



deX



Project progress report

October 2019

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About deX

The Decentralised Energy Exchange (deX) is a digital platform that allows electricity networks to better coordinate the increasing volume of distributed energy resources (DER) in the electricity grid, while helping consumers get more value from assets such as solar, batteries and electric vehicles.

To date, over 100 organisations across 20 countries have partnered with deX, including major utilities, leading technology brands and industry bodies. Globally, deX has been contracted for major projects in Europe and Japan.

ARENA is contributing \$10 million 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 next three years.

As an open access software platform, deX enables transparent and localised marketplaces to operate. Consumer owned devices - solar, smart appliances, batteries and electric vehicles - that are registered with deX will be visible to the network. These devices can then be contracted for grid services such as supplying energy during peak demand, managing frequency or grid voltage, or reducing network constraints.

About GreenSync

GreenSync is a software technology company headquartered in Melbourne, Australia with satellite offices in Singapore, San Francisco and London. Established in 2010, GreenSync has significant experience in developing solutions for energy utilities to manage and optimise DER. GreenSync has network and retailer clients across Australia and internationally. GreenSync has a highly capable dynamic staff, organised in cross-functional teams to effectively solve complex problems and ensure customer value. GreenSync is currently laying the foundations to scale over the next 18 months in line with the business strategy.



deX Software Development

Our Approach

The design and development of DER coordination and flexibility market platforms is in its infancy globally. However, the rapid rise of DER across Australia combined with the retirement of large dispatchable generators means Australia can't stand still. To navigate this challenge and manage both risk and opportunity for Australia's electricity industry, GreenSync is undertaking deX software development based on the following principles:

Present need

GreenSync is prioritising the development of functions that solve immediate or imminent system issues. Progressive implementation of the capabilities required by utilities and system operators in the immediate term should be the focus of any short-term pilot. In GreenSync's view, key sector benefit in Australia would arise from the creation of flexibility markets to facilitate:

- » Management of excess solar photovoltaic (PV) within South Australia and Western Australia during low demand periods
- » Contracting of demand response within Victoria, South Australia and New South Wales to enable load management during summer peak demand periods
- » Provision of frequency services to support wider procurement of ancillary services.

Clear roadmap

GreenSync is establishing a clear roadmap to meet immediate requirements and enable future functionality and markets. Acquiring and implementing the capabilities required for the Distribution System Operator (DSO) and Distribution Market Operator (DMO) is a significant undertaking. While it is important to maintain flexibility in the approach and the capacity to expand and evolve the thinking in pursuit of the optimal outcome, it is critical to commence with scaling in mind.

Industry collaboration

GreenSync brings together industry capability, collaboration and co-design. deX has a critical role in coordinating industry capability, largely through putting in place the market frameworks and signals to enable confident investment.

International technology vendors will respond to these signals through their product offerings in the

Australian market, and this will be critical in ensuring that the DER being deployed are capable of participating in the provision of services as markets are created and grow.

Pilot

GreenSync can capitalise upon existing DER registration and DSO technical trials and investment. There are a significant number of related technical pilots and trials underway that can be learned from. It is critical that the experience and capabilities of these existing programs are brought to bear within a broader structure to ensure their insights can be contextualised and applied. This is also true of the Australian Energy Market Operator (AEMO) DER register, AEMO's virtual power plant (VPP) pilot and application programming interface (API), and broader state programs and policies that will influence the deployment of DER.

Examples of related trials and their potential interaction with an integrated scalable pilot:

- » VPPx trial (SA)
- » Evolve Energy project
- » EQ VPP trial (QLD)
- » Mondo/AusNet DSO (VIC)
- » AEMO VPP API

Sector development

GreenSync is supporting Australian technology businesses that provide customer value and export potential. There is an emerging ecosystem of Australian technology vendors, consultants and wider service businesses across solar PV, energy storage, demand response and electric vehicles. Companies including SwitchDin, Chargefox, Tridium, ZepBen, Reposit and WattWatchers are notable contributors.

Open standards/API framework

GreenSync is able to use industry standards, wherever possible, and develop open access API frameworks. Progress will involve navigating new and emerging standards in a way that supports all parts of the market. GreenSync needs to move forward within a framework for APIs in order to facilitate open market participation and avoid vendor-specific designs whilst ensuring predictability, security and auditability.

deX Software Platform Technological Overview

The decentralised energy eXchange (deX) is a grid-protecting, market-enabling middleware platform. It is the core of GreenSync's solution stack for distributed energy transactions between participants across the electricity system. deX specifically interfaces with the distribution grid to enforce boundaries for the safe operation of networks.

