Guidehouse INSIGHTS

How Modular Solutions Accelerate Worldwide Microgrid and VPP Opportunities

Building the Business Case for a Resilient, Sustainable, and Digital Energy Distribution System

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Introductions

Today's Panelists

Peter Asmus
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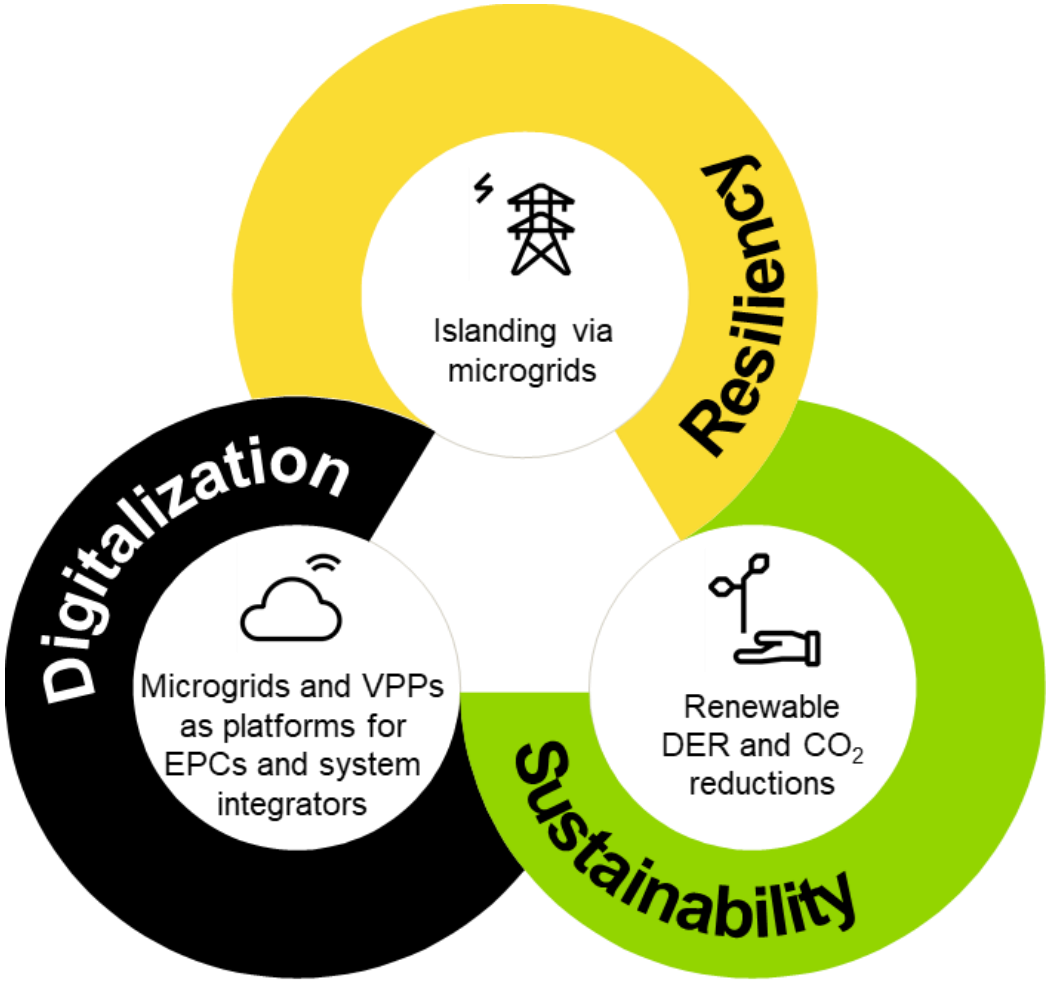
Fabio Monachesi
Global Microgrid Applications and Digital Offering Leader
ABB Electrification

Claus T. Larsen
Vice President
Strategic Key Accounts
DEIF A/S

Microgrids and VPPs Emerging as Vital Digital Platforms



(Source: Guidehouse Insights- ABB)

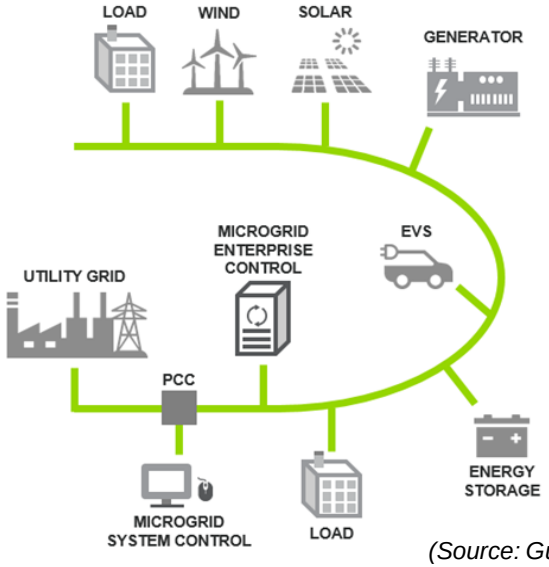
- Three global trends are driving the transformation of industries dependent on reliable energy in the 21st century:
  - Resiliency
  - Sustainability
  - Digitalization
- The last trend – digitalization – is the means by which greater resiliency and sustainability can be achieved.
- Microgrids and virtual power plants (VPPs) are digital platforms driving innovation in energy today.

Defining Features of Digital Platforms

Both platforms aggregate and optimize diverse DER assets

What is a microgrid?

