ENERGY INDUSTRY INSIDER

Q2 2019 | Industry Pulse

Distributed Energy Management – Monitoring and Control

FutureBridge

WHAT'S INSIDE!

- Emerging trends related to distributed energy monitoring and control. It provides an insight about the trends that were captured during Q2 2019 and has a significant effect on energy industry.

- Innovative pilot projects to expand the scope of distributed resources on a grid in Europe.

- Focus on Solo Energy's technology for DERs

01

Pulse Themes:
a.   VPP's set to break new grounds
b.   Blockchain Is 'Transformative'
c.   DER software platforms continues to grow

02

Quarterly review of Project Update

03

Startup Tracker highlights
a.   Summary, investment & funding
b.   Highlights of Key Start-up

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01 | **Emerging trends**

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VPP's set to break new grounds

These one of its kind projects will describe the applicability of VPP in present and upcoming electricity generation, transmission and distribution scenarios in variety of operational conditions.

Australia, US, UK and Japan are the early movers and are attracting new players in the region.

Funding for VPP pilots

TENAGA NASIONAL

3rd April 2019
Tenaga Nasional Bhd, Malaysia has collaborated with South Korean companies; I-ON Communications Corp, Busan City Gas Co. Ltd. and Shinwa SnC to run a VPP pilot.

ARENA — Australian Government Australian Renewable Energy Agency

5th April 2019
ARENA has sanctioned $2.46 million to the Australian Energy Market Operator (AEMO) for virtual power plant (VPP) which shall deliver energy and frequency control services.

ReFLEX ORKNEY — UK Research and Innovation

3rd April 2019
UKRI funded ReFLEX Orkney project to create a Virtual Energy System (VES) in Scotland. The project will demonstrate a first-of-its-kind Virtual Energy System (VES) including electricity, transport, and heat networks.

moixa

3rd May 2019
Moixa plans to create a VPP combining solar panels, batteries and electric vehicles, a groundbreaking project in West Sussex under government's Industrial Strategy Challenge Fund.

DEVELOPMENTS
Emerging Trends

The increasing share of renewable energy is stating the need of 'as and when' required power supply, and the VPP appears as a promising solution for it. VPPs can enhance grid reliability and solve the flexibility problems in renewable energy demand and supply. VPPs are capable of providing real-time, cumulative control of available energy resources on the grid.

VPP has been witnessing the traction, continuing the trend from previous quarter, various governments worldwide are showing interest in VPP and have sanctioned large sum of funding for running VPP pilots for variety of applications such as frequency control, energy balancing or peak shaving.

FutureBridge Insight & What should you investigate ?

Partnerships, Investments and Acquisition

Partnerships, acquisitions and investments for developing software platforms for achieving flexibility, reliability, visibility and controllability of DERs are becoming the preferred route of industry players

Future Projects

Pilot Projects

Risks

Opportunities

Lessons learnt

ENERES partnered with AutoGrid to develop VPPs and customer engagement software to aggregate, dispatch and, market the energy from demand response and DER in Japan

Schneider Electric invested in in AutoGrid and acquired 10% stake. It plans to establish a co-innovation partnership focused on driving new AI and machine learning solutions for the utilities and C&I companies.

Dubai Electricity and Water Authority (DEWA) to partner with Canadian company Enbala to build the region's first VPP aiming at increased visibility of DER and providing grid services.

innogy InnovationHub, arm of innogy SE has invested in GreenCom Networks. The GreenCom's technology is capable in aggregating multiple distributed energy resources into a VPP and manage a home's energy balance.

The software solution providers are taking the partnership route to venture into energy sector across geographies through a local well-established players to access their larger consumer base and local market expertise. Simultaneously, the energy market players are focusing on digital transformation to stay ahead amidst the massive software-driven energy market transformation.

For example, In DEWA's affiliation with Enbala, DEWA brings local energy market expertise and Enbala, its international VPP experience.

Similarly, Japan's ENERES has strong local market knowledge and Autogrid brings in their expertise in developing VPPs to Japan.

These partnerships will enable fulfilling the future grid requirement such as flexibility, reliability, visibility and controllability with increasing penetration of DERs.

