© 2019 Schneider Electric, All Rights Reserved |

Life Is On Schneider Electric

Schneider Electric provides energy and automation digital solutions for efficiency and sustainability

Key figures for 2019

5% of revenues devoted to R&D

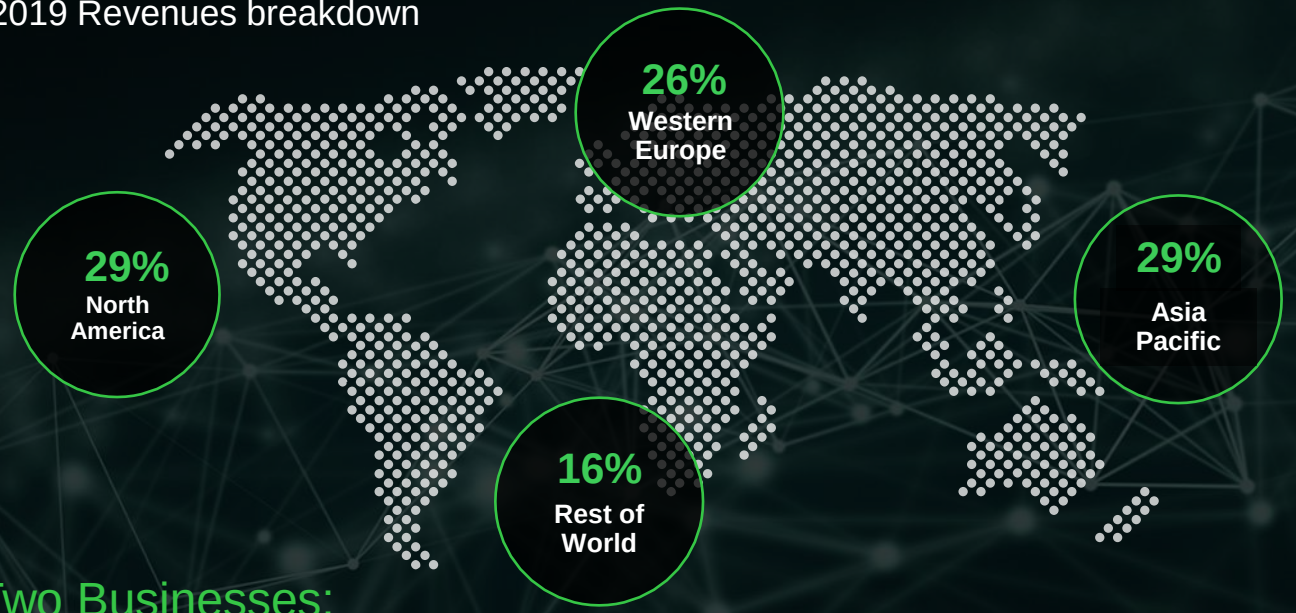
€27.2 billion
2019 revenues

41%
of revenues in new economies

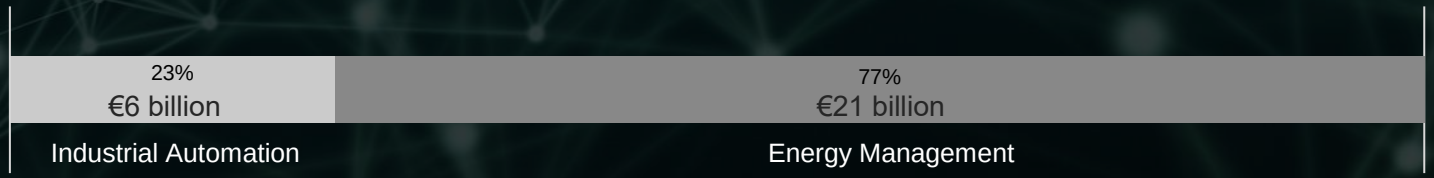
135,000+
Employees in over 100 countries

A well-balanced global presence

2019 Revenues breakdown



Two Businesses:



Life Is On Schneider Electric

© 2019 Schneider Electric, All Rights Reserved |

Our technologies enable the digital transformation of Industrial Automation and Energy Management

Industrial Automation → **Process Efficiency**

€ 6 billion

€ 20 billion

Energy Management → **Energy Efficiency**

A portfolio of integrated digital solutions designed to increase customers' efficiency

Life Is On Schneider Electric

© 2019 Schneider Electric, All Rights Reserved

ECOSTRUXURE

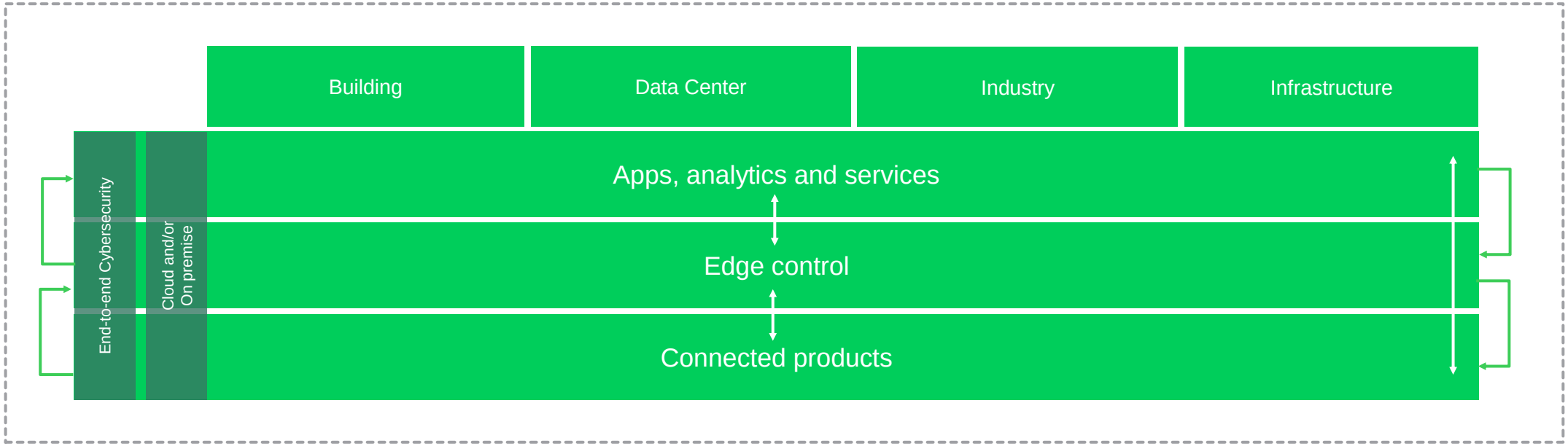
We help our customers carry out their digital transformation thanks to our EcoStruxure architecture and platform

The Platform • Expertise • Community • Lifecycle tools

© 2019 Schneider Electric. All Rights Reserved

Life Is On Schneider Electric

EcoStruxure™
Innovation At Every Level



EcoStruxure Building

EcoStruxure Power

EcoStruxure IT

EcoStruxure Machine

EcoStruxure Plant

EcoStruxure Grid

© 2019 Schneider Electric. All Rights Reserved

Life Is On Schneider Electric

EcoStruxure™ Grid
Innovation At Every Level

EcoStruxure™ Architecture

Apps, Analytics & Services

EcoStruxure ADMS

EcoStruxure ArcFM

EcoStruxure Asset Advisor

EcoStruxure Microgrid Advisor

EcoStruxure Smart Metering Advisor

EcoStruxure Resource Advisor

Edge Control

EcoStruxure Substation Operation

EcoStruxure Microgrid Operation

EcoStruxure Advanced Metering Operation

Connected Products

RM6 & Easergy TH110

Easergy

PowerLogic

Minera SGrid

Conext SmartGen

Easergy T300

End-to-end Cybersecurity

Cloud and/or On Premise

© 2019 Schneider Electric, All Rights Reserved |

Life Is On Schneider Electric

Schneider Electric Thailand

Leading the digital transformation of energy management and automation in homes, buildings, data centers, infrastructure, and industries.

Schneider Electric Thailand Headquarters

- Established in 1978
- ESCO company since 2007
- More than 1,500 employees
- 1 office in Bangkok and 1 branch in Rayong
- 1 manufacturing facility in Bangpoo Industrial Estate certified with ISO50001 Energy Management
- 3 Solar service centers in Bangok, Phitsanulok and Ubonrajchatani
- Regional engineers nationwide
- 1 local distribution center

Corporate offices : Bangkok and Rayong

Manufacturing facility

Solar Service Centers : Phitsanulok and Ubon

Life Is On | Schneider Electric

Schneider Electric Bangpoo Factory in Thailand
World Class Manufacturing – Global Factory

Proven success with ISO 50001 certification in June 2013, it is the first factory that was granted with this award in East Asia.

- Grown from a small operation established in 1990 for the local market to a global plant
- Delivering more than 70% of the production to worldwide market
- The largest circuit breaker manufacturing in Thailand

Life Is On Schneider Electric

and this is what we do in Thailand

Solar Panel Project at Pobakli Village, Mae Sot, Tak

Mobiya donation at Mae Pok Village, Mae Chaem, Chiang Mai

Solar and Mobiya Donation at Ranong

Mobiya donation at Huay-kong Pae, Mae Hong Son

Life Is On | Schneider Electric

Awards and recognitions

Zero Accident Campaign 2019

CSR – DIW Award 2018, Thailand (since Y2014-present)

Green Star Award 2019

Green Industry Level 4 Award 2019

Thailand Safety Award 2018

Schneider Electric Ranked 11th in the Gartner Supply Chain Top 25 for 2019

Life Is On Schneider Electric

How to contact us

mySchneider application

ANDROID APP ON Google play

Available on the App Store

02 617 5555

customercare.th@se.com

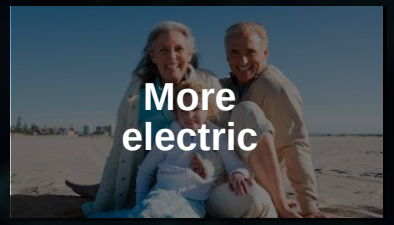
se.com/th

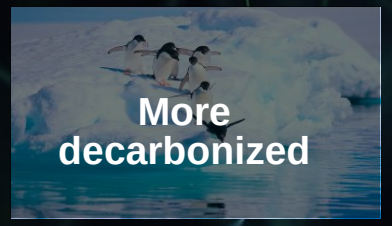
facebook.com/SchneiderElectricTH

Life Is On Schneider Electric

Emerging trends in the energy industry

Power industry is facing unprecedented changes





Trends

60% overall electricity demand increase in 2050 as compared to 2020

10x higher increase in connected devices than in connected people by 2020

86% of power generation investments will be in zero-carbon fuels until 2040

12% of capacity from DG by 2025

65% of DG investments in distributed PV

Challenges

Support growing electricity demand while decarbonizing electricity generation to avoid catastrophic climate change

In power generation, leverage digitization to lower TCO, extract value out of grid data to the benefit of the consumer, and mitigate cyber risks

Maximize renewable power injection while managing the variability of solar and wind energy resources

Maximize DER rate while maintaining a grid balance and avoiding massive CapEx investments

