MATURITY PLAN PILOT CO-DESIGN KNOWLEDGE SHARE

Knowledge Share Report

July 2021

ENERGY SECURITY BOARD

UTS:DESIGN INNOVATION RESEARCH CENTRE

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Overview

RPS, and UTS Design Innovation Research Center (DIRC) partnered with Energy Security Board (ESB) and stakeholders to collaboratively explore aspects of a key energy issue using design thinking as a means of developing policy.

The objective was to put the customer at the centre of a problem definition, with insights from solution generation outputs used to help inform the ESB's Post 2025 Final recommendations.

The Maturity Plan will be used to progressively work through priority customer issues in reforms, deliver detailed analysis or solutions, and necessary regulatory change or capability development. Its ongoing governance will allow it to function as a vehicle for collaborative co-design and coordination of distributed energy resources (DER) market development.

This pilot exercise addressed minimum demand – one of the most complex and complicated problems facing the energy sector.

This knowledge share report provides an explanation of the approach, summary of what we heard and how stakeholders responded to this experimental approach.

Contents

Introduction

The Energy Security Board (ESB) recognised there was a substantial amount of engagement already taking place across the energy sector and on topics related to ‘minimum demand’. As part of the Maturity Plan Pilot, a new approach was proposed to explore how a diversity of stakeholders could be brought together using design thinking to approach the problem and solutioning in a different way.

The co-design approach used design thinking principles and aimed to:

- Bring multiple stakeholder interests together
- Create a space for stakeholders to have equal input into understanding and exploring the problem
- Test how design thinking principles could apply to the complexity of the energy sector.

This report reflects the work by RPS and UTS Design Innovation Research Center (DIRC) and the insights generated through the co-design approach for ESB to consider to inform the ESB's Post 2025 Final recommendations.

The Maturity Plan Pilot

With support from stakeholders and the Board, the ESB commenced a trial of the Maturity Plan in April 2021 to develop recommendations for the June 2021 paper. Insights and feedback from the pilot, together with stakeholder feedback via submissions, will be fed into ESB considerations for final recommendations.

PILOT GOALS

Over nine weeks, the pilot focused on immediate measures to meet the challenge of minimum demand, such as emergency backstops to:

a) test the Maturity Plan program concept; and,

b) work through practical solutions, from a customer perspective, to deliver a robust outcome

PILOT OUTPUTS

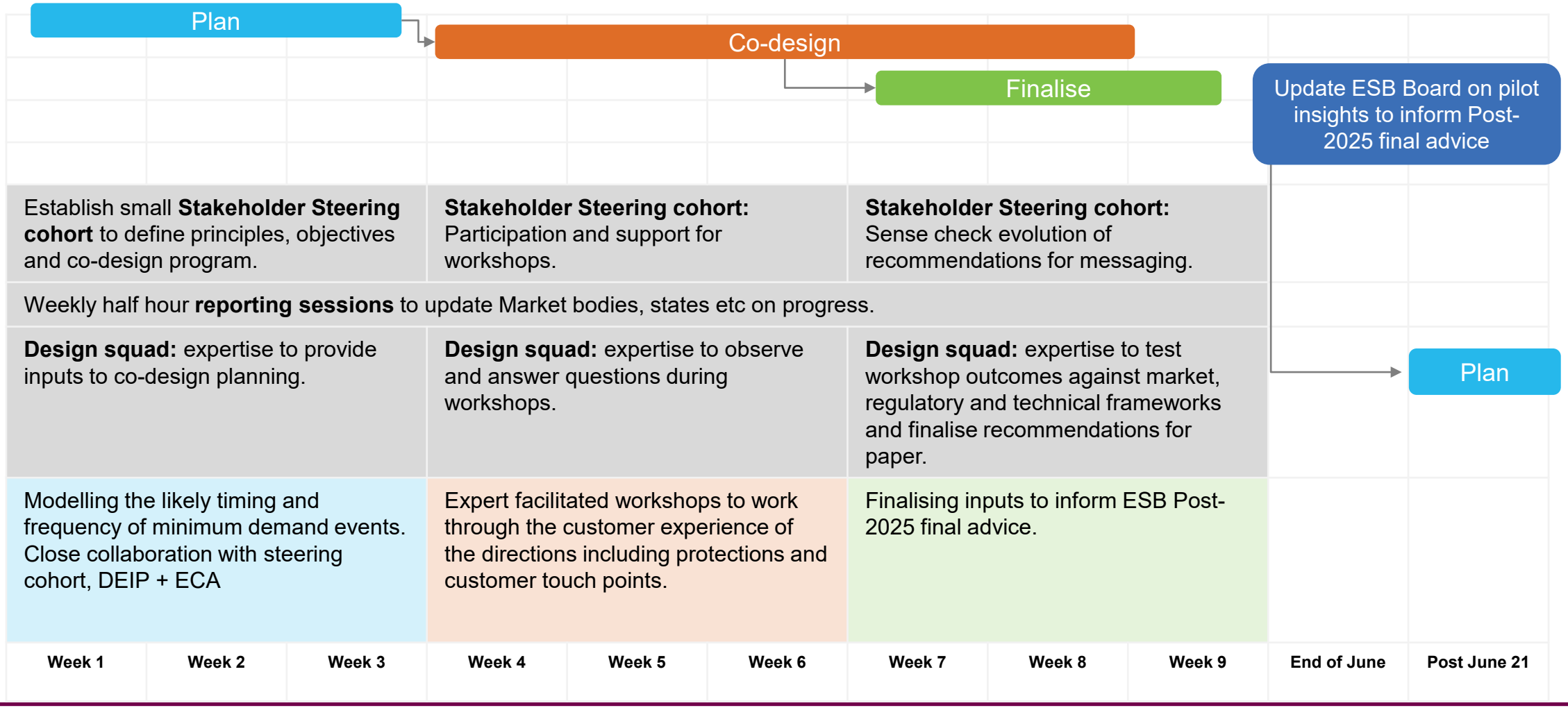
The outputs from the pilot will be fed through the ESB governance process.

