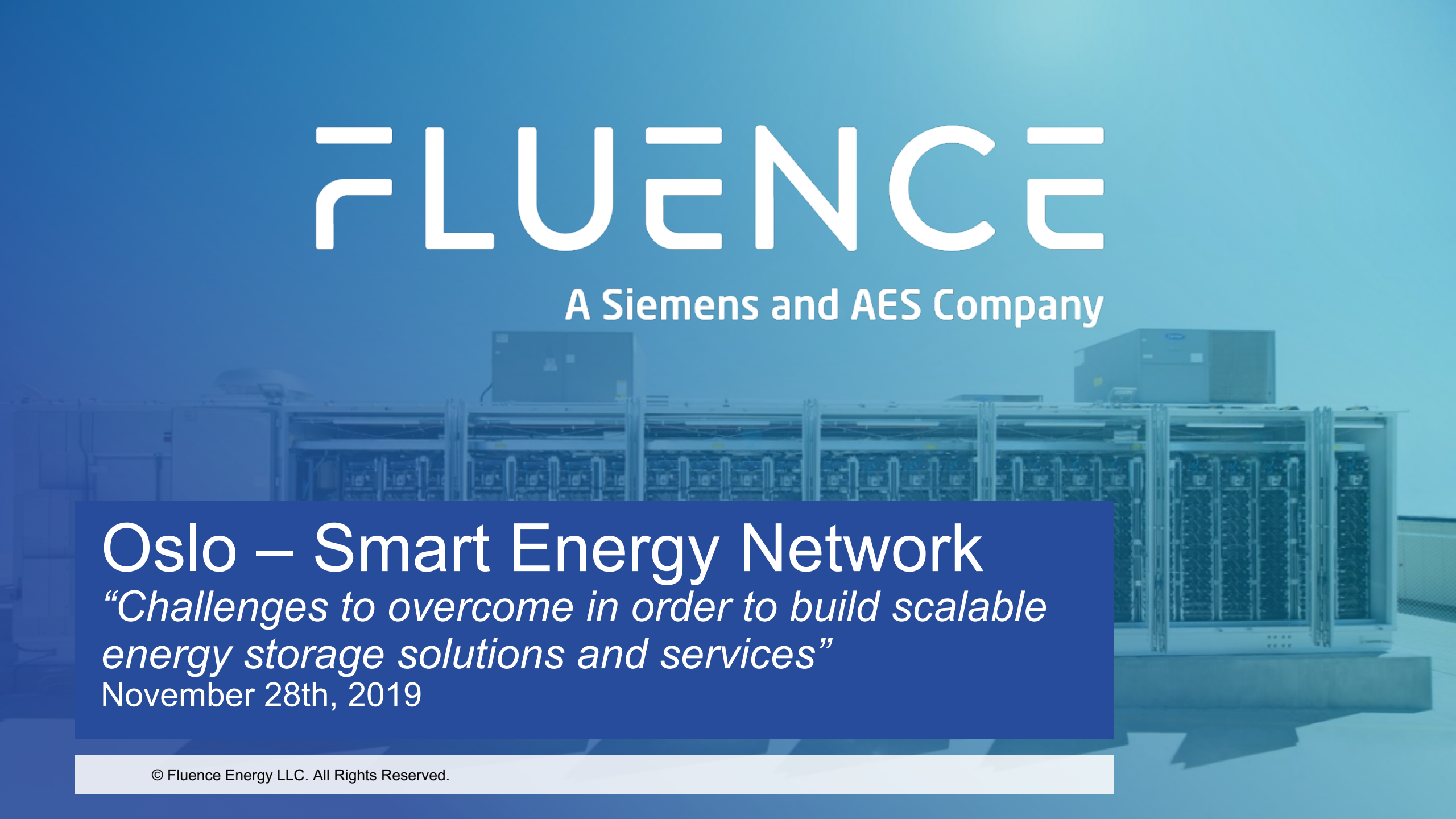


FLUENCE

A Siemens and AES Company

Oslo – Smart Energy Network

"Challenges to overcome in order to build scalable energy storage solutions and services"