Life Is On | Schneider Electric

© 2019 Schneider Electric, All Rights Reserved |

We invent the New Electric World **Everywhere**
…And **we connect the dots** between everything

Grids of the Future
- Sustainable
- Resilient
- Efficient
- Flexible
- Deregulated

Supply / demand

Homes of the Future
- Sustainable
- Resilient
- Hyper-efficient
- More personal

Buildings of the Future
- Sustainable
- Resilient
- Hyper-efficient
- People-centric

Data Centers of the Future
- Sustainable
- Resilient
- Hyper-efficient
- Adaptive

Industries of the Future
- Sustainable
- Efficient & Resilient
- People-centric
- Next Generation

Infrastructure of the Future
- Sustainable
- Resilient
- Efficient
- People-centric

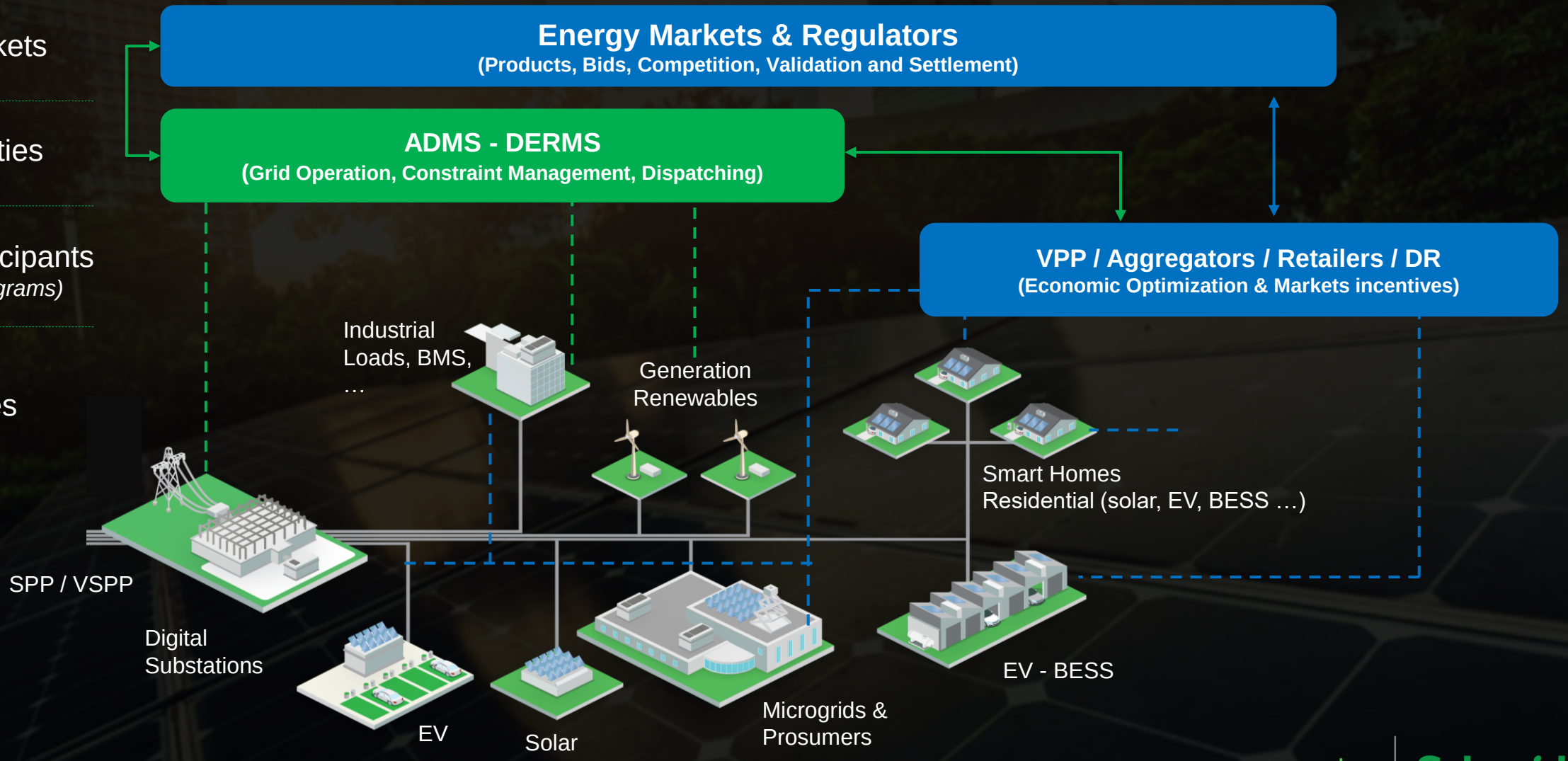
New Business Opportunity as Electricity Market Opens to Deregulation

Energy Markets

Electric Utilities

Market Participants
(VPPs / DR Programs)

Business Opportunities



Life Is On | Schneider Electric

Enterprise solutions for the Grid of the Future

Digitalization, optimization & automation for flexibility, resiliency & risk mitigation

ArcFM

Geospatial design, construction, as-built info mgmt

ADMS

Realtime and look-ahead operations and planning

DERMS

Optimization of DER to maximize grid flexibility

AutoGrid

Market based optimization of DER against grid constraints

Smart Metering

Meter data mgmt and low voltage analytics

Asset Advisor for Grid

Asset health, maintenance & management

Energy Profiler Online

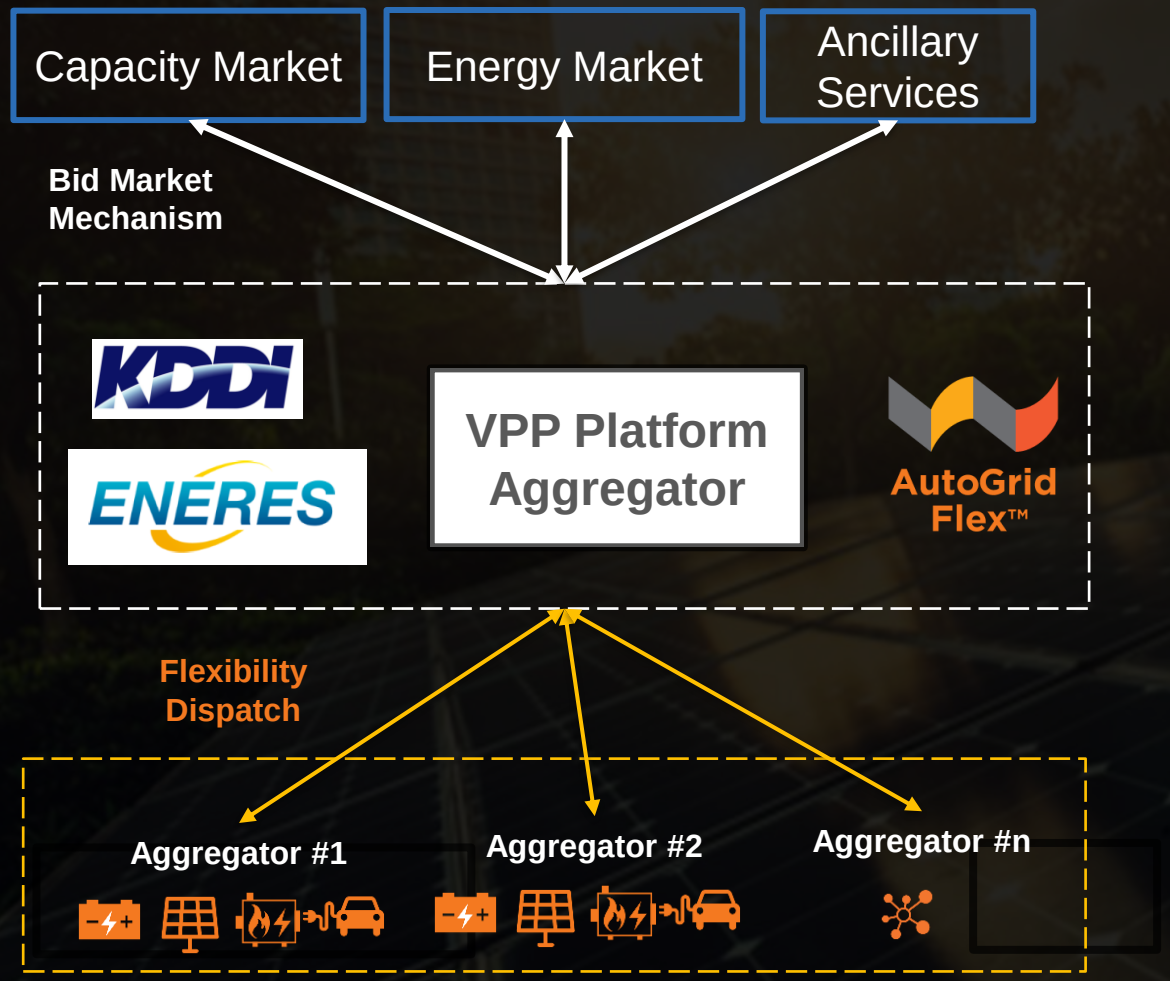
Customer engagement, energy efficiency & demand response

OT & IT **Realtime & Offline** **Planning & Design** **Capex & OpEx**

Life Is On | Schneider Electric

KDDI / Eneres Virtual Power Plant System in Japan

Expected to be the Largest Storage Virtual Power Plant (VPP) in the world by asset volume by 2021-end



Scalable VPP System to Aggregate and Monetize DERs in Japan's Wholesale Markets

Profile

- As PV and ESS costs decline, new revenue streams are opening in Japan's deregulated electricity markets
- DER & DR resources are becoming key for ENERES / KDDI's daily operations, creating the need for a scalable VPP solution
- METI-funded program for development of VPP applications