These outputs will include insights, options and evidence based on stakeholder input and will inform the ESB Post-2025 program final advice.

About the Maturity Plan Concept

In the April 2021 ESB paper, a Maturity Plan concept was proposed to work through urgent issues in integrating demand from a customer perspective. The Maturity Plan uses a rhythmic approach to streamline engagement and bring together diverse views using human centred design principles.

Program of work for the pilot



Problem context

The challenge of ‘minimum demand’

The system

- Australia is a world leader in rooftop solar PV uptake and is at the forefront of integrating these assets into the energy system.
- A large amount of uncontrolled, inverter-based generation and low levels of demand can create scenarios where it is difficult to maintain system security.
- This can be due to a lack of synchronous generation (gas, hydro and coal) able to operate in the system, or increased difficulty managing transmission level voltage, both of which can reduce system resiliency.

Why this is a problem

By not addressing minimum operational demand, there are:

- Increased risks of system level failures, such as statewide blackouts
- Costly remediations, borne by energy users, such as synchronous condensers, network upgrades, directing and paying generators to stay on; and
- Interventions to curtail renewables, including customer-owned assets.

A good solutions’ parameters

The nature of the minimum operational demand problem has technical, market, and customer dimensions. Solutions can:

- Increase the amount of solar that can be connected
- Accelerate the decarbonisation of the system
- Reduce costs by increasing the efficiency and the utilisation of existing assets in ways that are acceptable to energy users.

Addressing minimal operational demand should consider opportunities that:

- Provide greater flexibility in both demand and generation; and
- Could simultaneously be used to address distribution network congestion; and
- Provide customers with tools to enable engagement in existing and future markets.

This problem definition was the result of the first phase of workshops where stakeholders discussed the evolving problem.

Stakeholders invited to participate

To achieve a diversity of perspectives, a range of stakeholders were invited to participate throughout the co-design series. This included:

- Customer and energy representatives;
- Network providers;
- Retailers;
- Government agencies;
- Technology providers;
- Environmental representatives and organisations.

The Stakeholder Steering Cohort also met on a weekly basis to discuss the progress of the program. The cohort consisted of representatives from:

- Retailers: AGL;
- Technologyy providers: Schneider Electric;
- Networks: EnergyQueensland;
- Customers: The Customer Advocate;
- Independent expertise: ANU;
- Market bodies: AEMO;

The Steering Cohort acted as an advisory body.

Participants included representatives from:

- Evergen
- Shell Energy
- Flow Power
- Simply Energy
- Energy Australia
- Origin Energy
- Energetic communities
- Large energy users
- Energy Efficiency Council
- Smart Energy Council
- Australian Energy Council
- CSIRO
- Energy Consumers Australia
- South Australia Power Networks
- Enel X
- South Australian Council of Social Services
- Solar Edge
- The Australia Institute
- Australian Council of Social Services
- Council on the Ageing
- Australian Renewable Energy Agency
- Airconditioning and Refrigeration Equipment Manufacturers Association of Australia
- CS Energy
- Citipower, Powercor, United Energy
- Powerlink
- Australian Capital Territory Council of Social Services
- Department of Industry
- Public Interest Advocacy Centre
- Reposit Power
- VIOTAS
- Jemena
- Ausgrid
- Clean Energy Council
- Total Environment Centre
- Queensland Council of Social Services
- ENGIE Australia and NZ
- Schneider Electric
- Energy Networks Australia
- St Vincent de Paul
- Enphase Energy Australia
- Tesla

The approach

In the spirt of innovation, the co-designed approach of the pilot trialed a new way of engaging with stakeholders to build consensus and explore the complex problem of ‘minimum demand’.

Design thinking was used as a co-design methodology that aimed to bring diverse perspectives together. This was done through a series of online workshops to unravel the complexity and explore customer centric solutions.

Design thinking is a process of creative problem solving that is human-centered at its core.

Through a series of workshops, stakeholders were invited to:

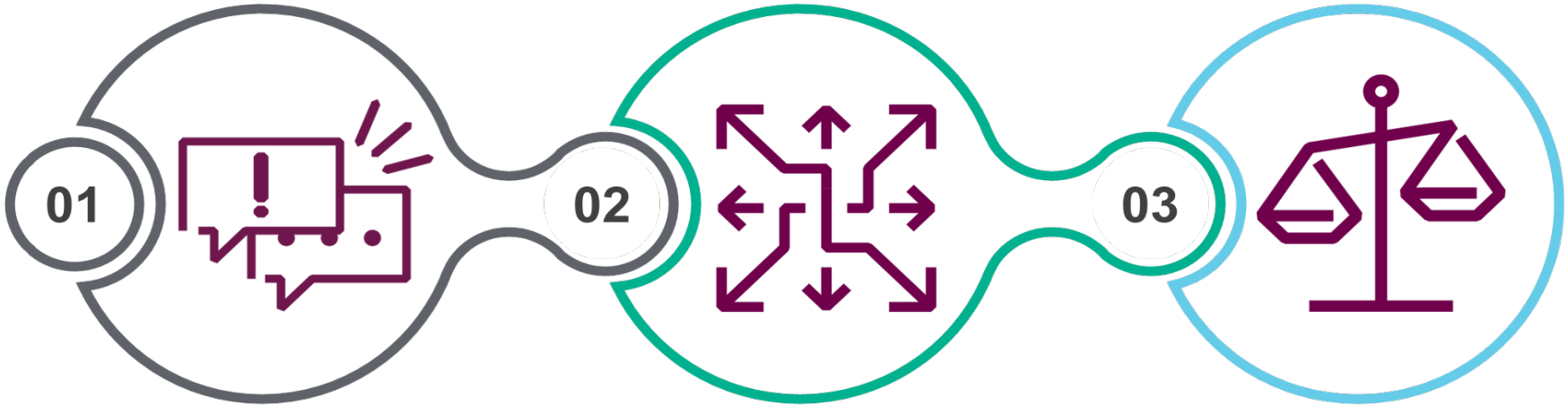
- Understand and define the problem from the perspective of customers;
- Generate ideas that would solve problems for customers;
- Refine and evaluate a series of scenario-based solutions.

The approach

The co-design methodology was developed to be iterative, collaborative and explorative. The three-phased approach aimed to create divergent and convergent thinking through a series of four-hour workshops.

Importantly, between each workshop, the collated insights were further refined and developed by the ESB *design squad*. This provided the opportunity for additional stakeholder input to shape the outcomes of the Maturity Plan as it was developed.

In the same way that stakeholders used design thinking and customer centric techniques, the *design squad* used these same principles to analyse, synthesise and create meaning from workshop content. This supported the evolution of thinking and generation of workshop outcomes that have informed the development of the Maturity Plan.



Phase 1: Understand and define the problem

Phase 2: Generating solutions

Phase 3: Prioritisation and evaluation

Phase 1 – Understand and define the problem	Phase 2 – Generating solutions	Phase 3 – Prioritisation and evaluation
Phase 1 workshop was held by the ESB on 13 May 2021 and introduced the Maturity Plan Pilot, including the process, timeline and role of the Stakeholder Steering Cohort. A discussion paper, *Integrating Distributed Energy Resources and Flexible Demand*, was presented by representatives of the Stakeholder Steering Cohort, to provide background, context to the challenge and help frame the workshop's focus. Through a series of small group activities, participants considered "minimum demand" through a range of lens to develop problem statements that could be considered for use in Phase 2 (Generating solutions).	Phase 2 workshop was held on 27 May 2021. The ESB provided an update and overview of the Maturity Plan Pilot. Cameron Tonkinwise from UTS Design Innovation Research Centre outlined the fundamentals of Design Thinking and how the process works. A panel discussion provided opportunity for participants to hear from: • Rebecca Knights, SA Department of Energy and Mining; • Scott Chapman, Australian Energy Market Operator; • Kurt Winter, AGL; • Craig Memery, Public Interest Advocacy Centre. The group work activities focused on customer-centric ideation across four broader directions: • Backstop curtailment • Passive to active solar • Inducing customer energy use • Blue-sky thinking	Phase 3 workshop, held on 10 June 2021, brought together the problem exploration and ideation generation to test a series of scenarios. The ESB *design squad* provided a detailed summary of the synthesis process that was undertaken to distill the ideas generated in the Phase 2 workshop. The themes were used to shape eight scenarios that were then tested by participants. In a round robin-style process, each group was assigned a customer persona and asked to consider at least two scenarios. A Customer Risk Assessment Framework was used to consider and test each of the scenarios from the perspective of the customer personas. This uncovered opportunities and possible risks for each of the scenarios.
The outcome was a divergent understanding of the problem from many perspectives. This was used to shape a series of possible problem statements.	**The outcome was a diverse range of ideas, contributions and considerations for each of the direction themes. These were used to shape a series of scenarios for Phase 3.**	**The outcomes from Phase 3 have provided insights into customer considerations, possible risks and technical implications for the potential scenarios presented. This has informed the recommendations as part of the Maturity Plan Pilot.**

What we heard

The co-design approach explored the complex challenge of ‘minimum demand’ and captured feedback from a diverse group of stakeholders as they navigated a design thinking process. Throughout the series of workshops, feedback was captured and reported back through summary documents.

The key insights heard from each workshop and phase of the journey are outlined in the following pages. This includes what we heard about:

- The challenge of minimum demand
- How to respond to the challenge of minimum demand
- Scenarios offering the best outcomes
- Views on the pilot process

What we heard about

Phase 1

The challenge of “minimum demand”

The purpose of Phase 1 was to understand and define the challenge of “minimum demand”. The insights from this conversation were used to develop a series of problem statements as input for Phase 2.

