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Smart Cities of Romania

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We are in the "urban millennium"

Population

- 2014: 54% of the world's population lives in cities & it is expected to increase to 66% in 2050;
- Projections show that urbanization combined with the overall growth of the world's population could add another 2.5 billion people to urban populations by 2050, with close to 90 percent of the increase concentrated in Asia and Africa, according to a new UN report from 2014;

Economy

- ~60% of global GDP is produced in 600 cities;
- By 2025, 40% of global GDP growth will be generated by middleweight cities in emerging markets

Environment

Cities stand for

- Two-thirds of the world's energy
- 60% of its drinking water
- Up to 70% of its CO2 emissions



Sustainable urbanization is key to successful development

Most Developed Cities considering GDP :

Tokyo – 1,520 billion €

New York – 1,210 billion €

Los Angeles – 789 billion €

Seoul – 779 billion €

London – 731 billion €

Most populous cities in the world

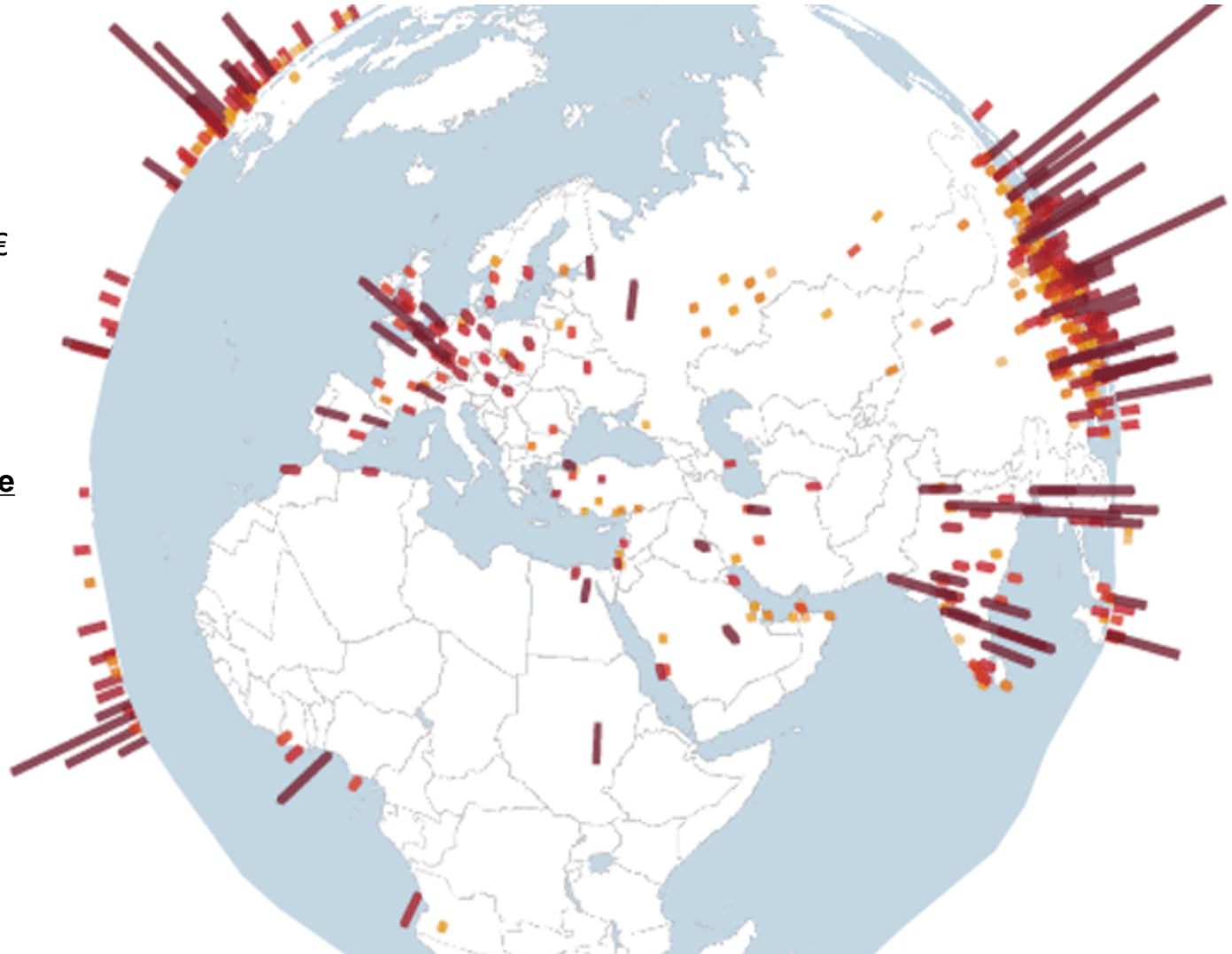
Shanghai – 24,25 MIO

Karachi – 23,50 MIO

Beijing – 21,50 MIO

Delhi – 16,35 MIO

Lagos – 16,10 MIO



Basic needs of a city drive the market for intelligent infrastructure solutions



Efficient transportation of people and goods

Reliable and efficient supply of utilities (water, energy, etc);

Smart building

Comfort and security

Low emissions

Siemens mission – Transform cities for the better through sustainable technology

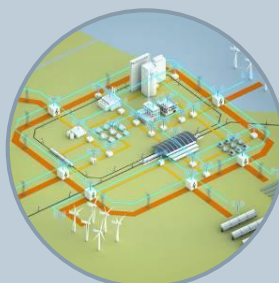
Intelligent traffic management

- Traffic flow management
- Tolling systems



Smart grid solutions

- Demand response system
- Decentralized energy management
- Grid automation



Rail-bound transit solutions

- High-speed and metro rail
- Train control systems
- Traction power supply



Safety and security

- Fire safety
- Access control and identification



We are the
pioneering partner
for infrastructure & cities

and address
our customers needs such as:

- Clean technology
- Energy storage
- Secure & reliable energy distribution

Energy efficient buildings

- Building Automation
- Energy performance contracting



**Siemens' water
automation technologies
and energy supply
complement
this portfolio**

Intelligent load and demand-side management

Challenges in changing energy system

Renewable and distributed generation

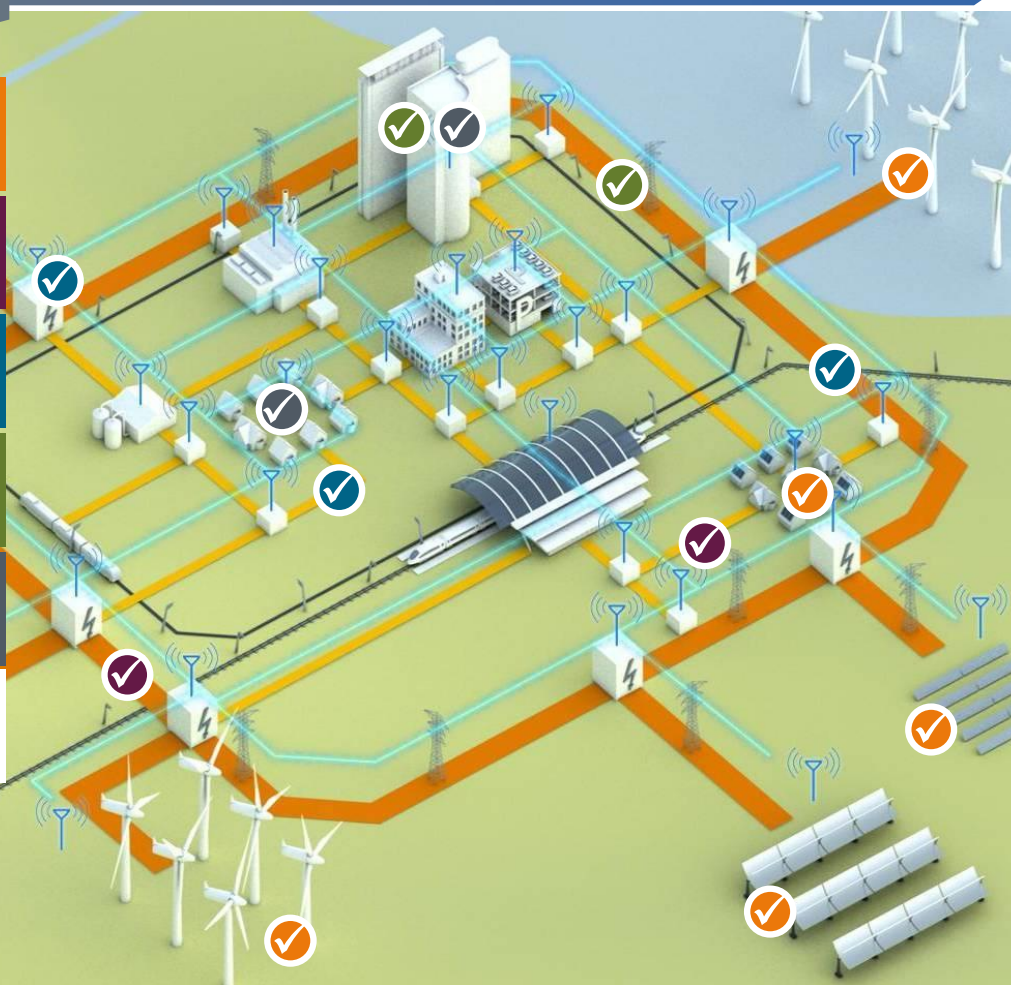
Limited generation and grid capacity

Aging and/or weak infrastructure

Cost and emissions of energy supply