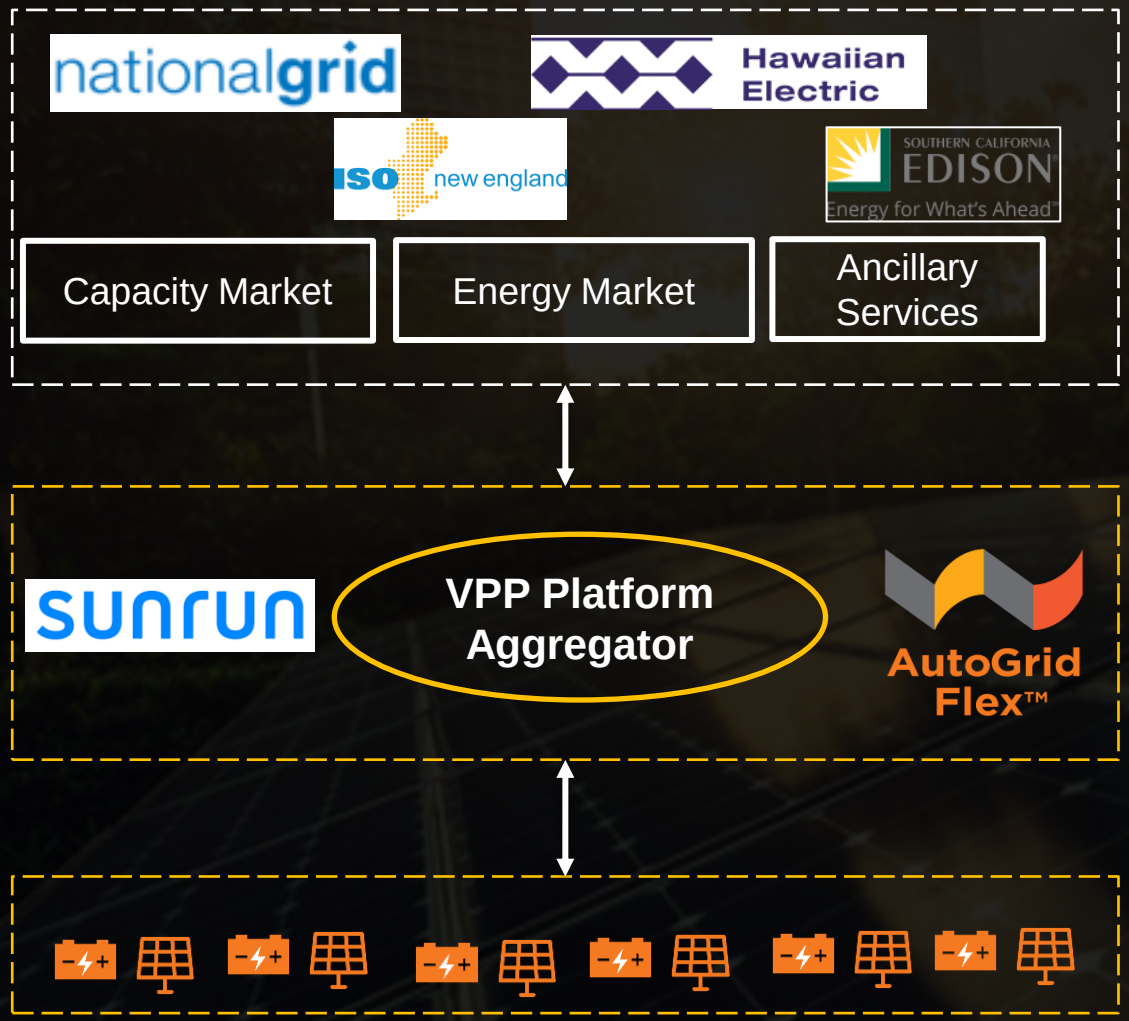
Scope and Solution

- Support a hierarchical multi-tenant architecture to dispatch resource aggregator DER portfolios.
- Real-time dispatch optimization in response to market signals
- Advanced analytics for forecasting and M&V.
- Aggregation of 10,000 storage assets on one platform.

AutoGrid | Life Is On Schneider Electric

Sunrun Virtual Power Plant System in US

Largest residential solar & storage systems in the US



Lynn Jurich
CEO, Sunrun

"AutoGrid will enhance our capabilities to offer utilities aggregated fleet of solar and battery resources to make the grid cleaner and more resilient, while reducing cost for energy consumers"

Profile

- Monetizing value of large installed base of solar + storage
- Needed highly scalable software platform to match growth

Scope and Solution

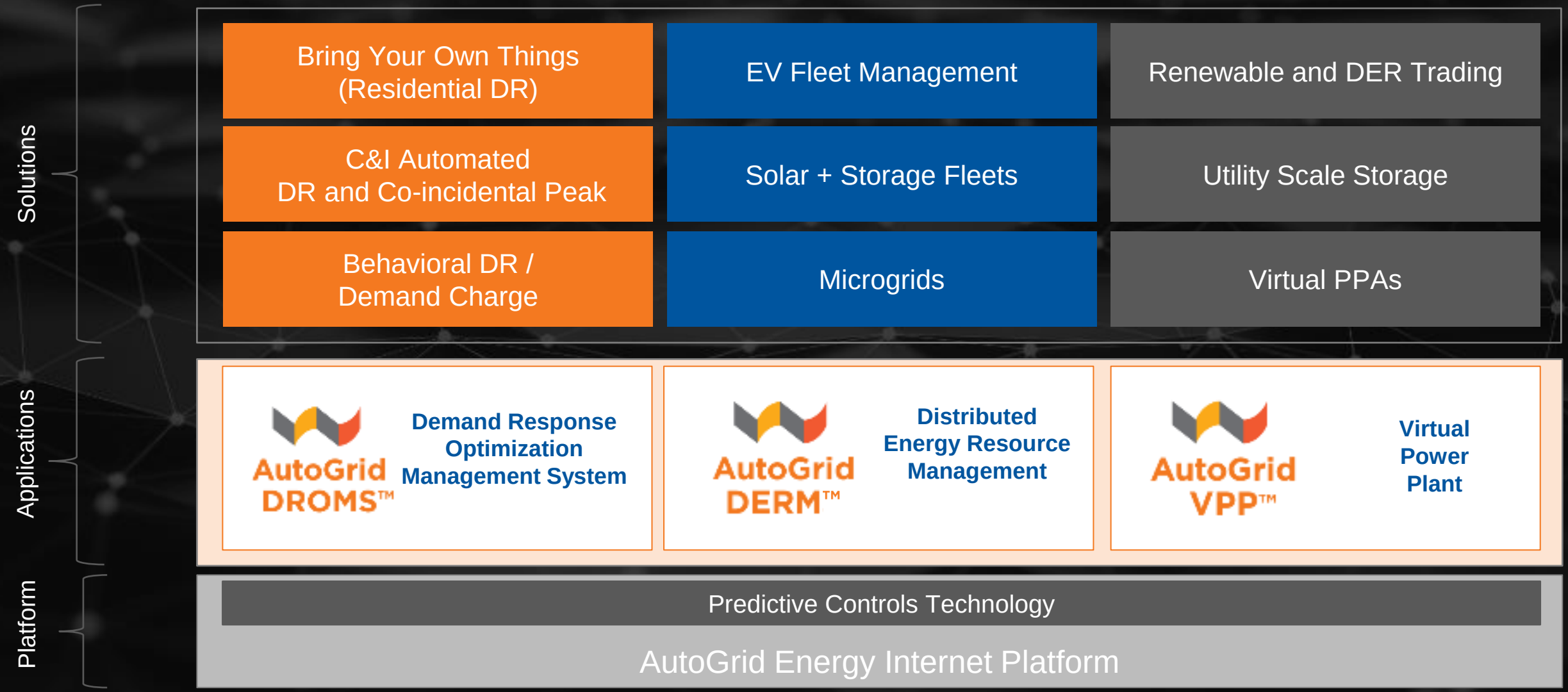
- VPP to deliver $50 million in grid services contracts
- Scaling up from 10,000 to 100,000 batteries by 2022+
- Enterprise grade, API first, cloud native, open-standards
- Ability to onboard and control all types of storage assets
- ~$700/Yr Potential revenue from each home

sunrun Grid Services

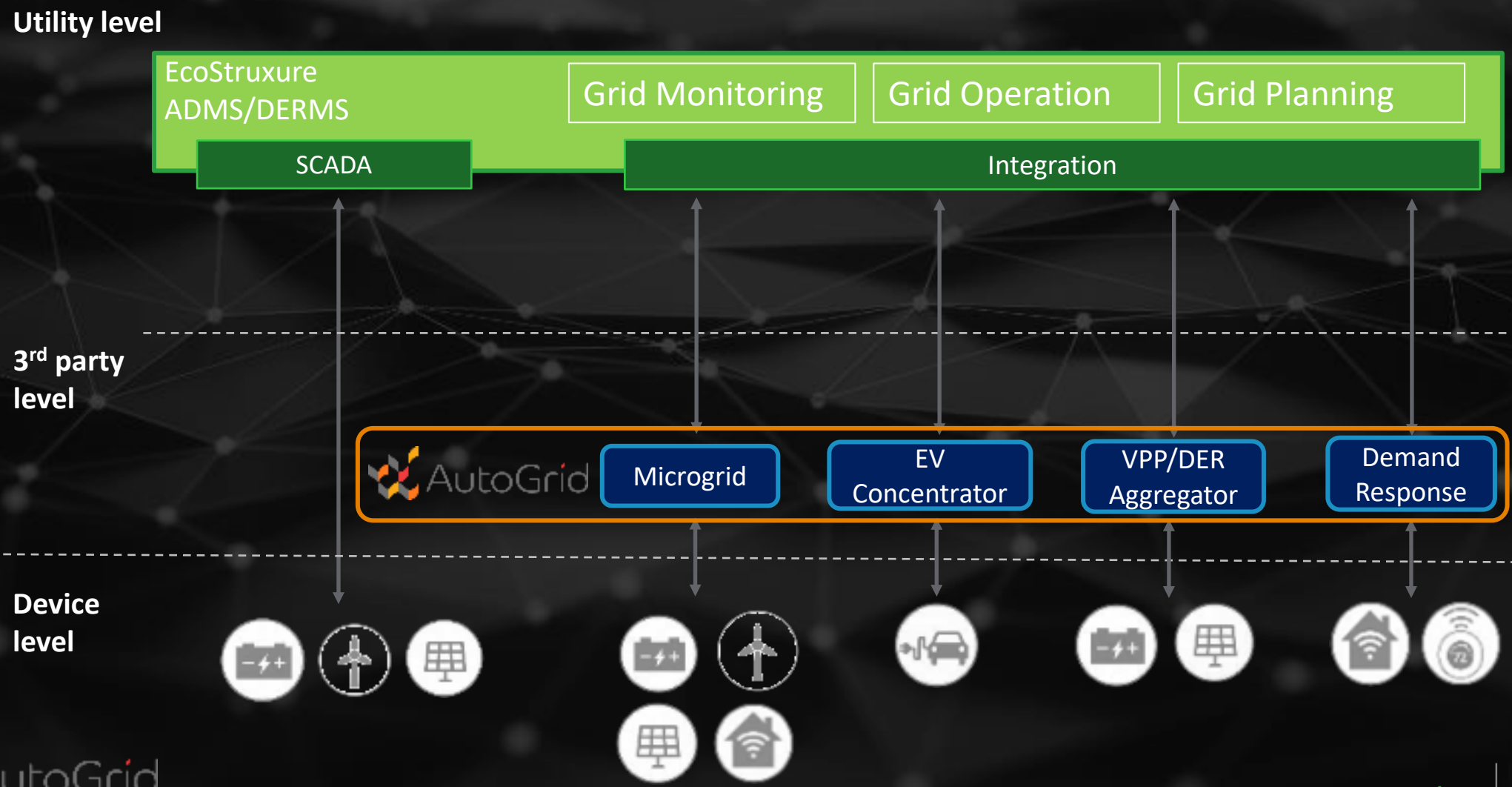
AutoGrid

Life Is On Schneider Electric

AutoGrid Flex™ - Energy Internet Platform



EcoStruxure™ DERMS – Integrating with all types of DERs



Life Is On Schneider Electric

Schneider Electric DERMS projects across geographies

Demonstrating innovation

Energy storage

- Intermediate Feeder Energy Storage
- Three 350-400kw deployments
- Single phase cap bank control
- Energy storage & cap banks