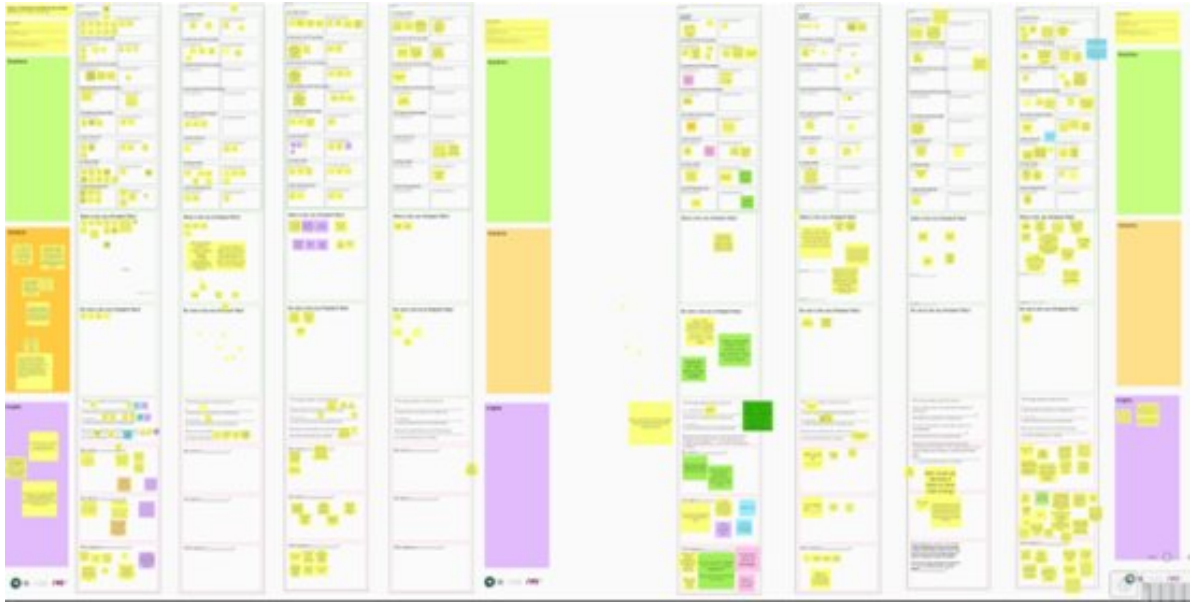
Feedback from multiple breakout sessions was reviewed and potential problem statements developed, against three broad lenses:

1. Customer
2. Societal
3. Technical

Key insights heard from the conversation:

- There is a diversity of perspectives regarding the layers of the problem related to “minimum demand”.
- No clear consensus or alignment was generated in relation to a series of problem areas.
- Approaching the problem definition from a customer perspective provided a common ground from participants to engage.

Following synthesis of outputs from the first workshop, a series of problem statements were formed. These addressed the many facets and complexity of the challenge of “minimum demand”.



Digital whiteboards, with feedback

Synthesis summary

Phase 1

Phase 1 generated a substantial amount of data and insights, including perspectives on the problem, constraints and issues associated with “minimum demand”. Through a series of workshops and reviews, the ESB *design squad* analysed the data for trends and themes divided into the three areas below.

 **Customer impacts**	 **Technical understanding and solutions**	 **Maturity Plan process**
Insights relating to customer impacts: • Need to clearly identify the problem (visible and invisible capacity) • Clear communication • Language is vital, both directly with customers and when understanding customers • There is an aspect of behavioural change from customers • Future direction needs to address trust in the sector and choice • Holistic solutions are needed	Insights relating to technical understanding and solutions: • There is complexity in the problem definition that related to technical, network, regulatory, customer and technology • Consensus that there are multiple problems to be addressed • “Minimum demand” may not be the most accurate term for the problems to be solved • There is a need to break down the technical complexity into pieces • Need to accept some possible realities in order to prioritise ‘no regret’ propositions/solutions	Insights relating to the Maturity Plan process: • Prework done by the customer groups that was presented helped to shape and contextualise the conversation • Some concern about the “messiness” of the workshop and lack of concrete outcomes • Lack of understanding of the design thinking methodology • Some questions about whether the process should be technical or customer focused

Customer impacts

Phase 1

Need to clearly identify the problem (visible and invisible capacity)

Clarity on the problem from the customer's perspective was focused on the increased risk of outages and changing expectations around the return on investing of solar. There was also significant discussion on how this would impact different types of customer - the impact on a customer with and on one without solar may be quite difficult. Discussion focused on the need for customers to appreciate the paradigm shift in the market.

Clear communication

There were varying opinions on the level of communication necessary to the end customer, but stakeholders emphasised the importance of clear communication and signals to the market to drive buying choices and build social licence.

Language is vital both with customers and when understanding customers

For many years, the sector has spoken to customers about saving energy through peak demand management and energy efficiency. Asking customers to increase use could create confusion given that this challenge does not remove the need to continue those conversations, but rather add another dimension. Stakeholders raised the importance of market research and real customer voices in navigating this challenge.

There is an aspect of behavioural change from customers

Through Feed in Tariffs (FiTs) and other incentives, customers have been encouraged to overbuild solar systems and to date only early adopters have taken up Virtual Power Plants or similar technology. It was suggested that to efficiently resolve this challenge, signals could direct more self-consumption. Some raised that this was already happening with customers on spot pass-through models.

Future direction needs to address trust in the sector and choice

Early adopters in the sector have had minimal choice in their provider. As the market for trader/aggregator/retail evolves, customers will need to feel protected to encourage them to adopt new technologies. This can be delivered through clear communication as well as increasing information on protections in place.