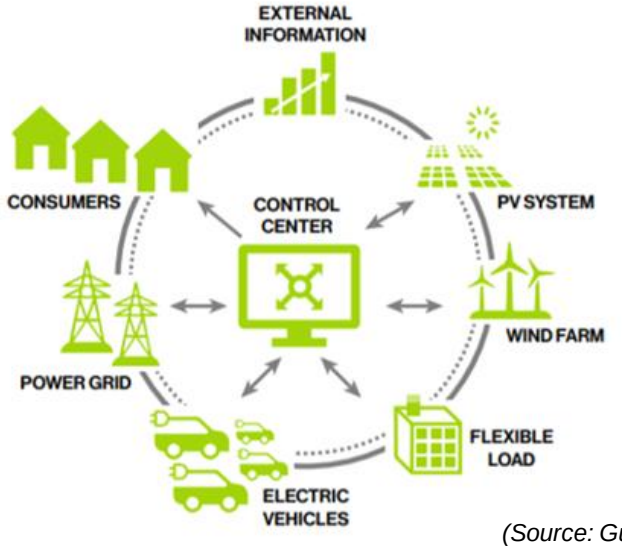
A group with clearly defined electrical boundaries of low voltage distributed energy resources (DER) and loads that can be operated in a controlled, coordinated way either connected to the main power network or in islanded mode.



(Source: Guidehouse Insights)

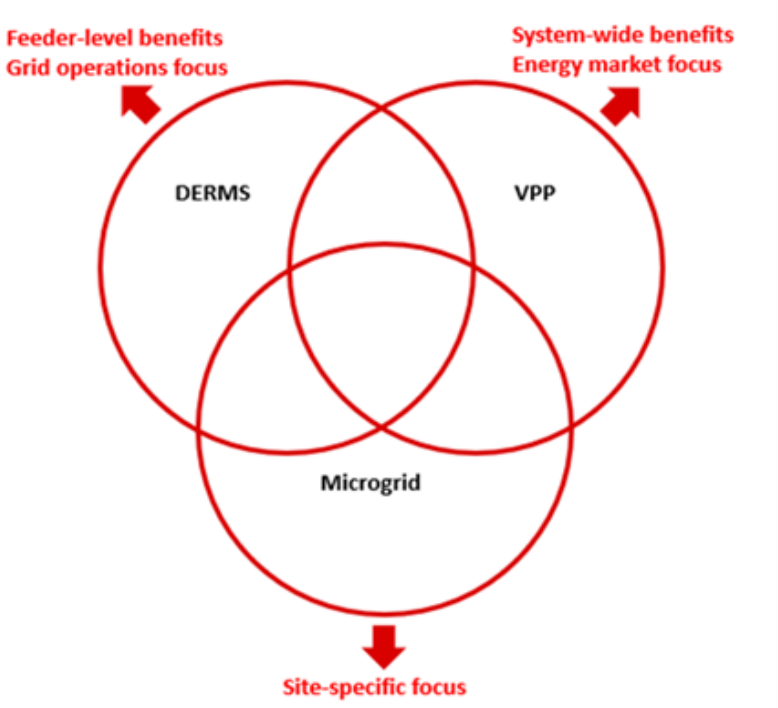
What is a VPP?

An aggregated system of energy assets remotely and automatically optimized by a software-based platform to dispatch services for distribution or wholesale market.

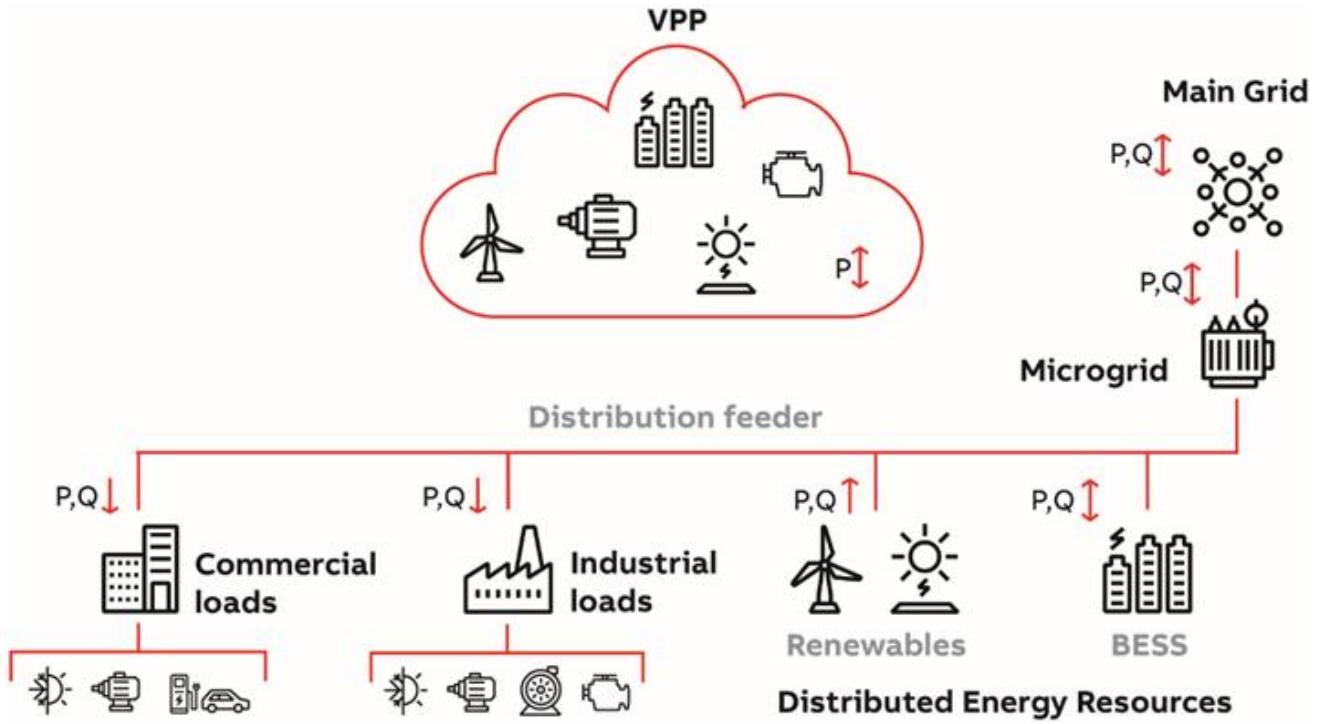


(Source: Guidehouse Insights)

