# International Microgrid Symposiums

## 20th Symposium on Microgrids

Beyond DER Aggregation: Microgrids, System Value and Reflections on the Future Grid

Veikka Pirhonen, Siemens

16th June

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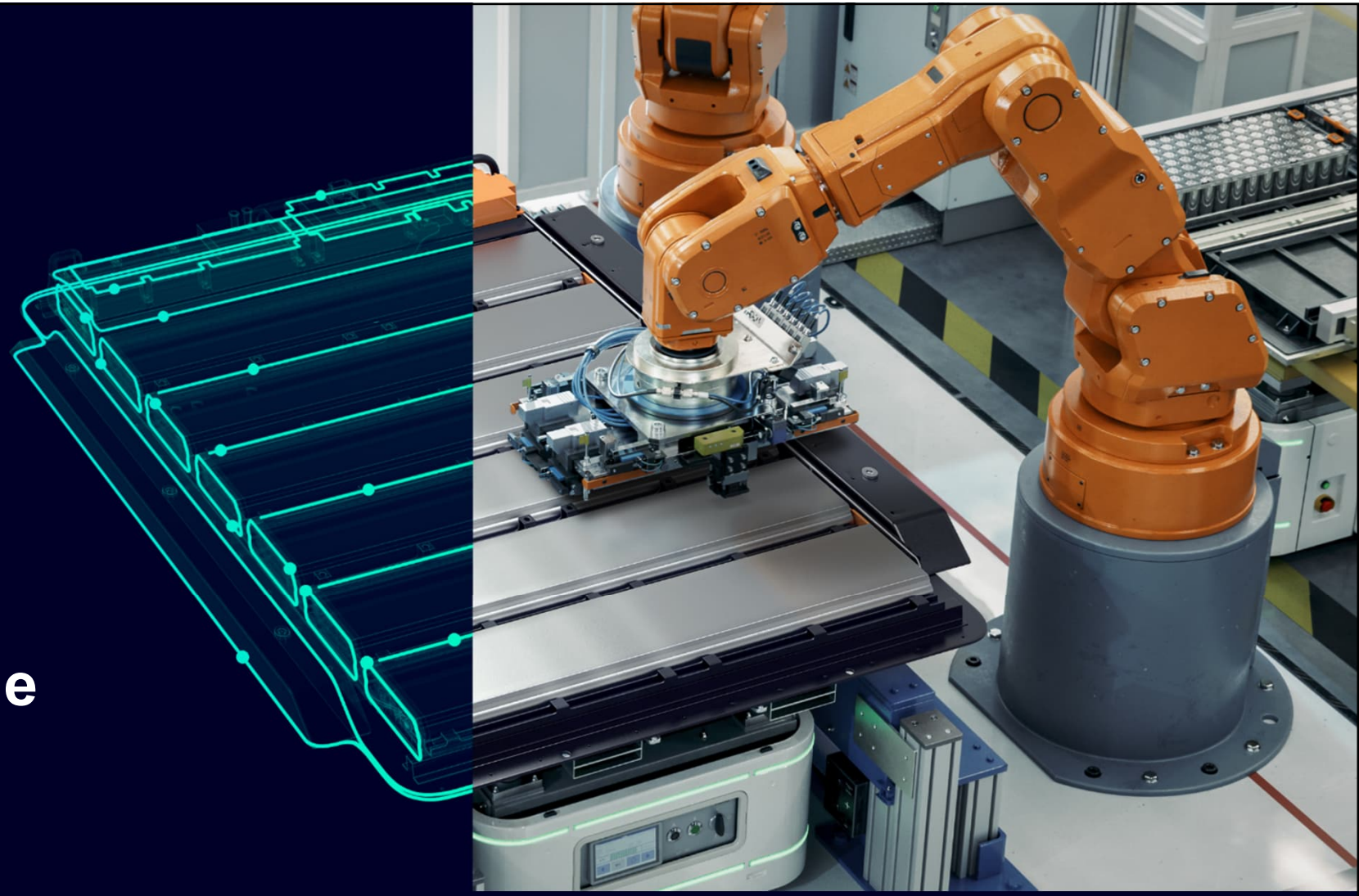
We fulfill our purpose
through our strategy:

# We combine the real and the digital worlds



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# We have set four strategic priorities that guide our mindset, behaviors and actions

## Customer impact

**We think and act customer first**

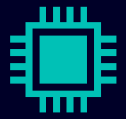
Everything we do is motivated by creating more impact for our customers and accelerating their digitalization and sustainability journey.



## Technology with purpose

**Solving real-world problems**

For more than 175 years, Siemens has been developing technology with purpose.



## Empowered people

**Better and faster decisions**

We are driving progress by empowering our people to take decisions in the best interest of the company.



## Growth mindset

**Try, learn, improve**

We think about the businesses of tomorrow as well as today, always exploring what's possible to expand our technology leadership.



