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Microgrids Solutions

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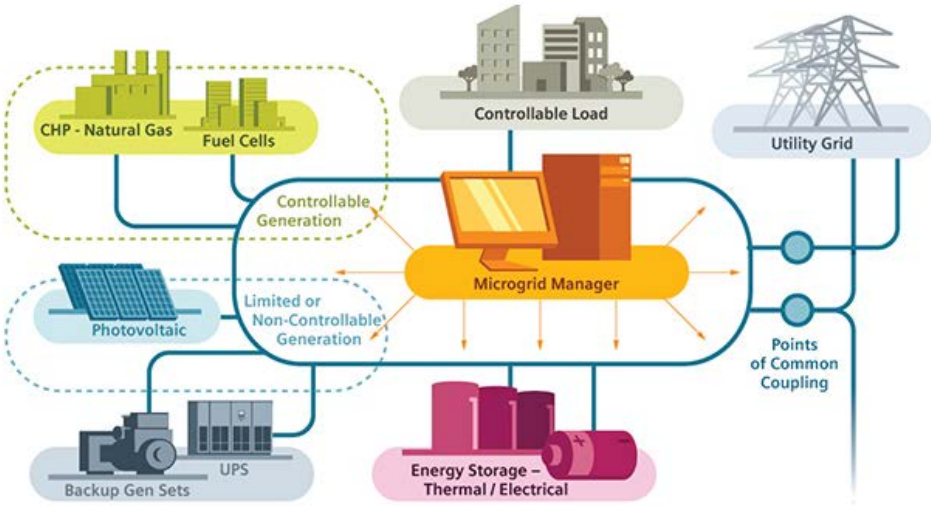
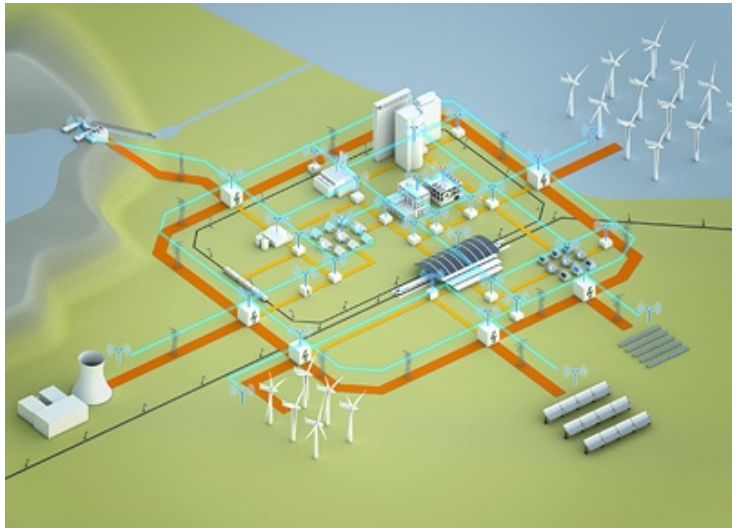
Microgrid – just another definition

A Microgrid is electricity **generation** and **loads**, and in some cases storage **managed collectively** in a network. Besides electricity, microgrids may include other vectors such as heat, gas, water.

Microgrids **manage energy resources** according to a given set of criteria. They may be operated in **off-grid**, **on-grid** as well as in dual mode to optimize technical (e.g. power quality, frequency) and economic aspects (e.g. optimal use of renewable energy).

In an optional emergency mode the microgrid provides **blackstart capabilities**.





Source: Microgrd Market, Global Forecast & Analysis (2012-2022), adapted

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Drivers for implementing Microgrids

Microgrid Technical challenges

Efficient energy use - power and heat

Reliability / Security

Integration of renewables

Drivers

Economical index:

cost/kWh, Energy security (reliability of infrastructure, energy import dependency, energy efficiency use), presence of remote areas

►Positive Business Case

Political index:

Taxes on fuel/CO_2, Environment targets, Subsidies scheme, regulatory framework for renewable (feed-in tariffs)

►Long term investment, Sustainability

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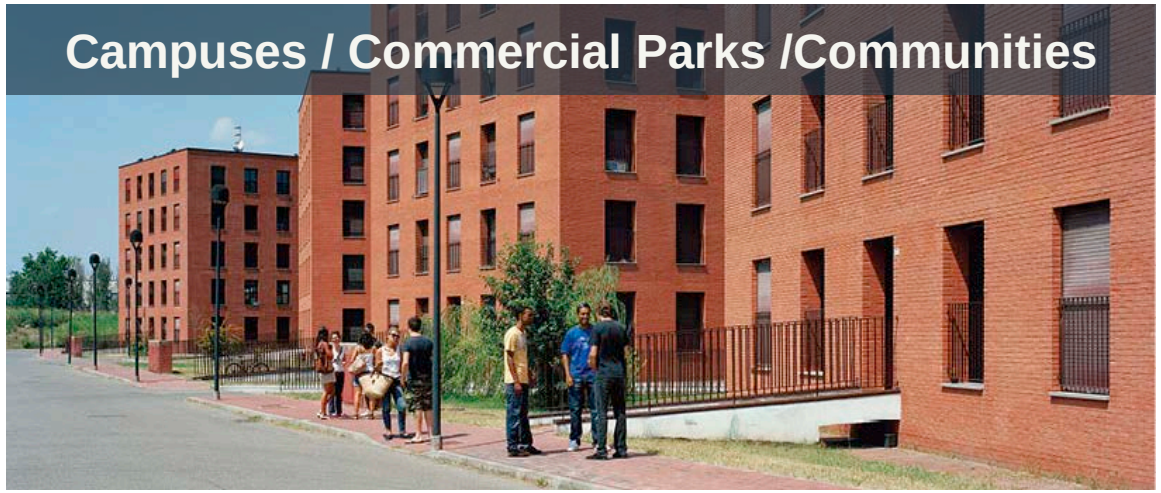
Typical Microgrid Installations



Drivers

- Change to more green facilities
- Electrical bill reduction
- Increasing demand of reliable and resilient energy
- Independence from disturbances of higher-level grids
- Integrate renewable production