Revenue losses, e.g. non-technical losses

Lack of intelligence in distribution grids



Smart Grid offers solutions

Balancing generation & demand, new business models

Load management & peak avoidance

Reliability through automatic outage prevention and restoration

Efficient generation, transmission, distribution and consumption

Full transparency on distribution level and automated loss prevention

Intelligent local substations, smart metering

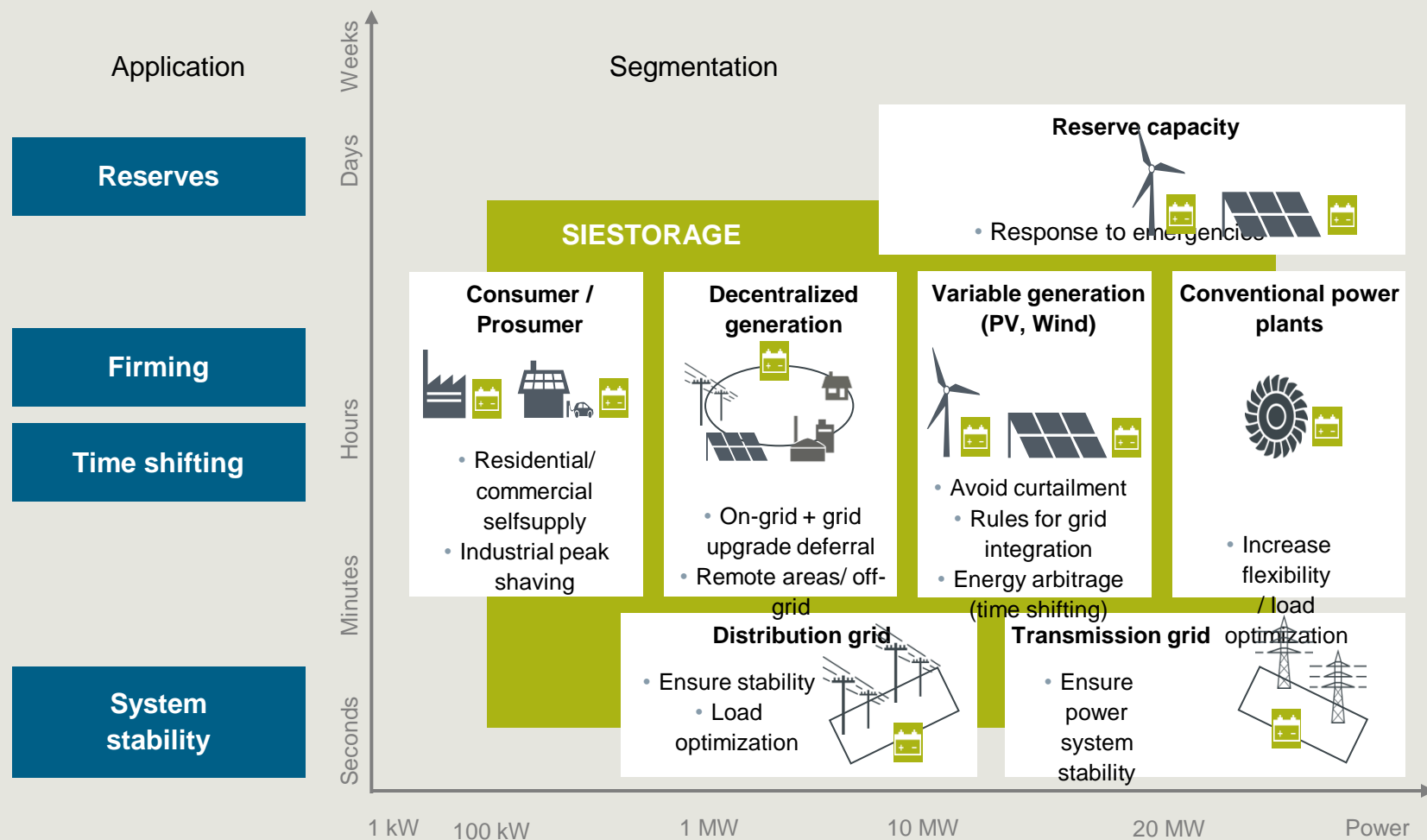
SIESTORAGE Battery energy storage system

