



Project Progress Report

January 2021

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This project received funding from the Australian Renewable Energy Agency (ARENA) as part of their Advancing 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.

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1. About the Project

deX is a digital platform that enables electricity grids to support more renewables, handling the growing increase in rooftop solar, electric vehicles and other distributed energy resources (DER). As well as giving the industry a panoramic view of energy demand and supply from these DER, it also opens up new opportunities in managing energy marketplaces, trading energy services, protecting the network and more.

ARENA is contributing \$10 million over four years to accelerate the development of deX. This funding contributes to the total project value of \$32 million to enable scaling up of the deX platform in Australia through select partnership projects with governments, networks and technology vendors over the remaining two years.

2. Executive Summary

The primary focus of the report is to outline the progress of the deX platform's development in terms of the software application suite, product / feature development, ability to scale the platform and partnerships underway within the remit of the project or alongside. The report details both software development progress and wider industry engagement and collaboration activities during the period from July to December 2020.

Development was initially impacted by the Covid-19 pandemic, however, in the second half of 2020 we were able to return to our pre-pandemic rate of productivity and momentum and make substantial advancements across all the key deX applications. In particular, significant enhancements have been made to the technology vendor integration and DER registration functionality and their associated processes.

3. deX Software Development

deX Vision

deX Vision is the overarching term that encompasses all deX products and services for network and system operators. The deX Vision application and the deX for Distribution Networks product offering provides Distribution Network Service Providers (DNSPs) with the capability to manage the impacts of DER on their networks. This application's feature set represents an essential, foundational capability for distribution businesses who wish to bridge the transition to a customer-oriented Distribution System Operator (DSO) operating model.

deX Vision works with existing network management systems to enable the management of both aggregated and unaggregated DER across the network at scale. In near real-time, both static and dynamic DER information showing the **capability, telemetry and impact of DER** can be viewed. Through mechanisms in deX that can adjust DER behaviour, DER can be employed to provide services to the network such as energy exporting to ensure that the network is maintained within technical limits.

Significant progress in the deX Vision application feature set has been driven by the ARENA funded DER Integration and Automation project between Evoenergy, GreenSync and an Advanced Distribution Management System (ADMS) provider. The project is researching and testing (via simulation) potential market platforms that will support Canberra's rapidly changing energy market. Primarily using the DSO contracting capability of deX Markets and the dynamic limits functionality of deX Vision, this project explores the effect that DER such as solar photovoltaics (PV), battery installations and electric vehicles have on the electricity network, and explore how these resources can be utilised by customers to their full potential.

In particular, work has been focussed on completing the development and internal testing of the deX Evaluation Engine and associated functionality required for the above mentioned project. The role of the Evaluation Engine is to evaluate sets of existing contracts with service providers and - subject to a set of constraints - determine an optimal dispatch strategy to achieve a certain objective. The Evaluation Engine has been designed and built to be extensible so that different criteria can be applied according to the needs of the network. The Evaluation Engine has also been completely automated and all service requirements received by the Evaluation Engine are actioned as dispatches without any user interaction.

To provide visibility of the Evaluation Engine outputs a view of the Evaluation Engine within deX Vision has been implemented. Although the user has no ability to change the configuration or behaviour of the Evaluation Engine, this view allows the results of the Evaluation Engine to be

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visualised, including the utilisation of the service contracts. Furthermore, deX vision provides a convenient mechanism for visualising the behaviour of DER and the impacts of control in the network.