- Ensure Power Quality for sensible loads

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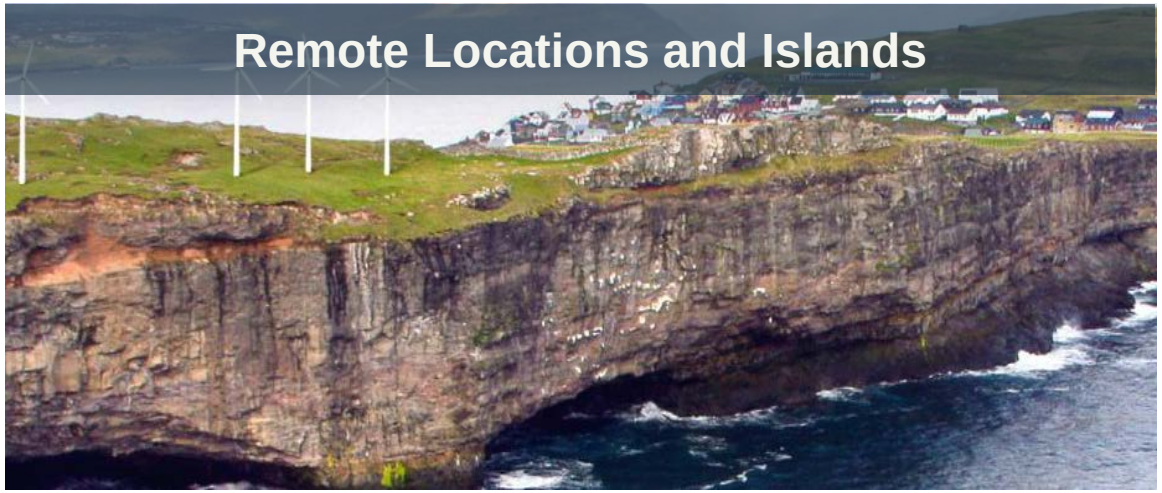
Typical Microgrid Installations



Drivers

- Integrate renewable production
- Reduction of CO_2 emissions
- Ensure reliable energy supply
- Increase grid availability even in poorly supplied areas
- Decrease overall energy infrastructure costs

- Grid independence
- Ensuring reliability and resiliency
- Decreasing energy costs

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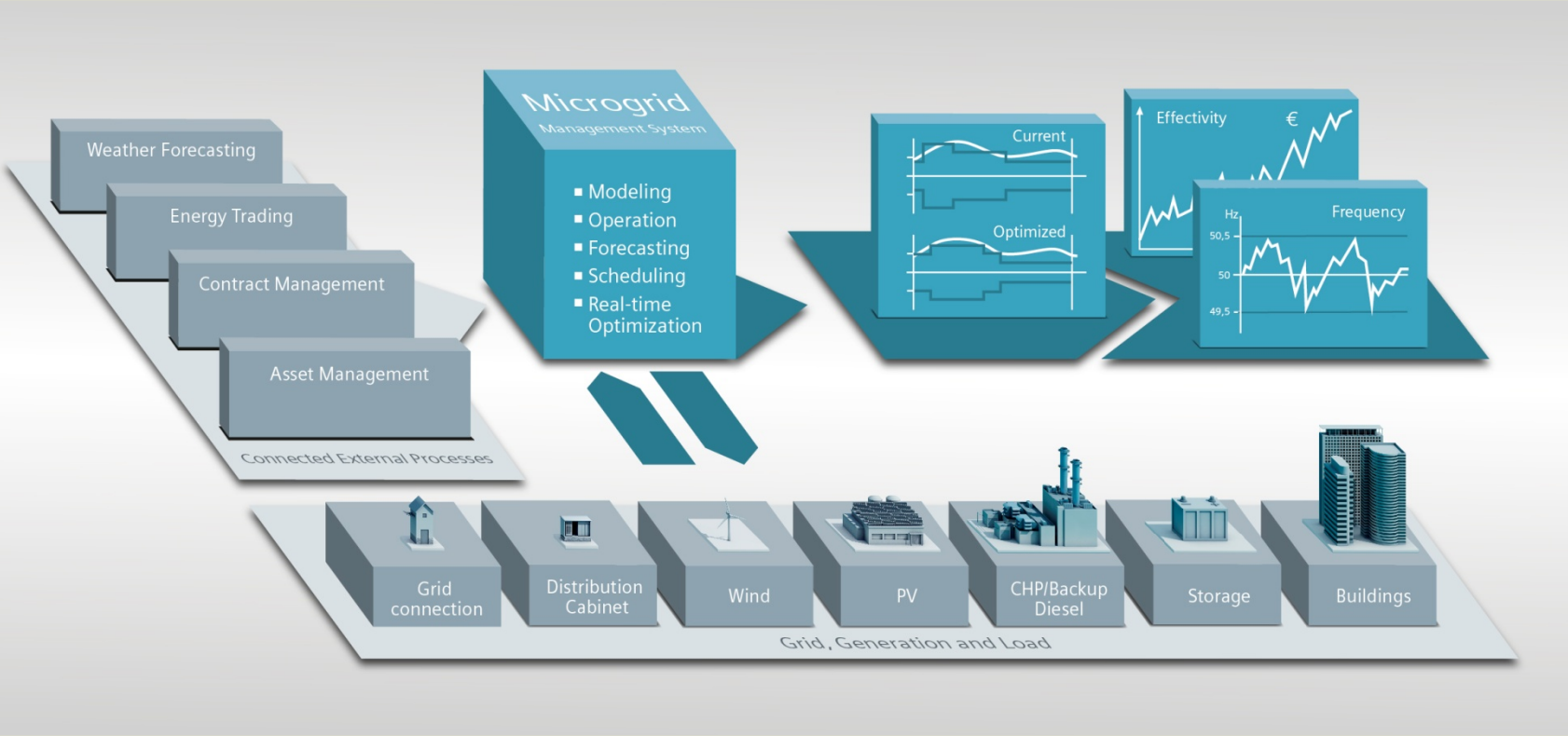
Functionality of a fully integrated Microgrid solution

- **Reliable network operation** in diverse scenarios
- **Inclusion of all network assets**, distributed generation, storage systems and loads
- **Modular,** allowing a flexible and scalable structure
- **Forecasting and planning** of generation and loads
- **Frequency and Voltage Control**
- **Real-time optimization**



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Microgrid – Basic
Siemens Solution Portfolio