Benefits





- **One-stop shop:**
From analysis to planning, system integration and services
- **Advanced technology:**
Cutting-edge power electronics and control combined with Li-ion batteries
- **Safety:**
Fully security-tested and certified system
- **Reliability:**
Power supply in milliseconds and high redundancy for outstanding availability
- **Cost-efficiency:**
Optimization and savings potential for a wide range of applications
- **Flexibility:**
Covering many power and capacity needs thanks to a modular system design
- **Eco-friendly:**
Integration of renewables and less CO₂ emissions



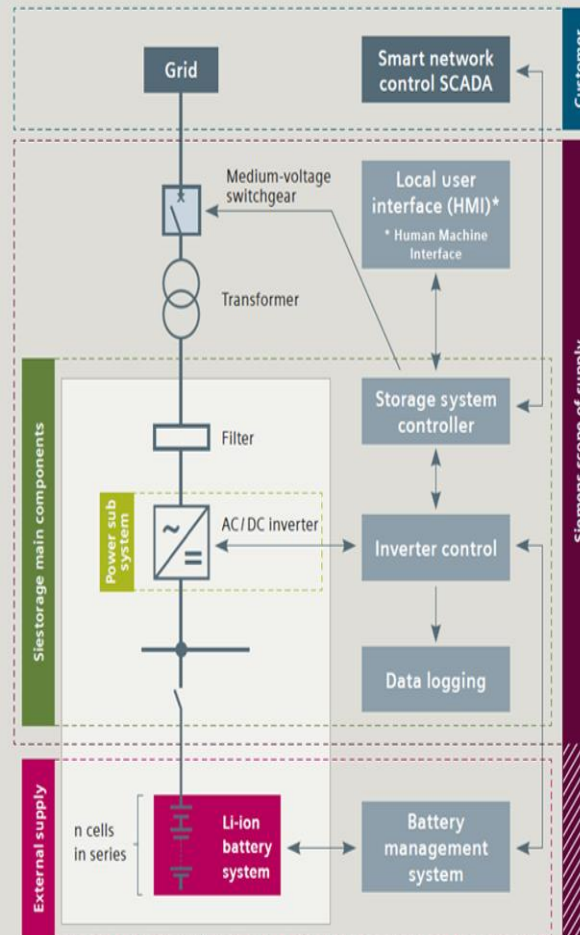
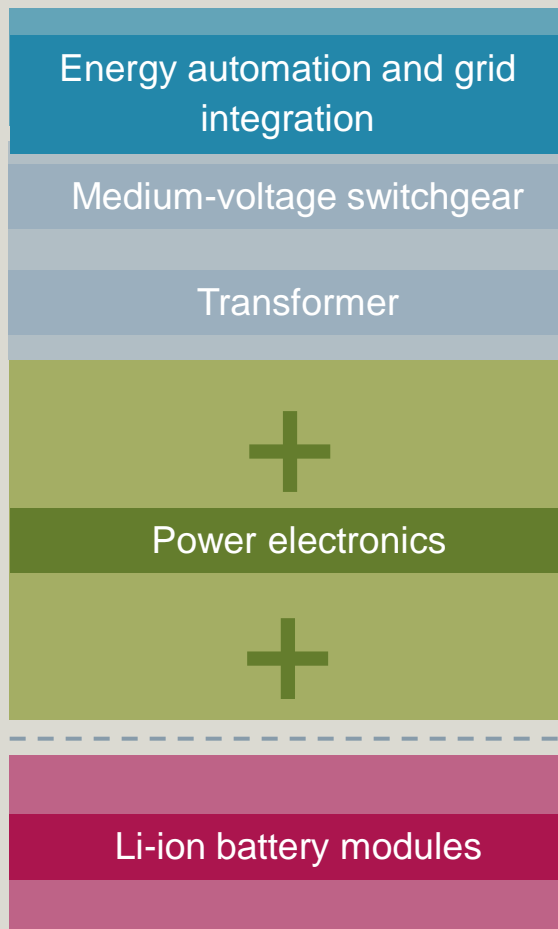
Energy Storage for very different purposes