Distributed PV

- DERMS optimizing distributed PV
- Integrated with ADMS operations
- Dispatchable (3) 1MW PV arrays
- Non-dispatchable rooftop PV

Microgrid integration

- Monitor/dispatch µgrid controller
- Dispatch microgrid assets directly
- Disconnect (island) / reconnect
- Setpoints (MW, MVAR, MV)

Distributed grid mgmt

- Islanding operations of feeder section
- Pre-event – prepare simulation plan
- Go-time – grid forming inverters
- Post-event – maintain island stability

Active Network Management

- Flexible network & customer resources
- Less need for network reinforcement
- Providing access for ancillary services

DERMS ARENA

- Improving network hosting capacity
- Dispatching behind-the-meter DER
- Optimized for market and grid
- Includes retailer and market operator

100 MW Challenge

- Managing low-load events
- Curtail solar and increase load
- Engage, notify, report and settle
- Manual and automated dispatch

Life Is On Schneider Electric

PEA Distribution Dispatching Center (ADMS project)

Customer Key Highlights

- Operations: Sub-Transmission, Distribution & Retail
- Area of Responsibility: All Thailand, excluding Bangkok (510sqkm)
- Metered Customers: 20million
- Yearly Revenue: 13.7BUSD
- Primary Substations: 550
- Distribution Substations: +22,000
- SAIDI: 89.82 minutes/person/year
- SAIFI: 3.81 times/person/year
- Network Losses: 5.37%

Customer Vision – PEA 4.0

"Transformation to become a digital utility. To improve field operations, increase Renewable Energy penetration and prepare PEA for Microgrid, Solar Rooftop & Electric Vehicles"

SE Key Success Factors

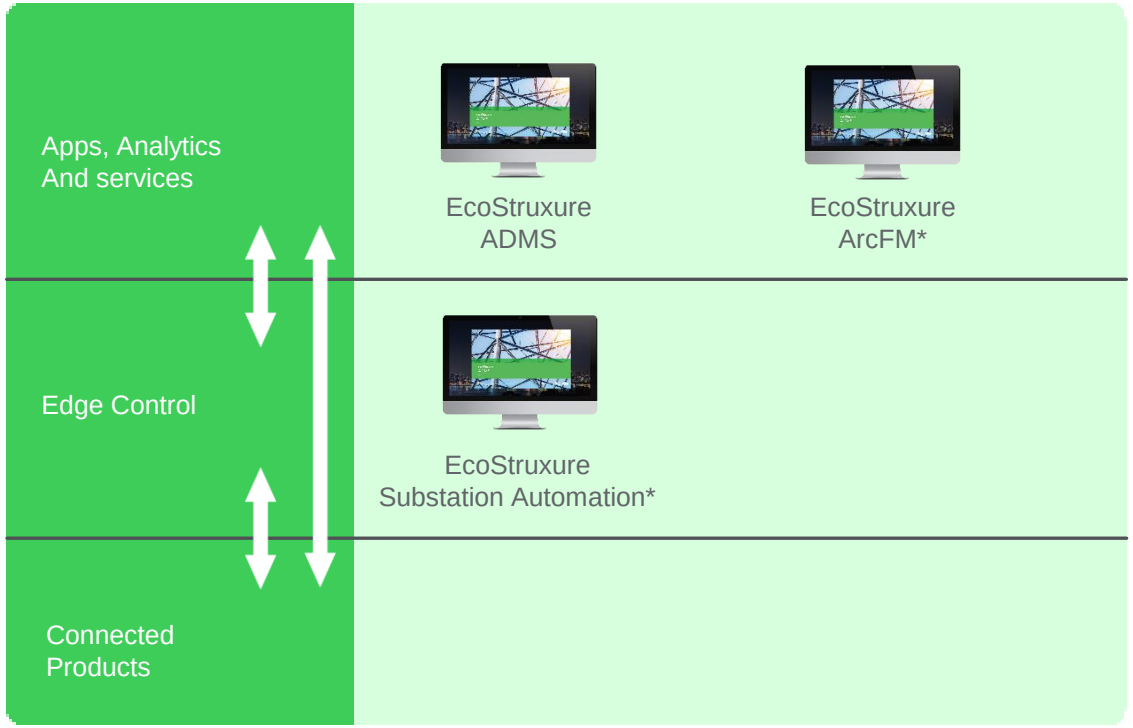
- Understanding PEA's business & being their partner of choice to help them achieve their vision.
- Expertise in specialized topics such as ADMS, DERMS, Microgrid, Cybersecurity.
- Excellent cross-country teamwork, between SE Thailand & SGS

Project Scope of Work

Supply of **SE EcoStruxure ADMS** solution for the monitoring and control of PEA's **High Voltage, Medium Voltage & Low Voltage** network.

EcoStruxure ADMS solution will be **integrated with PEA's existing EcoStruxure ArcFM solution.**

EcoStruxure Grid
Innovation At Every Level



Life Is On | Schneider Electric

Link for definition of VPP (and difference with Microgrid / DR)

https://www.greentechmedia.com/articles/read/so-what-exactly-are-virtual-power-plants#:~:text=VPPs%20can%20be%20assembled%20using,systems%20for%20control%20and%20operation.

https://www.powermag.com/the-role-of-virtual-power-plants-in-a-decentralized-power-grid/