Technology Overview

deX is a cloud based technology infrastructure offering, which enables GreenSync to easily scale, reduce operating costs and ensure a solid security foundation.

- » deX provides machine to machine API which allows partners / vendors to integrate their systems, and access the markets and services provided by the platform
- » deX provides a "Developer Centre" and can also offer hands on support (e.g. design, coding, Q&A) to help partners and licensees access the deX API
- » A comprehensive set of resources has been created and is open to our partners. All partners must pass certification prior to participating on deX.

deX Connect

About

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.

Progress

To date, deX Connect has successfully certified five technology vendors. GreenSync has also delivered a DER registration pilot that included the prototyping and deployment of a DER registration process. The scope of the pilot included building the functionality to enable workflows and processes to register consenting devices in deX.

Improvements have also been made to operational monitoring and controls, participant management and DER deregistration functionality in deX Connect. In parallel, enhancements to the Developer Centre and the associated certification process to enable more vendors to integrate have been completed.

deX Developer Centre

The deX Developer Centre is a self-service support hub that helps DER vendors to provide the best possible developer experience for deX APIs. It has recently been significantly enhanced and the associated certification program has been launched.

The deX Developer Centre primarily supports software engineering and secondarily sales and marketing functions. The Centre:

- » Provides all necessary materials needed to reduce friction when working with the deX API (e.g. onboarding, registration and API key provisioning)
- » Has content for all API stakeholders no matter where they are in their user journey
- » Has tools to manage and maintain the relationship with technology vendors using the API.

deX Vision

About

deX Vision provides visibility and trust of DER operation for distribution, transmission and system operators enabling planning, real-time monitoring and the ability to coordinate and contract DER services for system reliability.

Progress

Work on deX Vision has focused on developing functionality to enable the establishment of Dynamic Connection Agreements (DCAs). Specifically, limit charge commands have been implemented and the associated integration has enabled dynamic limits to be specified.

deX Software Platform Technological Overview

deX Markets

About

deX Markets enables simple and transparent market formation within system and regulatory frameworks, allowing the financial value of DER to be traded.

Progress

deX Markets is in early stage development. GreenSync has been building on the VPPx and UKPN projects (see Pp 16-17) to define key principles for tenders and bids, establishing foundations within the deX platform to support the ARENA deX Program.

deX Exchange

About

deX Exchange (previously referred to as deX Platform) is the core of the deX platform. deX Exchange facilitates the interaction between the deX Connect, deX Vision and deX Markets products.

deX exposes a RESTful, JSON API, documented in OpenAPI format – the accepted common language of internet APIs today.

Data updates are published via RFC7464 (JSON Text Sequences) feeds.

Endpoints are protected using HTTPS and OAuth Bearer Token authentication.

Progress

GreenSync is establishing a dedicated team to support deX Exchange and manage services between the deX products.

deX Command

About

deX Command is a new product providing market participants (retailers, aggregators and energy services companies (ESCOs)) with the ability to contract and dispatch DER and better facilitate coordination and support for third party VPP platforms.

Progress

GreenSync is trialling deX Command beta with Simply Energy as part of the VPPx project, transitioning from GreenSync VPP to support scaling. deX Command is expected to be in production by

December 2019.

Lessons learnt

Knowledge GreenSync has gained over the last few months:

- » There is a need to establish deX Exchange as a more defined core functional service of the deX Platform to ensure the long-term scalability, connectivity and operability of product services between key user groups
- » Accelerating the development of deX Command's early stage contracting and dispatch functionality was necessary to increase registrations and use. It has also laid the foundations for better integration and function for third party VPPs
- » Linking use cases across projects and partners is critical to developing overall platform architecture and developing transferable product functionality
- » Co-design workshops and regular partner feedback are key to successful functional development and creation of agile tools and services for scalable benefits
- » Technology vendors are most receptive to completing integrations where a pilot program opportunity exists.

What's next?

Over the coming months deX plans to:

- » Release beta deX products and services for wider partner use
- » Use a reference model for DSO and DMO functions to guide deX software architecture
- » Register more deX Connect-capable devices in different jurisdictions
- » Further develop the DSO procurement and exchange design
- » Further develop the application of DCAs
- » Provide practical support through the Developer Centre and deX Connect to assist technology vendor integrations and asset registrations.