Applications and use cases

| APPLICATIONS | USE CASES |
|---|--|
|  <p>Electricity supply for microgrids/stand-alone grids</p> | <ul style="list-style-type: none"> • Black start • Ramping control • Time shifting • Capacity firming • Diesel offset • Frequency regulation (Primary Control Reserve) • Peak load management |
|  <p>Electricity supply for industry</p> | <ul style="list-style-type: none"> • Black start • Backup energy • Diesel offset • Peak load management |
|  <p>Integration of renewable energy</p> | <ul style="list-style-type: none"> • Ramping control • Time shifting • Capacity firming |
|  <p>T&D upgrade deferral</p> | <ul style="list-style-type: none"> • Peak load management • Ramping control • Frequency regulation |

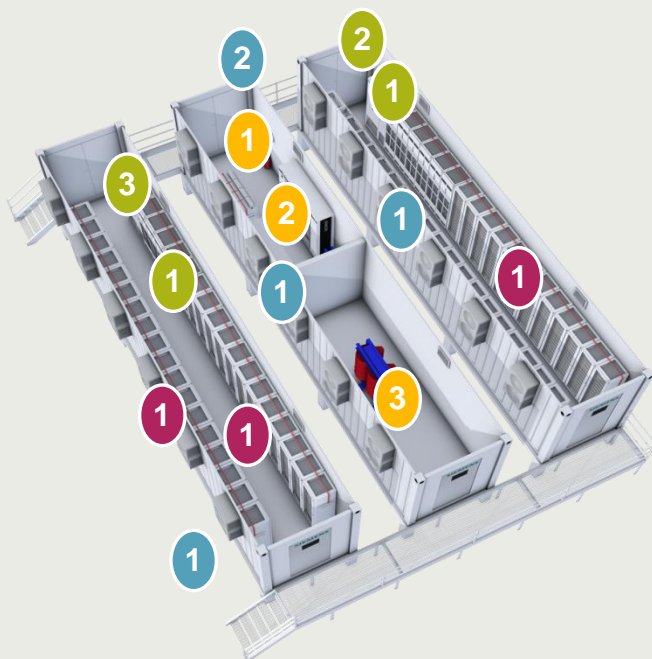
Comprehensive system and cutting-edge technology



Cutting-edge technology

- SIESTORAGE combines cutting edge power electronics, automation, and state-of-the-art Li-ion battery technology, resulting in the following advantages:
 - Fast and accurate response time to consume and discharge energy
 - Assured power quality
 - Flexible and scalable design for many use cases
 - Increased reliability thanks to system architecture redundancy

Example of system integration



SIESTORAGE components

- Converter cabinet 1
- Grid connection cabinet 2
- Control cabinet 3

Battery cabinets incl. battery management system

- Battery cabinet 1

LV + MV components

- 8DJH gas-insulated medium-voltage switchgear 1
- SIVACON S8 low-voltage switchboard 2
- GEAFOL cast-resin rectifier transformer 3