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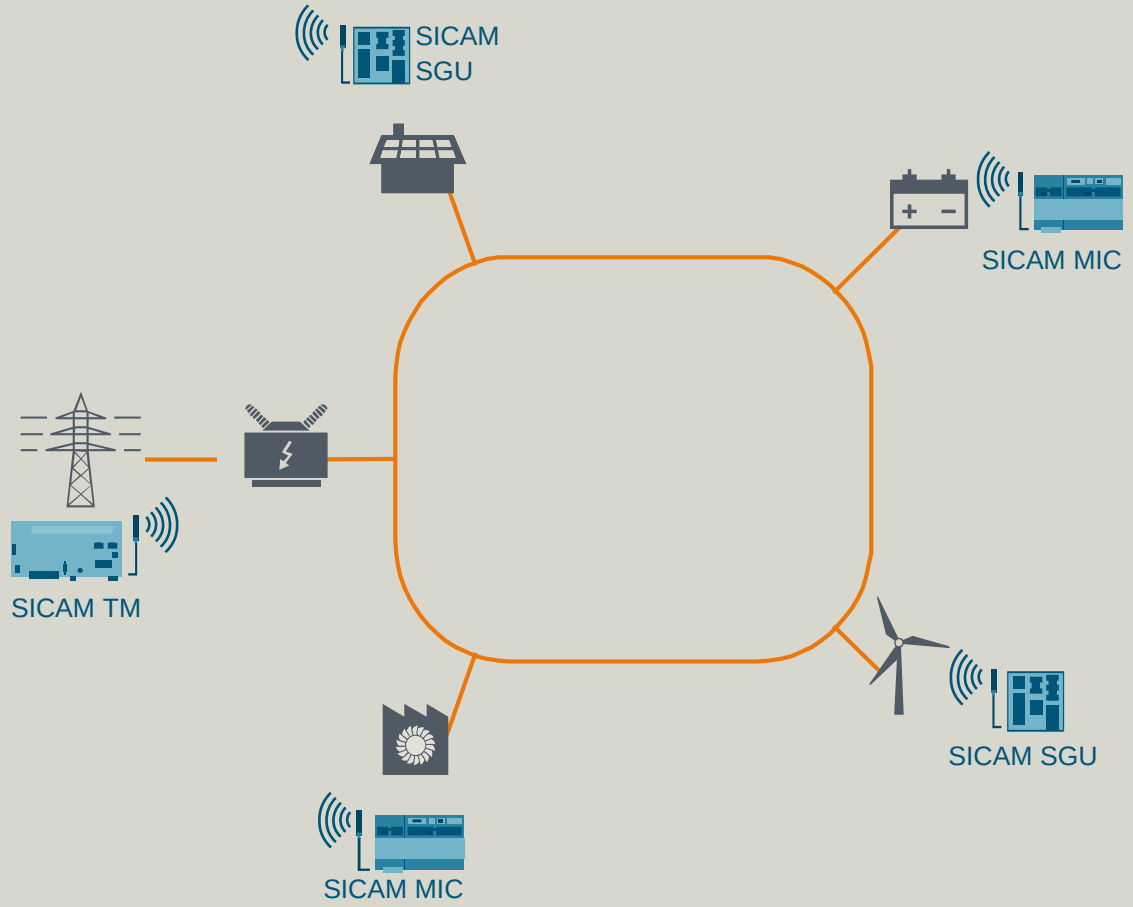
Control: SICAM TM

Automation Equipment: SICAM EMIC, MIC, SGU

Features

- Distributed generator control also for renewables
- Network synchronisation
- Load Control
- Storage control



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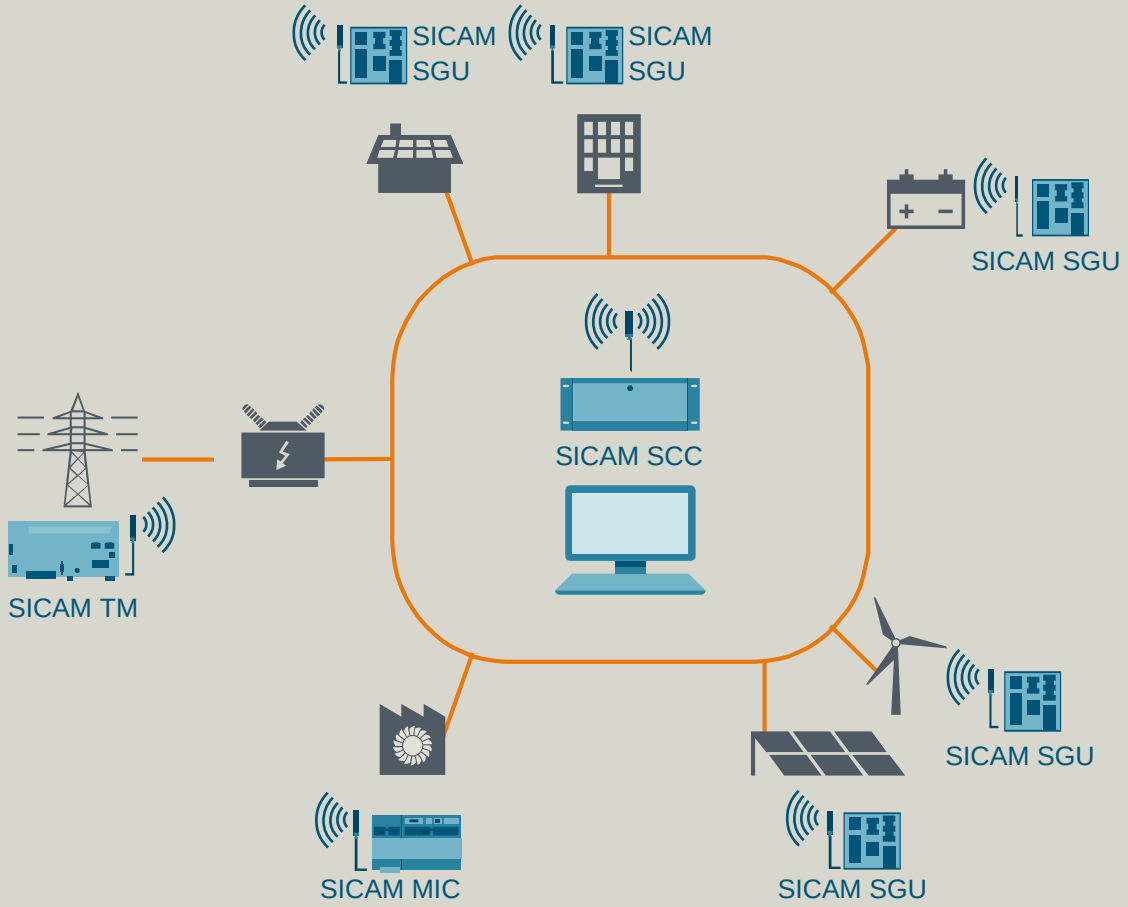
Microgrid – Operator Driven
Siemens Solution Portfolio

Control: SICAM SCC

Automation Equipment: SICAM TM, EMIC, MIC, SGU

Features

- Distributed generator control also for renewables
- Network synchronisation
- Load Control
- Storage control
- Online control via HMI
- Grid monitoring and control