Joint Solution Landscape

EcoStruxure™ Innovation At Every Level

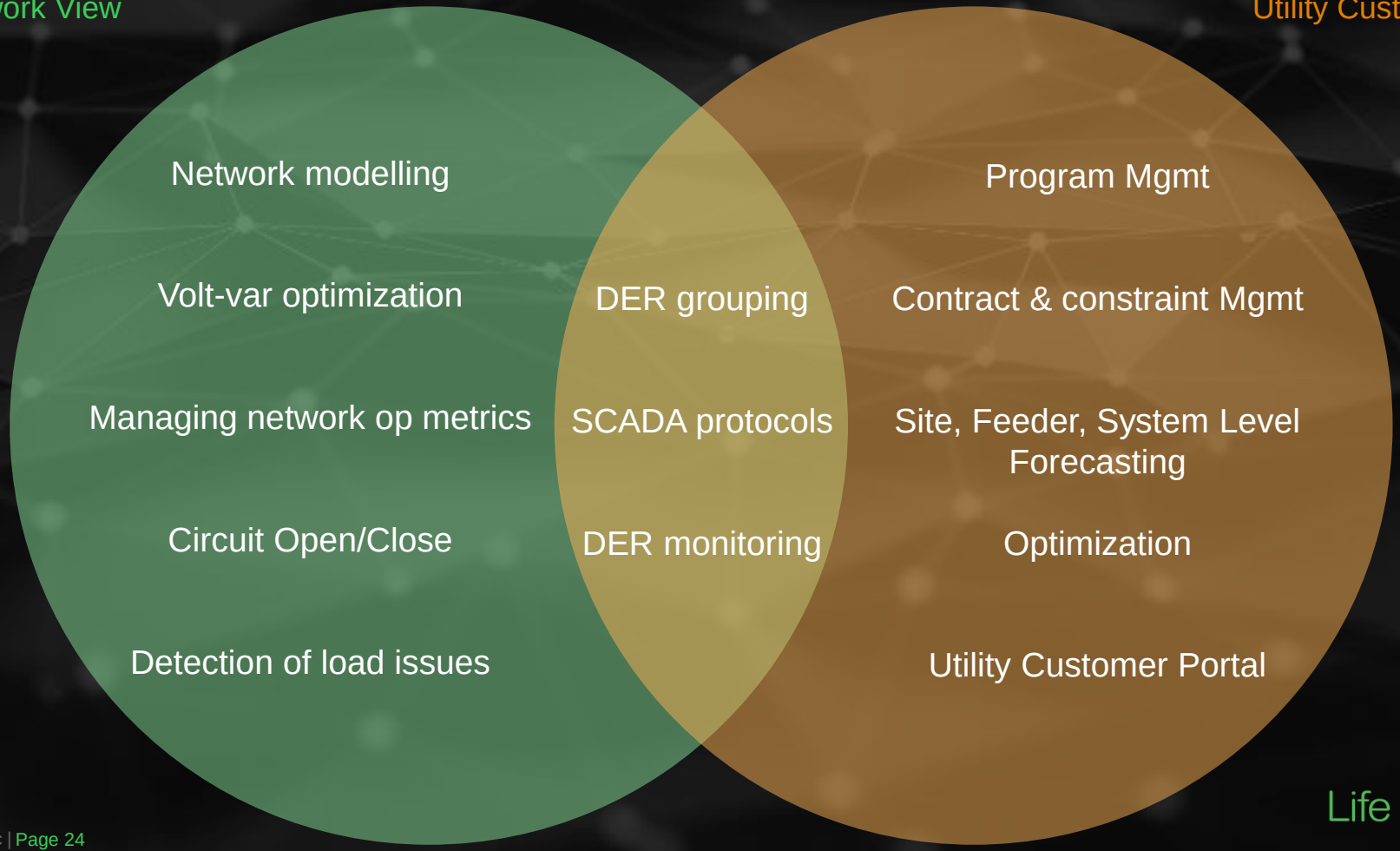
DERMS

DRMS

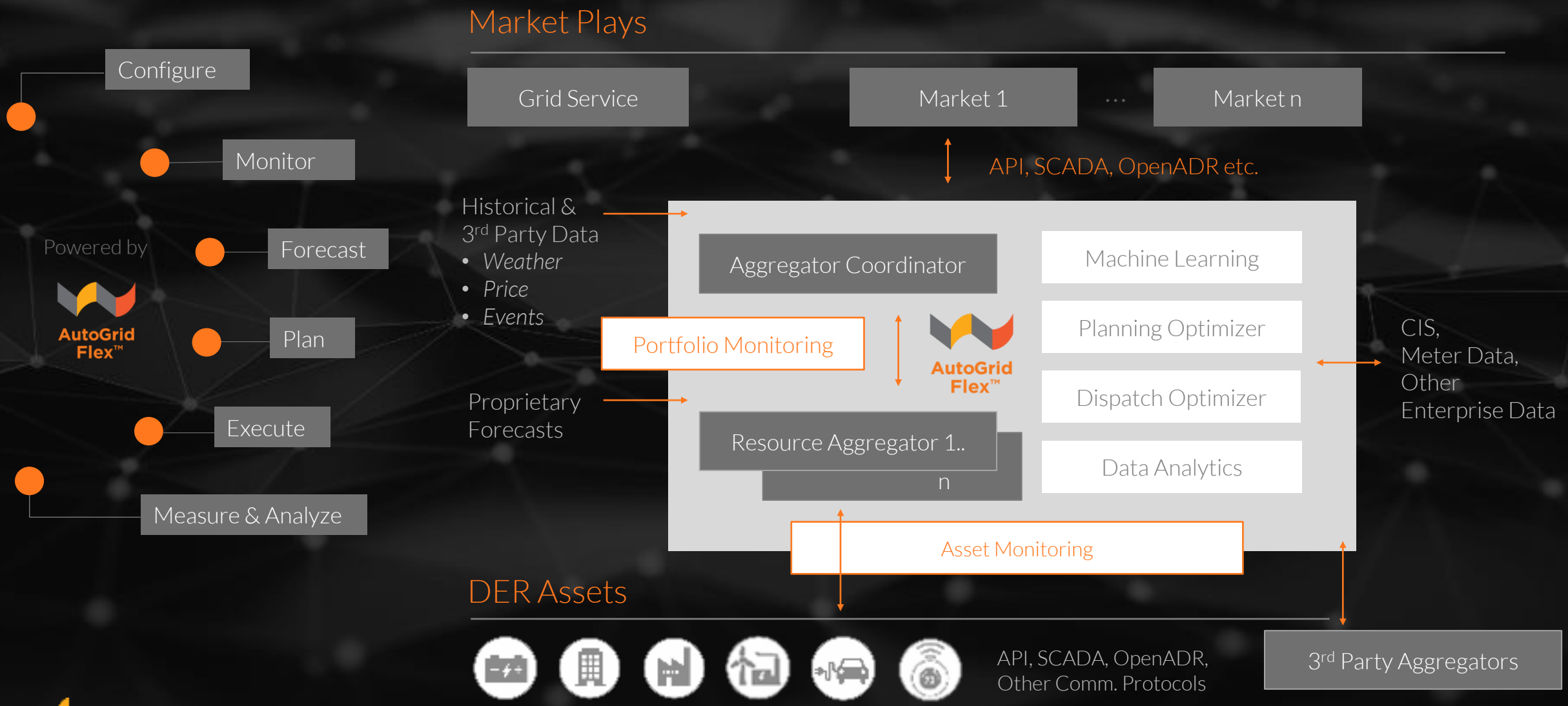
AutoGrid

Distribution Network View

Utility Customer DER View



AutoGrid Flex™ - Virtual Power Plant



AutoGrid

Life Is On Schneider Electric

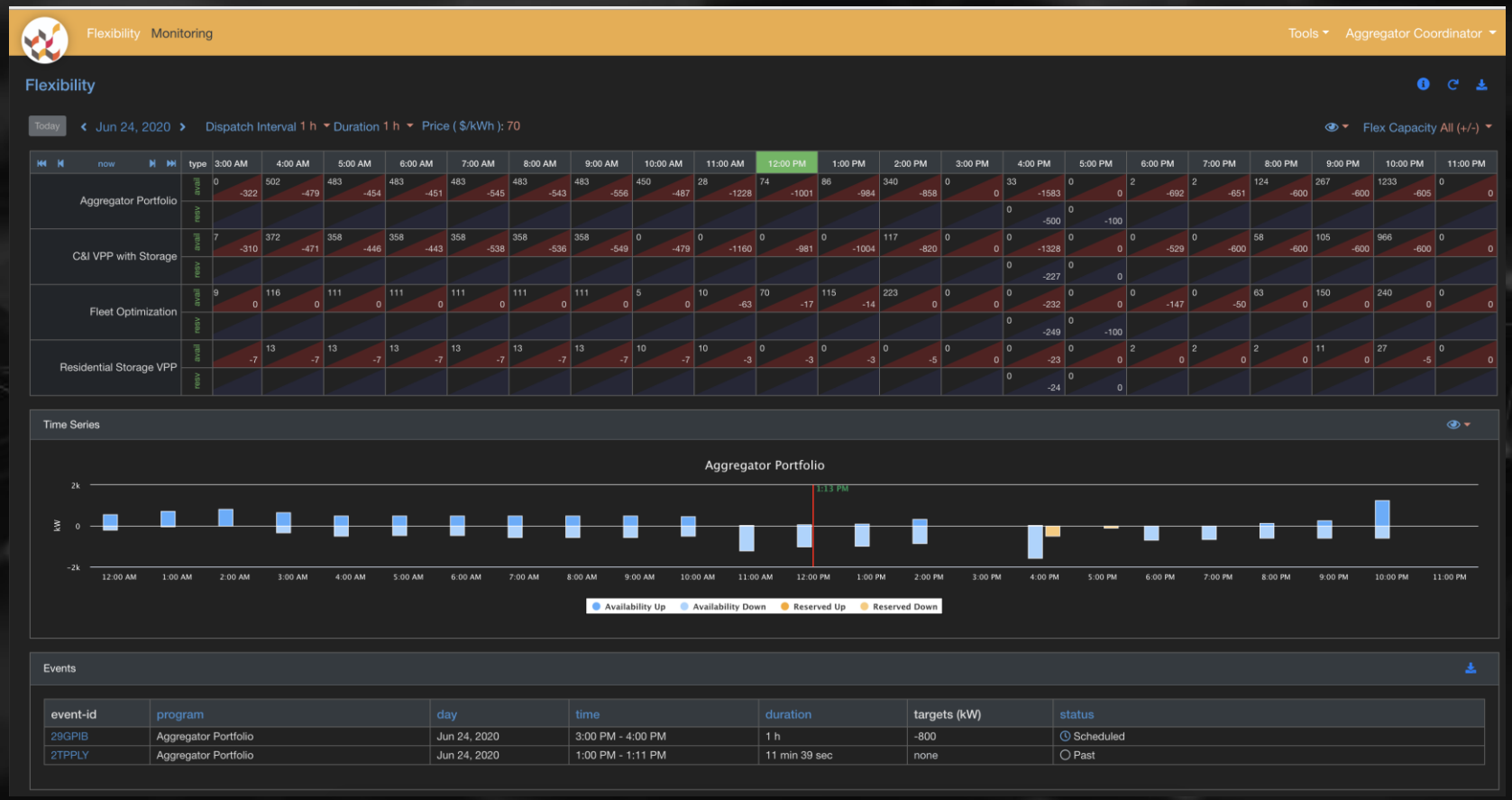
AutoGrid Flex™ - Virtual Power Plant

Co-optimise and dispatch value streams across:

- Market Products
- Local Value Streams
- Asset Classes
- Resource Pools

AutoGrid Flex™ provides real-time visibility into your resource pools and assets.

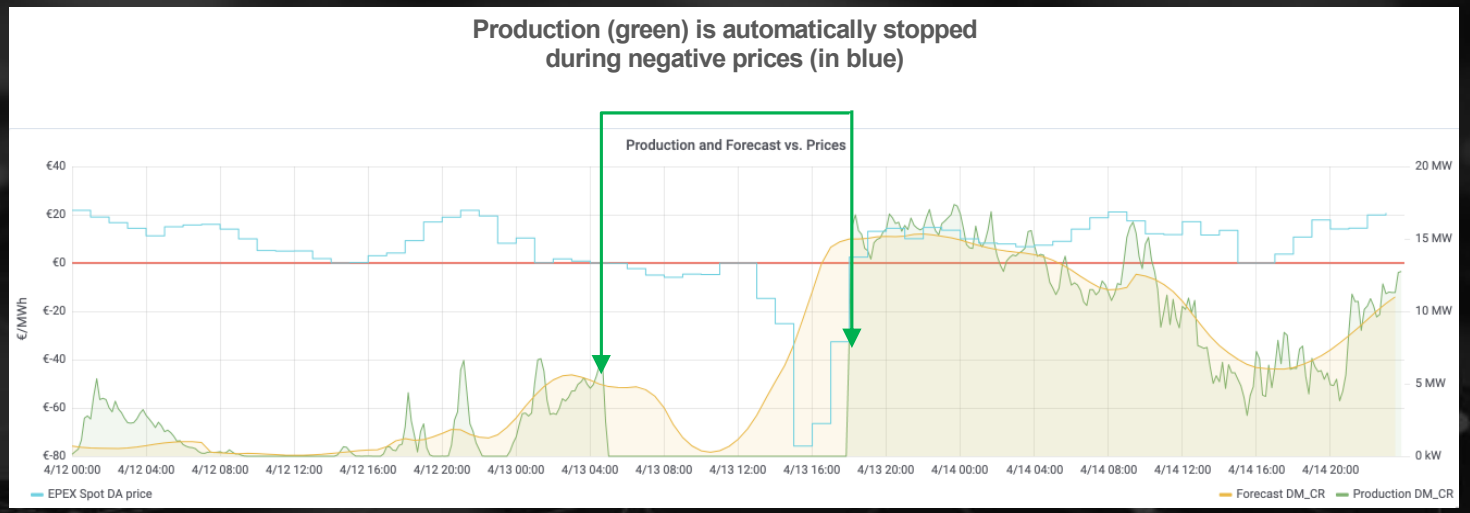
Manage event-based (e.g.: spot arbitrage) dispatches alongside continuous programs such as FCAS.



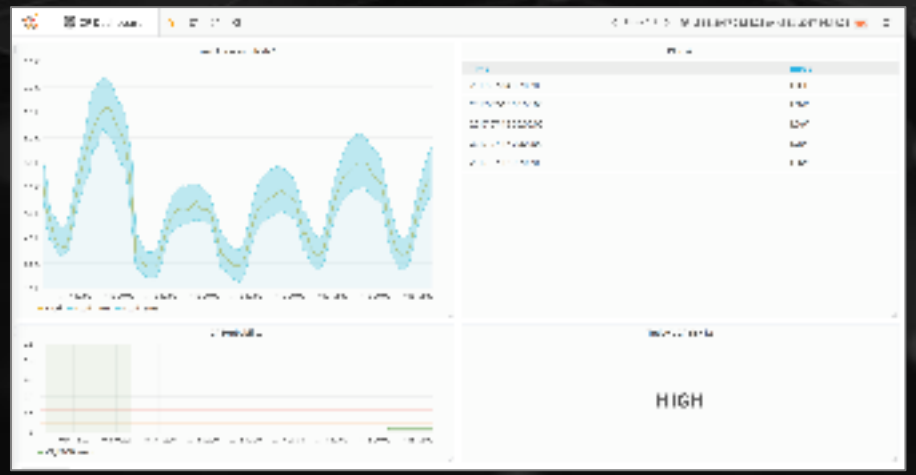
AutoGrid Flex™ - Energy Internet Platform

Dispatch Resources programmatically, via API, or through the user interface. Examples include:

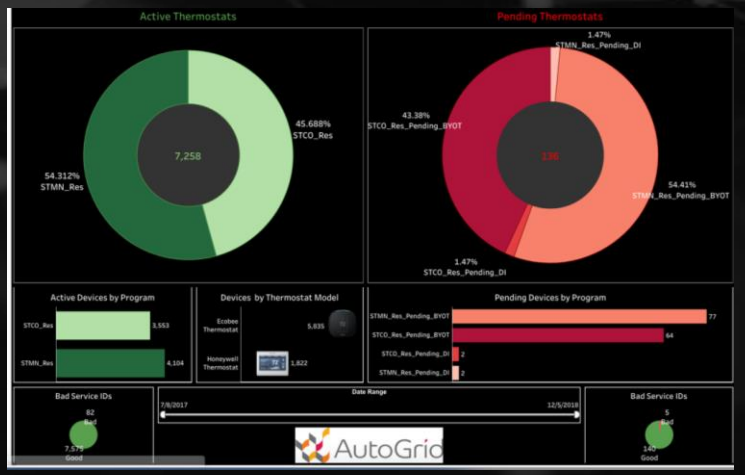
- Automatic control based on prices
- Follow AGC signals for regulation FCAS
- Positions taken by trading desks
- Localized congestion management