Holistic solutions are needed

Signals to customers will vary – financial and moral. Customers will also have varying abilities to respond. Again, it was acknowledged that customer driven solutions will take time to implement but that policy makers could make 'no regrets' decisions today, to ease the problem in the future.

Technical understanding and possible solutions

Phase 1

There is complexity in the problem definition that related to technical, network, regulatory, customer and technology

Stakeholders suggested that minimum demand was an expected part of transition to a system with higher levels of non-synchronous generation. However the lack of information, understanding and visibility was creating difficultly in market-led solutions. Variances between states were also noted, with South Australia having already experienced a minimum demand event.

Consensus that there are multiple problems to be addressed

Conversations raised the varying elements that could be included such as:

- System strength issues due to high levels of non-synchronous generation
- Pace of change and role of technology
- Social licence for orchestration/control
- Economic impacts of low pricing on customers who have invested in local solar PV

“Minimum demand” may not be the most accurate term

Language was an important topic, with stakeholders raising negative connotations with the term “demand” and the supply centric nature of the term “minimum demand”. A range of suggestions were made including “Minimum System Load”.

Need to accept some possible realities in order to prioritise ‘no regret’ solutions

It was acknowledged that this is an emerging challenge that will be driven by the pace of customer demand. In many ways this was a sign of the success of the solar sector, but this meant traditional forecasting mechanisms were not always suitable. Stakeholders raised the significant work underway to support DER integration e.g. Dynamic Operating Envelopes, Standards etc. However there was acknowledgement that the system strength issue may emerge faster in some locations than implementation of these solutions. With that in mind, ‘no regrets’ decisions need to made today to enable future solutions and this will involve a range of solutions.

Maturity Plan process

Phase 1

Prework done by the customer groups presented helped to shape and contextualise the conversation

Independent to the Maturity Plan Pilot, customer advocates drafted a problem statement document that gave stakeholders a starting point for discussion. This process also helped the less technical stakeholders to understand the challenge, while ensuring the challenge was framed from a customer perspective.

Some concern about the "messiness" of the workshop and lack of concrete outcomes

Stakeholders unfamiliar with the design thinking process found the initial workshop difficult. Some felt that there were still varying thoughts on the problem statement and that the activities moved into solutioning mode too quickly. The online format and technology also created some issues.

Lack of understanding of the design thinking methodology

Design thinking and human centered design are commonly used to create customer centered policy and solutions. However, the energy sector has traditionally used more linear processes.

Questions about whether the process should be technical or customer focused

The "minimum demand" challenge is an emerging challenge which is not being directly addressed in many other forums. The Maturity Plan was designed to take a customer perspective on a range of problems that impact customers. Given that this is a system issue, many raised that it could be resolved with minimal impact on customers, however others mentioned that any form of control behind the meter, or increase in costs, would impact the customer. This is why a customer perspective was needed.

What we heard about

Phase 2

Responding to the challenge of “minimum demand”

The Phase 2 workshop provided an opportunity for participants to explore the problems of “minimum demand” in more detail and begin to consider the wide range of solution ideas.

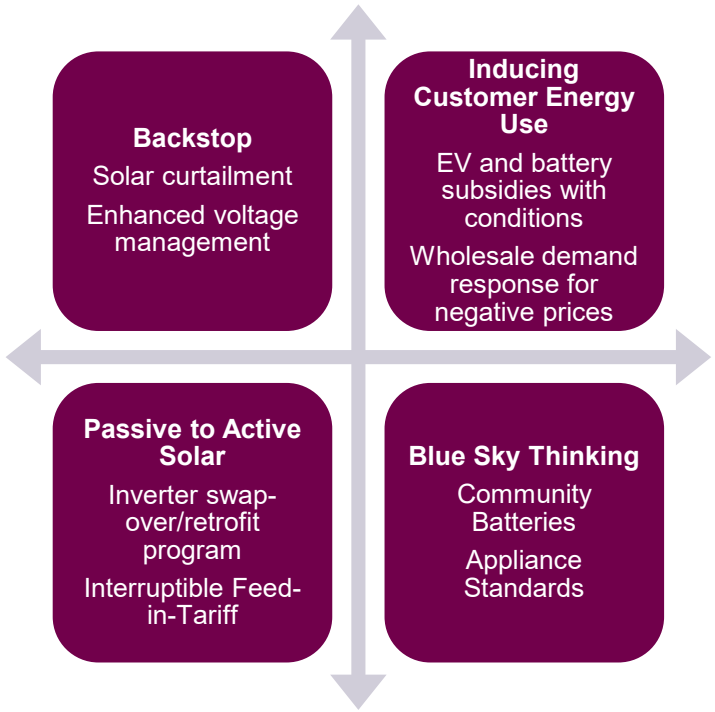
Key insights heard from the conversation:

- The problem(s) could be contained within three key areas: technology, market and policy
- “Minimum demand” is not the best term to use to define the problem(s)
- The diversity of constraints and considerations mean that assumptions need to be made and accepted to move forward to develop ‘no regrets’ options
- Solutions will need to cover a range of issues and address several different areas to provide a whole-of-system approach

When exploring customer needs and expectations from solutions related to “minimum demand”, the following need to be considered:

- Cost consideration and support stabilisation of costs
- Provision of energy security and reliability
- Ease and trustworthiness
- Support ROI/investment for customers who have solar and battery assets
- Support empowering customers

Following workshop 2, the ESB *design squad* reviewed the solutions proposed and data captured. Their role was to refine the long list of ideas into a series of workable options. What evolved were a series of scenarios based on each of the directions.