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# Businesses and Services of Siemens AG

## Industrial Business

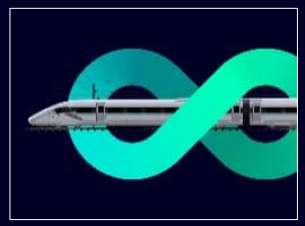
Digital Industries



Smart Infrastructure



Mobility



Siemens Healthineers[1]



Siemens Advanta



## Services

Siemens Financial Services



Siemens Real Estate




Global Business Services



Foundational Technologies



**1** Publicly listed subsidiary of Siemens; Siemens' share in Siemens Healthineers is 67%

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# Our digital portfolio and Siemens Xcelerator are growing continuously, delivering outstanding value to Siemens, our customers and partners



**€9bn**

digital revenue with 14% CAGR[1] over the cycle (FY20 – 24)

**Top 10**

Siemens is one of the top 10 software companies, #1 in industrial software[2]

**>€28bn**

invested in digital companies since 2007[2]

**#1 AI**

in Industrial AI patent families among industry peers[2]

**>2,500**

offerings onboarded to the Siemens Xcelerator Marketplace[3]

**>880**

sellers onboarded to the ecosystem >400 in pipeline[3]

**>40%**

contribution from 3rd-party sellers to the platform, raising industry standards

**>100**

companies test the Siemens Industrial Copilot with positive feedback

**1** "Digital Business" means Siemens vertical specific software and IoT and Digital services from Smart Infrastructure, Digital Industries, Mobility, Siemens Advanta; unconsolidated values | **2** As of September 30, 2025 | **3** Includes offerings by Siemens Xcelerator Marketplace sellers as well as Siemens offerings, as of April 2026

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# Focus on eleven Company Core Technologies
Strategic R&D across all Siemens businesses

**Siemens R&D**
(FY 2025)

**€6.6 bn**

**~ €511 m**

Investments in future technologies

## Company Core Technologies

- Cybersecurity & Trust
- Data & Artificial Intelligence
- Future of Automation
- Integrated Circuits & Electronics
- Power Electronics
- Simulation & Digital Twin
- Software Systems & Processes
- Sustainable Energy & Infrastructure
- Advanced Manufacturing & Circularity
- Connectivity & Edge
- User Experience

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# Innovation is the basis for our success

**€6.6 bn**
R&D expenditures[1]

**53,200**
R&D employees[2]

**5,300**
inventions[1]

**2,600**
patent first filings[1]

## Cooperation
with universities, research institutes, and start-ups

## ONE
Siemens Research and Innovation Ecosystem (Siemens RIE) with over 100 academic and startup partners

**1** In FY 2025 | **2** On average during FY 2025

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# Managing Flexibility and create value

## Offer Value

- Guaranteed outcome/insurance
- Consultancy (expertise, data, scenarios) service
- Market participation (streamlined) service
- Commercial aggregation service
- Technical aggregation service
- Forecast service (real-time weather, prices, flex need and availability)
- Revenue streams stacking service
- Post-event feedback service
- Identification and quantification of flex. potential assets service
- Baseline calculation service
- Control service
- Monitor service
- Devices maintenance service
- IoT connection service
- IoT devices provision
- Control devices provision
- Monitor devices provision

Assets provision (and maintenance)

### 1 Forecasting and calculating the operations

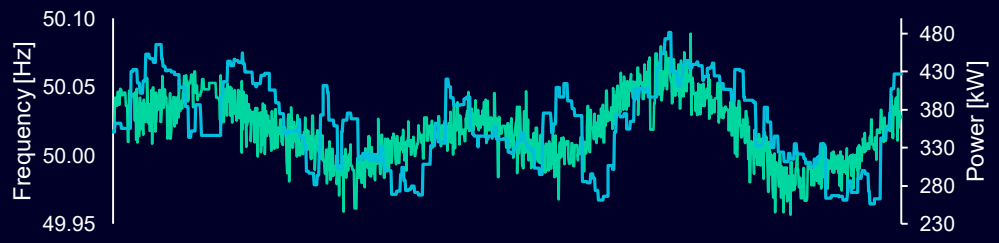
The expected electrical consumption is forecasted. Recover times and optimization impact on following hours are calculated. Physical constraints the available capacity to increase or decrease power is calculated per hour.

### 2 Energy and Power markets

The available capacity to shift from hour to another or controlled inside an hour based on frequency is participating to electricity markets. TSO reserve markets are compensating the flexibility maintained based on the grid needs.

### 3 Control and maintain conditions

For each respective hour where capacity has been sold frequency regulation is performed. This is done by continuously measuring the grid frequency, calculating the capacity to be activated based on the frequency, and distributing this between all assets. Assets primary objectives are not compromised.

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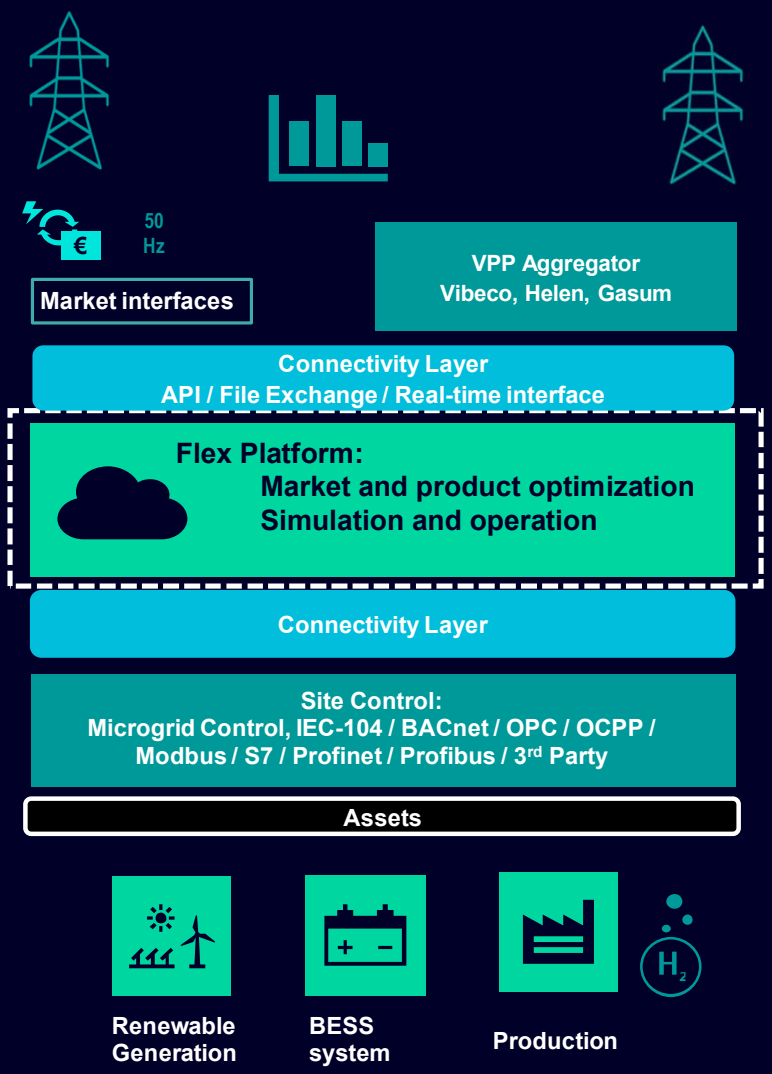