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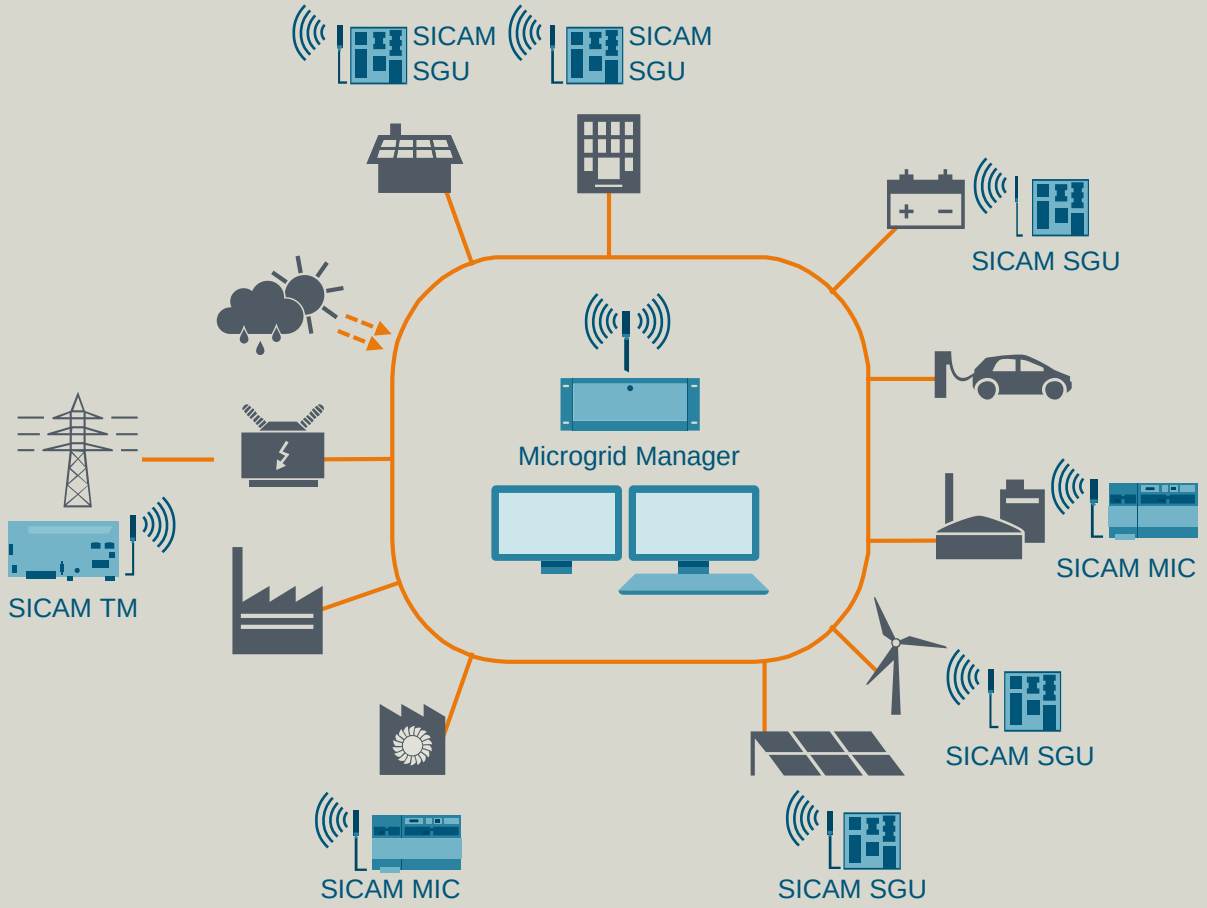
Microgrid – Interactive Intelligence
Siemens Solution Portfolio

Control: Microgrid Manager

Automation Equipment: MIC, EMIC, TM, SGU

Features

- Distributed generator control also for renewables
- Network synchronisation
- Load Control
- Storage control
- Online control via HMI
- Grid monitoring and control
- Generation forecast
- Load forecast
- Schedule optimization



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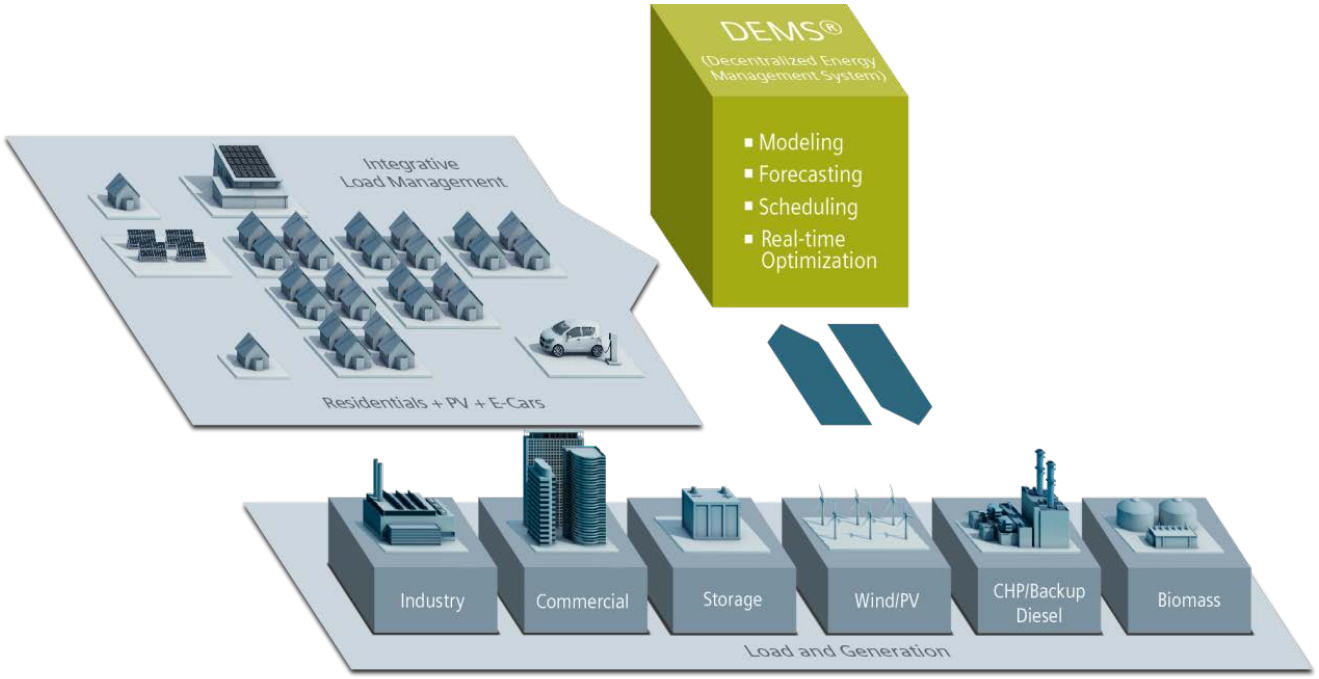
Microgrid Management System - Benefits



- **Modelling**
- **Forecasting**
- **Scheduling**
- **Real-time optimization**

Benefits

- Intelligent forecasting and planning
- Easy real-time optimization
- Inclusion of all distributed power generators, storage systems and loads
- Modular structure
- Can be customized to all the needs of grid operators, energy aggregators, power brokers and other players
- Flexible and scalable
- Simple modelling and setting of parameters

