form peer networks of like-minded energy users and jointly act in line with their values and priorities.  |
| 2018-12 NREL – Electrification Futures Study   | Energy companies have advanced consumer choice models for an expansive list of end-use technologies, to provide insights on the drivers of electric technology adoption. These models capture economic trade-offs between different technologies, customer preferences and behaviour, supply chain and infrastructure impacts, risks, financing, and integrated challenges and opportunities. These consumer choice models inform policymakers, guide R&D strategies that lower costs and improve desirability and motivate engineering design to influence appropriate adoption. |



|   |   |
|---|---|
| <p>2015–12 CSIRO &amp; ENA – Customer-centric Networks</p>  | <p>Customers can compare competing electricity solutions based on each option’s ability to perform the combination of ‘jobs’ that they uniquely want done (including functional and financial ‘jobs’ as well as social and emotional ‘jobs’)</p> <p>Customers are offered energy solutions that are highly customised and delivered in the emotionally and socially engaging ways that customers already expect from service providers outside the energy sector.</p> <p>Customers are offered simple, accessible choices, with the option of bundled products and services that conveniently combine technologies, data access and/or entertainment</p>  |
| <p>2014–05 CSIRO – Applying behavioural economics to understand energy consumer decision-making and behaviour</p> | <p>Energy companies and policymakers ethically and effectively utilise social psychology learnings to inform the development of more efficient marketing, more user-friendly platform interfaces and processes, and more customer-focused regulation development.</p> <p>Research indicates that Consumer choices and behaviour are to a large extent understood to be driven by cognitive biases, heuristics and other 'predictably irrational' tendencies. For example, people use mental shortcuts to cut through complexity, they dislike losses more than they like gains, prefer lower value certainties over higher-value risks, evaluate things in relative rather than absolute terms, and are heavily influenced by the people around them. However, these cognitive biases and motivational factors are often overlooked by practitioners and policymakers seeking to promote energy efficiency and conservation.</p> <p>To ensure cost-effectiveness and maximise return on investment, the objective is that energy companies and policies take these phenomena into account when developing strategies for encouraging renewable and sustainable energy use, and for motivating pro-environmental behaviour more broadly. By understanding these predictable deviations from economically rational behaviour, policymakers will be better placed to craft interventions that successfully bridge the gap between pro-environmental knowledge, values, attitudes and intentions, and the everyday energy-related behaviour of consumers.</p> |

|   |  |
|---|--|
| <p>2023-02 Y. Strengers, F. Kaviani, K. Dahlgren, H. Korsmeyer, S. Pink, L. Nicholls, and R. Martin – Digital Energy Futures: Scenarios for Future Living</p>   | <p>Customers are equipped with intuitive tools, accessible information, and sufficient agency to engage with the system in ways that match their preferences and capacities. Energy offerings reflect a range of engagement levels, allowing people to participate deeply, opt out, or automate decisions without penalty. System design anticipates and adapts to diverse customer behaviours, and avoids default assumptions about technical literacy or willingness to engage. This socially attuned approach to planning supports customer empowerment by ensuring the future grid evolves in ways that reflect, rather than overlook, the diversity of lived experience.</p>  |
| <p>2024-07 Energy Consumers Australia – PowerUp: Consumer Voices in the Energy Transition</p>   | <p>Consumers have confidence that they retain autonomy over their energy use and data. Regulatory guardrails ensure that networked technologies and third-party control mechanisms protect customer privacy, uphold consent, and are trusted by users.</p>   |
| <p>2024-12 Australian Council of Social Service, Australian Industry Group, Energy Efficiency Council, and Property Council of Australia – Demanding Better: A Reform Agenda for Harnessing the Power and Flexibility of Demand Side Energy Resources</p> | <p>Policy and regulatory frameworks intrinsically advocate the rights of all consumers to access affordable energy. Governance structures remove barriers to engagement and provide customers with clear, coordinated, and supportive mechanisms for contributing demand-side services, that reinforce their role as a partner in the energy transition.</p> <p>Australia's energy governance evolves to incorporate whole-of-system planning and learning from leading international models. New institutions or capabilities enable proactive coordination across regulatory and policy domains to support demand-side integration. Governance structures are responsive and forward-looking, able to adapt as consumer technologies, services, and needs evolve.</p> <p>A reformed regulatory framework explicitly reflects the public-good purpose of the energy system. By prioritising outcomes such as affordability, accessibility, environmental sustainability, and energy literacy, reforms rebuild public trust and ensure the energy system delivers meaningful benefits to current and future consumers. Demand-side governance is treated as a core pillar of a socially responsible energy system.</p> |