Synthesis summary

Phase 2

Phase 2 explored customer expectations and needs for a ‘good’ solution, before generating ideas associated with four broad solution directions. The insights validated the customer centric principles developed by the stakeholder cohort (presented Phase 1 workshop) and provided a framework for ideation. Following the workshop, the ESB *design squad* analysed the outputs to shape the continued development of the Maturity Plan.

Customer impacts	Technical understanding and solutions	Maturity Plan process
Insights relating to customers impacts: • General acceptance that a good solution would respond to the proposed customer centric principles • Transparency and communication was considered important in order to build trust • Relationships with a broader national vision were highlighted as a possible missing link • Cost consideration and support for stabilisation of costs for all customers, while also supporting ROI for customers who have solar and battery assets • Energy security and reliability remain front of mind for customers • Solutions need to support the empowering of customers	Insights relating to technical understanding and solutions highlighted concerns relating to “minimum demand,” using both backstop and transition measures. These included: • Any future backstops would require well defined arrangements and information • Allow short term or seasonal changes to when network direct load control can be used • Extend Wholesale Demand Response Mechanism to enable “Turn Up” capacity during negative pricing • Create negative RERT Mechanism (e.g., Turn Up RERT) • Enhanced voltage management	Insights relating to the Maturity Plan process: • An explanation of design thinking framework, and how it works, was received well and appeared to address some concerns from Phase 1 • Some were concerned that the customer centric approach limited the conversation and was not technically sufficient

Customer impacts

Phase 2

Language is a barrier to acceptance and understanding

Industry stakeholders currently use "minimum demand" as short-hand for minimum operational demand. Some stakeholders don't like this reference as it doesn't capture the system level nature of the problem and 'blaming' demand has negative connotations.

Some stakeholders suggested "Minimum System Load". This is the term the Reliability Panel used 27 times in their *2020 Annual Market Performance Review*. The ESB recommendations and Maturity Plan process may provide an opportunity to start shifting language to reflect feedback.

Recommend shift to "Minimum System Load".

Need to design for customer acceptance and compliance

There are continued questions on the application of the National Energy Customer Framework (NECF) to new energy services. Each solution needs to be assessed and there is possibility of leveraging the New Energy Tech Code under the Australian Consumer Law (ACL) where the NECF does not apply.

Compliance mechanisms will play an important role in building social license and trust with customers. This is still an open question in some jurisdictions where stakeholders have highlighted increasing risks.

Move the conversation from scarcity to abundance

Many stakeholders have long campaigned on energy efficiency and savings. The pilot saw significant shifts in stakeholder perspectives as they learn about the challenges of increasing periods of abundance.

This will require engagement to change understanding of 'demand side response' from a 'turning off / going without' concept. In a future with abundant renewable energy (and cheap midday solar), this becomes more about 'flexible demand' and where customers can shift (part of) their load to other times of the day.

Continued education and collaboration will be needed to build social license with installers and customers. Potential to do so through solar accreditation programs (e.g., via Clean Energy Council)

Clear, simple, timely communication

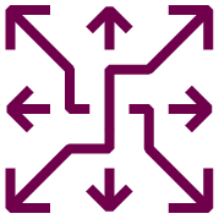
Changing demand profiles are contributing to a range of issues which can be confused by stakeholders and make engagement on solutions difficult.

This can make it challenging for stakeholders to understand when (or how likely) a minimum demand situation is to occur.

Clear information on the duration and frequency of minimum demand events will streamline consultation.

Technical understanding and possible solutions

Phase 2



Any future backstops would require well defined arrangements and information

- Clearly define in what circumstances a backstop will be used
- Quantify how often a backstop may be used now and, in the future
- Reporting obligations when a backstop is used: Why did it happen? How many people were affected? To what extent were people affected?
- Improve visibility to the market of system load events though market notices, 7-day outlooks, a ‘lack of load’ framework, like how peak demand is communicated
- If a solar curtailment backstop is implemented, allow customer choice of how they curtail solar
- This includes options to zero export vs zero generate, control at the inverter vs smart meter, etc.

Allow short term or seasonal changes to when network direct load control can be used

Options could include:

1. Allowing seasonal or shorter-term changes to when the controlled load tariff applies, moving it into the afternoon during shoulder periods e.g., hot water load
2. Allowing networks to use direct load control during minimum system load events when directed to maintain minimum operational demand levels
3. Explore contracts with large energy users for "turn up load" similar to emergency peak demand contracts.

Two-sided market reforms will encourage greater control of load in the medium term. Outside of technical challenges there will be many customer protection considerations to assess.

Technical understanding and possible solutions

Phase 2

Extend Wholesale Demand Response Mechanism to enable "Turn Up" capacity during negative pricing

- Advantages: In market mechanism; Can already use existing WDR mechanism, but in reverse.
- Disadvantages: Due to the shallower market floor there may be less incentive to take up these services relative to high price "Turn Down" services (although a provider could bid into both).

Create negative RERT Mechanism (e.g., Turn Up RERT)

- Advantages: Reliability and Emergency Reserve Trader (RERT) can be a good 'lead generation' to get participants into demand response that could lead to permanent load shifting/flexibility capabilities.
- Disadvantages: Off market mechanism; Could be very expensive, if used often, may get impermanent or wasteful load shifting.