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SIESTORAGE

Brief Overview

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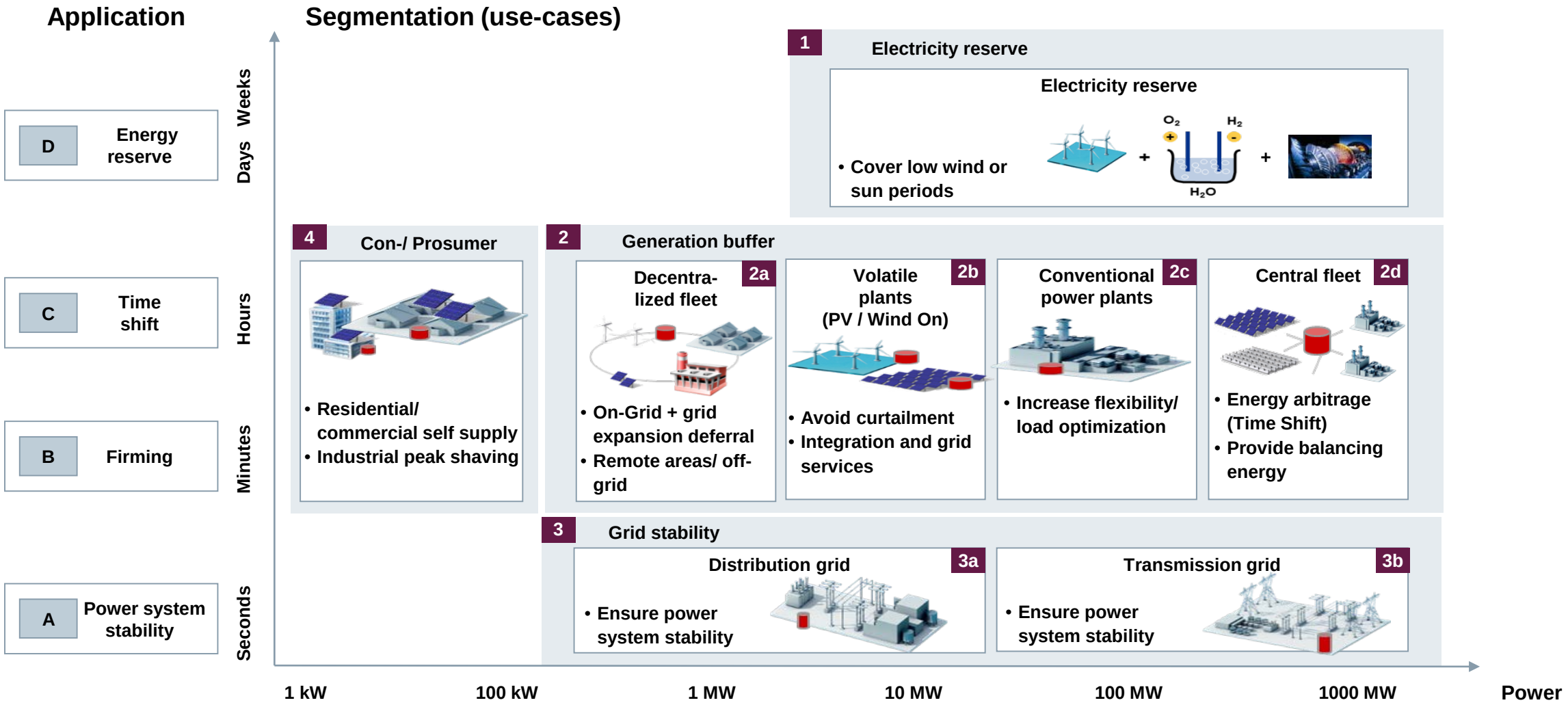
Typical Use-cases for Storage



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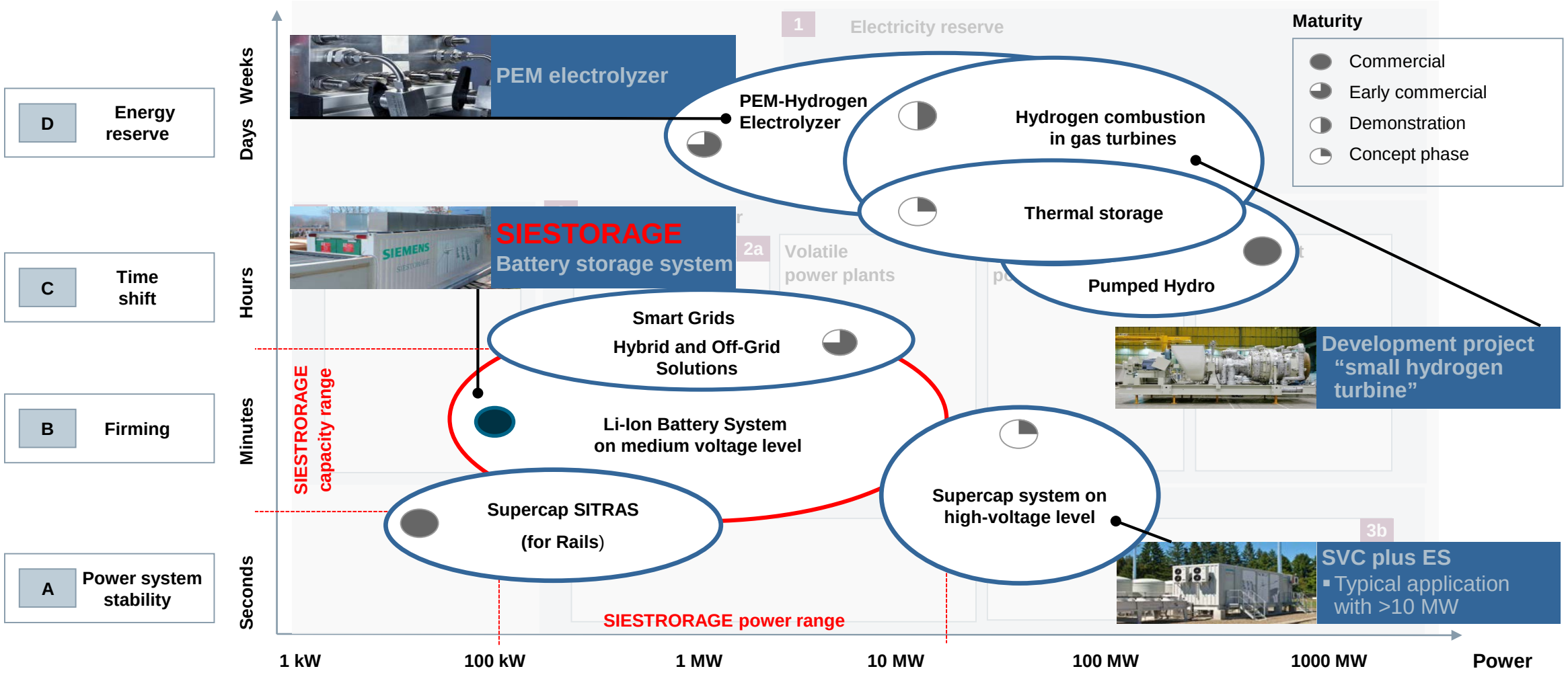
Siemens activities cover wide range of application areas