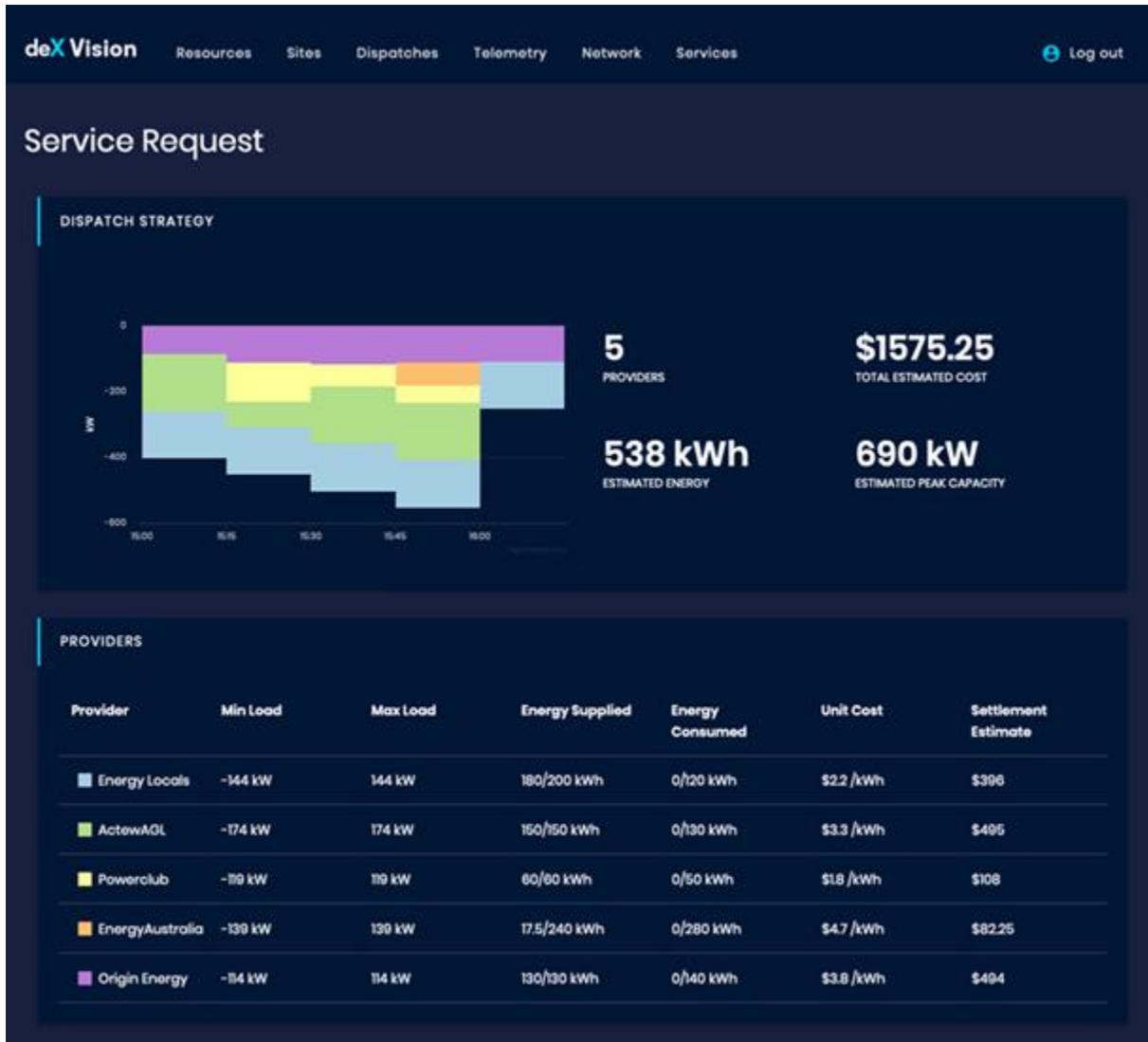


Image 1: Evaluation Engine dispatch view in deX Vision

The other recent development and integration work delivered as part of the DER Integration and Automation project included building interfaces between deX and the deX Evaluation Engine and between the deX Evaluation Engine and Evoenergy’s IoT (Information of Things) Hub, developing processes for deX to receive a single DER request and to approve/reject such requests, and developing and integrating a simulated VPP in to deX. In total there are six key

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deX systems that interact with each other and the IoT Hub to provide the required functionality for this project.

