



Project Symphony

Our energy future

Project Symphony

Lessons Learnt Report (Milestone 02: Build and Integrate)

Version 1.0

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Acknowledgements and Disclaimers

Project Symphony has received support from the Australian Renewable Energy Agency (ARENA) as part of ARENA's Advanced Renewables Program.

The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.

The views expressed herein are specific to the conditions set within the Symphony Pilot and are made within the context of the Wholesale Electricity Market in Western Australia.

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1. Background

Project Symphony is a pilot project where customer distributed energy resources (DER) like rooftop solar, battery energy storage and other major appliances, like air conditioning, will be orchestrated as a virtual power plant (VPP) to participate in a future energy market and unlock greater economic and environmental benefits for customers and the wider community.

A collaboration between Western Power, Synergy, AEMO and Energy Policy WA, with funding from the Australian Renewable Energy Agency (ARENA), the Project will understand how the opportunities and challenges of increasing DER can be managed to ensure a reliable, secure, and affordable electricity system. To achieve this purpose, the Project will design, procure, develop, implement, and test software based 'platforms' capable of registering, aggregating and orchestrating customer DER to provide 'must have' on-market and off-market scenarios.

While technology plays an important role in realising the safe and reliable integration of increasing DER, customer participation in sufficient numbers via a positive customer experience will be critical to the success of the Project. In addition to research of the customer experience, the Project includes installing and securing a meaningful aggregation of customer DER assets via direct engagement and multiple third-party aggregators.

To be completed by mid-2023, the Project will secure a minimum of 900 DER assets from approximately 500 customers on a single electricity distribution feeder in the pilot area of Southern River, south east of Perth.

The following four 'must-have' scenarios will be designed developed and tested during the Project:

a. **Scenario 1: Energy Services – Bi-directional Energy - Balancing Market:**

- a. The balancing market is a mandatory 'gross pool' market for dispatch and 'net pool' for settlement that determines the most economically efficient dispatch of generation to meet system electricity demand at a given time.
- b. All registered facilities, including DER aggregated generation facilities must be available to participate and must comply with the resulting dispatch instructions from the market operator (AEMO).
- c. The aggregator is able to offer (sell) or bid (buy) energy into the balancing market whilst incorporating or adhering to a 'dynamic operating envelope' (DOE), provided by the distribution system operator, which is designed to maximise or increase the amount of renewable hosting capacity on the network by publishing the total available power transfer capacity (load and generation) at a given time.

b. **Scenario 2: Network Support Services (as part of Alternative Options):**

- a. A contracted service provided by a generator, retailer, or DER aggregator to the network operator/DSO (Western Power) to help manage or solve localised network constraints.

- b. A network support service could alleviate distribution level peak electricity demand or reverse power flow and/or local voltage issues identified by the DSO at a cost that is less than traditional augmentation such as larger transformers, more ‘poles and wires’ or otherwise expanding capacity.
- c. **Scenario 3: ‘Constrain to Zero’:**
 - a. To demonstrate the ability of the AEMO Platform to instruct the Aggregator platform to constrain energy output from DER to zero export (net) or zero output (gross). The intention is that this could be offered as a market or retailer service.
- d. **Scenario 4: Essential System Service (ESS) - Contingency Raise:**
 - a. Market provided response to a locally detected frequency deviation to help restore frequency to an acceptable level in the case of a ‘contingency event’ such as the sudden loss of a large generator or load.
 - b. An example of raise is the discharge of rapid generation such as starting a fast response generator on the network to bring frequency back to an acceptable level.

2. Purpose and Approach

The purpose of this report is to provide a high-level overview of the lessons learnt during the *build and integrate* phase (Milestone 2) of Project Symphony.

A workshop-based approach with participation by key members of each partner organisation, including Energy Policy WA was used, and focussed on the following principles of engagement:

- Be open and transparent.
- Language should be neutral/unemotional and matter of fact – we are bystanders observing.
- Focus on behaviours, processes, and outcomes rather than people.
- Lessons aim to be insightful and valuable to others in a similar position.