HVAC, fire fighting and safety equipment

- HVAC 1
- Fire detection and extinguishing system 2

Projects and references in Europe

Finland

2015 Helsinki; Renewable Integration Test Plant; 118 kVA / 45 kWh

UK

2015 Manchester; Research & Test Plant; 236 kVA / 180 kWh

Germany

2015 Sindelfingen; Renewable Integration; 360 kVA / 180 kWh

2015 Flein; Renewable Integration; 118 kVA / 135 kWh

2015 Eisenhuettenstadt; Black Start; 2.8 MVA / 720 kWh

Italy

2015 Expo Milano; Smart Grid Test Plant; 354 kVA / 135 kWh

2015 Roma; Renewable Integration & Smart Grid; 118 kVA / 45 kWh

2015 Ventotene; Island/Microgrid Application; 500 kW / 600 kWh

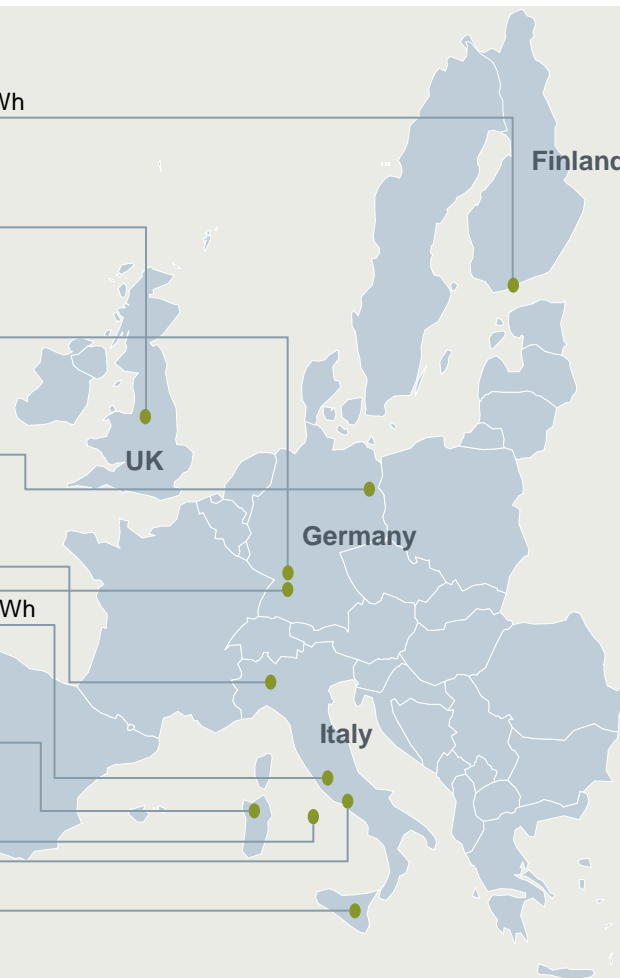
2015 Sardinia; Storage Lab Test Plant; 1 MVA / 500 kWh

2014 Sicily; NAS Storage Test Plant; 12 MW / 82 MWh

2012 Isernia; Smart Grid Test Plant; 1 MVA / 500 kWh

Portugal

2015 Evora; Smart Grid Integration; 472 kW / 360 kWh



— ~ 20 MW storage projects

— **Variety of customers:**

Grid operators, utilities,
industries and ports

— **Variety of applications:**

Islands, Diesel offset,
renewable, integration,
black start, shore-to-ship
connection

A burning desire for better fire protection

The facts speak for themselves

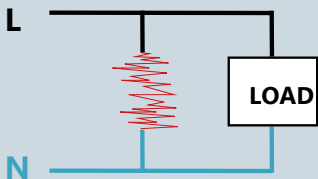

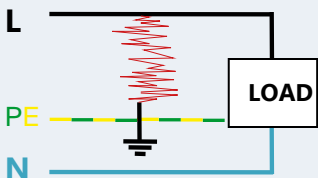

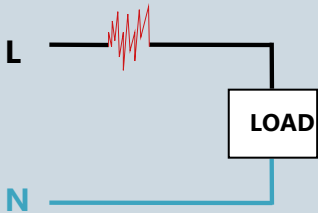

In Europe, one-third of all fires reported can be traced back to dangerous defects in the electrical installation. The figures are shocking: Fire damage in the billions, thousands of people injured and even deaths! Given this serious background, the installation of arc-fault detection units (AFD units) is urgently recommended.

According to the international standard IEC 60364-4-42, AFD units are strongly recommended all over Europe as the recognized state-of-the-art technology in specific locations of use. With the publication of the DIN VDE 0100-420 standard, the installation of AFD units has become mandatory in Germany for many locations.



5SM6 AFD units

Closing the previous protection gap

| Type of fault | Protection options |
|--|---|
| Parallel phase – neutral / phase – phase  | <div>MCB</div>  <div>Line and system protection</div> |
| Parallel phase-protective conductor  | <div>RCD / RCBO</div>  <div>Personal safety / personal line and overcurrent protection</div> |
| Serial  | <div>AFD unit</div>  <div>Fire protection</div> |

MCB = miniature circuit breaker AFD unit = arc-fault detection unit RCD = residual current protective

For serial arcs, residual current and overcurrent protection equipment offer no protection!
The **arc-fault detection unit (AFD unit)** closes this gap.