# Multi-Energy Control Layers
## for more detailed and optimized business

Flexibility Platform:

- Hybrid cloud system
- On-cloud market control and aggregation
- On-cloud multi-market optimization
- Data connectivity layer from cloud to external data sources
- Connection to local assets
- Local dispatching and logic

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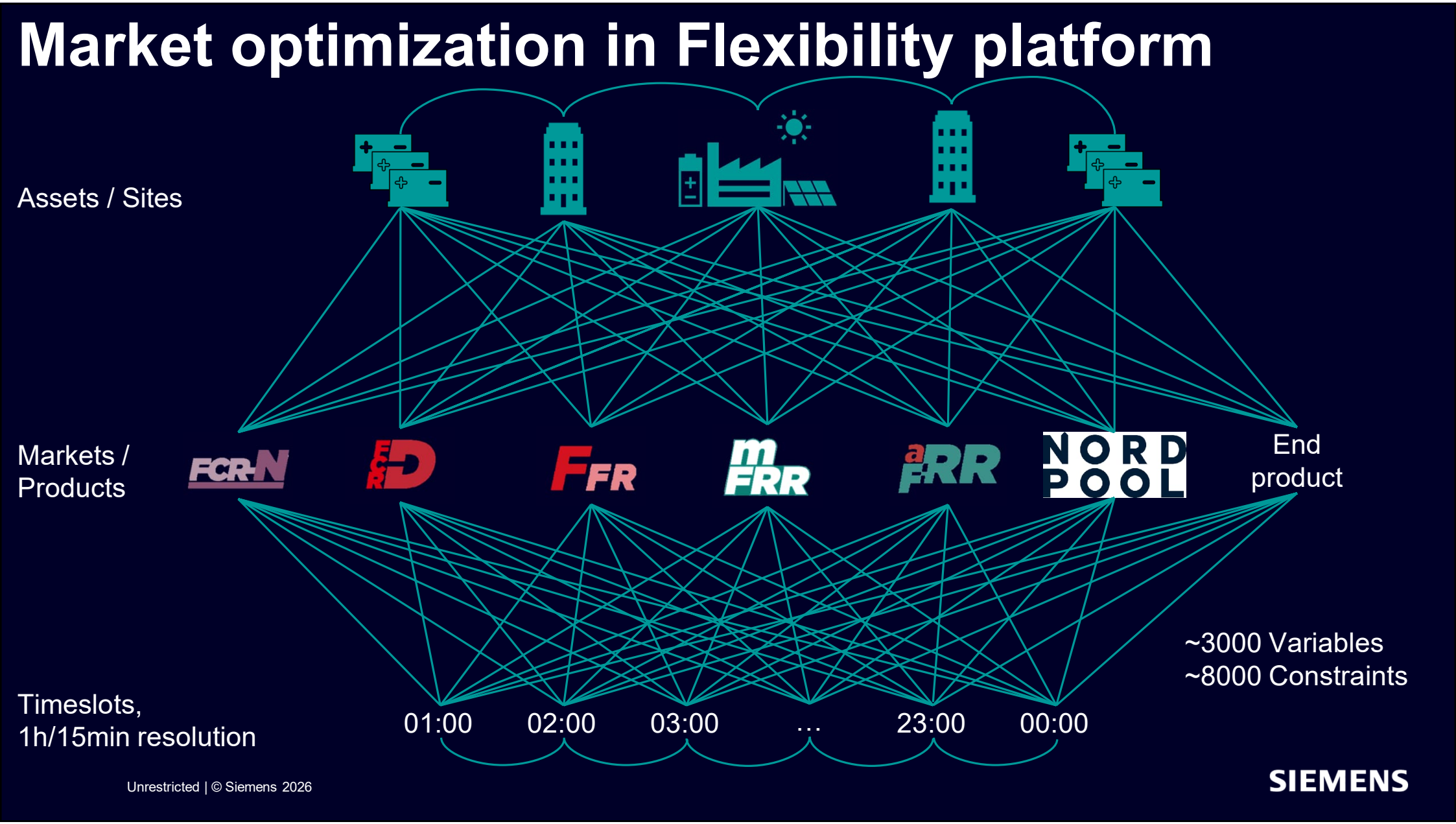
# Market optimization in Flexibility platform