Increasing Convergence on Digital Platforms



(Source: ABB)

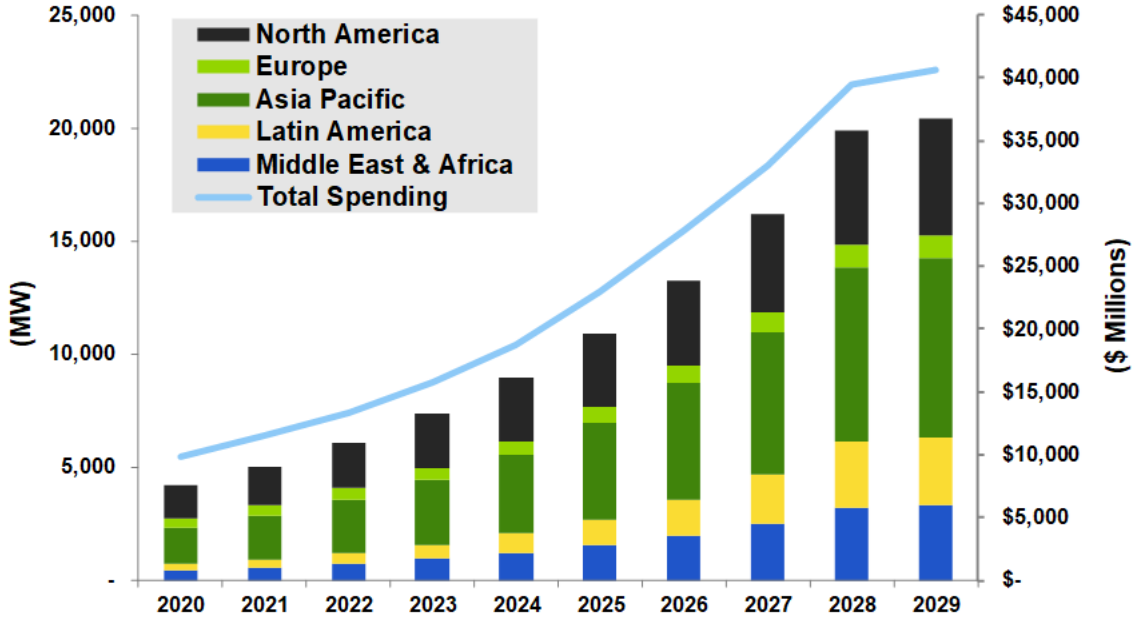


(Source: ABB)

Both Microgrids and VPPs Showcase Major Growth

These are global markets but feature regional hotspots

Annual Total Microgrid Power Capacity and Implementation Spending by Region, World Markets: 2020-2029



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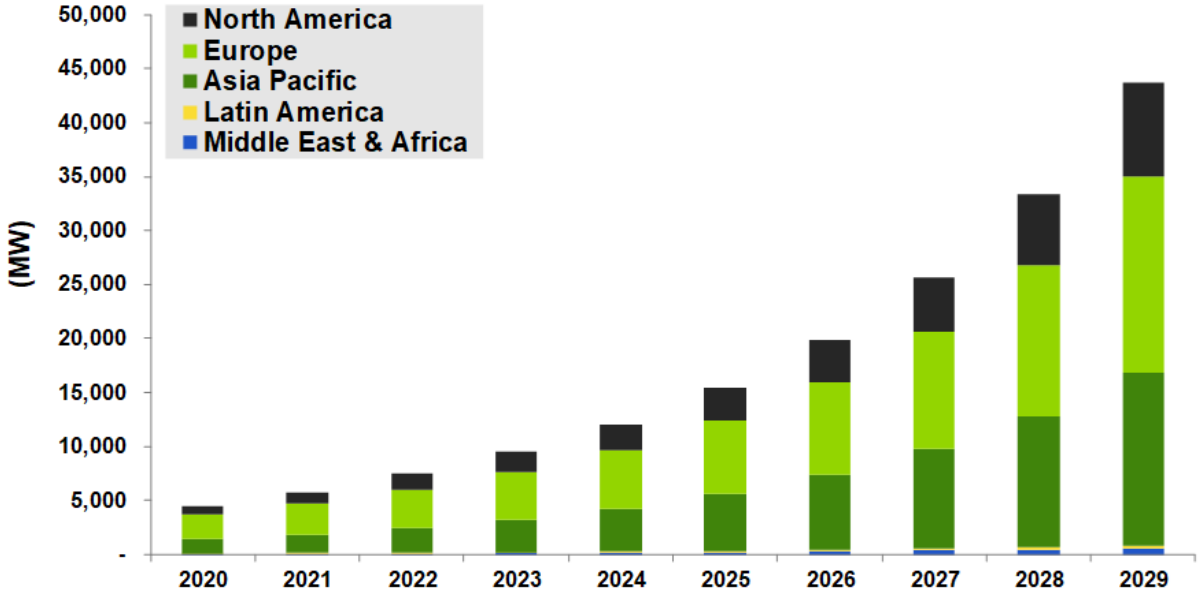
VPP Capacity by Region, World Markets: 2020-2029



(Source: Guidehouse Insights)

Three Regional Hotspots for Microgrids and VPPs

- **Asia Pacific**
  - The world's leading market for microgrids by project number, this part of the world is focused on remote microgrids deployed in the absence of a utility grid.
  - Australia and China are leading markets, both featuring microgrids and VPPs.
  - Noteworthy projects include a VPP serving Jibei Electric Power Co., Ltd., of China that will grow to more than 250 MW in size and serve 12.4 million consumers.