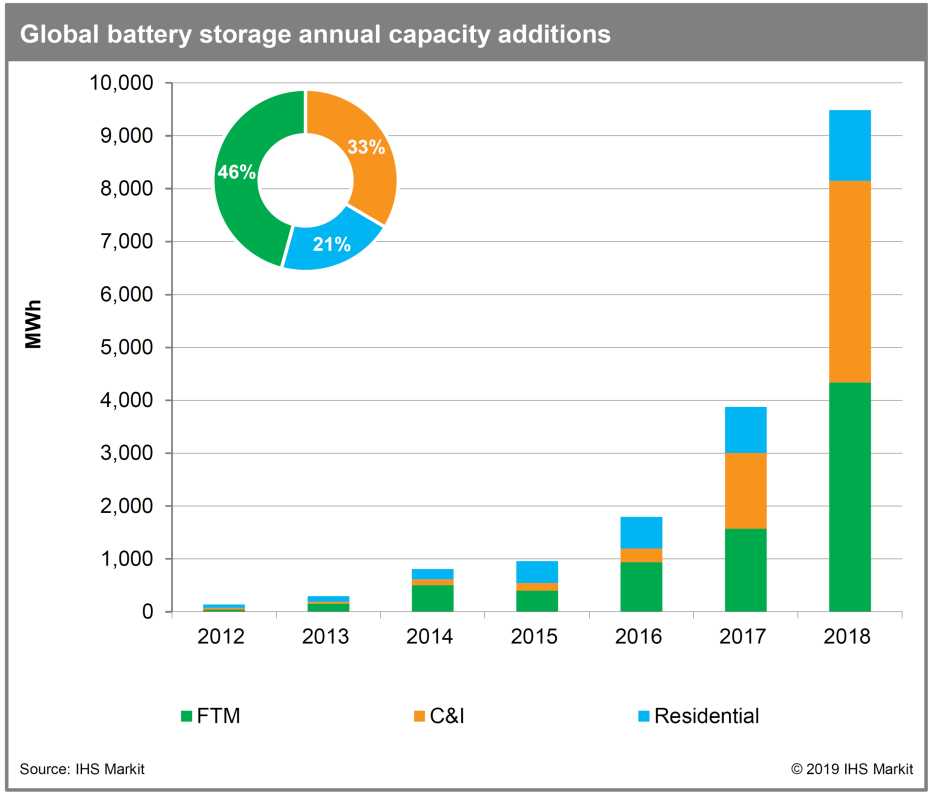
November 28th, 2019

About the title: „*Challenges to overcome in order to build scalable energy storage solutions and services*”

Challenges to overcome

1) **Business case**
2) **Market rules**
3) **Regulation and Laws**

in order to build scalable energy storage



solutions and services

1) **Turnkey available**
2) **Guaranteed**
   a) **Availability**
   b) **Performance**
   c) **Lifetime**
3) **Full spectrum service**

Fluence is the global leader in grid connected energy storage

Joint Venture of Siemens & The AES Corporation delivers complete, proven storage systems

OUR TRACK RECORD

12+ YEARS

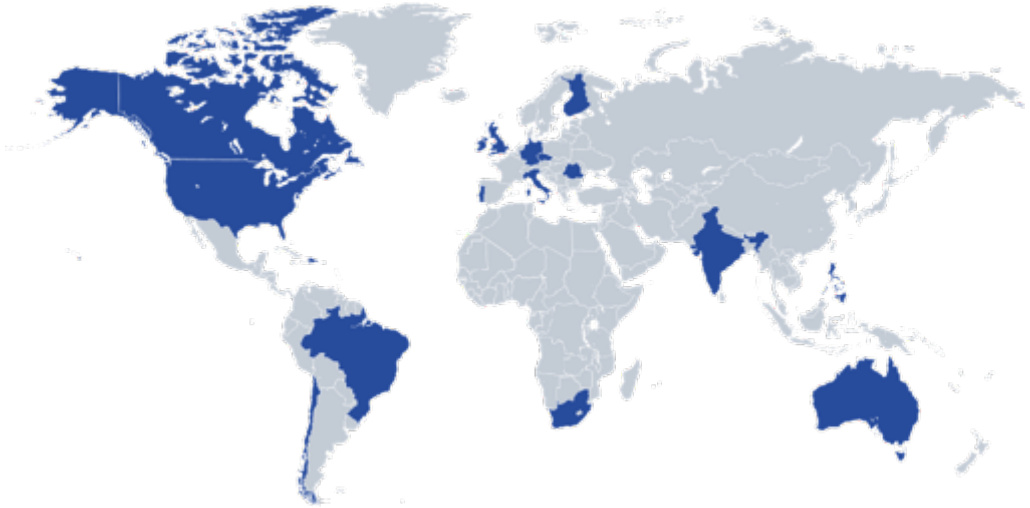
100+ PROJECTS

21 COUNTRIES AND TERRITORIES

1,500+ TOTAL MW

6,700+ GW-HOURS OF DELIVERED SERVICE GLOBALLY

OUR PROJECTS



OUR CUSTOMERS

SEABOARD CORPORATION
SDGE
A Sempra Energy utility
SIEMENS Ingenuity for life
SAN MIGUEL CORPORATION
SWM Stadtwerke München
BRUNSWICK ELECTRIC Membership Corporation A Touchstone Energy Cooperative
AusNet services
SCA
ukpowerreserve PART OF sembcorp GROUP
aps
AES India
SPOTLESS
e·on
Mitsubishi Corporation
VSB
LEMPÄÄLÄN ENERGIA
c-energy
NEXIF ENERGY
stadtwerk haßfurt
AES
TATA POWER-DDL
AES Dominicana