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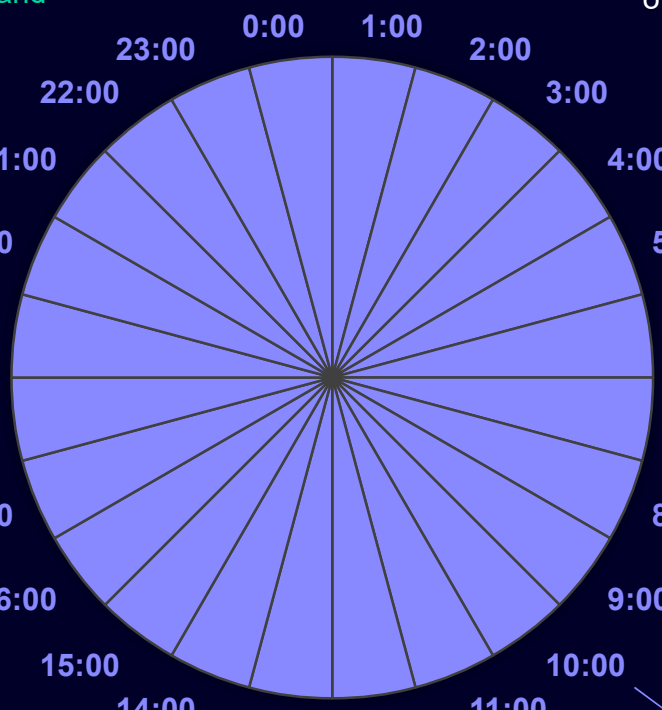
# Daily schedule

Every hour, normal operation during DAY -1 according to the accepted offers, Elspot, FCR, and FFR markets

DAY -1 bids in accordance with approved capacity market bids for approved hours




01:00 The electricity market day DAY 0 begins

Optimization: participation in aFRR and mFRR energy markets and re-optimization based on accepted offers every hour

DAY 0: For every hour mFRR energy market trading, offers no later than 45 mins before the delivery time

DAY 0: For every hour aFRR energy market trading, offers no later than 25 min before the delivery time

DAY 0: Intraday trading for every hour, in Finland 0 min before the delivery hour

Optimization: participation in the aFRR capacity market DAY +1

aFRR capacity market offers by 7:30 for DAY +1

Optimization: participation in the mFRR capacity market DAY +1

mFRR capacity market offers by 9:30 for DAY +1

Optimization: According to spot forecasts and capacity market orders, spot plans, preliminary reserve offers

13:00 The Elspot trade for the next day (DAY +1) closes

13:45 (or later) The Elspot prices are published

Optimization: Refinement of reserve market offers based on spot data

18:30 The FCR hourly market for the next day closes (DAY +1)

18:00 The FFR hourly market for the next day closes (DAY +1)

18:00 FCR annual market plans must be submitted for the next day (DAY +1)



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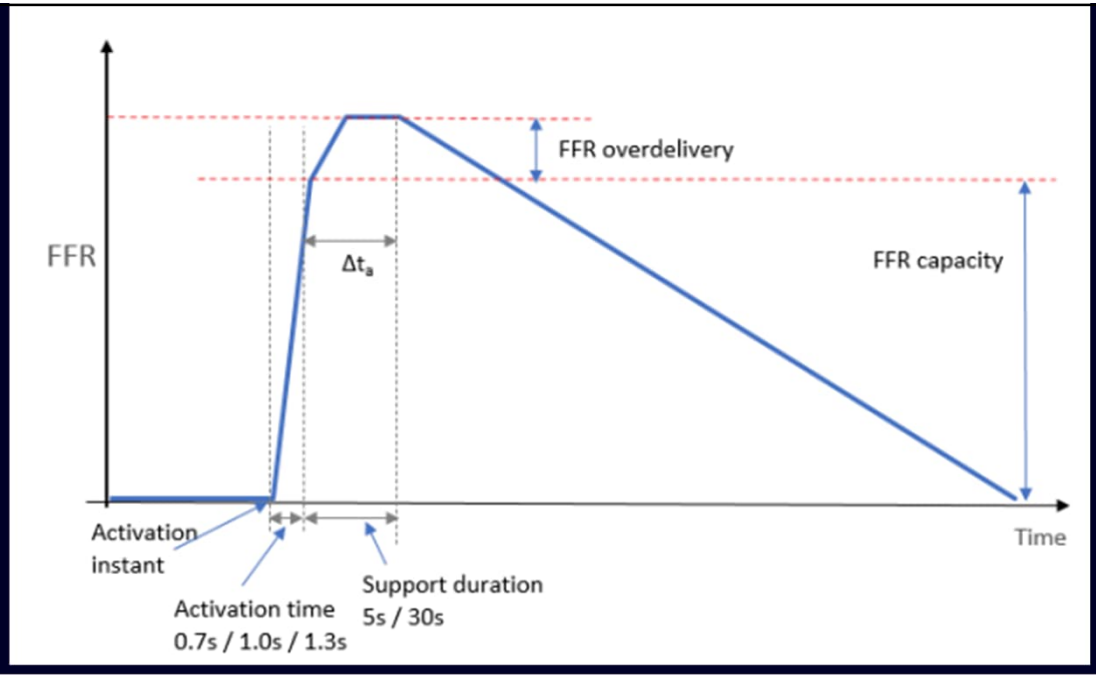
# Examples of TSO requirements