Industry Engagement Partnerships

deX is an industry-wide collaboration, touching every corner of the energy landscape. Over the last two years GreenSync has established formal partnerships with technology vendors, public and not-for profit organisations to support, co-design, share knowledge and thought leadership.

Under this ARENA project, officially starting at the end of March 2019, deX partnerships have grown in number and significance to sit at over 100 today.

As the deX platform comes to life GreenSync is now moving to accelerate partnerships through pilot programs across multiple geographies and technology integrations to bring key platforms together. As such, expanding our activities around our partners provides mutual benefit.

Highlights

Key updates since March 2019

- deX partnerships have reached 113
- Recent technology partner additions include leading global virtual power plant (VPP) technology vendors Autogrid and AMS
- GreenSync has co-designed integration paths with advanced distribution management system (ADMS) technology providers Schneider and Zepben
- GreenSync is expanding our integrations focus to electric vehicle (EV) technologies including Chargefox, Everyt and GoodMeasure
- GreenSync is adding emphasis on external partner focused communications through updates, profiles and engagement in industry focussed events and discussions.


Example Partner Profiles

Profiles
Meet a deX Partner




"SwitchDin is happy to be one of the first third-party technology vendors to enable its customers to plug into GreenSync's decentralised energy exchange - deX."

Led by Dr Andrew Mears, [SwitchDin](#) has been driving the integration of DERs in virtual power plants and microgrids for Australian networks and retailers; connecting with GreenSync's platform will give SwitchDin customers another option to get the most from their solar, batteries & controlled loads.



Meet a deX partner
Solar Analytics brings capabilities to deX.

We caught up with [Solar Analytics](#) to discuss what exciting capabilities they are bringing to the deX ecosystem, what's on the horizon for the company and what value they see in being a deX partner.

Industry Engagement Our Partners (at 30 September 2019)



Industry Engagement Thought Leadership - GreenRoom Events

During 2019, GreenSync began hosting a series of events at our exciting new technology collaboration space, the GreenRoom, located at GreenSync's head office in Melbourne. The theme this year is 'technology demystified', where invited experts explore and unpack the technology, innovations and trends shaping our future energy grid.

This unique event series features leading thinkers and industry representatives across energy and technology who are helping to get us to where the industry needs to go. GreenSync invites collaboration from key sections of industry and provide valuable insight into, and thought leadership on, what the next twelve months to five years looks like as the energy system heads towards a flexible grid and DER marketplaces.

The objectives of these sessions are to:

- » Facilitate thought-provoking discussions – provide multiple angles, perspectives and fresh insights into the topic issues
- » Paint a picture of what the next steps in the industry are and why these steps matter
- » Show why full industry collaboration, not just incumbents/institutions, will enable us to all get where we – collectively – want to go, faster
- » Educate the audience about current technologies and the trends and changes that are coming.

Enabling the grid for dynamic solar participation, at scale

- **Event held:** 28 March 2019
- **Audience:** 60 people in attendance
- **Facilitator:** Nigel Morris, Solar Analytics
- **Panelists:**
 - ◇ Network: (Citipower/Powercor): Ruchika Deora
 - ◇ Technology manufacturer (Fronius): Keshia Norohno
 - ◇ Solar installations (Gippsland Solar): Andy McCarthy

This session focused on how the industry can lay the foundations today to prepare for the future ahead; how to enable grid flexibility to handle the coordination of distributed energy resources (DER) at scale, specifically at this time in Australia, dynamic solar and storage.

The panel explored why it is important for all players to understand the technologies and systems required to facilitate visibility, control, reliability, innovation, and ultimately allow consumer participation and reward in a commercial DER marketplace.

Key points from the panel discussion

Challenges with integrating solar

- » There are challenges across all facets with solar, the network, standards, policies and regulations; particularly in moving the traditional grid, from a one-way system to a two way system.
- » The electricity system has always had to be dynamic in one shape or form – balancing load all the time. But the problem is.... Where flexibility needs to be has shifted to distribution networks. That is a massive change.
- » Being a solar supplier today in Australia brings many and varied challenges: between the delay in getting approval from network operators, to getting the system installed, to creating Small Technology Certificates (STCs) to having them approved, to being paid for them. Some solar projects are sitting at 150 days turnaround for a company that does 30 installations a week.
- » For networks; voltage variations, constraints and energy fairness are key challenges. This includes "non smart" inverters tripping. From a consumer perspective there is a "noisy" frustration around the constraint to connect. Following the announcement of the (Victorian Government) Solar Homes package, many networks saw an almost overnight tenfold increase in the number of connection requests coming down the pipeline.