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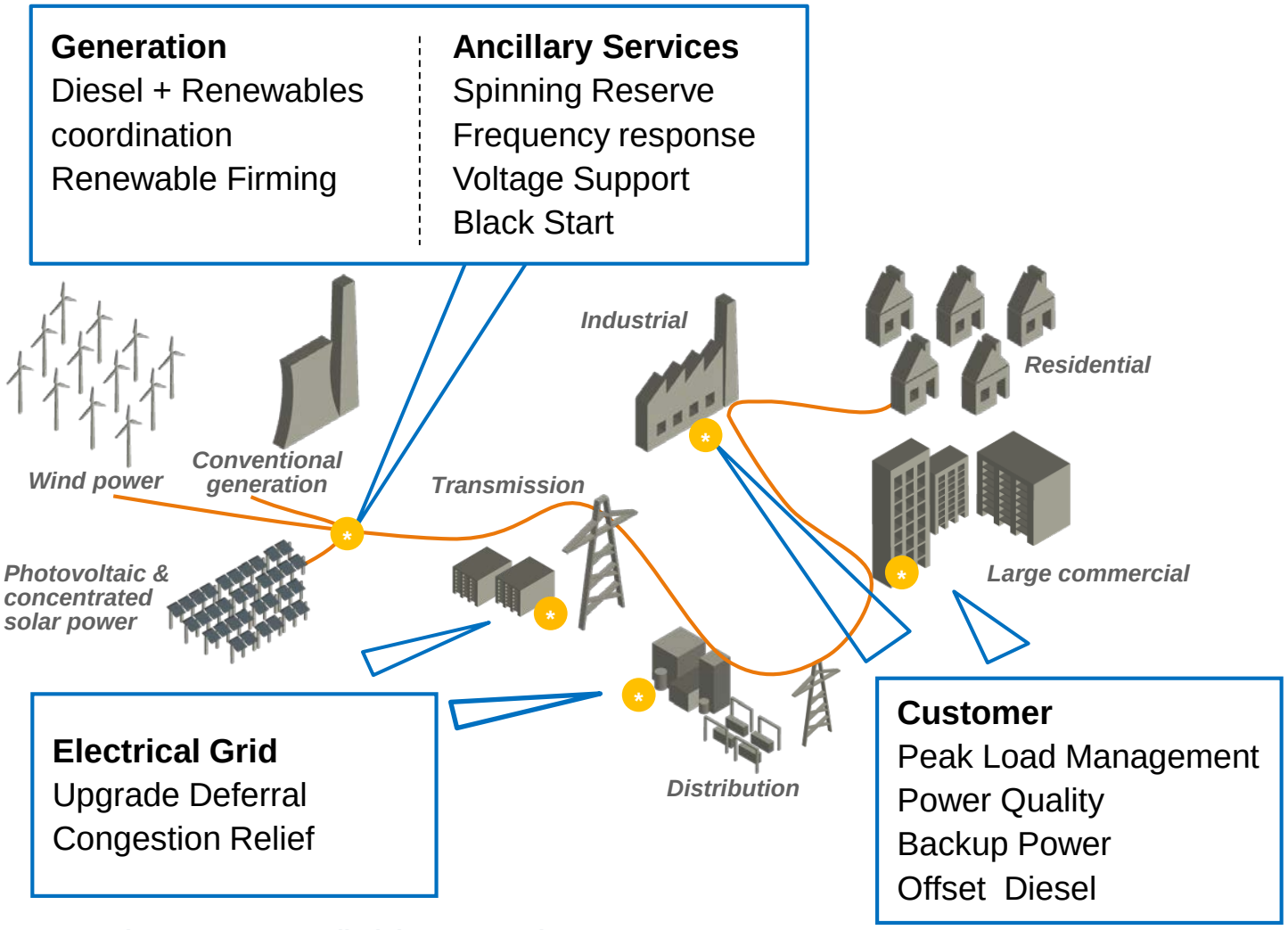
Applications of SIESTORAGE

Combination of various applications leads to an economic solution



Large field of application areas for utilities, network operators, industry and infrastructure

SIESTORAGE is also suitable for:

- Supplying continuous power for sensitive industrial processes
- Energy-efficient buildings
- Isolated sites with limited power access
- Autonomous microgrids supplied with diesel genset
- Public transportation
- Electromobility

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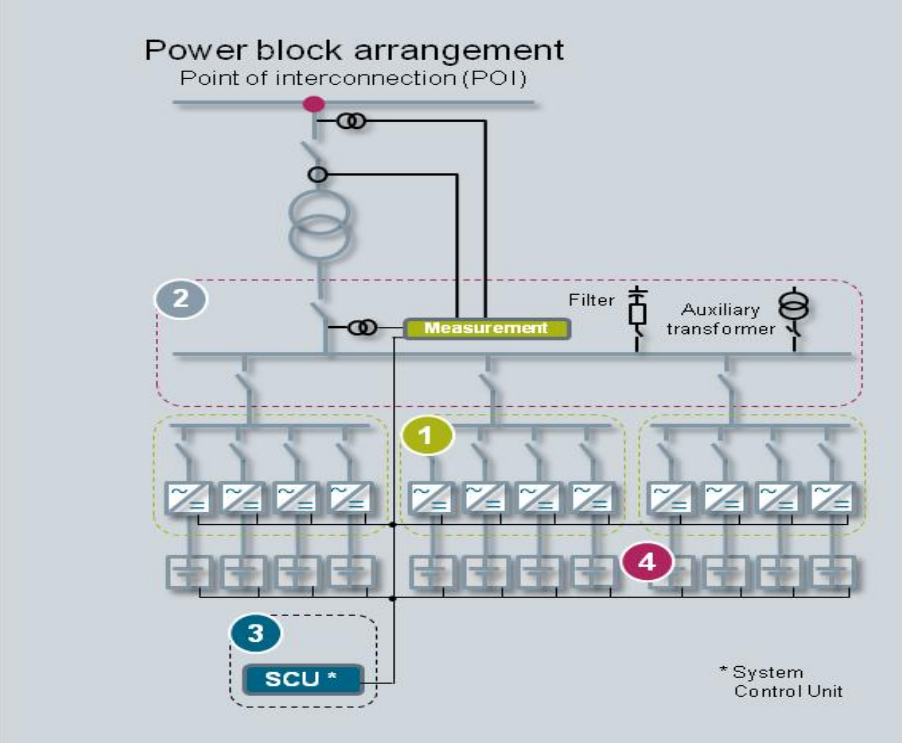
SIESTORAGE modular concept
Four components into an innovative solution