5SM6 AFD units

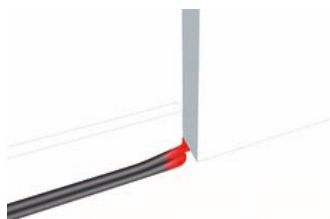
Closing the previous protection gap

Parallel arcing phase and neutral conductor / ground

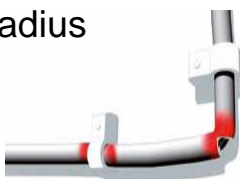
Nail or screw



Crushed cable



Bending radius too small



High temperature of the arc



ignitable material



Serial arcing fault in phase or neutral conductor

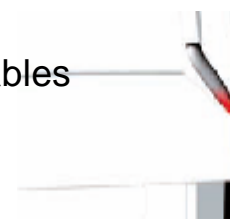
Loose contacts and terminals



UV radiation / gnawing animals

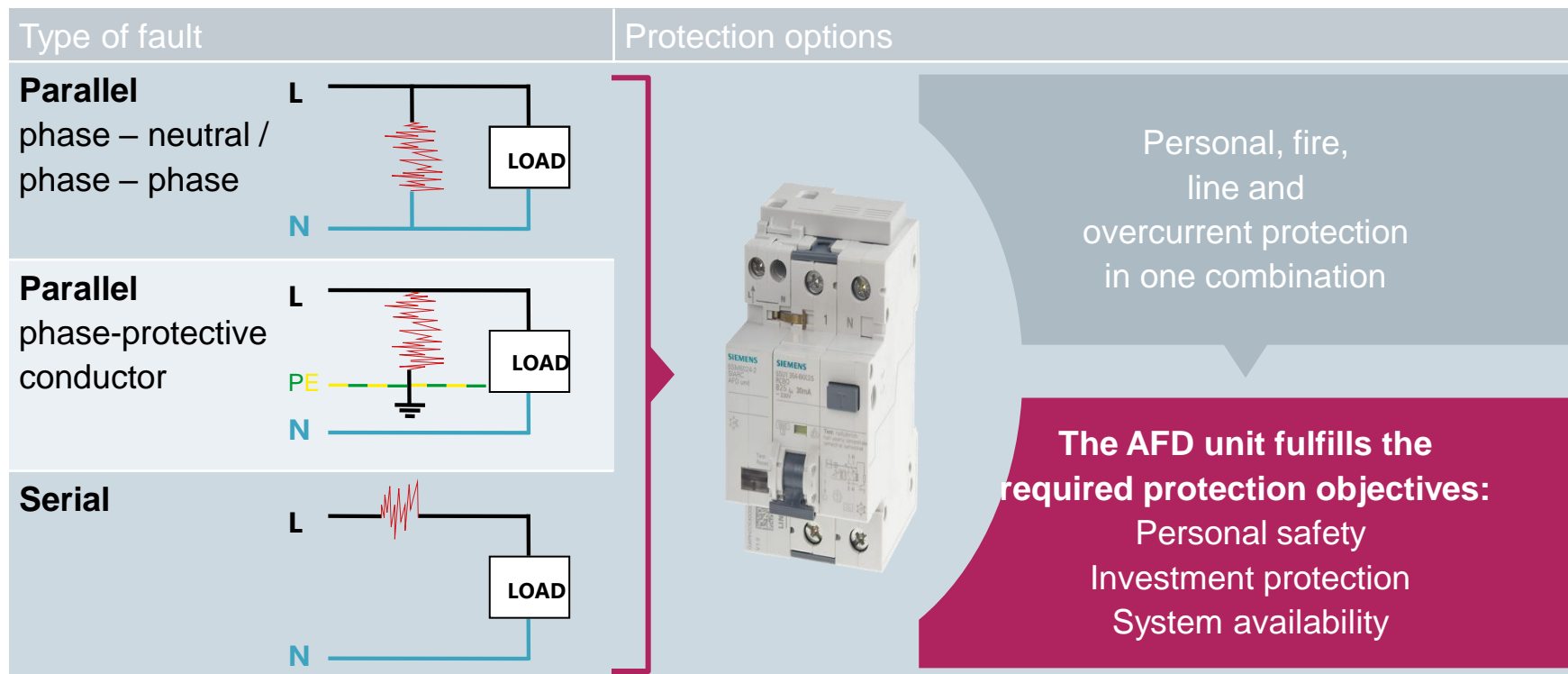


Kinks in connectors / cables



5SM6 AFD units

Closing the previous protection gap



MCB = miniature circuit breaker

AFD = arc-fault detection unit













RCD = residual current protective device

The AFD unit safely shuts down the electrical circuit in case of dangerous arcing faults and only trips in the event of an actual fault.