The implementation of these components collectively enable deX to automate the calling of forward option contracts to meet a service requirement from the ADMS, as well as the ability to identify dispatch combinations that will meet service requirements. The realisation of this functionality ultimately culminates in the ability for deX to protect the network from PV generation and VPP behaviour via Dynamic Limits, and from overloads by calling on Forward Option Contracts.

Lessons Learnt

DER capabilities

The DER Integration and Automation project highlights the opportunities in utilising dynamic control to maximise customer's access to, and utilisation of existing network capacity. For the benefits identified in this project to be realised in a real life context, the percentage of DER that is able to provide these functions should be maximised. This could be achieved through a number of mechanisms including regulatory obligations, incentives (e.g. export limits, or tariffs) or others.

There are a set of minimum technical capabilities that the DER must meet to be able to provide these functions (in conjunction with other systems in the project). These include:

- Being internet connected with frequent communications to a management system
- Ability to provide telemetry for real power on a relatively frequent time basis (e.g. 5 minutes)
- Ability to receive control on a relatively frequent time basis (e.g. 5 minutes) to:
 - Limit behaviour
 - Target output to some setpoint value
- Ability to revert to some default safe behaviour in loss of communications
- Ability to be able to provide scheduled behaviour and flexibility for consumption by network management systems

Race conditions

The inability for network systems to receive and associate schedules with a unique identifier introduces potential race conditions that may result in non-deterministic outcomes. To ensure that schedules received by deX are correctly associated with the most recent revision of submitted schedules, network systems must be capable of receiving and providing a unique identifier with the schedules.

The implication of not having a unique identifier associated with a schedule is that instructions received from the network systems could be out of date. This may result in requests for services being provided by network systems that are either insufficient or exceed the requirements for resolution of network issues. Both of these outcomes are sub-optimal from a network operation perspective.

Non-exclusivity

To allow DER to provide the greatest possible value, it should be possible for DER to be used in resolution of more than one network issue. To achieve this, it is necessary for DER to be capable of belonging to multiple DER groups in network systems.

For example, a DER may be simultaneously capable of solving:

- Thermal overload on a zone substation;
- Thermal overload on feeder section;
- Overvoltage on a distribution substation.

Non-exclusivity would allow for resources to be members of groups to solve each of these network issues simultaneously.

Dynamic membership

To reflect the dynamic nature of the distribution network configuration, it is essential that DER group membership can be updated over time. Dynamic membership complements the non-exclusivity functionality, by ensuring that the membership of DER to DER group(s), reflects the capability of those resources to address network issues associated with that group.

For example a resource that moves from one feeder to another as a result of network reconfiguration, should be removed from any groups of network areas that it no longer belongs to added to any new groups for network areas that it is now connected to. The membership of resource to DER groups should be updated and provided by network systems on a periodic basis.

Limit allocation strategy

Current industry thinking around the allocation of network capacity has individual limits determined through some kind of equal/equitable allocation mechanism. These limits would be allocated to ensure that, with suitable headroom, any combination of DER behaviour within their respective limits would not result in violation of any network limits. To achieve this, network systems should be capable of (relatively efficiently) determining the set of limit values for all DER in a network according to some kind of allocation policy.

deX Markets

deX Markets allows distribution market operators, both existing and those wanting to move into this space, to buy and sell energy services and operate flexibility service markets, in any jurisdiction. It supports system operators to limit spending on capital assets and reduces costs for consumers through greater capital efficiency. In essence, it provides more flexibility in the management of the network, including contracting with DER owners to turn up/down services in periods where DER operations would otherwise cause issues such as voltage spikes on low voltage lines and thermal overloading of substation transformers.