Overall, what supportive advice would you give to a similar project team about to embark on exactly the same type of project?

3. WA Context

The West Australian context for the pilot is important, noting that unlike the NEM, the SWIS is an isolated network that must balance all demand and generation loads internally without reliance on interconnectors. The independent Australian Energy Market Operator (AEMO), a participant in Symphony, has the role of ensuring this balance is maintained at all times as it manages the security of the SWIS and the WEM.

Energy Policy WA (EPWA) is the government agency responsible for the delivery of energy policy advice to the WA Minister for Energy, and is also responsible for supporting the delivery of the government’s Energy Transformation Strategy, including a key partner to Project Symphony providing active guidance and oversight.

The WA Government owns three corporations with active roles in the WA electricity supply chain. Two of these corporations are involved in Project Symphony:

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- Western Power, as lead participant, which is solely responsible for building, maintaining and operating the electricity transmission and distribution network within the South West Interconnected System (SWIS); and
- Synergy, which sells and generates power within the SWIS. Synergy is the sole retailer for most customers consuming less than 50MWh/year in the SWIS. Retail and export tariffs are regulated and set by the State Government for these customers.

The rapid growth in distributed energy resources (DER), such as rooftop solar, while delivering significant financial and environmental benefits for individuals owning DER, is leading to a range of emerging issues for network operators such as Western Power and challenging the traditional electricity generation and retail business models.

The WA community is installing rooftop solar at unprecedented rates. With one in three households in the SWIS already having a rooftop solar PV system, and around 4,000 households adding a new system each month, customers with DER are already enjoying the benefits of lower electricity bills while contributing to de-carbonising the power system.

However, the high penetration of DER can pose a significant risk to power system stability, for example at times of low system demand. Based on advice from AEMO the stability of the SWIS may be at material risk as early as 2022, if DER are not efficiently and effectively managed (Australian Energy Market Operator (AEMO), 2019).

In response, the WA Government released the DER Roadmap of which Project Symphony is a key DER Roadmap Action.

Action	Element	Owner	Description	Priority
22	DER Orchestration	Synergy, EPWA Western Power	By July 2020, commence a comprehensive VPP technology pilot to demonstrate the end to end technical capability of DER in the SWIS...and transition to market participation testing.	High
23	DER Orchestration	Synergy AEMO	Complete a comprehensive VPP market participation pilot that tests the incorporation of aggregated DER into energy markets, including market dispatch and settlement arrangements from the market operator to individual customer.	High

Rooftop solar installation rates have already far exceeded forecasts with over 500MW of new capacity added since the DER Roadmap was published. Other technical issues have also come to light and the risks associated with low load and high levels of DER have further been refined (AEMO, 2021c). While EPWA and AEMO will work with Western Power and Synergy to develop and implement interim solutions to these challenges, including 'last resort' measures to reduce or constrain rooftop solar generation such as Emergency Solar Management (ESM), the Project is still regarded as delivering the best long-term outcomes for customers and the power system via active DER participation through market-based mechanisms. Project Symphony will lay the groundwork for enabling WA consumers to opt-in to aggregated virtual power plants and provide services to the network and WEM, including turning down (or using up) excess output, or managing demand in

return for compensation. One of the Project's working hypotheses is that DER can provide cheaper, lower carbon outcomes through network and market services (e.g. load under control, generation under control, frequency, voltage) in a way that shares the most value with customers through their participation, than the alternative of significant network investment and transmission level responses.

4. Lessons Learnt

4.1. Summary

Following the delivery of the scoping and planning phase of the project (Milestone 1), Project Symphony has focused on the build and integrate (Milestone 2) of the partners' technology solutions, along with the scaled acquisition of customers, and the integration of newly acquired customer assets into the aggregator platform.