- **North America**
  - Hurricanes, wildfires, and other extreme weather events have prompted 18 states in the US to enact microgrid support programs.
  - The approval of Federal Energy Regulatory Commission Order 2222 is opening new VPP opportunities across the US.
  - A noteworthy microgrid project is a Florida Air Force base that required cybersecure resiliency upgrades.

- **Europe**
  - This region of the world is the most advanced VPP market due to deregulation and market designs focused on energy trading.
  - Most microgrids installed historically were on islands.
  - An exception to this generalization is a grid-tied microgrid serving a major European bank located in Rome, Italy, benefiting from state-of-the-art circuit breakers.

ABB New Modular Solution Blocks

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Let’s lead the energy revolution together

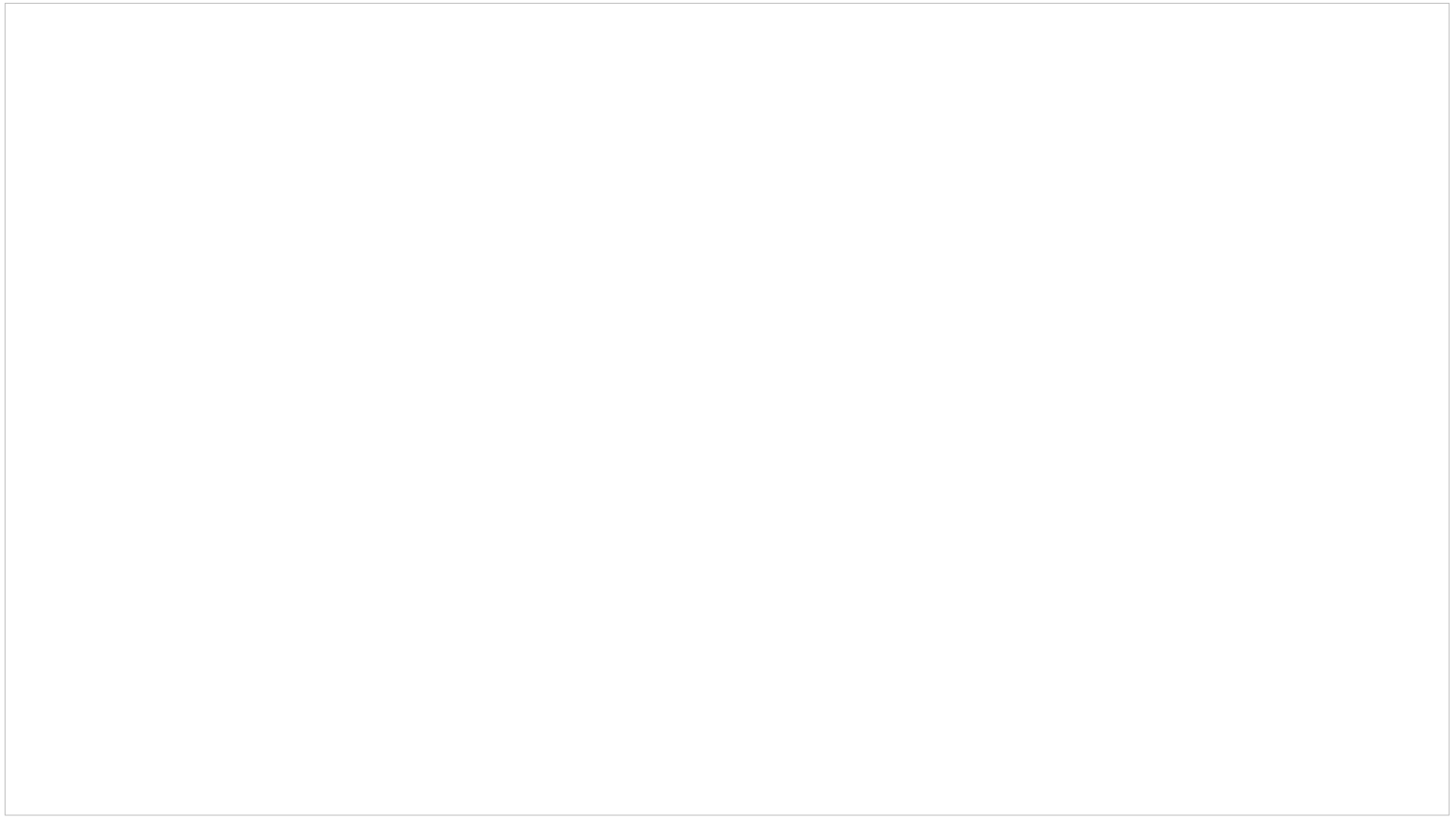

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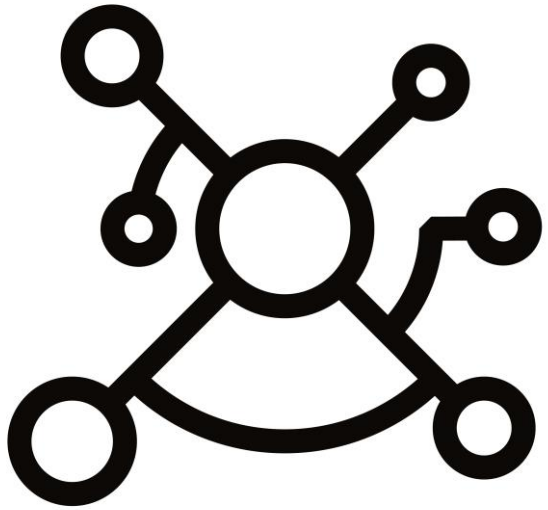
ABB Microgrids and VPP Strategy