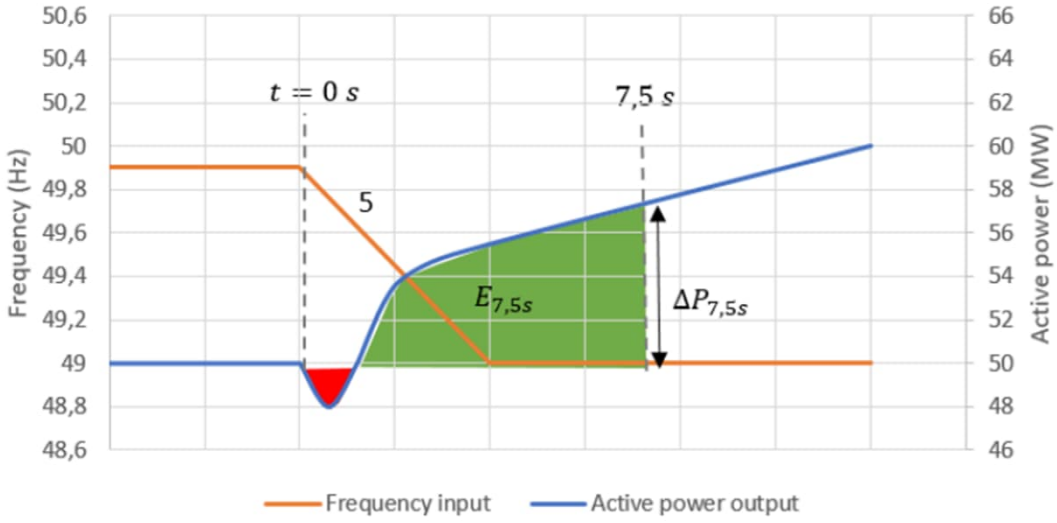
A graph is drawn from the measurement results showing the instantaneous power, the reference power, the activated aFRR and the activation signal with respect the time. In addition, the data (e.g., CSV or Excel file) with the mentioned signals shall be provided. The sampling interval shall be at least 1 second. The resolution of the power measurement shall be at least 0,01 MW.

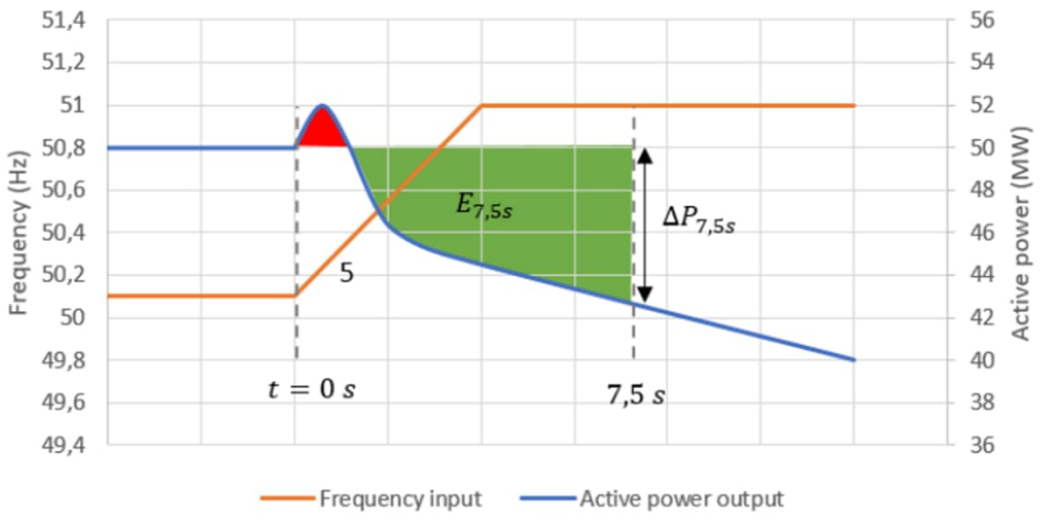
The resolution and sample rate of the power and frequency measurement shall not be less than the values given in Table 5.2.

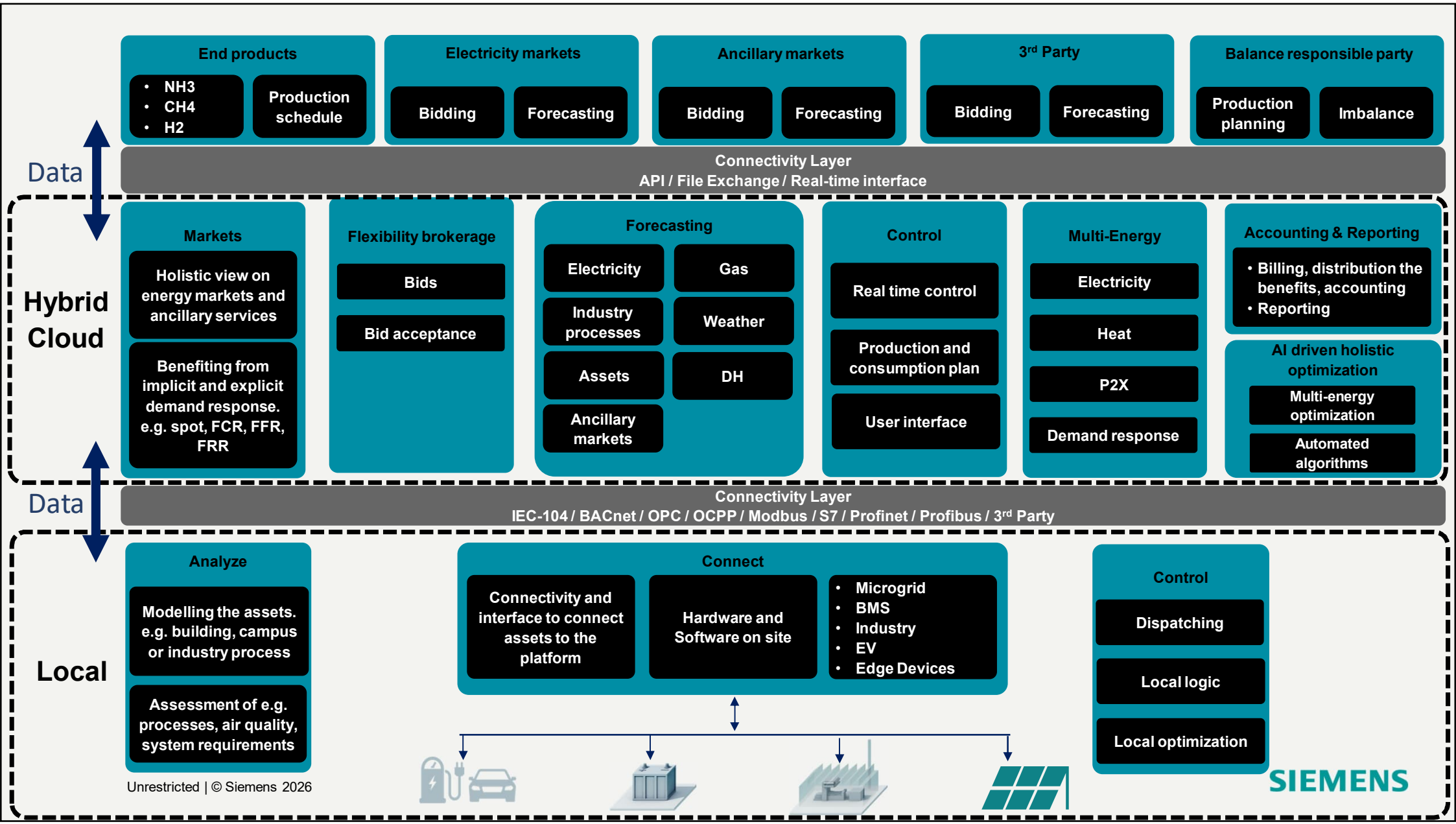
*Table 5.2 Resolution and sample rate requirement for measuring and recording device*