Fluence focuses on 8 primary energy storage applications to address the full spectrum of customer use cases

TRANSFORM YOUR GENERATION

- Frequency Regulation
- Capacity Peak Power
- Generation Enhancement

TRANSFORM YOUR NETWORK

- Transmission & Distribution Enhancement

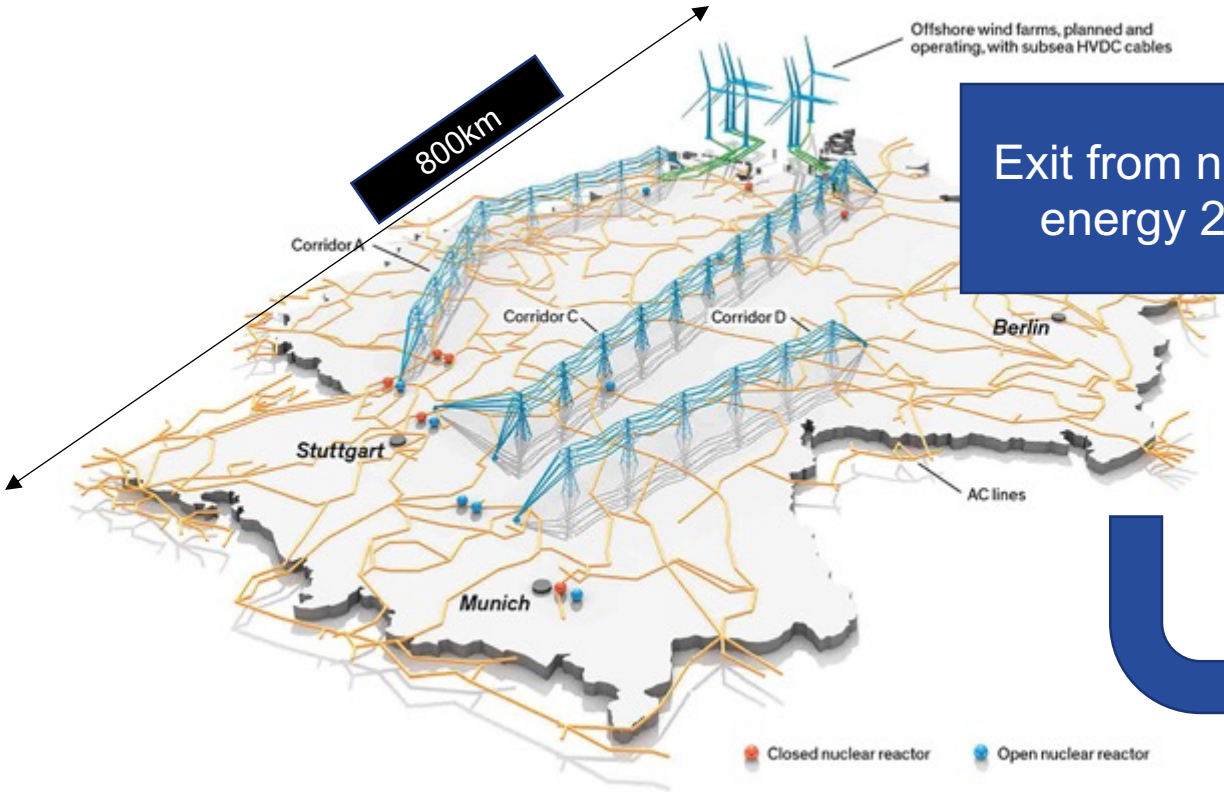
TRANSFORM YOUR ENERGY USE

- Critical Power
- Energy Cost Control

- Renewable Integration
- Microgrids & Islands

“Netzentwicklungsplan” 2019 stated GW-scale storage options as ad-hoc activities in parallel to needed gird expansion in long term

Plenty of impacts will lead to short term (ad-hoc) and long term gird necessary adjustments



Exit from nuclear energy 2022

Delay grid expansion

EE: goal 65% in 2035

Increasing re-dispatch (1.4bn€ 2017)

Exit from coal energy 2038

Ad – hoc activities:
“near term assets which were refinanced by lowering redispatch costs”

1) **Gridbooster (e.g. batteries)**
2) Phase shifter transformer
3) Preventive intervention in generation

“Netzentwicklungsplan” – Scenario B 2025 shows 3 ad-hoc Gridbooster systems to lower Redispatch costs