Global trends in power generation market

Four major topics:

Resiliency, Sustainability, **Digitalization** and **Renewables**

Resiliency
- 24/7 power availability is a must for critical power facilities like hospitals, banks, data centers, and process industries

Sustainability
- 7.6% annual reduction of greenhouse gas emissions to reduce the average temperature of 1.5°C by 2030

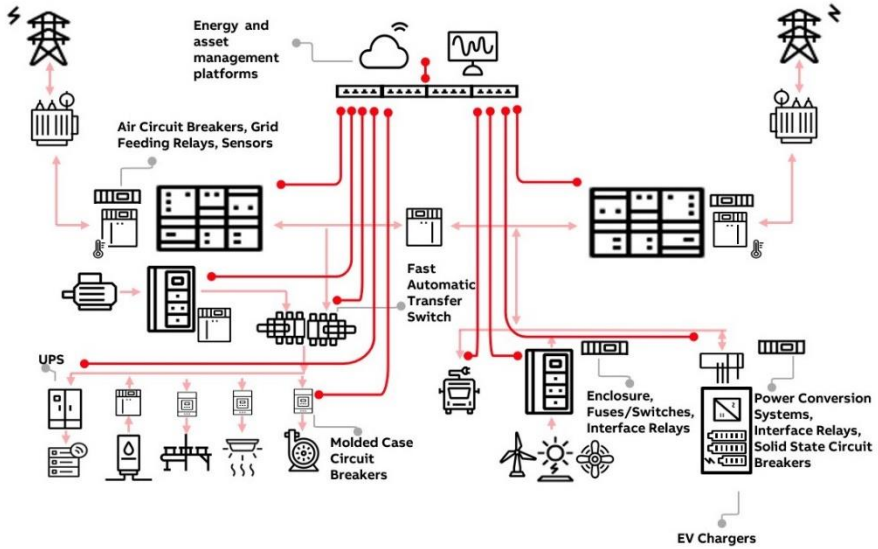
Digitalization
- Analytic models based on data to drive decisions

Renewables
- Declining DER costs
- Growing e-mobility energy storage availability

ABB Microgrids and VPP Strategy

ABB response to global trends

Modular, Scalable, and Plug & Play Solution Blocks



Design reference architectures for specific microgrid assets, from grid connection to solar PV plant for major segments like commercial, communities, industrial, and marine

Pre-tested and pre-engineered digital functions

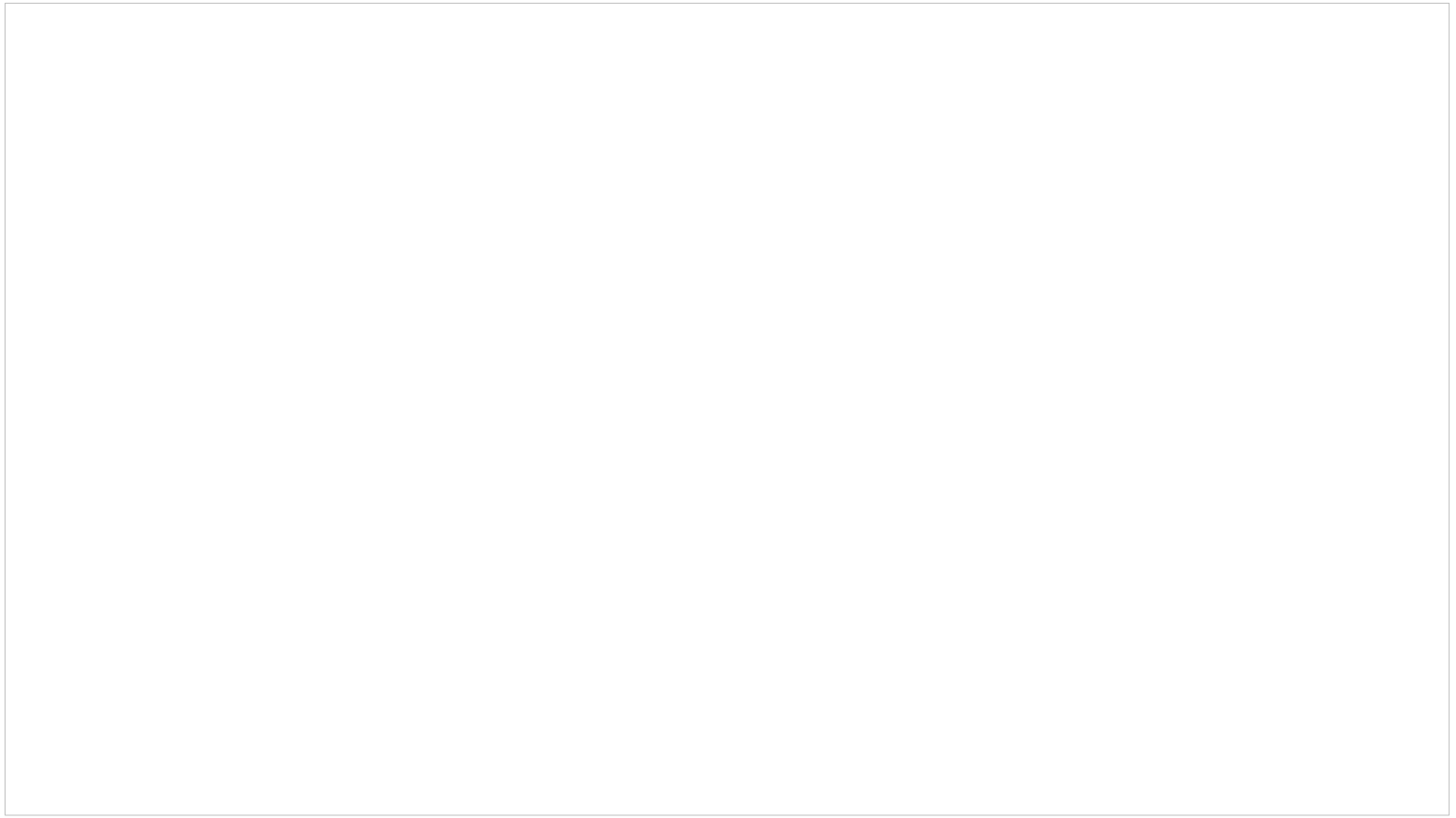
- Interface protection, load shedding, peak shaving, automatic transfer switching (ATS), power quality analyzer, and compensation