The deX Markets functionality outlined above has been developed and applied to the UK Power Networks (UKPN) Advanced Network Management (ANM) project. As part of this project, along with consortium partners Smarter Grid Solutions (SGS) and Nexant, GreenSync is providing UKPN with production quality Distribution System Operator (DSO) capability. GreenSync's deliverables for this project were successfully completed in December 2020. The final release included the functionality to upload telemetry data, nullify/archive contracts, handle unavailability submissions, record dispatch information and perform settlement calculations. The project is scheduled to go-live in the second quarter of 2020.

The successful deployment of this release completes the foundational, and important first implementation, of back-end contracting functionality required in deX Markets. This includes: registration (both participant and DER); tender creation, customer bidding and contracting and bid acceptance; contract lifecycle and operation; measurement and telemetry; and settlement activities.

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Lessons Learnt

A number of learnings and insights were gained during the most recent phase of the UKPN ANM project.

During the development of the bid withdrawal functionality, the decision was made to use a finite state machine to handle state transition for bid submissions. This approach was taken as it enabled strict validation protocols to be implemented that dictate how a bid can move through the bid tendering process. This is important to ensure stringent and verifiable bidding and tendering governance is in place.

When developing the approach for handling unavailability submissions, it was decided that the submission of unavailability periods would be dealt with synchronously by GreenSync's Application Programming Interface (API). By taking this approach unnecessary optimisation was avoided and needless complexity removed. Furthermore, given the expected volume of data provided was relatively small, the decision to avoid premature optimisation was considered both prudent and warranted.

Relevant insights for the Australian market/context

It is useful to understand that the UK network regulatory framework is more conducive to Distribution System Operator (DSO) contracting for flexible services from DER. It is this framework that underpins the drive from UKPN to develop the ANM flexible service contracting platform and market functions. The UK national policy context also includes a very clear drive towards net zero emissions and express desire for increased renewable energy and fast acceleration to electric vehicles across the country.

In contrast, Australia's network regulatory framework is less expressly directive for networks to contract with external parties for services. This can happen, but is - in our experience - slower, and harder to deliver.

However, as Australia moves towards a more open and transparent demand response mechanism, emergency reserve capacity contracts and other 'DER service markets', the potential for flexible contracting for services from DER will grow. It is more likely that once these service markets begin to open more widely in Australia that the capabilities and functions developed through the UKPN ANM project will be applicable for local deployment.

deX Command

The deX Command application enables retailers, aggregators and energy services companies (ESCOs) to leverage deX integrations to facilitate increased DER fleet visibility and management capabilities as well as the ability to contract and dispatch DER. Additionally, and unique to deX Command, is the ability to respond to Distribution System Operator (DSO) contracts, which enables access to dynamic network support opportunities such as real power dispatch to defer network augmentation. The first version of deX Command was released in December 2019.

Work was recently completed to enable Frequency Control Ancillary Services (FCAS) to be managed via deX Command. This functionality takes advantage of continuous trading opportunities within the market and in doing so generates higher value for our clients and DER owners. The first release of this functionality was delivered in September 2020 as part of the ARENA funded VPPx project that GreenSync is working on with partners Simply Energy, South Australian Power Networks (SAPN) and Tesla. This release delivered the functionality to enable Simply Energy's VPP fleet to be registered and participate in the FCAS market. A second release was delivered in December 2020 which included an integration with the AEMO VPP demonstration API, the functionality to produce VPP operational and telemetry data and development of the functionality to enable reactive power dispatch capabilities.

Lessons Learnt

AEMO VPP API Specification has the ability to collect many different data points and there were a number of key learnings acquired during the registration process.