| f. EXPANDABLE: Enables electrification of transport, building services and industrial processes |   |
|---|---|
| Source  | Stated or Inferred Objectives (Future Tense)  |
| 2022-06 Caltech Energy – Cutting US global warming gas emissions in half by 2030                | Current consumer-based products that have high demand are replaced with demand-flexible products at the end of their lifetime over the next 5–10 years. These products include water heaters, pumps, dishwashers, cars, etc. End-users and consumers are educated and empowered to make more and better decisions around making their own household net zero. If each household has their own net zero plan, then the community will collectively achieve it as a cumulation of micro-incremental step functions.   |
| 2021-10 ECA – Strategic Plan 2021–2024  | Localised, community-centred forms of generation, while more complex, are critical to a more robust system that is less radial and more networked. Community batteries, virtual power plants and co-located small-scale generation and storage facilities are embedded within communities. Power comes from a large number of diffuse and diverse sources such that the system is less vulnerable to failure caused by a single catastrophic event and therefore more resilient.  |
| 2021-10 UoM – EV Charging Consumer Survey   | <p>Managed EV smart charging is widely adopted, supported by:</p> <ul style="list-style-type: none"> <li>• Clear and simple communication of monetary savings on offer.</li> <li>• Third-party management and control that is performed via Apps that increase users' sense of control over charging and decrease their feeling of uncertainty.</li> <li>• Clarity in data sharing and user privacy policies.</li> <li>• Consumer awareness of environmental and community benefits.</li> <li>• A perception that public charging is an easy and accessible backup plan.</li> </ul> |

2021-09 ECA –  
Foresighting Forum –  
System Design Webinar

Mechanisms to identify and understand consumer aspirations, expectations, concerns and emerging issues are in place.

| g. ADAPTABLE: Flexible and adaptive to change, including technological, regulatory and business model innovation |   |
|--|---|
| Source   | Stated or Inferred Objectives (Future Tense)  |
| 2021-01 ECA – Future Energy Vision Research – Households   | Energy service providers align and adapt their products and services with the evolving and changing values across life-stages and generations.  |
| 2020-12 ECA – Social License for DER Control FINAL v2.0  | <p>Technical standards for hardware enable informed and competitive consumer choice to more interoperable and easily accessible product and services options. Hardware standards positively dictate the way in which consumers interact with their DER systems in terms of provision of information and manual over-rides to enable permanent or event-based opt-in or opt-out. The increased choice provided by well-designed hardware standards also reduces the effort/costs of gaining and maintaining a social licence.</p> <p>DER control programs are supported by technical standards that play a key role in ensuring that hardware and software limitations do not restrict the ability for consumers to opt-out, or that they do not increase the costs of opting-in. Interoperability and modular interfacing standards and practices are prioritised and enforced, so that DER controlled exclusively by proprietary communications technologies does not occur.</p> <p>A lack of interoperability has the potential to lock a consumer with DER into a particular service arrangement. Should the consumer wish to change service provider, or integrate multiple DER systems from different brands, they may find that this is not technically possible without completely replacing one or all of their DER systems. A lack of interoperability has the potential to increase the costs of the DER control program by effectively forcing a consumer to stay with a higher cost or lower value provider. For example, a consumer with a non-interoperable solar and battery system who is receiving unacceptable service from the party undertaking the control, may have no option but to opt-out completely from the DER control program (or buy a new solar and battery system).</p> |