Intelligent products combined and interconnected in the solution block architectures ready for use of systems integrators, EPCs, panel-builders, and OEMs

Digital platforms to enable energy and asset monitoring and optimization to be leveraged by consultants, energy service and facility management companies, and load aggregators

ABB New Modular Solution Blocks

An example: industrial applications



How Does ABB Support Smart Power Microgrids?

Consolidating a partnerships ecosystem

Inspire

Design

- **Research centers**

ABB has several research centers focused on microgrids across Europe and North America. There are many collaborations with European universities and national research centers operating in microgrid open-innovation.

- **Technology providers**

In addition to ABB smart power portfolio, there are strong connections with several other technology manufacturers and systems integrators, within the ABB Group or external partners, to complete the microgrid offering as one ecosystem.

- **Service providers**

In addition to its own services, ABB has a network of partners to support systems integration and commissioning in more than 50 countries.

Certify

For more info: https://new.abb.com/low-voltage/solutions/smart-power-solutions-for-microgrids

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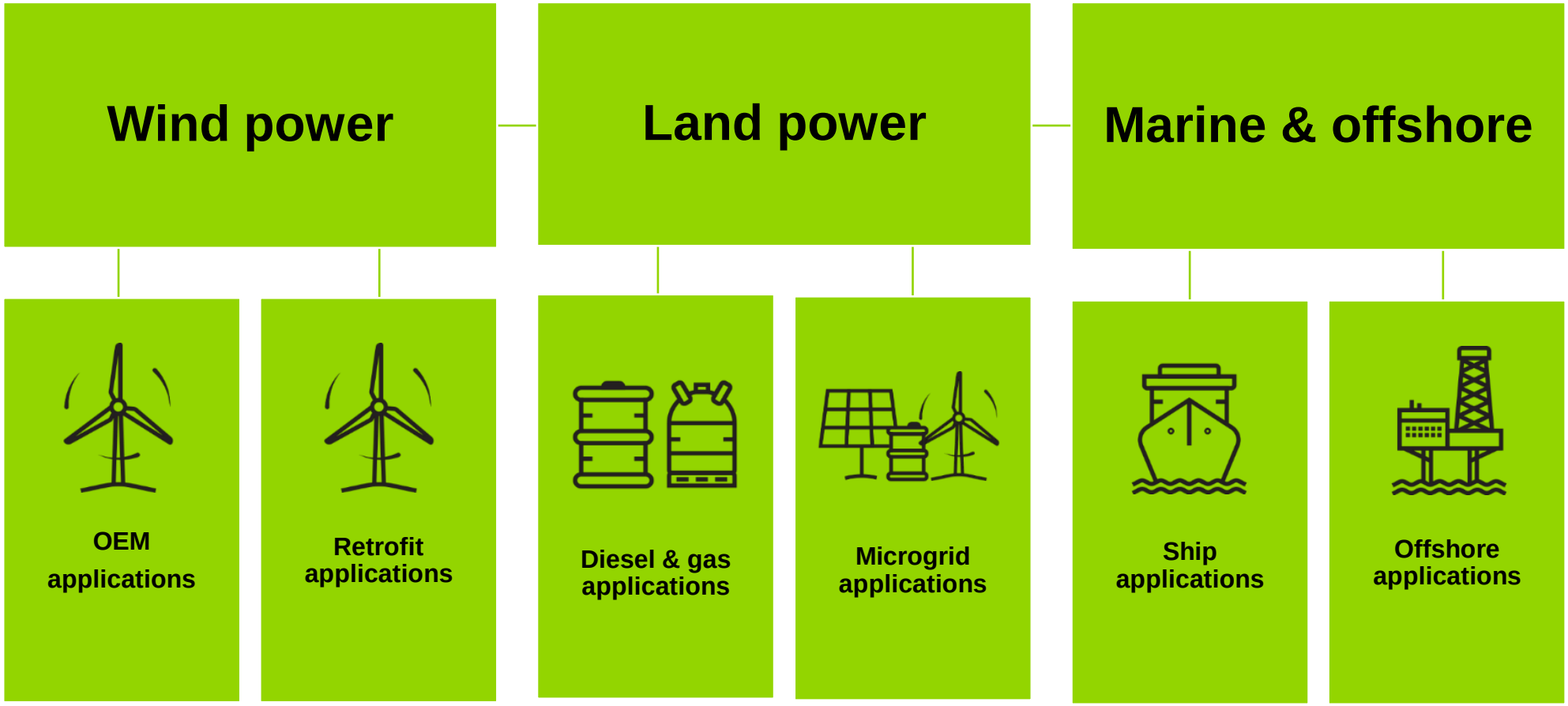
ABB and DEIF: Consolidating a Partnership Ecosystem