Industry Engagement Thought Leadership - GreenRoom Events

Key points from the panel discussion (continued)

This raised questions about equity; who pays for infrastructure upgrades and what is being done about the disparity between those that can afford DER devices, like solar, batteries and EVs and those who cannot.

There is a clear need to work towards solutions, together

- » We need to be able to see and understand the types of policy initiatives that are coming, to better co-create in a way that makes sense for the industry and for the consumers.
- » For those manufacturing solar systems, inverters and equipment the feeling was that Australia needs some form of direction on standards requirements.
- » Manufacturers are happy to invest resources for research and development for hardware and software but need good guidance on what is needed in Australia for the next 4-5 years as the lead time for developing those products is starting today.
- » Industry standards around smart inverters would help the customer to derive maximum value from their investment.
- » Technology and collaboration can get us to a future where dynamic solar at scale is possible.
- » The technology, the software and the passion exists to fix this issue and develop grid 2.0 but it is going to take all parties working together.
- » We as an industry didn't do a good job in the past of acknowledging the inevitability of this transition, however this is now true acknowledgement that the transition is inevitable.
- » As an industry we have been talking about this issue for many years, but what feels different now is that we seem to be on the same page.

Industry Engagement Thought Leadership - GreenRoom Events

Our Future with VPPs

- **Event Held:** 23 May 2019
- **Audience:** 130 people in attendance
- **Host and Facilitator:** Doug Cook, GreenSync
- **Panelists:**
 - ◊ Commercial and Industrial: Claire Richards, Enel X
 - ◊ Technology vendor: Andrew Mears, SwitchDin
 - ◊ Software: Dean Gowans, GoodMeasure
 - ◊ Guest panelist: Matt Armitage, AEMO (VPP Demo update only)

This session focused on the industry's talking point of the moment, Virtual Power Plants (VPPs). In this session our panel unpacked the different VPP technologies and models available, what applications they're each best suited to, who they are currently used by and what role the related technologies have in our transitioning energy system.

GreenSync brought together a panel of experts from companies who can talk to industry applications, challenges involved and what needs to be considered as the industry moves towards an energy future that will increasingly (perhaps inevitably) rely on consumer participation and reward when it comes to DER.

GreenSync wanted to ensure the audience left with a good understanding of the complicated nature of VPPs and gained a solid understanding of how they can be applied and monetised now, and where the key/enabling technology may go in the future.

Key points from the panel discussion

- » We can't, in the abstract, design the perfect approach. We must just get on with this, practically, and know that we will need to modify as we go.
- » Customers have other reasons for their DER being there in the first place. It's for them first, so working out how the VPP tech (or other type of tech) is able to ensure any other service provision that is possible is done in a way that delivers low or zero interruption to the owner is vital.
- » How permissions flow, who is able to control and access services is relatively clear at the commercial and industrial customer scale but is still being worked out at the residential scale.
- » We will need to get clear multi-party, rules-based control but we aren't quite there yet.
- » For VPP 'products' to scale, management of complexity on behalf of customers is the challenge to solve.
- » For all options, our approaches must accommodate innovation and complexity of technology to support customers and utilities.
- » While there are lots of potential opportunities, it is unlikely that one single vendor will "take it all". Diversity of customers will drive diversity of service providers and product innovation.
- » One big challenge for scalability is the shift in mind-set required from traditional utilities.



Industry Engagement

Thought Leadership - GreenRoom Events

How many EVs are too many EVs?

- **Event Held:** 6 August 2019
- **Audience:** 140 people in attendance
- **Host and Facilitator:** Bruce Thompson, GreenSync
- **Panelists:**
 - ◊ Network Utility: Greg Skelton, CEO Wellington Electricity (New Zealand)
 - ◊ Technology vendor: Carola Jonas, CEO Evertly
 - ◊ Technology Vendor: Tim Washington, Co-founder, Chargefox

Key points from the panel discussion

Electric Vehicles (EV) in New Zealand

- » New Zealand has stipulated a target of 64,000 EVs by 2021, and recently announced a rebate of NZ\$8,000 on every EV purchase. Economically, EVs make sense: a litre of petrol costs NZ\$2.50 while an equivalent charge costs NZ\$0.30.
- » As EV charging in residential homes increases, there is little consideration being given to commercial and residential high-rises that are in the planning process. Car parks need to be planned with charging in mind, and every charging asset should be a smart device that allows the possibility of future management

The paradigm shift and opportunities that EVs present

- » EVs are moving batteries which can be charged flexibly at different locations and could be matched to periods of high output from renewables.
- » Workplaces could provide EV charging as part of an employee or organisational incentives package. An employee's car could be charged at work, then used to power their home.
- » The main uptake is expected to come from transport fleets rather than end customers.
- » Consumers shouldn't be overlooked entirely, as their purchases are often informed by emotions as much as economic calculations.