|   |  |
|---|--|
| <p>2020–11 ACOSS – New Energy Compact Consultation Draft 5</p>  | <p>The power system is flexible, innovative, responsive, and based on consumers' expectations.</p>   |
| <p>2024–10 R. Ben-David – Submission to the Select Committee on Energy Planning and Regulation in Australia</p>           | <p>The regulatory environment governing the power system operates with greater coherence and clarity, having moved beyond its previous tendency to “hedge bets” by keeping all future options indefinitely open. While technological innovation continues to accelerate, the system maintains a clear and adaptable framework that supports progress without overwhelming consumers or creating unnecessary uncertainty.</p> <p>Regulatory bodies coordinate more effectively across sociocultural and institutional boundaries, focussing on a more unified and future-ready approach to planning. Long-term strategies are underpinned by a shared understanding of emerging risks (from action and inaction), rather than divergent regulatory philosophies. In this context, customers navigate a healthy breadth of offerings without being burdened by incoherent or unstable market rules.</p>  |
| <p>2024–07 V. L. McLeod – Developing Policy for Australia’s Clean Energy Transition Using a Systems Thinking Approach</p> | <p>The system fosters a shift from reactive policy patchwork to integrated, whole-system design. Place-based innovation is supported through structures like Local Renewable Energy Zones (LREZs), which serve as policy, regulatory, and technical ‘sandboxes’.</p> <p>Customers actively participate in flexible demand services through partnerships with aggregators and non-traditional business models, with clear pathways to opt in and out. Their energy resources are enrolled in programs that generate value for the grid and for themselves, without requiring constant management or causing disruptions to daily life. Energy services are designed around customer autonomy, convenience, and trust.</p> <p>The system avoids reinforcing inequity by ensuring that DER deployment does not trigger network upgrades that then drive further bills upward. Instead, policy design ensures that flexibility is recognised, valued, and traded before defaulting to costly infrastructure expansion.</p> |

2024E. Brown, M. Frerk,  
R. Hey, L. Sandys, S.  
Steer, and A. Whitehead  
– Addressing Waste and  
Inefficiencies:  
Delivering Customer,  
Cost, Carbon and  
Connections Dividends

The energy system adopts modular reform pathways that enable efficient progress in discrete areas without being delayed by contentious issues in others. For contentious issues, policy frameworks support flexible implementation, allowing for iterative innovation and learning-by-doing. This staged and pragmatic approach to reform fosters a culture of continuous improvement across market, regulatory, and planning domains.

| h. BENEFICIAL: Socially trust, public good/benefits, commercially investable and financeable |   |
|--|---|
| Source   | Stated or Inferred Objectives (Future Tense)  |
| 2022-06 ECA – Energy Consumer Sentiment Survey – Households                                  | <p>Households are satisfied with their interaction and experience of the power system across the following areas: provision of electricity, customer service, billing platforms and arrangements, value for money, time to restore following outages, advances in technology, future reliability, ability to access information and tools, ability to make choices, confidence in the market, and dispute resolution.</p> <p>Electricity suppliers have sufficient trust from consumers to be happy to hand over control of their load/devices.</p>   |
| 2022-03 ESB – Customer Insights Collaboration Workshop 1 – Defining the problem              | <p>All customers can realise the value of flexible demand and DER for both individual and collective benefit. The barrier of perceived complexity of DER demand response processes is removed or mitigated. Customers' effective understanding of these processes is enabled by clearer language, communication, and information and technology that is designed to be user friendly.</p> <p>Customers realise the value of flexible demand through more relevant incentives. These incentives respond to customer needs and improve the customer experiences. Energy companies provide different incentives for different customers, where the incentives are tailored to suit the customers' circumstances and financial and energy goals. Barriers such as lack of value certainty and transparency are removed or mitigated by providing clear, informative, and easy to understand information which is easily accessible on user friendly platforms.</p> <p>Further, there are significant improvements to the customer experience through the building of trust in energy companies and the building of consumers' confidence in their choice and capability to participate.</p> |
| 2022-03 ECA – Feedback on the Draft  | Consumer voice and lived experience inform and refine regulatory design and change.   |