What We Do

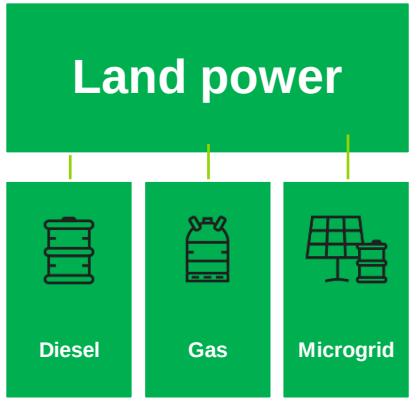
We develop, manufacture, and sell **power control solutions** for decentralised power production placed on land or at sea.

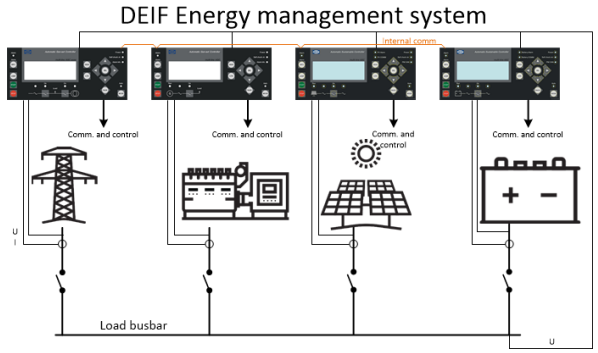


DEIF Digital Strategy

DEIF response to global trends

Scalable modular plug & play controller concept:
Integration of all power sources and load management





References from various microgrid and VPPs ranging from simple to advanced applications

Standard, highly flexible and configurable concept to satisfy customer demands from simple off-grid microgrids to advanced VPP management systems

Intelligent scalable product concept with interconnected architectures for VPPs

Remote monitoring platforms to optimize performance of microgrids and VPPs

DEIF+ABB Digital Strategy

Common green focus

ABB and DEIF as independent companies both have a focused and dedicated green vision

- DEIF + ABB: Companies with a sustainability-oriented profile and clear future green strategy
- DEIF: World-leading company offering control solutions for the power industry
- ABB: World-leading company with digital products for the power industry

- Strategic cooperation for modular microgrid solution (MMS)

- High focus on microgrid solutions and continuous roadmap developments

- Modular plug & play solutions for low to high level integration for diverse customer applications

Panel Discussion

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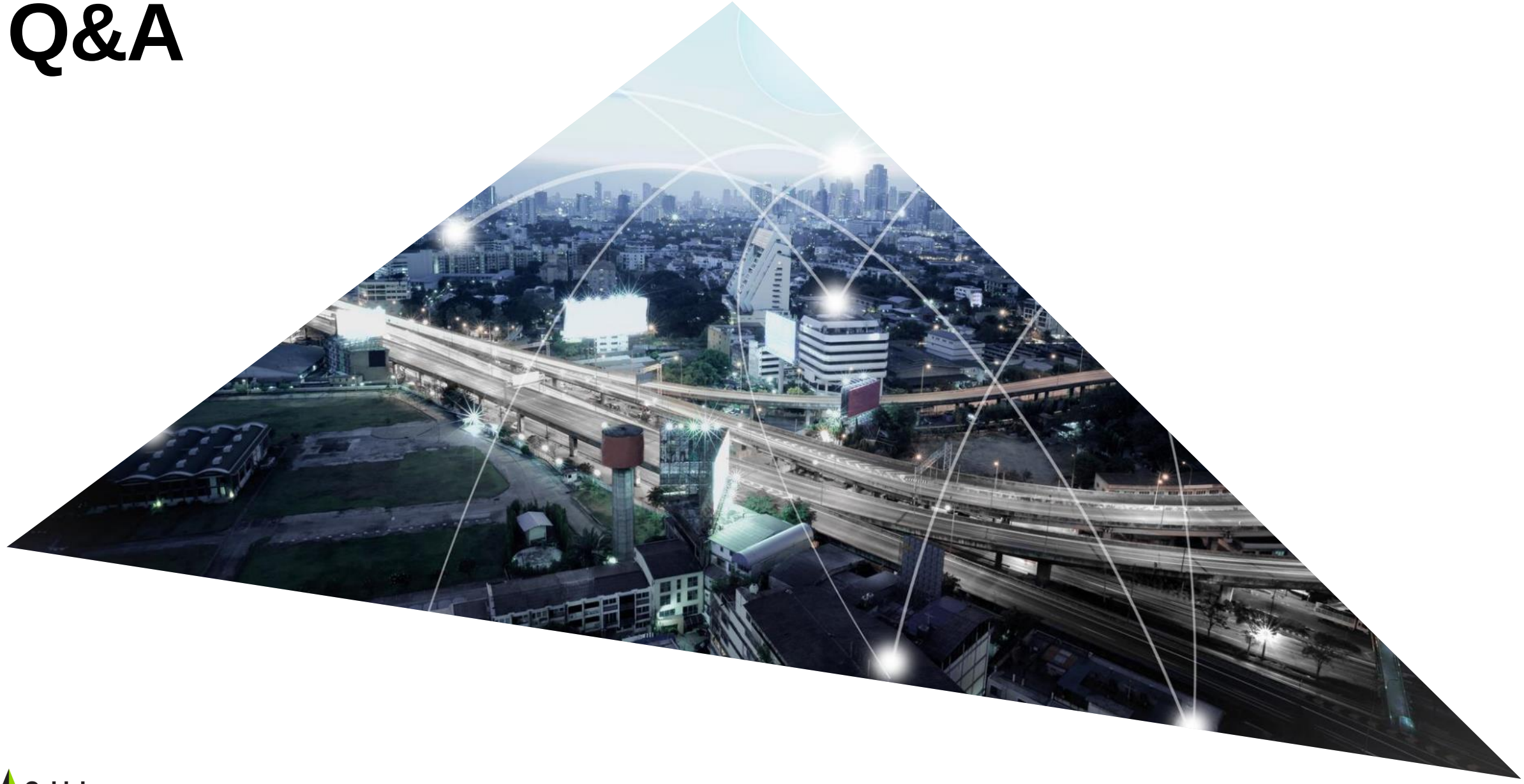
Roundtable Discussion Topics