Blockchain Is 'Transformative'

Companies are partnering with / acquiring others to gain technological expertise and expand to other geographies. Blockchain is being used for storing, verifying and maintaining peer-to-peer transactions and has huge potential to disrupt the energy sector, offering a viable transaction alternative to traditional models.

Partnerships, Investments and Acquisition

opus one   Ameren

2nd April 2019

Ameren, Illinois utility and Opus One plans to test viability of Blockchain-Enabled Microgrid energy trading which will include rooftop solar, electric vehicles and home batteries.

ABB   evolvere

16th May 2019

ABB and the Italian Utility, Evolvere have jointly launched a blockchain energy pilot to facilitate peer-to-peer energy transactions. This pilot is expected to bring the blockchain technology closer to residential energy sector.

TRENDE   TOYOTA

23rd May 2019

TRENDE has partnered with Toyota and University of Tokyo to jointly demonstrate a blockchain based peer-to-peer electricity system in Japan, targeting to creating a marketplace for those who produce and consume renewable energy.

energy web

31st May 2019

Energy Web Foundation (EWF) tested its blockchain, EW Chain with validator nodes hosted by 10 companies including utilities such as Centrica, Duke Energy and E.ON.

DEVELOPMENTS Emerging Trends

The traditional centralized energy exchange models are eyeing new energy exchange solution for it.

The pilot projects for testing blockchain technology's viability in energy sector is attracting the Utilities to partner with solution providers. These pilots will evaluate blockchain for transparent and secure peer-to-peer energy transactions. Further, the pilot projects to combine blockchain technology with VPP is also is another area of interest for both energy sector majors and solution providers.

FutureBridge Insight & What should you investigate ?

DER software platforms continues to grow
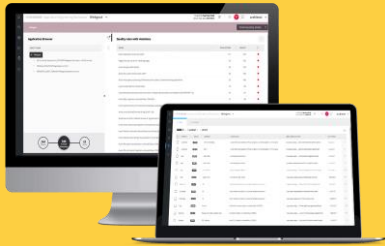
DERs software solution providers are leading the transition of the way utilities do their business and upgrade their network to integrate and manage flexible generation and ensuring grid stability.

Partnerships, Investments and Acquisition

ABB
Rolls-Royce
Rolls-Royce Power Systems AG

2nd April 2019

Rolls-Royce Power Systems has partnered with ABB for microgrid and advanced automation which will integrate the digital technology and efficient hybrid power systems to offer microgrid solution to utilities, commercial and industrial entities.

ENGIE
GENBRIGHT

15th May 2019

ENGIE has acquired Genbright, which has a proprietary wholesale market platform. This will enable integration of wholesale market bidding, scheduling, and dispatch optimization capabilities into ENGIE's GridSynergy® platform.

UK Power Networks
Delivering your electricity
smarter grid solutions
Nexant · GreenSync

28th June 2019

The UK Power Network has partnered with Nexant, Smarter Grid Solutions and GreenSync for advanced energy network management and control system.

DEVELOPMENTS
Emerging Trends

The collaborations and partnerships between technology and software solution providers aids in optimizing the use of DER sources. Engagement of utilities is providing the technical know-how to the software developers and implementing it in their regions is supporting the further advancements in the software.

The DERs and DERMS platforms are expected to take the center stage in the grid transformation.

FutureBridge Insight & What should you investigate ?

What should you investigate ?

↓
What are the key partnerships and alliances in VPP market?

↓
What are the avenues and applications for deployment of Blockchain technology in DER market?

↓
Which are the key geographies investing in the deployment of DER's?

→ **FutureBridge Insight on Energy market transformation**

- Blockchain can disrupt the energy sector and is being tested for various applications, but before that it is necessary to understand blockchain's potential, prove its commercial viability and finally strategize its adoption in the mainstream.

- Partnerships and investments to run VPPs and check their applicability in mainstream is catching the eye worldwide and is presenting new business opportunities across geographies.

- DERs software solution providers and energy service providers are working in sync to develop stakeholder-friendly platforms, bringing their expertise together to better serve the end-user.

Breakthrough Technology

First custom-built Blockchain for energy sector by Energy Web Foundation – EW Chain

The Energy Web Chain accelerating the energy transition with an Open-Source, Decentralized Blockchain Platform
More than 10 EWF Affiliates including utilities, grid operators, and blockchain developers in June 2019 began hosting validator nodes for the live network.