|  |  |
|--|--|
| AER Consumer Vulnerability Strategy  |  |
| 2021-12 Race for 2030 – Tariffs for Rewarding Flexible Demand                | Energy service providers have built trust with consumers and broadly addressed concerns over participation in flexibility schemes, including time constraints, loss and risk aversion, status quo bias, low perceived benefit, information or choice overload, more pressing priorities, decreased comfort or convenience, safety risks, lack of control or autonomy, data security or loss of privacy.  |
| 2021-12 PEI – Customer Load Management Evolution & Revolution                | Customers are encouraged to participate in problem-solving and program design processes to produce mutually valued outcomes for customers and the power system.  |
| 2021-10 IEA – Social License to Automate                                     | The dynamics of trust and other social dimensions are favourable to user engagement with automation technologies used in demand side management.   |
| 2021-10 ECA – Strategic Plan 2021-2024                                       | <p>Consumers are willing participants in flexibility schemes, agreeing to adjust their energy use in ways that help their community, themselves, and the system. The process of doing this is simple and frictionless and does not require expert knowledge or high-level engagement.</p> <p>Consumers have sufficient trust in the system and goodwill towards key actors within it that they respond to system events when invited. They have a clear understanding of what they are being asked to do and what their options are, and the way they respond is intuitive and easy.</p> |
| 2021-09 ECA – Foresighting Forum – System Design Webinar                     | Clear and valuable information is available to inform energy choices as they navigate the changing energy landscape.   |
| 2021-05 US DOE – A National Roadmap for Grid-Interactive Efficient Buildings | Technology maturity has grown such that customers have confidence to invest in Grid-Interactive Efficient Buildings without fear of obsolescence.  |

|   |   |
|---|---|
| <p>2021-04 Upowr – Customer Segmentation Research and Design for DER Orchestration Programs</p> | <p>DER/CER orchestration programs, including how they are communicated and understood (the why), cater to and appeal to a broad range of customer types from "innovators" to "laggards", as they are aligned with customer motivations, emotions and values. This has resulted in deep participation in such programs, increased technology adoption, and greater contribution of distributed assets to whole-of-system objectives.</p>   |
| <p>2020-12 ECA – Social License for DER Control FINAL v2.0</p>                                  | <p>A social licence to control DER is acquired, and results in individual consumers perceiving the private and public benefits of DER control to be greater than the private costs. The social licence increases participation in voluntary DER control programs and the uptake of DER more broadly. Further, where a social licence for mandatory programs is obtained, it increases compliance and therefore decreases non-compliance and enforcement costs. The government or institution enabling the DER control (through policy, regulation or via programs) requires the licence. This body may not ultimately be directly doing the control; however, it generally regulates the way in which the third party must undertake the control, communicate with and reward consumers and provide data and information to monitor the effectiveness of the DER control program.</p> <p>The three different levels of social licence for control of DER are obtained by parties which reasonably require a social licence to manage their respective initiative:</p> <ul style="list-style-type: none"> <li>+ Acceptance: Whereby the consumers subject to DER control perceive that the private benefits of the control outweigh the private costs of the control.</li> <li>+ Approval: Whereby to the extent practicable, consumers and consumer representatives perceive that:</li> <li>+ The benefits of the DER control are allocated according to their views of fairness</li> <li>+ The institution enabling the DER control program engages in two-way dialogue with consumers (both those subject to control and those receiving the broader system benefits of the control).</li> <li>+ Psychological Identification: Whereby consumer representatives and the institution enabling the DER control</li> </ul> |

|  |  |
|--|--|
|  | <p>program develop enduring regard for each other over the course of DER control program design, implementation, evaluation and modification.</p> <p>The cost/effort required to gain and maintain a social licence for control of DER is directly related to the consumer's choice (in terms of the mandatory/voluntary nature of the program) and the extent to which the private costs are outweighed by private benefits for all consumers with DER subject to control. The more mandatory and the higher the private costs, the more difficult it is to achieve a social licence.</p> <p>To obtain a social licence, close to 100% of consumers with DER subject to control must perceive the benefits of the control to outweigh the private costs. This is achieved where the program enables the energy system (public) benefits to be directly transferred to the DER consumer via an incentive payment, rebate or bill reduction or by personalising the public value to infer an indirect or perceived benefit. In consideration of the role of choice, the level of participation/uptake required to deliver the benefits must be taken into account. Mandatory participation has the potential to drive the greatest uptake and therefore deliver the greatest benefit. However, where a DER control program is made mandatory, a social licence must be obtained from close to 100% of consumers with DER subject to control.</p> <p>DER consumers tend to fall into four main categories when it comes to the perceived private cost and benefits of DER:</p> <p>Derives personal satisfaction in adopting modern technology and automation and perceives little to no disbenefit of control</p> <p>Willing to absorb any private costs where the DER control provides for financial benefits and/or solves a practical problem</p> <p>Places a high value on social/environmental outcomes, perceives DER control as in alignment with these values, and is therefore willing to absorb reasonable costs</p> <p>Place a high value on social/environmental outcomes but perceives DER control (and often technology generally) as in conflict with these values and is therefore unlikely to adopt DER control.</p> <p>Consideration of these four groups, in terms of the make up of each for any given DER control program, is a critical component in the</p> |
|--|--|