Advanced forecasting



Post-dispatch analytics



Life Is On Schneider Electric

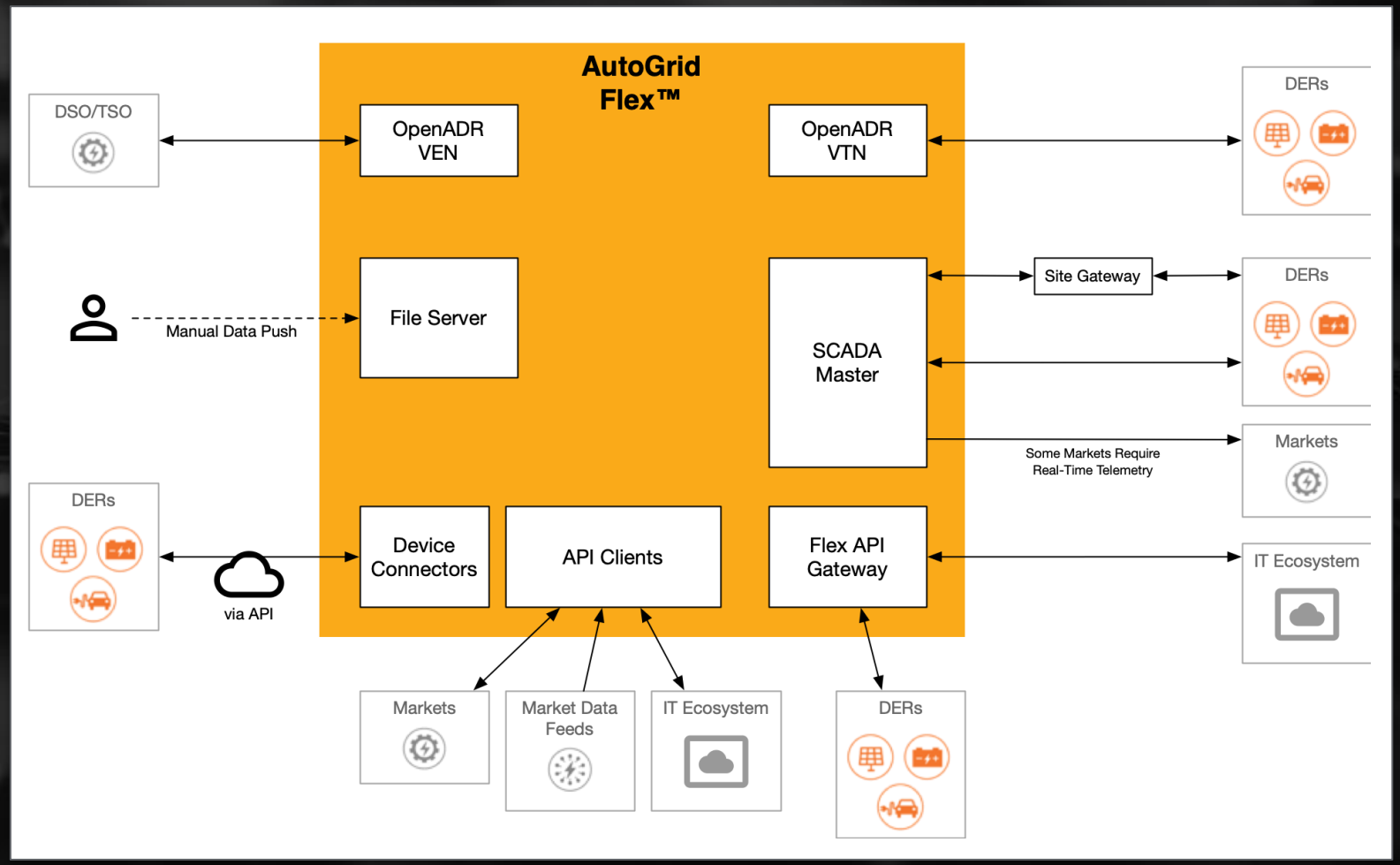
AutoGrid Flex™ – DER Enablement

Open, standards-oriented platform with broad interface and protocol support.

- SCADA: Modbus, OPC, DNP3
- MQTT (Sparkplug B, Others)
- OpenADR (VTN and VEN)
- IEEE 2030.5
- OCPP (coming soon)

Example device connectors for OEMs:

- Tesla, Panasonic, myRata
- Sonnen
- Rheem water heater
- LG thinQ
- Ecobee, Nest, Honeywell
- Redback (roadmap)
- AmbiClimate (roadmap)
- EV Chargers (SE, NewMotion, AddEnergie)



Life Is On Schneider Electric

AutoGrid Flex™ – Bring Your Own Things

Bring Your Own Things

The only BYOT program able to support and manage the full range of customer-owned assets, such as smart thermostats and EV chargers, regardless of hardware vendor, with plug-n-play asset connectivity. Addresses the end-to-end workflow including enrollment, installation support, incentive processing, ongoing event dispatch, and M&V. Powered by AutoGrid DROMS™, our BYOT program provides customers choice and self-control without sacrificing operational reliability.

Now Available for Download on
AWS Marketplace

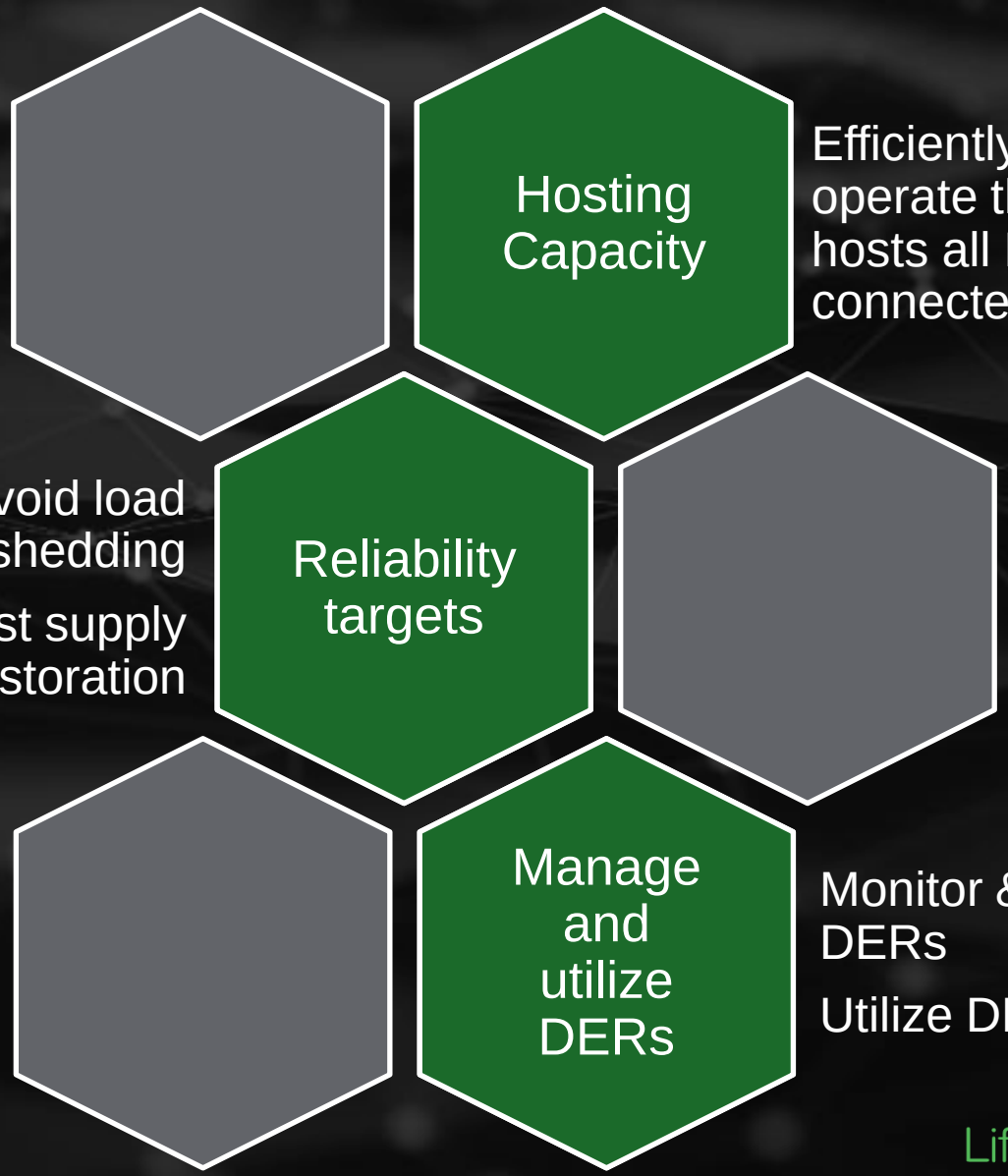
aws partner network
Advanced Technology Partner