- The EW Chain is an open-source, publicly-accessible blockchain derived from the Ethereum technology stack.

- It is designed specifically for energy-sector applications, using a **Proof-of-Authority** consensus mechanism to significantly increase transaction capacity and decrease energy consumption compared to the Ethereum mainnet and other public blockchains.

- The EW Chain supports novel privacy preservation and permissioning features that make it possible to control data access for competitive and/or regulated energy market applications.

- In addition, providing technical solutions for secure, low- cost, and efficient integration with the hardware.

ⱳ energy web

100 energy and Blockchain Affiliates

Community
↕
Technology
↕
Delivery

Proof-of-Authority (PoA) Consensus Mechanism

Proof-of-Authority Consensus has improved functionality and increased technical capability for regulatory oversight while maintaining network trust and security. The key criteria for a consensus mechanism compatible with the energy sector are: a) high capacity, b) security, c) resource efficiency, d) regulatory ability, and e) fidelity.

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02 Quarterly review of Project Updates

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Project Update - Smart Hubs SLES (Urban Demonstration of Virtual Power Plant)

The Smart Hubs project will deploy multi-scalar and multi-vector open-architecture smart local energy systems across heat, power & transport with interoperable Internet of Things layers for future local energy Smart Grids.

The project will include:

Marine source heat pump and combined heat and power system

**Grid-scale battery using second-life electric car batteries**

Air source heat pumps supporting domestic boilers

H₂ Hybrid refueling station supporting EV's and hydrogen fuel cell vehicles

10%
Reduction of electricity costs

£32 Billion
Financial Savings

2000 Tonnes
CO_2 emissions savings per year

Moixa's VPP will be the first operational element of a smart local energy system (SLES) around Worthing and Shoreham-By-Sea, West Sussex.

Smart Hubs Consortium

advanced infrastructure | icax INTERSEASONAL HEAT TRANSFER | moixa | CONNECTED ENERGY | west sussex county council

Newcastle University UK|Malaysia|Singapore | switch2 | ITM POWER Energy Storage | Clean Fuel | passivSYSTEMS | HONDA

Flexitricity

As a part of larger £40 million Smart Hubs SLES, Moixa plans to demonstrate a virtual power plant (VPP) linking solar panels, batteries and electric vehicles in hundreds of homes, schools and council buildings.

❑ Moixa will use £7.2 million of the project budget to create the UK's largest mixed asset VPP aggregating up to 2MW of capacity and the first to use batteries from a range of manufacturers in combination with electric vehicles plugged into the network.

❑ It will be integrated with other smart technologies, once they are operational, to form a VPP with 17MW of storage, managed by Flexitricity.

❑ Moixa's GridShare platform will aggregate more than 1MW of spare capacity from batteries in homes, schools and council offices, enough to be able to trade in most markets and provide a range of services to National Grid, energy companies and energy distribution networks. Once electric vehicles are fully integrated into the VPP they will be capable of providing a further 1MW.
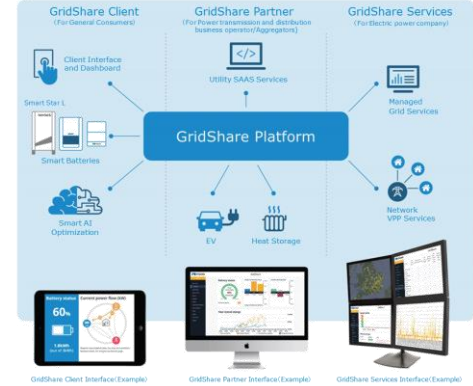
Project Layout

2019
4MW of generation and 4.2MWh of storage
Installation of solar panels and batteries in 250 council homes, 100 schools and council buildings

2020
Installation of 250 electric vehicle chargers in homes and at strategic locations such as council depots and schools.

❑ GridShare will use machine learning and artificial intelligence to tailor their performance to customers' needs and maximize their savings, and this is expected to cut home energy bills by up to 40%.

❑ GridShare will also learn drivers' patterns of use, making sure car is ready when needed and charged in the most cost-effective way.