Operational telemetry

- Many VPP operators and DR vendors do not collect, or pass on, the majority of the data points specified in the VPP API specification, but rather the data points which are directly relevant to realising customer and aggregator value for a VPP. Hence they are unavailable
- There are costs for the collection, storage and validation of all telemetry which cannot be justified without a direct benefit to customers or the creation of portfolio revenue

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Operational forecasting

- In our view, the best party to create forecasts is the party which is relying on those forecasts for their decision making
- The forecasting methodology to be adopted must reflect the goals and risks of the decisions which will be driven by the forecast
- If a third party is generating forecasts – but are not incentivised to provide accurate forecasts – they are unlikely to apply the degree of rigour necessary to assure that optimal decision making:
 - If a required forecasting methodology is determined as part of a compliance obligation, then third parties can be asked to adhere to that approach; notwithstanding the data quality issues highlighted above
 - If no methodology is agreed and mandated then a summation/ conglomeration of forecasts from many different methodologies will produce an arbitrary value – however it will not meet the rigour required for decision making and risk management – “you can’t average, averages” - to create a meaningful data point
 - If forecasting methodology can be agreed, asking a series of third parties to adhere to that approach creates two outcomes:
 - Compliance risk and the cost of managing that risk, for the quality of forecasts generated; and
 - Replication of infrastructure – forecasting capability must be developed, deployed and maintained by every single actor
- Modern forecasting techniques are not static, machine learning and artificial intelligence capabilities by their very design, take in new data and refine and improve their algorithms. In our view there is no way for new improved forecasting standards to be practically rolled out to third parties.

Subsequently, it is the view of GreenSync that a centralised solution will be best placed to develop and manage DER forecasting capabilities across the NEM moving forward.

deX Connect

deX Connect establishes an open access digital protocol (and associated physical standards) allowing all DER technologies to participate, create standard contractible services and ensure cybersecurity.

To date, deX Connect has successfully certified nine technology vendors and deX partnerships reached 118 organisations. Most recently we completed integrations with Chargefox and Solar Analytics. The increasing number of integrations, along with the associated exponential growth in registered DER in deX, has required us to reinforce and enhance our integration practices to ensure the greater volume of DER can be seamlessly accommodated in deX.

These integrations enable devices, with customer consents in place, to be registered in deX, and in doing so unlock access to value for the device owners as well as support to the retailers, aggregators, market operators or networks who contract their services. Specifically, registered devices are made visible via deX Connect, in other deX applications. They can then be contracted, via an aggregator or retailer for grid services, unlocking new value streams for device owners such as energy generation during peak demand, managing frequency or grid voltage, or reducing network constraints.

Complementary to the integration related enhancements, the DER registration process has also been improved to provide a more streamlined and efficient experience. The most significant advancements in this area have been the development of a Device Registration Portal and App.

The Device Registration Portal was deployed into production on 25 November 2020 as part of the deX SA project. The deX South Australia Project is supported by the Government of South Australia through the Demand Management Trials Program.

The Device Registration Portal enables DER owners to directly register their personal and DER device details into deX. It can be accessed via the Registration and Enrolment page on the deX SA Portal homepage: <https://dex.energy/locations/south-australia/registration-enrolment/>

In order for the end-to-end DER registration process to be fully realised in production, the following functionality needed to be developed:

- User authentication to ensure only genuine registrations occur
- User consent acceptance and capture
- DER owner record creation and updating

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- DER device record creation and updating
- DER NMI record creation and updating
- DER data validation
- DER data recording

Collectively, the successful development and deployment of all of the functionality listed above enable DER to be registered in deX and 'live' in production.

Following are images of the deX Device Registration and Enrolment pages.

deX

Device Registration

Use this page to register with your contact details.

We will collect your email, first name, last name and a phone number. You will also need to tick the Ts&Cs checkbox before clicking the Submit button.

1 User information

Email *

First name * Last name *

Phone number

2 Terms and conditions

In submitting this form, you:

- acknowledge that GreenSync Pty Ltd will collect:
 - the information included in this form (including any of your personal or sensitive information); and
 - data streams associated with your energy devices or assets, at 1 – 300 second intervals
 for the purposes of your registration and use of the deX platform, and enabling any related communications; and
- consent to GreenSync Pty Ltd collecting and handling this information (including your personal and sensitive information) in accordance with its Privacy Policy. Please see our Privacy Policy for further details about how we use and disclose your personal information (including how we might use it to communicate with you about our products and services) and how you can contact us to access or correct your personal information, or make a complaint.