- **How do digital platforms create value and help customers meet their resiliency and sustainability goals?**
  - Shift toward inverter-based renewables and energy storage assets
  - The opening of markets seeking flexibility resources
  - Need for real-time market interactions
- **Why does the shift to modular solution blocks for microgrids and VPPs make sense today?**
  - Growing maturity of these markets
  - Shift away from complex and customized solutions to more standardized offers
- **Why ABB and DEIF are a good fit?**
  - Modular microgrid solutions covering from less complex to highly complex and fully integrated microgrid applications managing all kinds of power sources such as solar, batteries, genset, and grid connection
  - Estimated 10% engineering time savings for systems integrators and EPCs
  - Reducing CAPEX, as the solution can be connected to any existing plant without retrofitting the existing system, and OPEX, due to maximum penetration of renewable sources and high reliability with no downtimes/blackouts

Q&A



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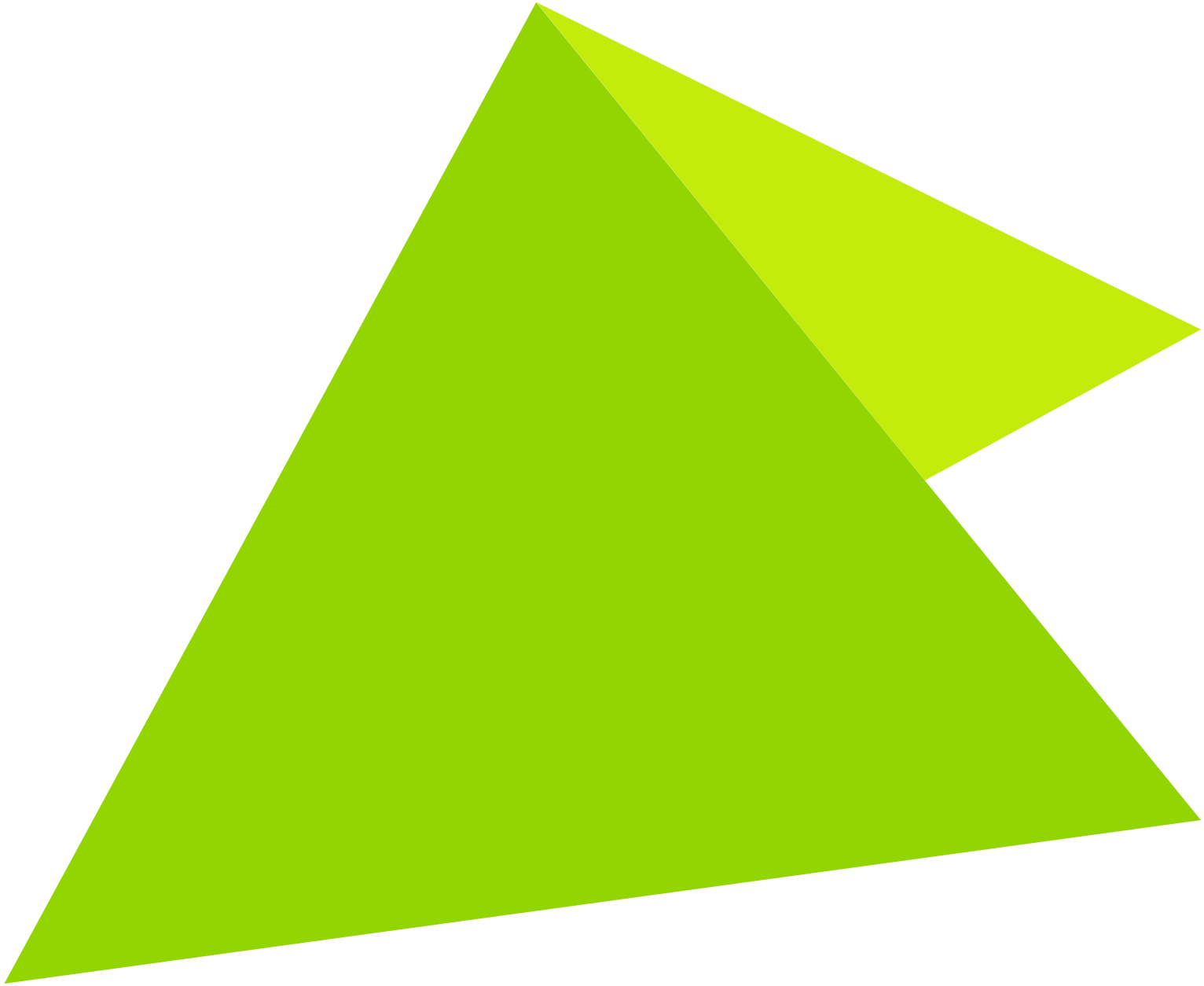

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