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Project Update - ReFLEX (Responsive Flexibility) (First-of-its-kind Virtual Energy System (VES): Electricity + Transportation + Heating)

- Led by the European Marine Energy Centre, the £28.5 million project will couple Electricity, transport and heat powered by local renewable energy generation with flexible energy demand balancing the intermittency of renewables.

- After proven demonstration, these technologies will be introduced under an attractive leasing type finance and novel ways of ownership that avoid end users requiring major capital investment, and will be replicated in other areas across the UK and internationally.

- It will understand and test digitally link, distributed and intermittent renewable generation to flexible demand in commercial environments.

- The project will also demonstrate peer-to-peer trading service and new business models that incentivize the consumption or storage of energy when generation is high, and encourage uptake of low carbon heating and transport.

ReFLEX
Responsive Flexibility

Project Partners:

EMEC THE EUROPEAN MARINE ENERGY CENTRE LTD

solo energy

DOOSAN

HERIOT WATT UNIVERSITY

ORKNEY ISLANDS COUNCIL

Community Energy Scotland

aquatera environmental services and products

- The project will demonstrate a first-of-its-kind Virtual Energy System (VES) interlinking local electricity, transport, and heat networks into one controllable, overarching system.

- This project will help Orkney maximize the potential of its significant renewable generation capabilities, help to ensure higher quality and more affordable energy services, as well as further lowering the county's carbon footprint by decreasing reliance on imported carbon-intensive grid electricity from the UK mainland.

- These technologies will be introduced under an attractive leasing type finance and novel ways of ownership that avoid the end user requiring major capital investment.

Solo Energy's Virtual Power Plant

Solo Energy is implementing their FlexiGrid software platform enabling smart monitoring and control of the flexible technologies to charge during periods of peak local renewable generation, and release stored energy during times of peak demand.
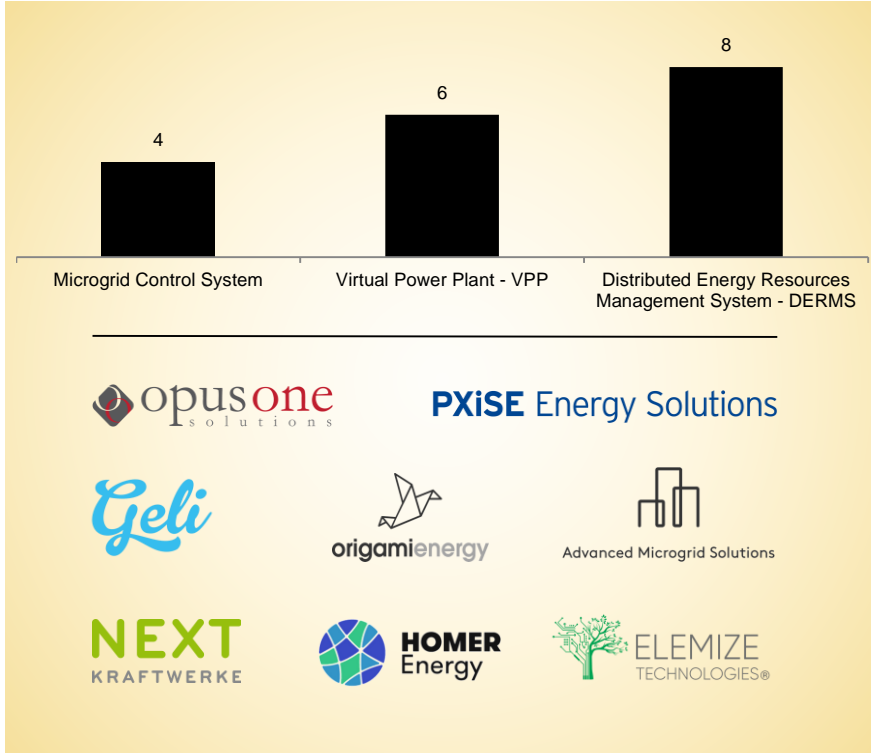
~500 domestic and ~100 business and large-scale batteries

~100 flexible heating systems

~200 Vehicle-to-Grid (V2G) chargers

~600 new electrical vehicles

Industrial-scale Hydrogen fuel cell

Island community-powered electric bus and e-bike integrated transport system

Orkney, Scotland, **UK**

03 Startup Tracker highlights

Startup Tracker summary Q2 2019

Distribution by technology segmentation

Bar chart:
- Microgrid Control System: 4
- Virtual Power Plant - VPP: 6
- Distributed Energy Resources Management System - DERMS: 8

Companies: opus one solutions, PXiSE Energy Solutions, Geli, origami energy, Advanced Microgrid Solutions, NEXT KRAFTWERKE, HOMER Energy, ELEMIZE TECHNOLOGIES®

Funding distribution & activities

AutoGrid

$75 Million

AutoGrid builds software platforms that utilize AI, machine learning, big data and IoT for distributed energy.