| Measured quantity | Resoluutio | Näytteenottoväli |
|---|---|---|
| Active power | 0.01 MW | 0.1 s |
| Measured grid frequency | 10 mHz | 0.1 s |
| Synthetic frequency signal | 10 mHz | 0.1 s |



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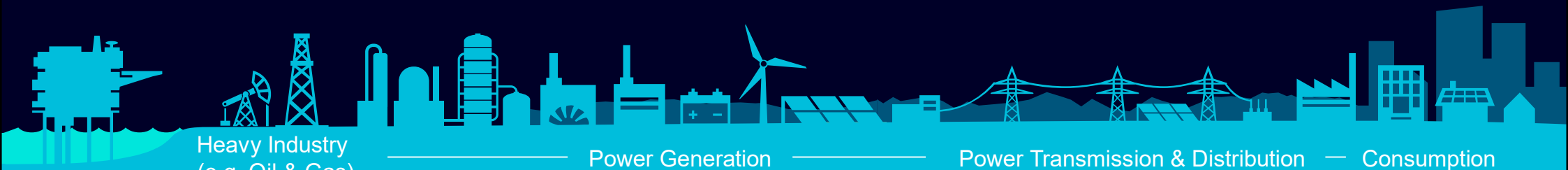
# SICAM –
# a Siemens' global and reliable platform

## > 85.000 SICAM automation units worldwide



Heavy Industry (e.g. Oil & Gas) — Power Generation — Power Transmission & Distribution — Consumption

**SICAM Applications**

- Power Management
- Generation Control
- Storage Control
- Photovoltaic Control & Monitoring
- Self Healing
- Microgrid Control

**SICAM platform**

- One open standardized architecture and infrastructure
- Modular design and applications
- Integrated functionalities
- Easy future expansion

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# What is a Microgrid?
# Systems & typical use cases

Even "normal" systems are microgrids…

…different customers, different goals.

| | | |
|---|---|---|
| **Public Spa**  CHP – thermal control | **Hospital**  BESS - resilience | **Parking & Fleet**  Peak load management |
| **Industrial Site**  Minimize demand charges | **Shopping Center**  Minimize $CO_2$ footprint | **Campus**  Asset integration |
| **Island**  Minimize fuel consumption | **City District**  Cross commodity control | **Remote System**  Automatic operation |