Project Symphony is an innovative project that is ambitiously aggregating several types, and several different manufacturer brands, of new and existing customer owned DER assets being; rooftop solar, battery energy storage systems, hot water systems and air-conditioners along with a large behind the meter battery and a network connected 1.2MW battery. The complexity inherent in Project Symphony is reflected in the lessons learnt for Milestone 2, with a focus on Technology and Customer Acquisition.

From a technology perspective, the highlight of Milestone 2 was the successful minimum viable product (MVP) testing which simulated the aggregation of energy from 10 customers and 20 assets into a facility which was then dispatched and 'traded' over six 5-min trading intervals. Whilst this integration was largely manual, subsequent testing has increased the automation of these functions.

From a customer acquisition perspective, the highlight has been the acquisition of approximately 200 customers and over 500 DER assets. Synergy, as the aggregator, deliberately used a phased recruitment strategy, utilising customer feedback from each phase to refine product development or offer additional products in order to sign up the right type, location and concentration of DER assets on a single electricity distribution 'feeder'. This resulted in a key lesson that a phased recruitment strategy, along with the early analysis of customer feedback into product development will lead to new and enhanced offerings which results in a larger pool of eligible customers to recruit from.

The project is now also observing the initial lessons learnt with regards to policy and regulation with aggregated DER's performance standards being tested along with an understanding of the suitability of existing market rules to accommodate aggregated DER.

Whilst Project Symphony is demonstrating its flexibility by accommodating different requirements, specifications and solutions, it is understood that while testing these against different constructs can be valuable, it will not necessarily result in greater or faster VPP facilitation without rule or policy changes. The importance is in the identification of barriers to the participation of customer DER in providing on and off market services in the future which will require a gap analysis to highlight the required rule and policy changes based on the robust outcomes of Project Symphony.

Finally, the lessons learnt for Milestone 2 clearly demonstrate the continued need for collaborative ways of working across four independent partner organisations. They also highlight the requirement for the project to be flexible and open to refinement and iteration as it is being delivered.

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4.2. Lessons Learnt - Customer Engagement & Experience

No.	Subject / Topic	Barrier OR Benefit	Outcome and / or Lesson
1	Customer – data sharing	Barrier: The original customer contract along with the Electricity Industry (Metering) Code 2012, and project partner privacy obligations did not adequately facilitate the level of data sharing required.	<p>Outcome: Some data / information was deemed confidential and could not be shared between project partners during functional testing, impacting the efficiency and transparency of data flows between platforms. As a solution, an amendment to contracts with customers participating in Project Symphony enabling the sharing of relevant data has been implemented.</p> <p>Lesson: To enable VPP services and participation, higher levels of customer data sharing are required across the different value chain participants than has previously been the case for a traditional ‘one-way’ electricity network. Data sharing arrangements for all scenarios should be considered at the outset of the project.</p>
2	Customer – customer benefits	Barrier: Customer participation in a VPP, particularly for battery customers, still requires a significant financial investment. Currently there are challenges in demonstrating the ongoing benefits of VPP participation when existing tariffs are not more cost reflective and are protecting customers against negative or peak pricing.	<p>Outcome: Customer acquisition targets impacted by the relative inability to demonstrate a clearer financial or reliability benefit beyond the timeframes of the project.</p> <p>Lesson: Consideration of adopting more cost reflective pricing / tariffs, with clear economic signalling, ahead of scaling a VPP roll out.</p>
3	Customer - engagement	Benefit: A mix of broad reach (Harrisdale Shopping Centre) and direct marketing channels provides multiple opportunities to engage customers on the benefits of participation.	<p>Outcome: Enabled initial contact with a large group of people within the target area to be followed up via several different channels to provide the right message to the right people at the right time to enhance marketing effectiveness.</p> <p>Lesson: Similar programs would likely benefit from adopting both broad and direct marketing approaches, including</p>