I agree to the terms and conditions

Image 2: deX Device Registration user information page

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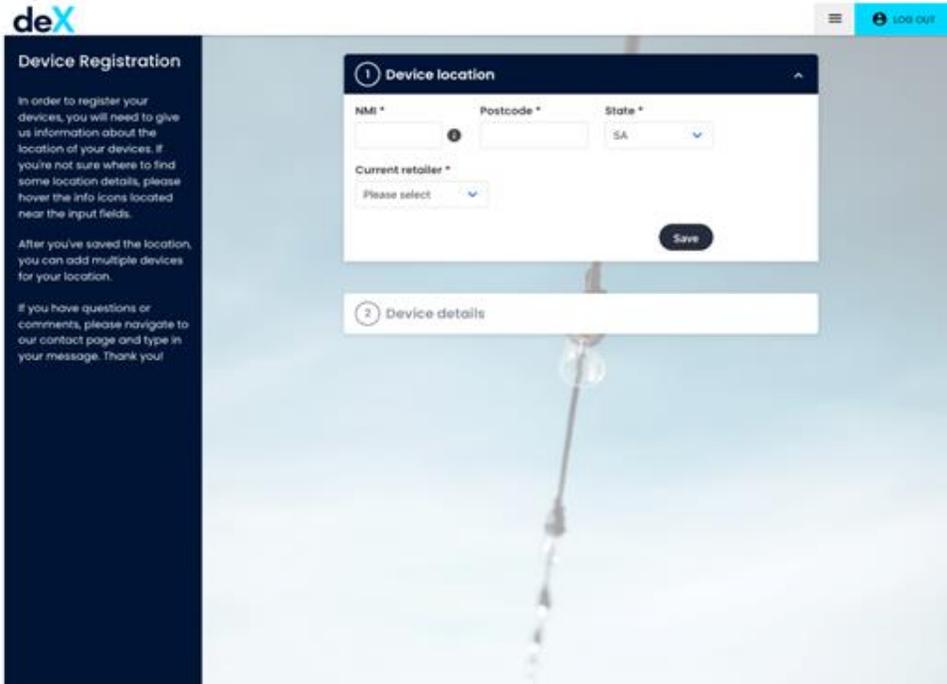