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# Our solutions for you



Renewable Generation



Industrial Prosumers



Grid connection

## SICAM applications for

**Microgrids**
microgrids and decentralized energy systems

**Power Management**
generation assets and loads (incl. loadshedding)

**Dynamic Load Management**
e-car-charging infrastructures and other controllable loads

**Photovoltaic Power Plants**
PV power plants (incl. batteries) and hybrid power plants (incl. wind)



Residential



Commercial



Campus



Transportation

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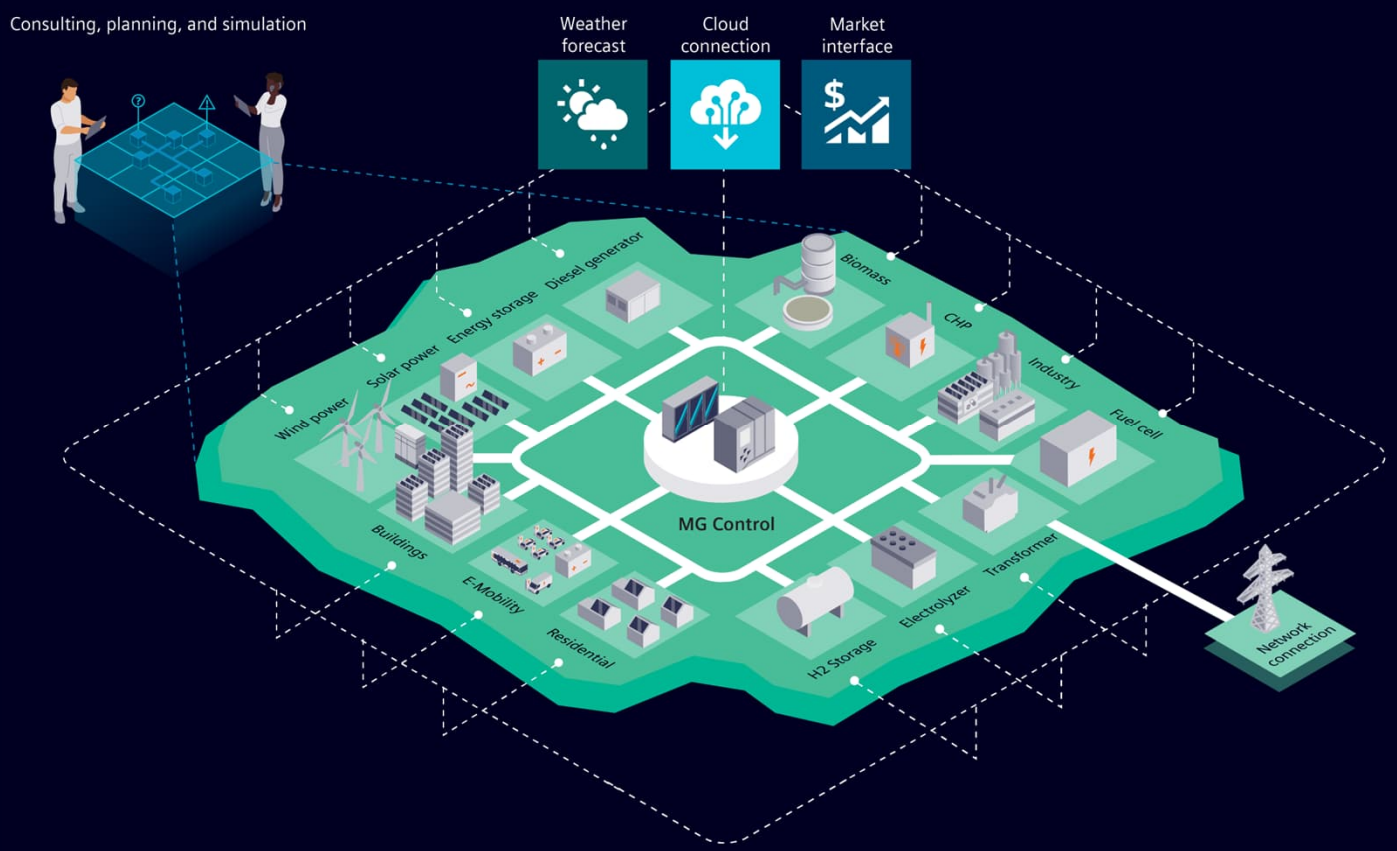
# Microgrid Control – a SICAM application
## The complete solution




- A holistic solution – the **complete package** of proven components, modern systems, and comprehensive service offerings.
- Ensures full grid compliance with precise **P, Q & V control** and a **swift cycle time** of approximately 100 ms.
- Enables **seamless integration** of renewable generation, energy storage, and flexible loads.
- **Enhances resilience** with blackout detection, black start capability, and grid synchronization.
- **Optimizes economic performance** through peak shaving, demand charge reduction, and OPEX minimization.
- Offers **advanced cybersecurity, redundancy, and certification** for demanding substation environments

siemens.com/mediumvoltage

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# Lemene
## Commercial Campus, Finland

“Our partnership with Siemens has strengthened even more along LEMENE-project. LEMENE ensures the security of electricity in Marjamäki Business Park, which offers an innovative, intelligent business ecosystem for companies”

***Toni Laakso** – CEO, Lempäälän Energia ltd.*

**Island**
capability and resynchronization

**8 Self-supply**
using CHP, photovoltaics and battery storage

**Market**
participation for energy and ancillary services

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# LEMENE Microgrid, Finland

## Revenue generation through market participation and self sufficient electrical grid

### Customer environment

- Increasing energy cost
- High thermal demand
- Fluctuating load profile
- 8 MW CHP (6), 4 MW solar (2), 4 MW battery (2), 130 kW fuel cells (2), utility metered electricity

### Use case

- Energy cost reduction
- Increase resiliency
- Increase energy independence
- Renewable integration
- Energy market participation
- FCR Market participation