|   |   |
|---|---|
|   | processes of obtaining a social licence and/or increasing uptake and effectiveness.   |
| 2020-11 ACOSS – New Energy Compact Consultation Draft 5       | The power system is consumer focused, and everyone can access clean, affordable, dependable energy.   |
| 2020-05 Monash – Ron Ben-David on Two Sided Markets           | Market mechanisms and structures operate in a manner which reflects the broader society's standards of fairness. Great care is taken by energy companies and policymakers to understand and articulate the community's standard of fairness, and to ensure that market design, development, and implementation are built out of and satisfy these standards. Further, consumers have confidence in the alignment and integration of these standards throughout the whole process. Market designers, policy makers and regulators have access to tools that allow models and related assumptions to be tested in high definition, and experimental economics applies laboratory methods to economic questions. At the same time, behavioural economists help market designers peer into market participants' true decision-making processes. Likewise, economic theorists in the fields such as industrial organisation, game theory and institutional design apply their own assumption-bending techniques to theoretical models of proposed markets. The full arsenal of economic methods are openly deployed in search of comprehensive questions and equally comprehensive, satisfactory, and community confidence building answers. |
| 2018-05 ThinkPlace – Demand Response Consumer Insights Report | <p>Demand response mechanisms:</p> <ol style="list-style-type: none"> <li>1. Enable families to easily adapt their energy use habits and routines</li> <li>2. Connect people with energy management techniques that are of interest and benefit to them</li> <li>3. Support experimental learning and self-improvement to allow consumers to optimise their energy management</li> <li>4. Balance the desire of people to contribute to the greater good with equitable energy balancing</li> <li>5. Balance the perceived and actual effort with the perceived and actual significance of demand response</li> </ol>   |

|  |   |
|--|---|
|  | <ol style="list-style-type: none"> <li>6. Allow customers to connect their individual demand response to longer-term energy user patterns and affirm customers that they are valuable contributors to the results of collective demand management</li> <li>7. Tap into Australians' dominant social preferences if it is to attract and engage them, and change their long-term behaviour</li> <li>8. Allow users to share their experience of the program with family/friends and let them know the operational methodology and positive impacts it brings</li> </ol>  |
| 2024-05 R. Russell-Bennett, R. Gordon, K. Letheren, R. McAndrew, F. Mathmann, A. van Hummel, and N. Bowring –<br>Benchmarking Customer Priorities and Trust in the Energy Sector: Final Report | <p>A clearly articulated long-term national vision, led by government, provides customers with confidence in the direction of the energy transition. This vision enforces the essential nature of electricity and safeguards the public interest. This includes ensuring that system design choices are not overly driven by for-profit imperatives at the expense of customer outcomes.</p> <p>Trust is no longer viewed as a soft, intangible value, but as a system-critical enabler of customer participation and social licence. Energy actors prioritise reducing perceived malevolence or deceit and actively addressing historical sources of customer distrust.</p> <p>Customers experience the energy system as cohesive and navigable, supported by trusted institutions and/or single points of contact that provide assistance, information, and accountability.</p> |
| 2025 Energy Consumers Australia –<br>Three Year Plan 2025-2028   | <p>The energy transition is guided by a clear and cohesive national narrative that builds public trust and unites consumers, governments, and industry under a shared vision. This overarching story is communicated transparently, enabling households and communities to understand what decarbonisation means for them and what actions they are expected to take.</p> <p>Eliminating ambiguity and proactively addressing misinformation has strengthened social licence and mitigated the erosion of goodwill. Governments and industry take coordinated responsibility for providing timely, honest communication that helps consumers feel confident, informed, and connected to the broader purpose and benefits of the transition.</p>   |

## Appendix B: Principles, Methodologies & Acknowledgements

This section provides an overview of the guiding principles and integrated disciplines and tools employed in the development of this reference set.