5SM6 AFD units

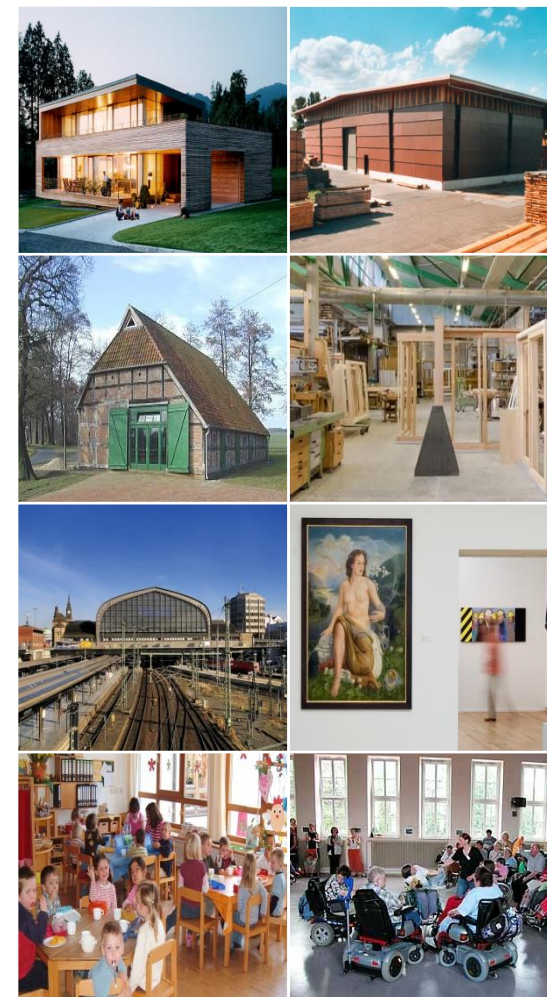
Recommended installation according to IEC 60364-4-42

Locations where the use of the AFD unit is recommended in single-phase branch circuits up to 16A

| | | | |
|---|---|---|---------------------------------------|
|  | Wood working shops, paper and textile factories or laboratories |  | Public buildings ¹⁾ |
|  | Warehouse areas with flammable materials |  | Nurseries ²⁾ |
|  | Wooden houses and farm buildings |  | Retirement homes ²⁾ |
|  | Airports |  | Barrier-free apartments ²⁾ |
|  | Railway stations |  | Laboratories |
|  | National monuments, museums |  | Computer centers |

1) With irreplaceable goods

2) to be provided in bedrooms and recreation rooms



References

Berlin's famous department store, KaDeWe, relies on AFD units

SIEMENS



| | |
|----------------------|--|
| Customer: | KaDeWe, Berlin |
| Retail space: | 66,000 m ² , 8 floors |
| Project: | additional protection of electrical installation |

“We only have limited influence on electrical devices from third-party companies. That's why one thing was certain to us: The AFD unit affords us additional safety in this area.”

Wolfgang Maschke, Head of Technical Services, KaDeWe

A burning desire for better fire protection:

At the beginning of 2014, eight AFD units were installed (in combination with RCBOs). Additional distributors are to be gradually retrofitted, primarily in the commercial kitchens on the catering level.

Pilot 120 kW DC Charger



SIEMENS

120 kW High Power DC Charger

Powerful charging modules



Short charging times are key factors to establish eCars in the market. Today 100km range can be charged in about 30 minutes with State-of-the-Art 50kW DC-technology. To reach ranges from 200 up to 500 km in the same time, charging systems with more than 100kW are necessary. NextGen High power DC-chargers with high voltage levels up to 800V are necessary. The systems are compatible to older systems so that today existing and future eCars can be charged „fast“.

Siemens developed the 120kW power unit solution and built up the system with the system integrator Heldele. The charging controller is basing on a CCS standard (combined charging system) and also developed by Siemens. The use of proven and high performance power electronics from Siemens and the innovative system concept leads to compact and powerful DC-Charging systems of the next Generation.

References:

Wien Energy GmbH – Airport Vienna
Ebreichsdorf Town – Austria;
Asia Net Hungary Ltd - Hungary

Thank you for your attention!