AutoGrid

Life Is On Schneider Electric

Utility targets

Addressing the challenges

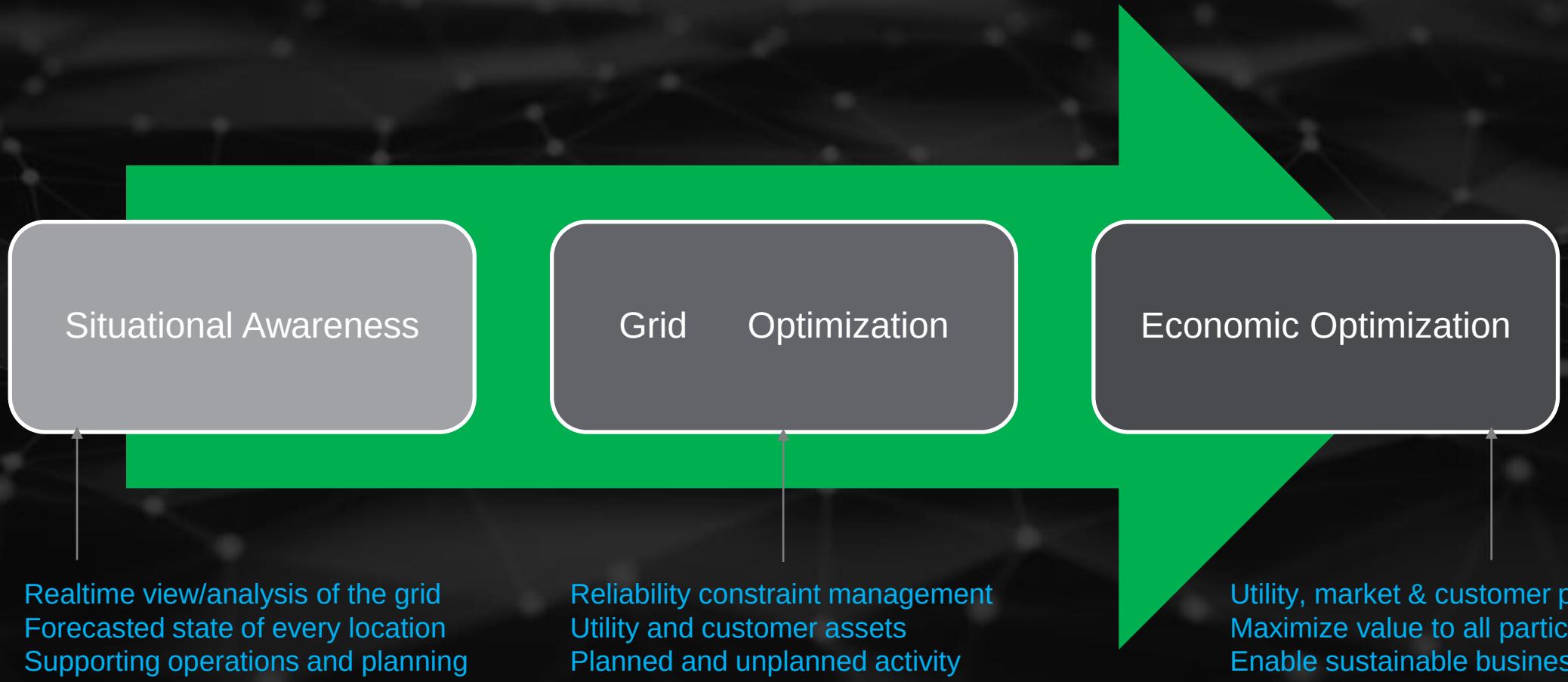


AutoGrid

Life Is On Schneider Electric

Distribution System Support for DER

Rise of the Distribution System Operator model

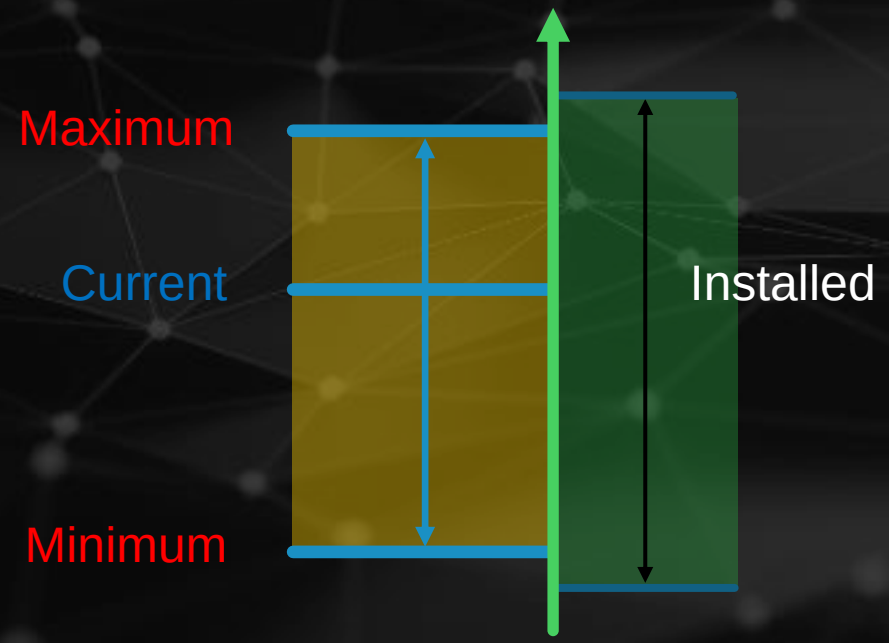


AutoGrid

Life Is On Schneider Electric

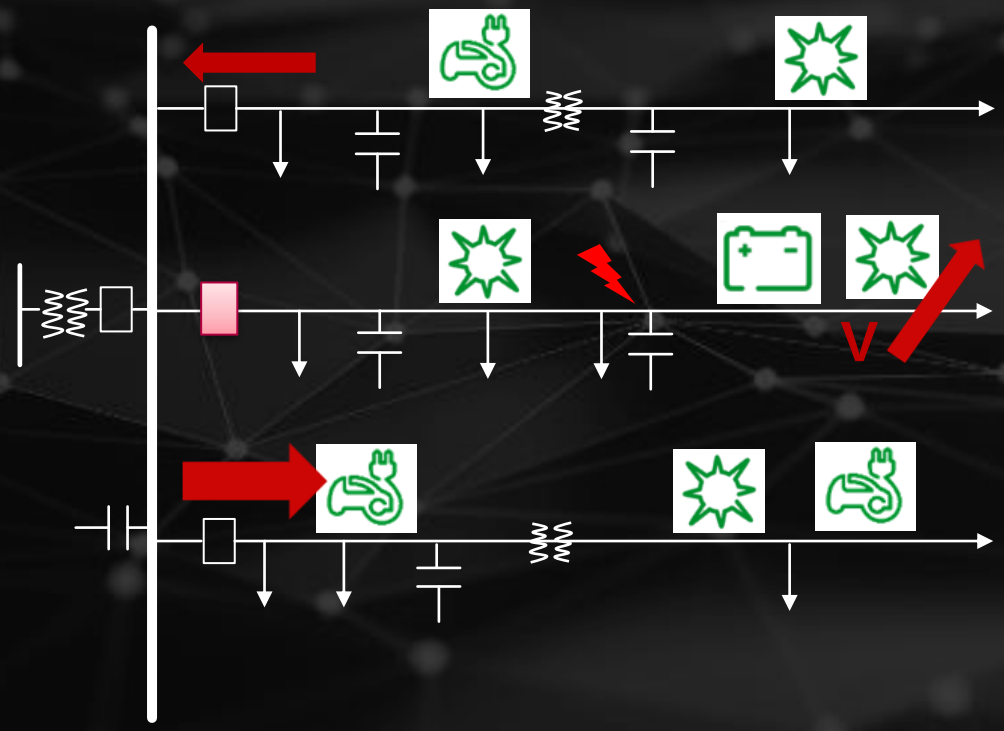
EcoStruxure DERMS – DER awareness

Real (Reactive) Power Output



- What?
  - Output
  - Flexibility
- When?
  - Real time
  - Forecasted
- How?
  - Per unit
  - Aggregated

EcoStruxure DERMS – Grid awareness



What?

- Manage constraints

When?

- Real time
- Forecasted

How?

- DER flexibility
- Traditional assets

EcoStruxure DERMS – Using DER Flexibility

Grid — Active network management

- Constraint Management
- Overloads, reverse power, voltage issues, relay protection issues

System — Peak demand management

- Watt & Var support
- System & region level

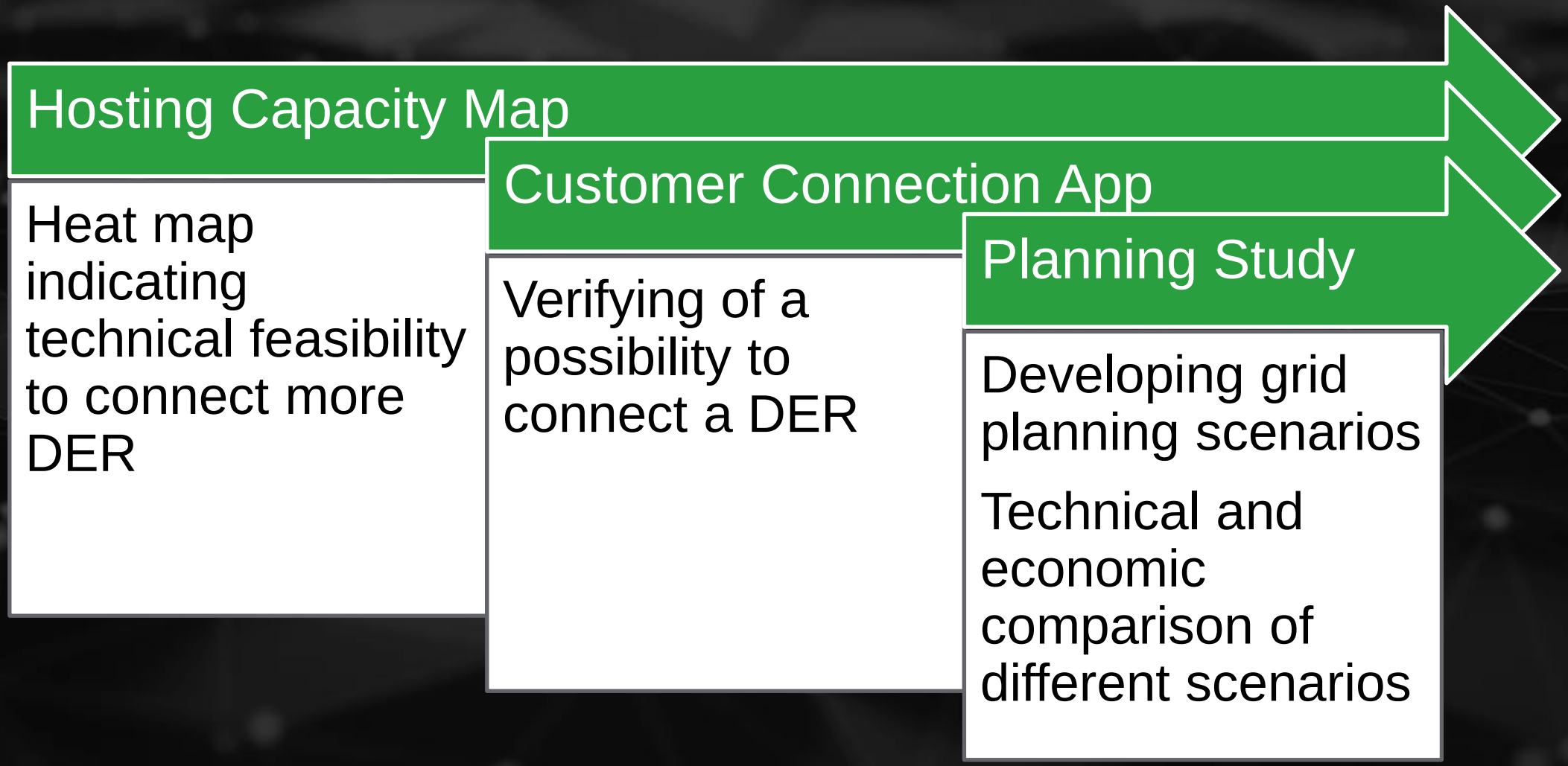
Market — Technical enabler

- Verifying technical feasibility of market transactions
- Using DER services for the Active network management