Image 3: deX Device Registration device information page

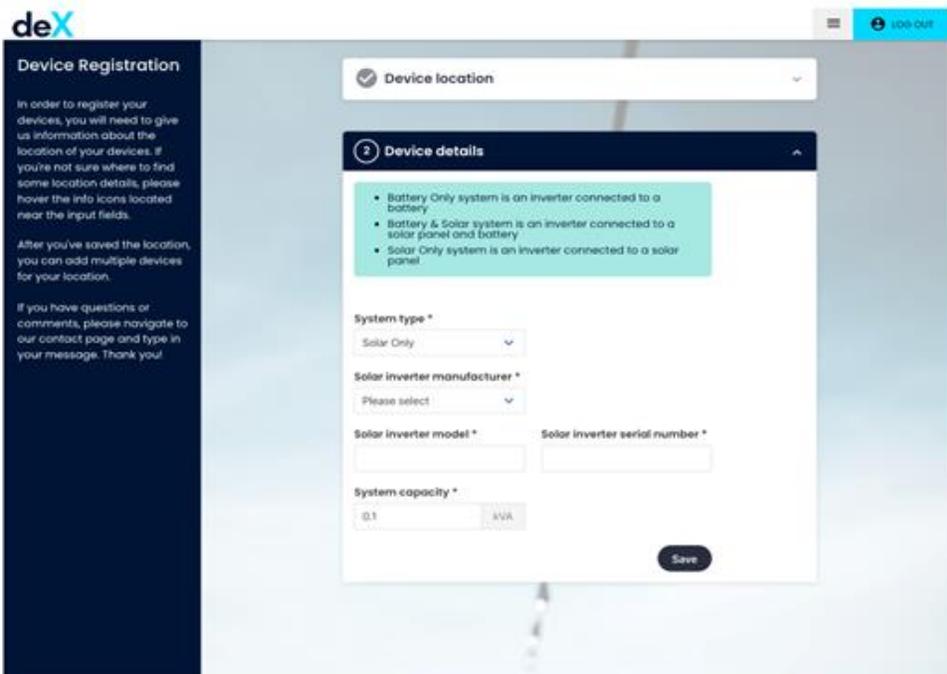


Image 4: deX Device Registration device details page

The Registration App enables solar PV and battery installers to register DER on behalf of owners (with their consent). The App was deployed into production on 25 September 2020. Through consultation with industry we learned that giving installers the ability to register DER at the time of installation would be an efficient way to streamline the registration process, improve data quality and increase the likelihood of successful DER registration. Consequently the decision was made to build an App that would enable installers to perform this task at installation.

For the end-to-end DER registration process to be fully realised in production, the following functionality was developed in the Device Registration App:

- User authentication to ensure only genuine registrations occur
- User consent acceptance and capture
- DER device record creation and updating, including nomination of authorised agent
- DER NMI record creation and updating
- DER record verification to ensure only valid DER are registered
- DER data validation
- DER data recording

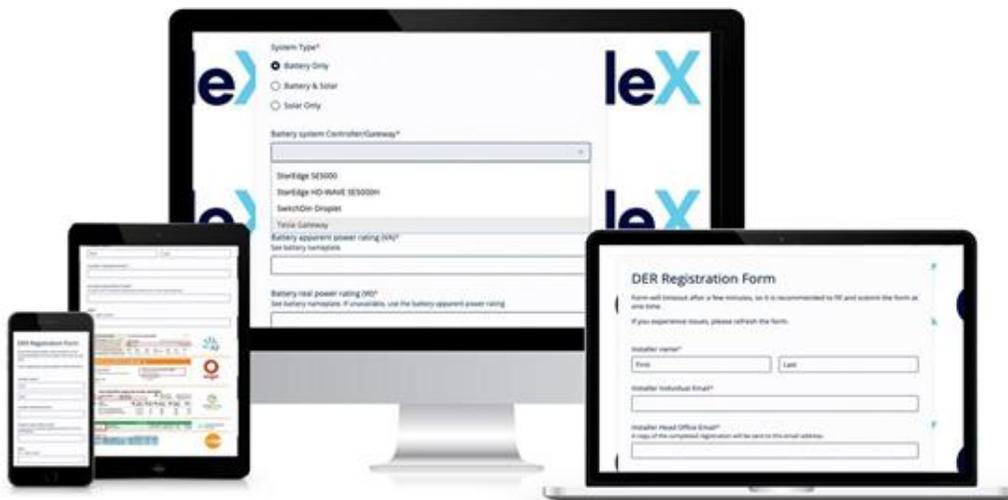


Image 5: deX Device Registration App - example displays

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Lessons Learnt

The long term importance of building robust integrations that can comfortably support large volumes of DER has become increasingly apparent. As the volume of DER continues to grow as does their impact on the network, highlighting the need for sturdy and secure integration and registration processes. In anticipation, GreenSync has been focussed on implementing robust integration and registration practices that will facilitate the seamless hosting, visibility and control of DER at scale before the situation becomes unwieldy.

During the development of the Device Registration App and Portal, it became apparent that data quality and manual processing were ongoing issues for both installers and retailers. As a result, development of these features focussed on functionality that would streamline the registration process, reduce the administrative burden, and minimise the need for manual data input to reduce the associated potential for human error.