### B1 Guiding Principles

Following are a set of principles and characteristics embedded in the Power System Architecture discipline that have guided the development of this reference set.

1. **Stakeholder / User-centric:** Systems architecture methodologies are grounded in a detailed exploration of the *Future Customer & Societal Objectives (Report 1)* for the power system to ensure the grid can deliver a balanced scorecard of societal outcomes.
2. **Contextually Informed:** Systems architecture methodologies give priority to examining the full range of *Emerging Trends Driving Transformation (Report 2)* that are driving significant change together with the resulting Systemic Issues that must be addressed if stakeholder expectations of the future system are to be made achievable.
3. **Structural Focus:** Systems architecture methodologies give particular attention to examining the underpinning legacy structure or 'architecture' of a complex system due to the disproportionate influence it has on what the system can safely, reliably and cost-efficiently do (i.e. the 'performance envelope' of the system).
4. **Principles-based:** Systems architecture methodologies are grounded in established principles and formal bases, ensuring conceptual integrity through consistent, traceable and verifiable processes, that enhance multi-stakeholder trust, and minimise the potential for unintended consequences.
5. **Whole-system Perspective:** Systems architecture methodologies provide a holistic view of the entire system as the primary basis for considering the interdependencies between its many tiers/layers, subsystems and components.
6. **Decadal Time Horizon:** By identifying structural options that enhance (rather than constrain) multi-year optionality, systems architecture methodologies ensure the system is robust, adaptable, scalable and extensible across a range of alternate future scenarios and maximise the 'future-proofing' of investments.
7. **Technology & Business Model Agnostic:** By focusing on the required outcomes of the current and future system, systems architecture actively identifies alternative implementation pathways, supports technology innovation and avoids dependence on any one proprietary solution or commercial model.
8. **Complexity Management:** By making the underpinning structures of a legacy system explicitly articulated, systems architecture enables the decomposition of inherent complexity, identification of legacy structural constraints, and proposed changes to be accurately targeted and avoid complexity escalation.

9. **Subsystem Analysis:** By providing formal analytical tools, systems architecture enables the detailed interrogation of all current Subsystems and Components, their individual form and function, boundaries, interfaces and functional interdependencies to holistically consider potential future enhancements in the context of the whole system.
10. **Stakeholder Empowerment:** By providing an objective and evidence-based set of tools that can be learned, systems architecture empowers diverse stakeholders – both technical and non-technical – to collectively reason about current and future options and better contribute to key trade-off decisions.

## B2 Integrated Disciplines & Tools

Following are a set of disciplines and tools that have informed and enabled the development of this reference set.

|   |   |
|---|---|
| <b>Design Thinking</b>                        | <p>A human-centered, iterative methodology for solving complex problems through empathetic understanding, creative ideation, and rapid experimentation. The purpose of Design Thinking is to foster innovation by prioritising human needs, reframing challenges as opportunities, and developing actionable solutions that balance desirability (user appeal), feasibility (technical viability), and viability (economic sustainability). It functions as a non-linear process that bridges creative exploration with practical implementation, enabling teams across disciplines to navigate ambiguity and deliver user-centric outcomes.</p>  |
| <b>Model-Based Systems Engineering (MBSE)</b> | <p>An approach to Systems Engineering that uses software-based models to represent various aspects and behaviours of a complex System. It provides dynamic modelling of System requirements, design, analysis, verification and validation activities in a manner that ensures requirements traceability, reduced errors and enhances multi-stakeholder collaboration in near real-time.</p> <p>MBSE leverages graphical and textual representations to capture, analyse, simulate, and communicate the requirements, designs, and behaviours of the System. Applied from the conceptual design phase and continuing throughout development and later life cycle phases, it enhances traditional Systems Engineering processes by providing a more structured, integrated, and visual representation of the Architecture and Functions of a System.</p> |

### Power Systems Architecture (PSA)

An integrated set of disciplines that support the structural transformation of legacy power systems, enabling them to more effectively serve evolving customer and societal objectives.