On EV charging as an essential service

- » Eventually, EV infrastructure will be an essential service. This necessitates thinking around how to provide for people living in areas less likely to attract for-profit businesses.
- » As EVs are linked with wholesale electricity prices, there need to be mechanisms that make charging as cheap as possible, with free charging or 'paid-to-charge' models a future goal.

EV charging, vehicle-to-grid and pricing

- » Vehicle-to-grid trials have been happening for a while, but the process is now moving into the consumer stage because of two developments:
 - ◊ Nissan is actively promoting vehicle-to-grid and no longer voids warranty if an EV is discharged into the grid as opposed to while driving.
 - ◊ Charging units are no longer the size of fridges.
- » EV charging is deferrable, up to several days, which means it is controllable. Charging time can be tied to favourable pricing in the wholesale market.
- » The standard discharge of EVs is 7-8kW per day and most EV charges last for 300km (up to 700km for premium cars), so EVs need to charge once or twice a week.
- » In NZ, a move to vehicle-to-home is more likely than vehicle-to-grid.

A distribution network perspective

- » Previously predictable low voltage (LV) networks are becoming increasingly unpredictable as more EVs come online.
- » Networks currently have no visibility of charging stations, so a priority is to establish where the heat maps are, in order to model load requirements.
- » DER visibility is a priority for network stability; DER management is key.
- » Curtailment for a fee is preferable to network augmentation, which is ten times more costly.
- » Distributors and retailers need to cooperate for mutual benefit.
- » Electrified transport fleets can serve as emergency capacity (for example, where

Industry Engagement Thought Leadership - GreenRoom Events

Key points from the panel discussion (continued)

- dynamic connection agreements don't cover curtailment).
- » Wellington Electricity (WE*) are exploring options to use bus batteries as a backup in the event of extra demand, instead of diesel generators (which are currently used).
 - » WE* are also currently testing electric planes and electric ferries.

What's needed?

- » Make charging intelligent by shifting charging periods into quieter times on the network. This avoids the need to reinvest in capacity and put up pricing.
- » Cooperation between distribution and retailers provides opportunities for both parties as well as customers. By paying a curtailment fee to retailers, distributors can keep load more stable, reduce peak demand and avoid network augmentation; lowering costs to customers.



Industry Engagement

Lessons Learnt and Next Steps

What GreenSync learnt through our industry engagement activities (partnerships, thought leadership events and development of issues and concepts papers) and our plans for engagement activities in future are outlined below.

Lessons learnt

- » There are gaps in industry, government and policy understanding about where standards fit in relation to DER
- » Our partners and stakeholders want access to clear explanations of how deX works, technically, in the world of standards and proprietary systems
- » Our partners and stakeholders want to take part in in-depth conversations and hear from thought leaders in an open, constructive forum
- » Our partners value and appreciate supportive communications activities that can be done in collaboration with them.

What's next?

Over the coming months GreenSync plans to:

- » Release a discussion paper on Dynamic Connection Agreements (DCAs) and engage stakeholders in further development of this concept
- » Develop a reference model for Distribution System Operator (DSO) and Distribution Market Operator (DMO) functions to contribute to industry discussion on architecture
- » Host two GreenRoom events including themes of customer value and industry trends.

Partner Projects

deX Program Pilots

In recent months, GreenSync has been working with key partners and stakeholders to establish pilot projects in at least three Australian states. Design, planning and contracting for these projects are underway and they are scheduled for launch in the coming months.

Lessons learnt

- » Partners and stakeholders benefit from experience in related pilot projects.
- » Commencement of new pilots has been slower than expected, due to the need to facilitate multiple stakeholder requirements and procurement processes.
- » ARENA facilitation, support and input is highly beneficial.

What's next?

Over the coming months deX plans to:

- » Commence key pilot projects within the deX program
- » Release beta products and services for deX partners to trial
- » Increase deX integrations for DER and VPP vendors to increase DER registration and contracting.



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