1 Inverter cabinet
(1,000 x 600 x 2,200 mm)
- 4 inverter modules and related control equipment

Each module:
- V nominal: 400 V
- I nominal: 170 A
- S nominal: 118 kVA
- P nominal: depending on the battery type

2 Grid connection cabinet
(800 x 600 x 2,200 mm)
- 400 V AC power distribution
- Switching system
- Power connection to the grid
- Filtering system
- Auxiliary transformer

3 Control cabinet
(800 x 600 x 2,200 mm)
- 1 x control unit (SCU)
- 1 x HMI (Human Machine Interface)
- 1 x Ethernet switch

4 Battery cabinet
(600 x 650 x 2,200 mm)

Content example*:
- 14 modules
- 1 BMS (Battery Management System)
- Power: 90 kW
- Energy: 45 kWh

* Depending on supplier

SIESTORAGE can be scaled according to use case needs

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Integration into container and delivery

Possibility of integration into prefabricated container (e.g 45´) or existing building

- Integration from one hand
- E-House manufacturing
- Power packaging solution expertise: MV equipment (switchgear, transformers…), utilities access control, HVAC, fire detection and extinguishing system
- Delivery
- Ready to install: completely developed, manufactured, assembled and pre-tested

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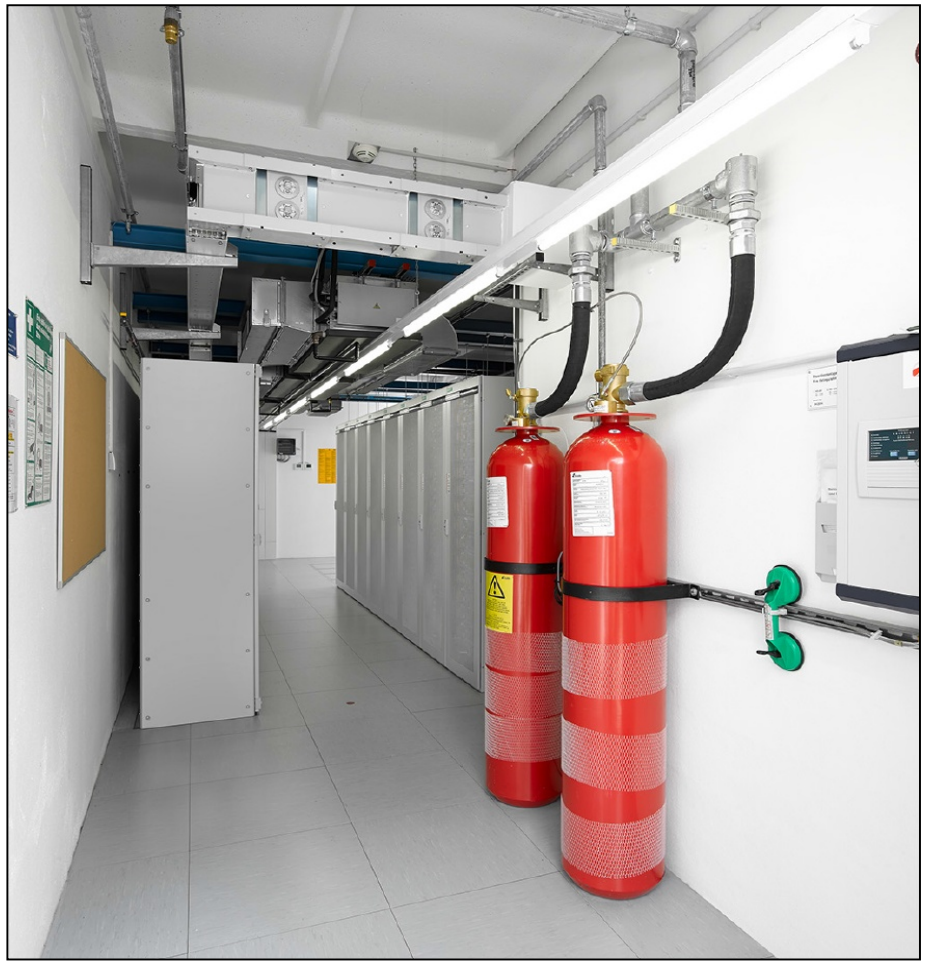
Photos from Energy Storage – Reference Sample



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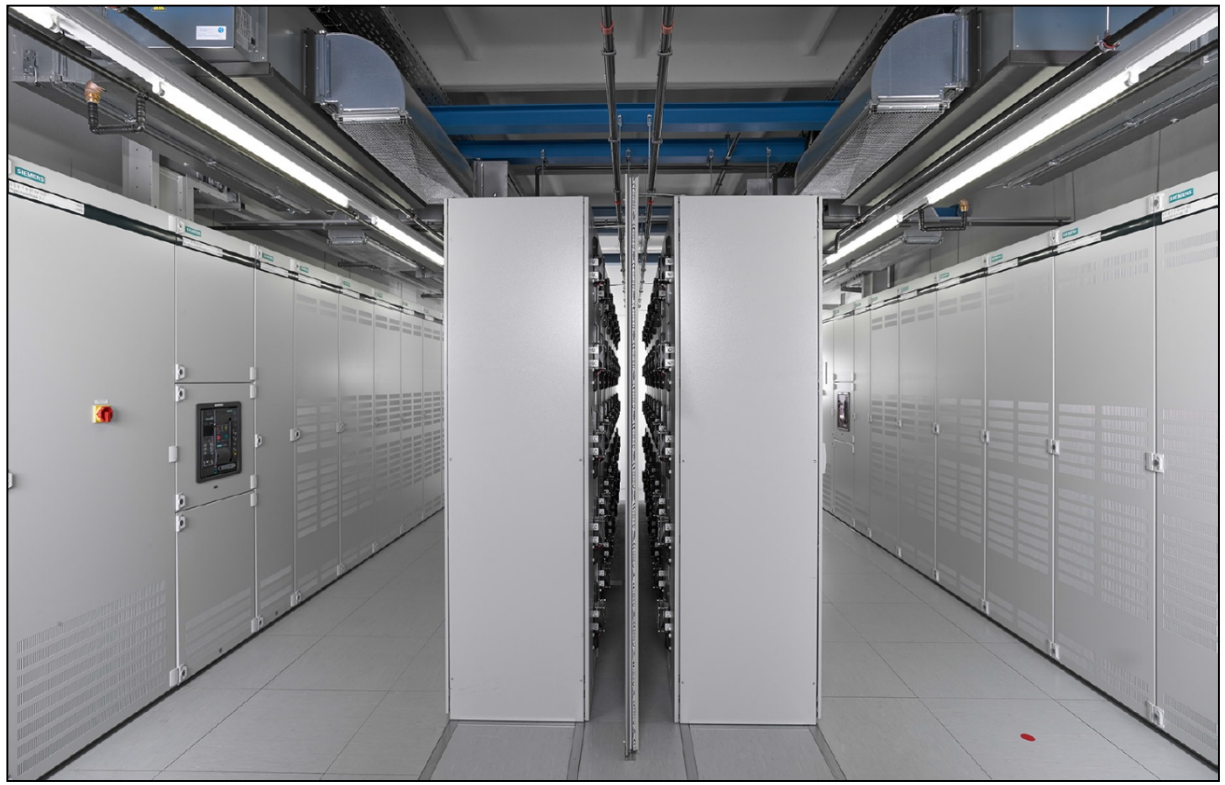
Photos from Energy Storage – Reference Sample