At its most fundamental, PSA reflects the application of systems engineering to the transformation of the power system. In recognising each power system as a complex Network of Structures, the PSA methodologies are uniquely designed to provide:

- Whole-system insight over 5, 10 and 20-year time horizons, enabling the interrogation and mapping of current, emerging and future system priorities and objectives including the role and responsibilities, operational coordination and co-optimisation across all vertical tiers/layers.
- Evidence-based tools to identify, analyse and shortlist key transformational options through the combination of systems architecture, network theory, control theory, systems science and Model-based Systems Engineering (MBSE).
- Future-resilient decision making by surfacing hidden structural constraints early which may otherwise propagate a range of architectural Issues including computational constraints, latency cascading and cyber-security vulnerabilities, providing greater assurance that new investments will be scalable and extensible under all plausible futures.

PSA provides a formalised toolkit for decomposing and 'taming' the massive complexity inherent to a transforming power system. The PSA toolkit empowers more informed, multi-stakeholder participation by making critical content explicit and tractable that would otherwise remain opaque and intractable.

It is designed to enhance decision quality, timeliness and traceability to support full benefits-realisation and avoid the propagation of unintended consequences.



|                               |   |
|-------------------------------|---|
| <b>Strategic Foresighting</b> | <p>A systematic, collaborative process for exploring plausible futures, identifying emerging trends, disruptions, and opportunities to inform resilient long-term strategies.</p> <p>The purpose of Strategic Foresighting is to enable organisations to proactively shape or adapt to future environments by reducing uncertainty, challenging assumptions, and aligning decisions with potential scenarios. It ensures that systems, architectures, and investments remain viable amid evolving technological, societal, economic, and regulatory landscapes.</p> <p>Strategic Foresighting functions as an upstream enabler of the Systems Architecture process. It facilitates cross-disciplinary dialogue to anticipate future needs, risks, and innovations before architectural decisions are formalised. By analysing weak signals, drivers of change, and systemic interdependencies, it provides context for defining robust requirements in the Reference Architecture phase and ensures Detailed Architecture designs embed adaptability.</p>   |
| <b>Structural Analysis</b>    | <p>In the context of electricity system transformation, structural analysis refers to the systematic evaluation of the physical, operational, and organisational structures of the power system to determine the changes necessary to transition from a conventional, fossil-fuel-based, unidirectional grid to a decarbonised, distributed, and bidirectional grid.</p> <p>This process involves assessing how new technologies (such as distributed energy resources, storage, and electric vehicles), market mechanisms, and control strategies will alter the system's topology, power flows, stability characteristics, and resilience requirements. The goal is to ensure that the restructured grid can accommodate variable renewable energy sources, enable two-way energy and information flows, and maintain security, reliability, and affordability under future scenarios.</p> <p>Key components of structural analysis include:</p> <ul style="list-style-type: none"> <li>• Physical Structure: Reconfiguration of transmission and distribution networks for bidirectional flows.</li> <li>• Operational Structure: Adaptation of protection systems, frequency control, and flexibility measures.</li> <li>• Institutional/Market Structure: Integration of distributed generation, demand-side participation, and new pricing models.</li> <li>• Resilience and Stability: Ensuring robust system performance under uncertainty and high penetration of renewables.</li> </ul> |

|                             |  |
|-----------------------------|--|
| <b>Systems Architecture</b> | <p>A formal discipline within Systems Engineering that supports objective and collective reasoning about the foundational structure and organisation of a complex system. This includes its components, interfaces, feedback loops, and other critical behaviours.</p> <p>The architecture of a system exerts a disproportionate influence on what the system can reliably and efficiently accomplish. Accordingly, a system should not be viewed merely as the sum of its parts, but rather as the product of the interactions among those parts—interactions that are enabled and constrained by the underlying architectural design.</p> <p>Although architecture plays a pivotal role in shaping system performance, it is often less tangible and more difficult to discern than the system’s individual components. The discipline of Systems Architecture, therefore, provides formal methods and tools to analyse how system components are interconnected, to identify emergent behaviours that arise from these interactions, and to explore robust options for modification and improvement.</p> <p>By enabling a deeper understanding of how legacy systems function and how their structures can evolve, Systems Architecture empowers stakeholders to visualise relationships, evaluate trade-offs, and make informed decisions that enhance the system’s capacity to meet current and future demands.</p> |
| <b>Systems Engineering</b>  | <p>An established engineering discipline applied in numerous sectors focused on the development and operation of ultra-complex Systems including aerospace, military, manufacturing, energy and electronics sectors.</p> <p>While many engineering disciplines are oriented toward individual Component technologies or sub-systems, Systems Engineering is a transdisciplinary approach that brings a holistic or whole-system approach to the realisation of successful Systems which consistently satisfy the needs of their customers, users and other stakeholders.</p>   |
| <b>Systems Science</b>      | <p>A multi-domain, integrative discipline that brings together research into all aspects of complex systems with a focus on identifying, exploring and understanding the universal patterns and behaviours of complexity and emergence.</p>  |