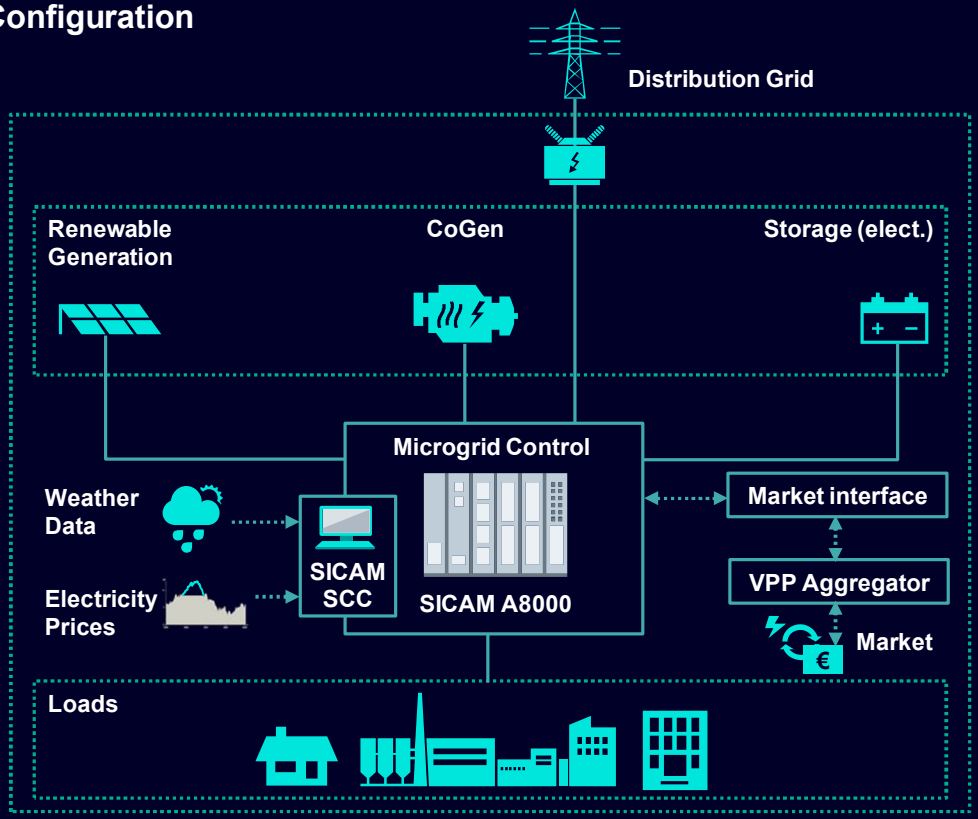
### Component

- Siemens Microgrid Control – a SICAM application

### Features

- DER control
- Island operation
- Reserve monitoring
- Tie-line control (peak shaving, Energy import/ Export control)
- Blackout detection
- Monitoring, alarms
- Demand charges
- Energy market interface
- Ancillary market interface

### Configuration





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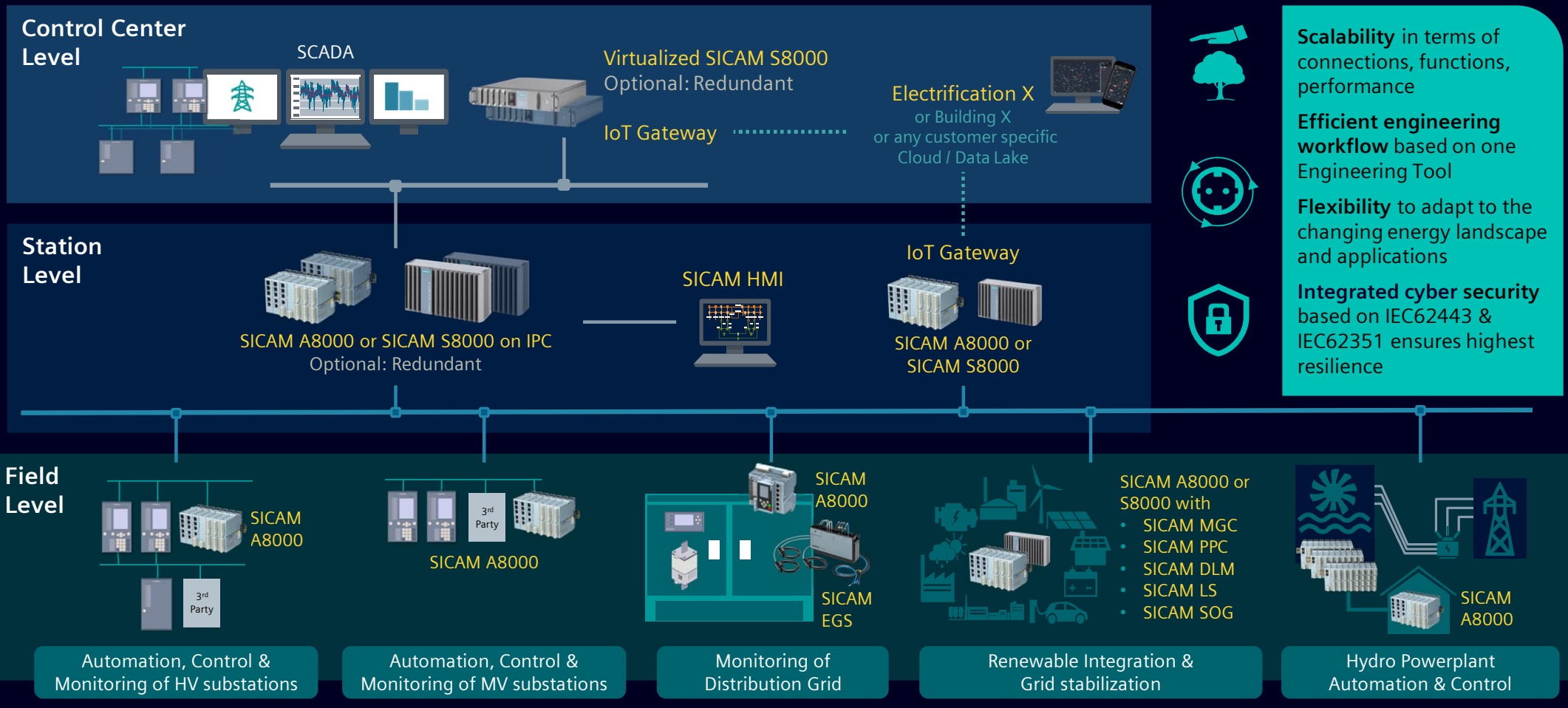
# SICAM 8 – an overview




**Scalability** in terms of connections, functions, performance

**Efficient engineering workflow** based on one Engineering Tool

**Flexibility** to adapt to the changing energy landscape and applications

**Integrated cyber security** based on IEC62443 & IEC62351 ensures highest resilience

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# Application examples

**Hospital**



Improve resilience with BESS

**Industrial Site**



Minimize demand charges

**Shopping Center**



Reduce $CO_2$ footprint

**Campus**



Integrate assets

**Parking & Fleet**



Decrease peak loads

**Critical Infrastructure**



Enhance reliability

**Remote System**



Operate automatically

**City District**



Control cross-commodity

**Island**



Downsize fuel consumption

**Public Spa**



Benefit from thermal control

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