Redwood City, US

Key Investors:
Ørsted, CLP 中電, TOTAL VENTURES, innogy, Shell, ENERGY IMPACT PARTNERS, national grid, ENVISION VENTURES

SUNVERGE

$54 Million

Sunverge Energy, Inc. provides integrated energy solutions for distributed generation and storage.

San Francisco, US

Key Investors:
SBCVC 软银中国资本, agl, ARENA Australian Government Australian Renewable Energy Agency, TOTAL VENTURES, SIEMENS

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Highlights of Key Start-up

Solo FlexiGrid Platform

Solo's FlexiGrid software controls energy storage systems to operate as a Virtual Power Plant, and also use blockchain technology to create a shared peer-to-peer energy trading economy so consumers can share locally generated renewable energy across the grid.

- **Solo Energy uses its intelligent software platform to store energy from low-cost renewable generation on the grid.**

- **The company has cloud-connected network centrally controlled by Solo as a "Virtual Power Plant".**
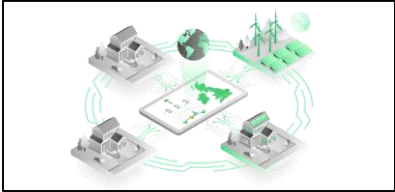
Applications:
- Arbitrage, Balancing Mechanism Revenue
- Ancillary Services: Fast Frequency Response, Operating Reserve, Demand Turn-Up
- Cost of Supply: Imbalance Position, Use of System, Wholesale
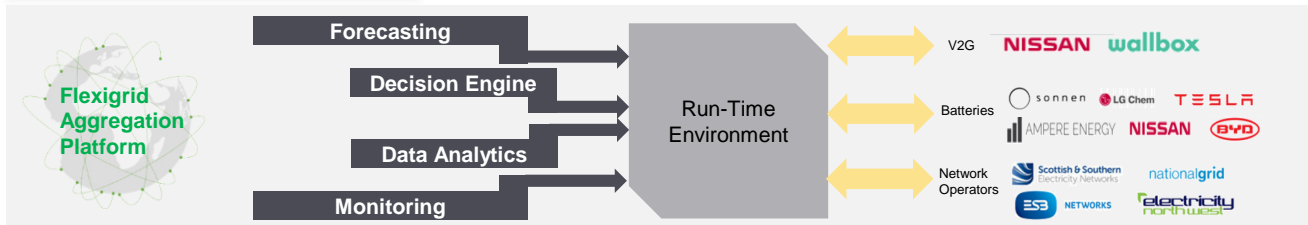
Business Model

- ❑ The company offers free battery and V2G charger installations, which are centrally controls distributed assets as a Virtual Power Plant.

- ❑ The company also partner with energy suppliers to offer low cost 100% renewable supply and uses blockchain-based P2P energy trading platform to share excess energy across the participating members and utilities.

TESLA — VPP — Electricity
Customer — solo energy — Wholesale Electricity Market
Grid Balancing Services
Grid Network

Revenue Model
Local P2P Energy Trading (via Blockchain Settlement)

TESLA — Customer 1
20 p/kWh
solo energy — 2 p/kWh — Grid Network
14 p/kWh
Customer 1

Solo's Margin - 4 p/kWh

Flexigrid Aggregation Platform

- Forecasting
- Decision Engine
- Data Analytics
- Monitoring

Run-Time Environment

- V2G — NISSAN wallbox
- Batteries — sonnen, LG Chem, TESLA, AMPERE ENERGY, NISSAN, BYD
- Network Operators — Scottish & Southern Electricity Networks, nationalgrid, ESB NETWORKS, electricity north west

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