Potential to carry out work identifying how much capacity industry may put into these market mechanisms and at what price points, and modelling on how often a RERT mechanism may be used.

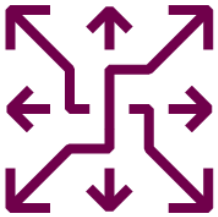
If successful, this could be trialled in the regulatory sandbox, as an in-market trial in conjunction with ARENA.

Enhanced voltage management

- The network would turn up the voltage on specific feeders to cause solar on that feeder to turn down or switch off due to the "volt-watt response mode" in the AS4777 standard.
- This was used by SAPN during the March 14th "minimum demand" event in conjunction with other measures to raise operational demand.
- Seen by many stakeholders as effective and cost-effective short-term measure.
- Needs safeguards and reporting to ensure safe use.
- Will become less palatable to stakeholders the more it's used over time, which is a feature to some stakeholders as it means that there is more incentive to limit its use and sunset this mechanism.

Maturity Plan process

Phase 2



Design thinking overview appeared to address some concern from Phase 1

Some time was taken during Phase 2 workshop to provide an overview of design thinking. This allowed participants to understand the process and provided context to their experience. Based on the groups' discussion it appeared to reduce some concerns about the process.

Customer centric approach can offer value in technical problems

While some participants voiced concern regarding the lack of technical importance and content within the conversations to date, a customer approach proved beneficial in establishing common ground. Participants were encouraged to accept a number of technical realities and explore the problem and solutions within a set of constraints. As such the conversation was able to move forward, centred on customer needs, which was a foundation that most could agree on.

Varying perspectives surfaced

There was significant value in understanding the broad church of perspectives both for policy makers but also the stakeholders present. A broad cross section of speakers were invited to talk at the beginning of this workshop. This sense of openness and honesty stimulated frank conversations in the breakout rooms.

End to end solutioning

Traditional rule change processes can start with a solution in mind that is then iterated. During this phase, stakeholders were encouraged to bring forward any possible directions. This allowed for a variety of technical solutions and enablers to be brought up.

What we heard about

Phase 3

Scenarios offering the best outcomes

The Phase 3 workshop brought together the problem definition insights with synthesis of the ideas generation to propose eight scenarios. These scenarios were tested using the Customer Risk Assessment Framework to understand opportunities, risks and considerations of implementation.

Key insights heard from the conversation:

- Transparency and clarity of information to customers was critical across all possible solutions. Setting clear explanations of what is being implemented and why prior to implementation was a common requirement.
- Customer choice and warning was the next evolution of information. It was identified that for a solution to be successful it would need to give customers access to information about what is happening and when. This would provide customers with choice and empower them to make good decisions or change their behaviours.
- Clear, strong regulation that allows for new technology while providing security and quality assurance is a further critical requirement. This will allow the balancing of customer needs, emerging technology and the existing system.
- There was recognition that there will be trade offs and that different customers will experience these differently. A robust approach considering costs and benefits needs to focus on equitably distributing both.

Phase 3

Synthesis summary

Phase 3 explored eight possible scenarios and applied a customer persona to exploring the risks, benefits and opportunities. This uncovered common themes across customer expectations and some initial technical considerations for each scenario.

Customer impacts	Technical understanding and solutions	Maturity Plan process
Insights relating to customer impacts reinforced needs and expectations from previous workshops. Across all scenarios, there was consensus that a good solution would provide customers with: • Transparency of information and rationale • Communication that would inform and empower • Cost benefit for all customers • Option to participate in the energy eco-system to varying degrees	Insights relating to technical issues uncovered a range of considerations, risks and benefits that could be provided by the specific scenarios. These related to: • Regulatory considerations • Technology acceptance, adoptions and integration • Quality assurance and safety • Network integrations and planning	Feedback collected at the conclusion of the workshop provided insights relating to the maturity plan process: • The approach brought together a diversity of stakeholders to share their perspectives • Format was considered too lengthy • Most people reported they enjoyed the process however it was difficult at times

Customer impacts

Phase 3

Solution scenario	Customer considerations or impacts
Community Batteries	• Allows customers to store excess energy and participate in the market with less complexity • Those without solar can get access to benefits of the solar power in their local network • Communication and implementation could be done through local governments, community owners, retailers depending on model • Customer could have flexibility to gift or sell their “excess” energy • Benefits will depend heavily on contracts involved; costs and benefits distribution, if done poorly, could create inequities or unintended consequences.
Appliance Standards	• Education is pivotal to the rollout • Opportunity to participate in Demand Resposonse DR programs • Removes burden of having to consciously shift load • Could increase cost and complexity of appliances
Inverter swap-over/retrofit program	• Enable the customer to access retail products and services (or network offerings such as flexible exports) that rely on having control • Benefits to other customers in the area (as it may allow more PV to be installed), but minimal benefits to power-generating customer unless they are getting paid when curtailed • Customers could lose their premium Feed in Tariff (FiT)