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List of references and projects in Europe (on-service)

- 2012 Italy/Isernia
  ENEL Distribuzione S.p.A.;
  Smart Grid Test Plant; 1 MVA/500 kWh
- 2014 Italy/Sicily
  TERNA S.p.A.; NAS Storage Test Plant; 12 MW/82 MWh
- 2015 Italy/Sardinia
  TERNA S.p.A.; Storage Lab Test Plant; 1 MVA/500 kWh
- 2015 Germany/Eisenhuettenstadt
  Vulkan Energiewirtschaft Oderbrücke GmbH (VEO),
  Black start; 2.8 MVA/720 kWh
- 2015 Germany/Flein
  Süwag Energie AG; Renewable Integration; 118 kVA/135 kWh
- 2015 Italy/Ventotene
  ENEL Generation S.p.A.; Island Application; 500 kW/600 kWh
- 2015 Italy/Roma Airport
  ADR S.p.A.; Renewable Integration and Smart Grid;
  118 kVA/45 kWh
- 2015 UK/Manchester
  University of Manchester;
  Research and Test Plant; 236 kVA/180 kWh
- 2015 Germany/Sindelfingen
  Daimler AG; Renewable Integration; 360 kVA/180 kWh
- 2015 Portugal/Evora
  EDP Distribuição; Smart Grid Integration; 472 kW/360 kWh
- 2015 Germany/Hamburg
  Hamburg Port Authority; Onshore Power Supply; 12 MW
- 2015 Italy/Expo Milano
  ENEL Distribuzione S.p.A.; Smart Grid Test Plant;
  354 kVA/135 kWh
- 2015 Finland/Helsinki
  Helsinki Environment Centre;
  Renewable Integration Test Plant; 118 kVA/45 kWh

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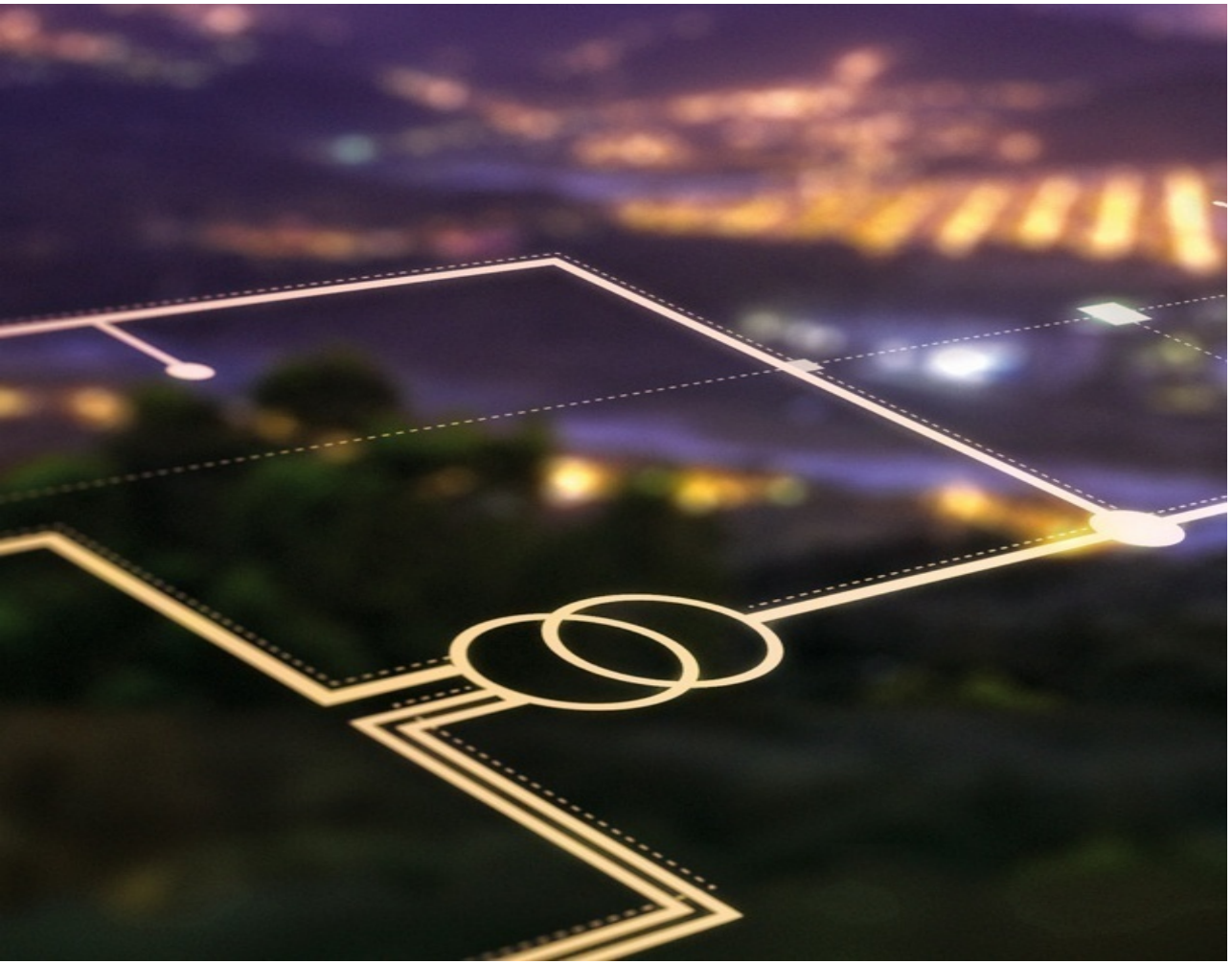
Thank you!



Siemens Portugal

Energy Management

Microgrids - **C**enter **o**f **C**ompetences

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