			<p>the use of different channels such as direct mail, electronic direct mail, outbound telephone 'nudge' calls, short message service (SMS), shopping centre 'pop up' stand, social media, website etc.</p>
4	Customer - recruitment	<p>Benefit: An iterative approach to product development, including enhancements, and new product offerings were established as a direct result of customer feedback received during initial recruitment phases.</p>	<p>Outcome: There was improved conversion for later recruitment stages including the re-targeting and recruitment of customers who initially may not have been eligible due to a preferred product or product feature not being available at the outset of the program.</p> <p>Lesson: A phased recruitment strategy, along with the early adoption of customer feedback into product development, leads to new enhanced offerings which results in a larger pool of eligible customers to recruit from.</p>
5	Customer - engagement / recruitment	<p>Barrier: Customer awareness/understanding of 'VPPs', power system fundamentals and 'DER orchestration' in general is low – and the concepts are relatively complex to communicate and understand, requiring multiple touch points and time to achieve customer participation</p>	<p>Outcome: Initially Synergy embedded a sales-person full time to make outbound follow up calls to support the customer through the sales funnel steps and to raise awareness around key DER integration concepts. Additionally, a contract portal was launched providing customers with an online hub which allowed contracts to be reviewed, common concepts to be better understood, as well as reducing the required interactions between Synergy and the potential participant.</p> <p>Lesson: Similar programs should gauge the level of prior understanding / knowledge of key DER integration concepts within the target recruitment area and should digitise the customer experience as much as possible from the outset of customer recruitment.</p>

4.3. Lessons Learnt - Technology

No.	Subject / Topic	Barrier OR Benefit	Outcome and / or Lesson
1	Technology integration – technical requirements	<p>Barrier: Ongoing 'discovery' of technical requirements beyond the planning and scoping phase of the Project. Discovery has continued due to both internal understanding and in response to changes outside of the project.</p>	<p>Outcome: Final functionality and performance requirements of each scenario not well established or understood ahead of integration and/or functional testing has caused some delay to the achievement of common technical outcomes. In addition, external changes including the introduction of Emergency Solar Management has impacted scenario design.</p> <p>Lesson: 'Known knows' and 'known unknowns' relevant to technical and functional requirements should be established and documented via early and ongoing consultation, engagement and agreement between partners.</p> <p>Lesson: Projects need the capacity and flexibility to pivot in response to external environment changes such as policy changes.</p>
2	Technology integration – DER orchestration	<p>Barrier: Limited compatibility / interoperability of DER asset types with, and between, the technology platforms.</p> <p>Barrier: No single technology vendor / provider could provide a turn-key solution.</p> <p>Barrier: Lack of understanding, and adoption, of relevant standards (such as AS4755) by manufacturers and technology providers.</p>	<p>Outcome: While growing in compatibility, a significant proportion of existing/legacy DER assets are unable to be seamlessly registered and integrated into the technology platforms for orchestration, further limiting the pool of eligible customers.</p> <p>Lesson: Contingency to enable the pivot to product enhancements and offerings to customers, including compatible inverter replacements, battery energy storage offerings and compatible appliance replacement.</p> <p>Lesson: Confirm vendors share a common understanding / interpretation of relevant standards and communication protocols. Future or scaled VPP rollouts will need to be supported by a common adoption of standards and protocols including consideration for mandatory application.</p>

			<p>Lesson: Bring platform providers together early, and frequently, in the project to ensure understanding, collaboration and co-operation is achieved.</p>
3	Technology integration – testing	<p>Barrier: Common, end to end integration testing objectives were not well understood or sufficiently defined / documented ahead of testing.</p>	<p>Outcome: Integration testing has been limited to the DER categories of PV and batteries in initial testing due to the volume of assets recruited at the time of testing.</p> <p>Lesson: Establish, document and agree high level strategic testing objectives / outcomes along with more specific tactical, technical objectives prior to each wave of testing.</p>