AutoGrid

Life Is On Schneider Electric

EcoStruxure DERMS – Planning the grid with DERs



Example of new Business Model: Microgrid-As-A-Services

Montgomery County Microgrid in US

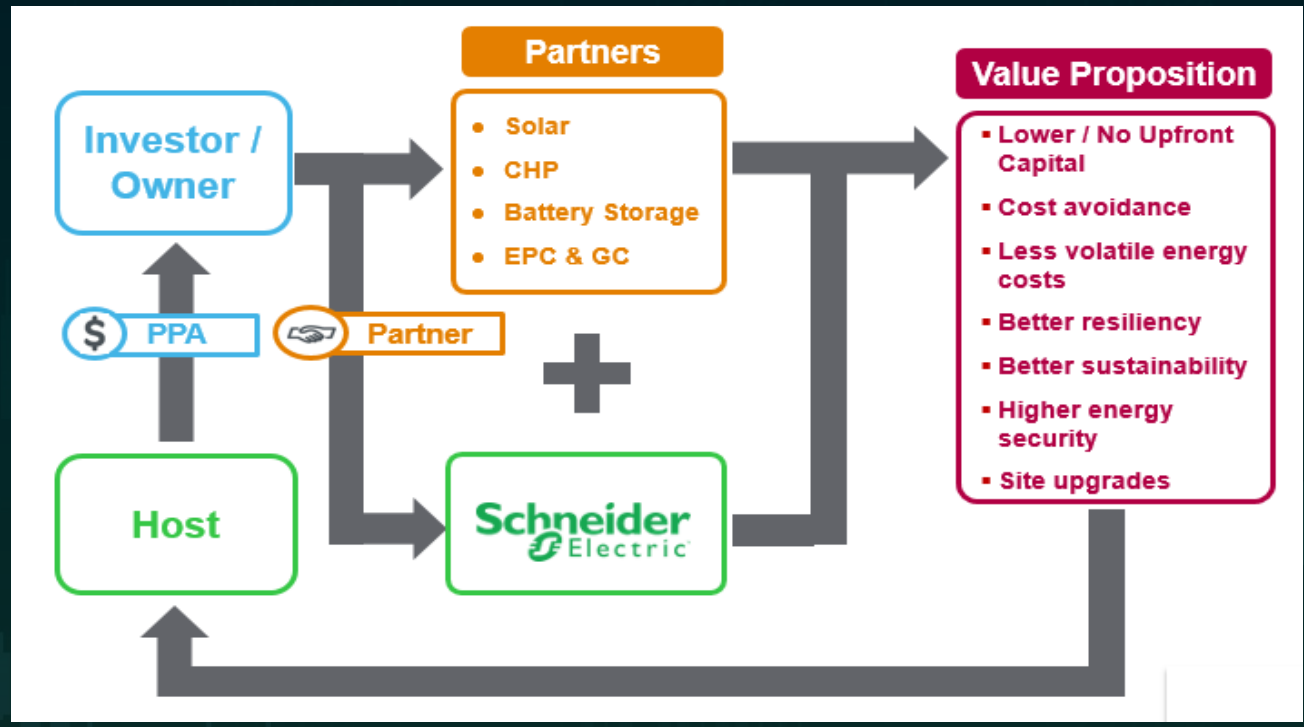
Customer: Public Safety HQ and Correction
Microgrid type: Facility, islandable
Location: Maryland, USA
Capacity: 1.2 MW

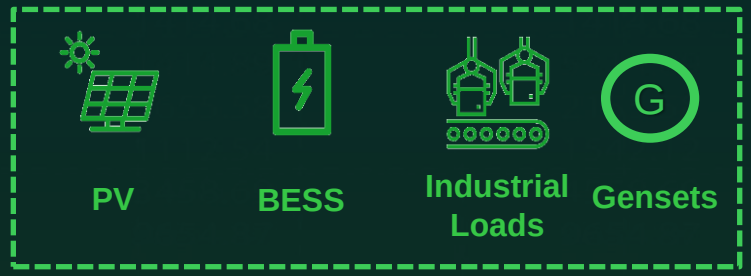
Customer pain point

Aging infrastructure with power outages, budget challenges with no capability to perform upfront investment, aggressive sustainability goals

Solution

Microgrid as a service business model with Duke energy, delivering solutions with no upfront cost





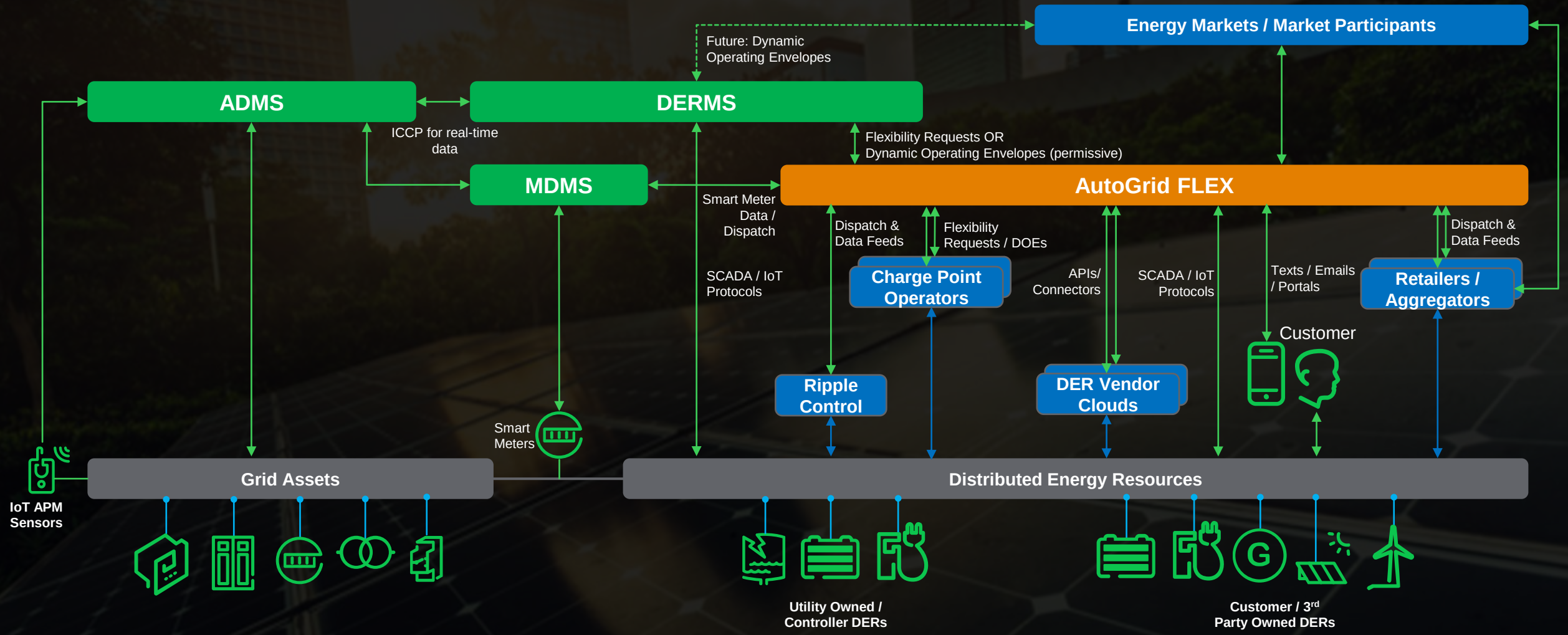
EcoStruxure™ Microgrid **Advisor**

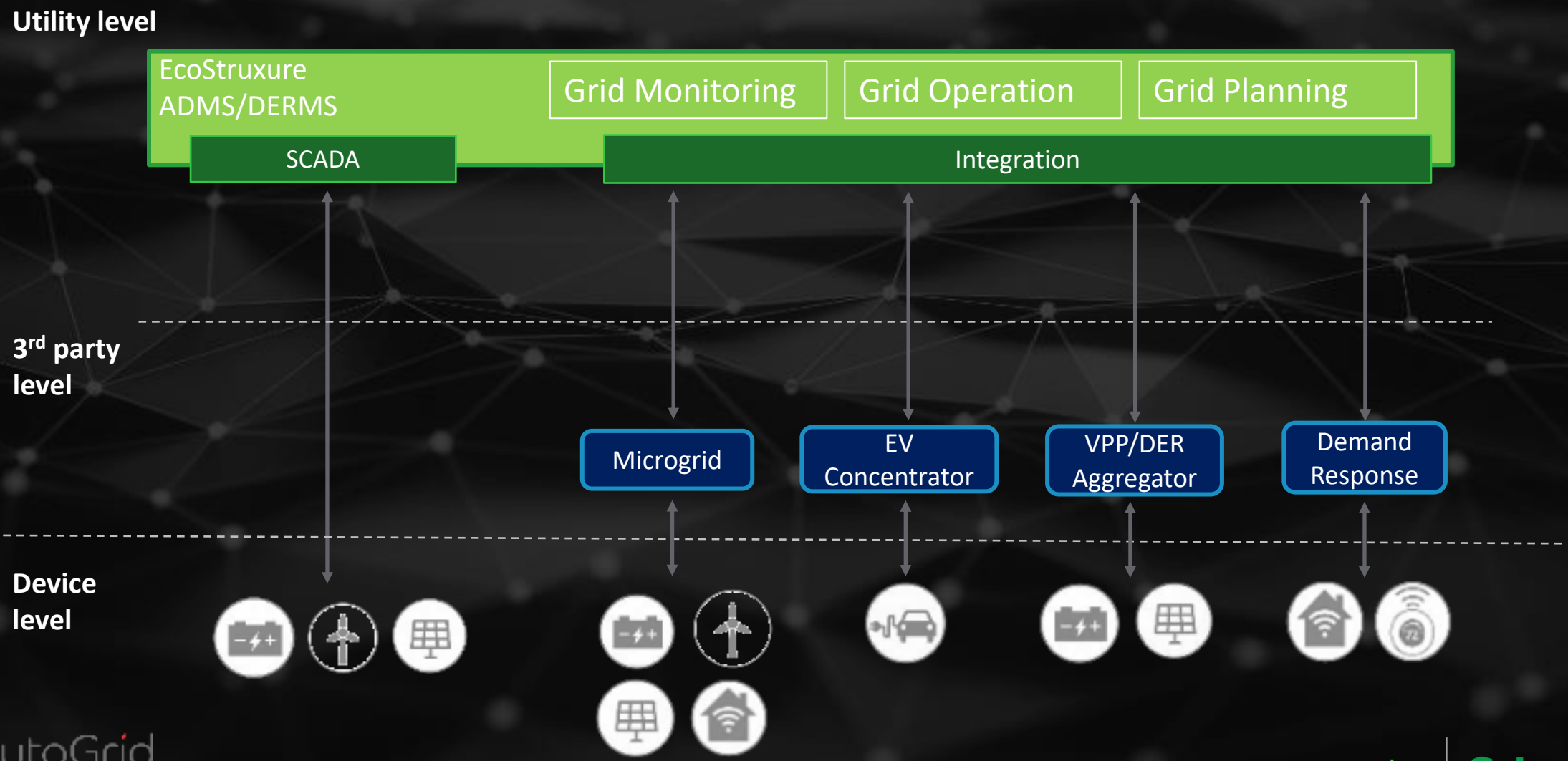
EcoStruxure™ Microgrid **Operation**

BESS + Solar inverters + LV/MV + BMS

ADMS/DERMS – AutoGrid Combined Ecosystem

Enabling control, connectivity & orchestration of DERs



Life Is On Schneider Electric

EcoStruxure™ DERMS – Integrating with all types of DERs