Customer impacts

Phase 3

Solution	Customer considerations or impacts
Interruptible Feed-in-Tariff	• Simple product, customer benefits with low effort and system operator gets access to curtail these systems in emergency • Needs an opt-out capability, guarantees, and ongoing information available to customers • Question about whether there's a need to inform customers about each instance of solar curtailment. There may be too much/unnecessary information. May also offer 'low' frequency communication, such as line item on bill • Retailer would be getting consent of customer and has relationship/will inform customer
EV and battery subsidies with conditions	• Could lead to savings from deferred network upgrades, although probably realised further into the future • customers need to understand the full terms and conditions • Is it a single option or different levels of compensations for different conditions? • Customers may be resistant to offering up centralised control of EVs
Wholesale demand response for negative prices	• Customers would be reliant on third party trusted "aggregator/retailer/agent" to operate this program on their behalf • Aggregators would reach out to customers to seek their participation and would give advanced notification • Need to resolve customer protection issues and allocation of risk/responsibility in these products • Could focus on C&I customers first
Solar curtailment	• Customer needs enough information to make a good investment decision. For example, they need to be told about frequency and duration of solar curtailment at the point of purchase, which will reduce uncertainty • Solar installers have a role to play in informing customers • There are likely concerns about security and decision-making powers
Enhanced voltage management	• Provides for continued high uptake of solar installation • Appliances sensitive to voltage may be at risk • May result in some increased costs to customers

Phase 3

Technical understanding and possible solutions

Curtailment

- A prudent, perhaps necessary emergency response, but should only be implemented in addition to other measures as a rare occurrence
- Could ensure the viability of continued rooftop solar installation, as long as regulation of and information about its implementation has a controlled impact on the return-on-investment of installation
- Retrofitting systems to allow curtailment could and should allow other system improvements for customers, though there will need to be standards for curtailment controllers
- Cyber security is a risk
- Possible that solar systems should be more appropriately sized

Inverter Retrofit/Swap

- Would significantly increase capacity to respond to the situation but would be a major logistics and cost challenge, with quality of product and installation being crucial
- Would require a significant public education campaign, especially if costs are involved
- Ties into standards work underway

Enhanced Voltage Management

- A technical solution that need not involve customers in its operation, though installation would need to be well explained
- Simple, fast and cheap to implement, but significant risks if not installed correctly, risking damage to devices

Interruptible Feed-in Tariff

- Seems to be a simple product to sell to customers to encourage participation
- There could be unintended consequences associated with expectations around feed-in tariffs even if interruptible, for instance, in relation to right-sizing systems and encouraging self-consumption
- May exacerbate the equity issues between those with the capacity to install rooftop solar and those without

Technical understanding and possible solutions

Phase 3

EV and Battery Subsidies

- Would need to ensure that the subsidies accomplished what was needed and were as effective in response as other subsidisable responses
- How to ensure compliance in the appropriate use of what has been subsidised – customers would need education if not training
- Who pays for the subsidies – perhaps they come from savings in regard to other system upgrades that can then be deferred

Community Batteries

- Can facilitate sustainable energy values and possibly benefit households without rooftop solar, though there are issues of installation and operation costs
- Key issues would be who owns and operates, and careful contracting for those feeding in and those then using the energy
- There may be issues of where these are located

WDR for Negative Prices

- Allows households without rooftop solar to benefit from the opportunities associated with surplus supply events
- customers would be reliant on third party aggregators and vice versa, so there would be customer protection issues

Appliance Standard

- Much work has been done in this area, so the key is rapid uptake
- This could increase the costs of systems, especially since installation quality must be high
- Standards may prove inadequate in keeping up with developing technology

Maturity Plan Process

Phase 3

At the end of the final workshop, we asked participants for their feedback on the overall co-design process. Feedback was sought about how much they enjoyed process, how collaborative it felt and how effective they felt this approach to problem-solving was.

Participants told us:

- More than half felt it was enjoyable (61% rated 7 or above, with an average rating of 6.7/10)
- Most indicated that the process was collaborative (86% rated 7 or above) with overall rating 7.8/10
- When asked what they enjoyed most:
  - Diversity of stakeholders, perspectives and views that were shared
  - Evidence of culture change in the market
  - Allowed collaboration and understanding
- When asked what they least enjoyed:
  - Problem clarity and lack of agreement around the problem definition
  - Lack of clarity around how this approach fits in with other working groups
  - Long sessions were difficult for some
- Suggested improvements included:
  - Bring in real customers or customer data
  - More information or data about the problem
  - Conduct over a longer period of time or in person

"Good mix of stakeholders"

"Being able to hear views from across the industry from my desk"

"Interactive reviewing of ideas"

"Collaboration, different approach, exploring, structured"

"Long sessions are hard to accommodate"

"Some participants' resistance to allowing the process to play out"

"Problem needed clearer explanation and agreement"

Conclusions

Design thinking is best applied to complex, human-centered problems. These problems typically involve multiple systems, affect diverse groups of people and are a result of rapidly changing social or market conditions. “Minimum demand” is a problem well-suited for this problem-solving approach.

Based on the aims of the co-design approach, it is considered that the objectives were achieved. This is supported by stakeholder feedback and outcomes generated from the process:

- A range of diverse stakeholders were brought together to represent their interests and explore the problem and possible solutions.
- A space was created for stakeholders to have equal input into understanding and exploring. Grounded by customer-centricity, this allowed for a shared understanding to be applied.
- The approach tested the validity of using design thinking principles as a way of exploring the complexity of the energy sector.

Key recommendations for future applications:

- Provide more detailed briefing at the start of the process
- Enhance data and evidence-base throughout the process
- Extend the time available for consensus building and sharing of information

Laura Stewart
General Manager – Insights, Communication and Creative
RPS Group

Prof Cameron Tonkinwise
Professor School of Design
UTS Design Innovation Research Centre

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