4.4. Lessons Learnt – Governance

No.	Subject / Topic	Barrier OR Benefit	Outcome and / or Lesson
1	Governance – working groups	<p>Barrier: Working groups process governance was not sufficiently or effectively established upfront.</p>	<p>Outcome: Scenario design was at times stalled and decision making was lengthy.</p> <p>Lesson: Remit of Working Groups needs to be clearly defined at the outset of the project including effective 'independent' facilitation roles and decision / issue escalation pathways.</p>
2	Governance – escalation pathways	<p>Barrier: Unclear escalation and resolution pathways within the technical working groups.</p>	<p>Outcome: Escalation and resolution to problems have at times been slow to be identified and resolved, resulting in time pressures and delays in the development of scenario design.</p> <p>Lesson: While collaboration on the project has generally been effective, at times achieving consensus or compromise on technical design elements between all Project Partners (representing each part of the value chain) has been challenging. For similar Projects, greater involvement from Project Managers and Product Owners or the establishment of independent facilitators to participate in technical working groups and to break deadlocks should be included.</p>

3	Governance – delivery methodology	Barrier: Use of different project management methodologies between the Project Partners: Agile and Waterfall.	Outcome: The key principles of both methodologies are not consistently applied between Project Partners, leading to some frustration in application, confusion and delays due to re-work. Lesson: Attempt to document, agree, communicate, and apply the project management methodology for the overall program upfront.
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4.5. Lessons Learnt – Roles and Responsibilities

No.	Subject / Topic	Barrier OR Benefit	Outcome and / or Lesson
1	Roles and Responsibilities – policy involvement	Benefit: Having EPWA as the policy maker involved at a project level continues to be very beneficial in helping partners reach greater understanding and alignment on future 'DER orchestration' roles and responsibilities.	Outcome: EPWA accelerated finalisation of the Roles and Responsibilities work within the DER Roadmap to assist the project partners in aligning to latest government strategy. Lesson: Involve policy makers at a project level, rather than only at a governance level, to align tactical and strategic directions for project partners.

4.6. Lessons Learnt – Policy and Regulation

No.	Subject / Topic	Barrier OR Benefit	Outcome and / or Lesson
1	Policy and Regulation - participation	Barrier: While recognised as an important benchmark for participation, compliance with existing WEM procedures / specifications (such as the need for high-speed recorder devices on customer batteries) for certain market services may erode the benefit / value of DER participation.	Outcome: A focus on compliance with current market rules, when these will likely have to change, has at times limited the opportunity for innovation and has the potential to slow the scalability of residential VPPs post project completion. Lesson: As with Symphony, similar projects should remain open to testing different possible constructs and solutions in comparison with existing constructs to enable greater and faster VPP facilitation post project completion. Lesson: Test against the existing market rules, identify and quantify the barriers, and if possible, accommodate the testing of alternative solutions to

inform recommendations for DER participation in the future.

4.7. Lessons Learnt – Markets and Services

No.	Subject / Topic	Barrier OR Benefit	Outcome and / or Lesson
1	New Markets – value stacking	Benefit: Having a range of scenarios that are being tested individually and concurrently will enable a greater commercial and technical capability build.	<p>Outcome: By having 2 on market and 2 off market services, Project Symphony will be able to form a view on the benefit and ability for VPP value stacking.</p> <p>Lesson: A range of on-market and off-market services will enable a greater technical and commercial understanding of VPP value.</p>

4.8. Lessons Learnt – Other (external)

No.	Subject / Topic	Barrier OR Benefit	Outcome and / or Lesson
1.	Media Coverage	Benefit: Widespread and ongoing positive media coverage.	<p>Outcome: Creation of Symphony Brand, along with aligned communication from partner organisations, has raised the project's profile within the state and across the country.</p> <p>Lesson: Strong branding with aligned communications can create a greater buy-in from customers and key external stakeholders, including the media.</p>