4. Industry Engagement

Due to the Covid-19 pandemic, opportunities to engage with industry have been significantly reduced. The interactions that have been possible have mostly been via videoconference as well as the occasional webinar.

deX South Australia

The deX South Australia Project is supported by the Government of South Australia through the Demand Management Trials Program. It presents a world-leading opportunity to establish a digital exchange to register distributed energy resources (DER) like solar PV/batteries and facilitate service contracting between owners, aggregators/ Retailers and networks or the market operator. The Project enables a smooth registration pathway for individual devices, and in doing so brings these assets into the market so that consumers can benefit from the services provided by their device.

Central to the Project is a new publicly accessible site (“portal”) for digital asset registration and a DER services portal. These two elements are key to enabling customers, or their agents, to access a range of offers from aggregators and Retailers and to derive more value from their asset – be that a battery system, solar PV, EV charger or other smart device.

As part of the deX South Australia project, targeted industry engagement has recently been undertaken with a number of innovative Retailers, Aggregators, Installers and solar Retailers who operate in South Australia, who had expressed interest in the deX South Australia project. Initially, these introductory sessions addressed key industry concepts, the intent of the deX SA project and deX and its application within the deX SA project. Subsequent and more detailed sessions were undertaken with those who expressed strong interest in involvement. These typically included further technical details about deX software capabilities, along with detail on legal agreements required to facilitate participation.

We also worked closely with industry partners during the development of the Device Registration App, seeking their expertise and input to ensure a useful and user-friendly tool was ultimately produced. This process began by identifying the baseline requirements for the App such as being quick and simple to use, providing structured input fields to reduce the potential for human error, and the capability to upload images for verification and record keeping purposes. Next, and again in consultation with partners, the development evolved into a process of rapid prototyping, testing and deployment in production. To maximise likely adoption of the App, which in turn would increase device registration and VPP enrolment, a number of

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supporting materials and tools were developed to assist users. These included training sessions on how to use the App, a user guide, and access to ongoing support.

SA Smarter Homes Compliance

The South Australia Smarter Homes program came into effect on Monday 28 September 2020. deX is supporting global smart inverter brands to meet the South Australian Smarter Homes compliance requirements for remote disconnection/ reconnection and customer nomination of the Relevant Agent.

Initially engagement with industry was done via an email campaign, primarily directed to the solar PV installer community in South Australia during October 2020. Information regarding how the deX solution enables compliance with the SA Smarter Homes program was provided, along with an invitation to register for a training webinar to find out more. Subsequent follow up communications with additional information were also sent.

A number of tools and materials were developed to assist industry to understand and comply with the new regulations. These include the development of a device registration app for installers, brand specific Quick Start Guides, an on-demand training video and a deX Smarter Homes factsheet.

Awards and Recognition

Finalist in 2020 Japan Energy Challenge

GreenSync was a finalist in the 2020 Japan Energy Challenge (JEC), and was chosen from over 600 companies from around the world to compete. On Thursday, 19 November 2020 we demonstrated deX at Energy Engage Live to the JEC team and sponsors which included some of Japan's biggest energy companies.

South Australian Premier's 2020 Awards

Simply Energy's 'VPPx Project' was the South Australian Premier's 2020 award winner for Innovation and Collaboration. As mentioned earlier in this report, GreenSync have been one of the four cornerstone partners in this project.

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Policy and Regulatory Engagement (Australia)

Energy Security Board - Post 2025 Market Design

GreenSync is a member of the Technical Working Group incorporating industry and businesses to provide input and perspectives to the ESB teams working on key P25 project areas.

Our interest, focus and participation in workshops/meetings was on the discussions and ideas being raised within the ESB P25 project activities on:

- two-sided markets
- ahead markets
- DER markets

Distributed Energy Integration **Partnership** (DEIP) workshops

GreenSync participated in the November 2020 DEIP workshop on Dynamic Operating Envelopes - Regulatory and Technical dimensions.

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