## B3 Acknowledgements & Foundational Sources

The Energy Catalyst team has benefited from the expertise of and privilege of collaborating with many global organisations and experts. While it would be impossible to exhaustively recognise all relevant entities, individuals and sources, the following are particularly relevant to the development of this reference set, noting that any errors are those of Energy Catalyst alone.

### *Entities*

- Australian Energy Market Operator (AEMO)
- Commonwealth Scientific Industrial Research Organisation (CSIRO)
- Energy Systems Catapult (ESC)
- Massachusetts Institute of Technology (MIT)
- Pacific Northwest National Laboratory (PNNL)
- Rocky Mountains Institute (RMI)
- United States Department of Energy, Office of Electricity (DOE)

### *Individuals*

- Dr Thomas Brinsmead
- Pablo Campillos
- Paul De Martini
- Prof. Lynne Kiesling
- Dr Lorenzo Kristov
- Rama Ganguli
- Eamonn McCormick
- Dr Ron Melton
- Peter Senge
- Dr Jeffrey Taft
- Dr John Ward

### *Foundational Sources*

The following sources provide key principles and bases for the application of the disciplines and tools employed in developing this reference set.

- International Council on Systems Engineering (INCOSE), INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, 4th ed. San Diego, CA, USA: INCOSE, 2015.

- R. D. Adcock, S. Friedenthal, D. Dori, R. Walden, and D. Giammarco, "Guide to the Systems Engineering Body of Knowledge (SEBoK)," ver. 2.9, The Systems Engineering Research Center, Hoboken, NJ, USA, May 2023. [Online]. Available: [https://sebokwiki.org/wiki/Guide\\_to\\_the\\_Systems\\_Engineering\\_Body\\_of\\_Knowledge\\_\(SE\\_BoK\)](https://sebokwiki.org/wiki/Guide_to_the_Systems_Engineering_Body_of_Knowledge_(SE_BoK))
- Bruce Cameron, Edward F. Crawley, and Daniel Selva, Systems Architecture, Global Edition, 1st ed., Pearson Education, 2015.
- J. D. Taft, S. Widergren, A. Shankar, R. Melton, and B. Kelley, Grid Architecture Specification: High DER/DA/STO Reference Architecture (GMLC 1.2.1 v0.3), Pacific Northwest National Laboratory, Richland, WA, USA, Dec. 2019.
- J. D. Taft and A. Becker-Dippmann, Grid Architecture, Pacific Northwest National Laboratory (PNNL), Richland, WA, USA, Jan. 2015, Report No. PNNL-24044. [Online]. Available: <https://gridarchitecture.pnnl.gov/media/white-papers/Grid%20Architecture%20%20-%20DOE%20QER.pdf>
- J. D. Taft, Grid Architecture 2, Pacific Northwest National Laboratory (PNNL), Richland, WA, USA, Jan. 2016, Report No. PNNL-24044 2. [Online]. Available: <https://gridarchitecture.pnnl.gov/media/white-papers/GridArchitecture2final.pdf>
- J. D. Taft, Comparative Architecture Analysis: Using Laminar Structure to Unify Multiple Grid Architectures, Pacific Northwest National Laboratory (PNNL), Richland, WA, USA, Nov. 2016, Report No. PNNL-26089. [Online]. Available: <https://gridarchitecture.pnnl.gov/media/advanced/Comparative%20Architecture%20Analysis-Final.pdf>