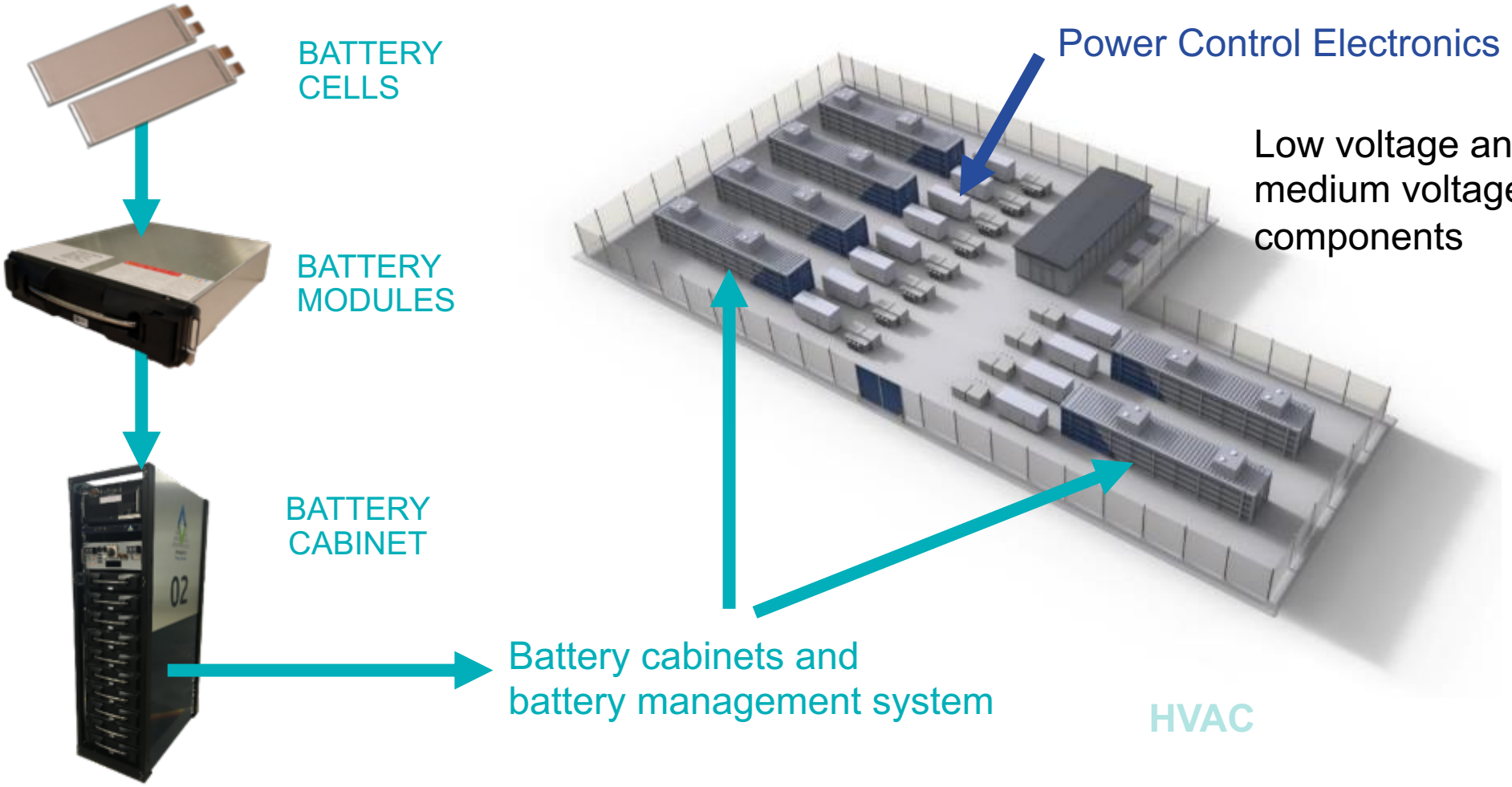
Storage as Gridbooster		
P365-M583	2 * 100MW (tandem) Audorf/Süd und Ottenhofen	TenneT
P411-M625	2 * 300MW (tandem) Wehrendorf* und Hoheneck	Amprion
P427-M646	1 * 500MW Kupferzell	TransnetBW
Total	1300MW	

„Nach erster Abschätzung **reduzieren die Netzbooster-**Pilotanlagen den **Redispatchbedarf** ausgehend von der Topologie mit den bestätigten Ad-hoc-Maßnahmen (11,2 TWh, davon 4,8 TWh EE-Einspeisemanagement) **um 9,3 %** auf 10,2 TWh Einspeisereduktion, davon 4,4 TWh EE-Einspeisemanagement.“ (Netzentwicklungsplan)

* NEP: “Thermal energy conversion unit”

What is energy storage? Large-scale batteries for industrial applications.

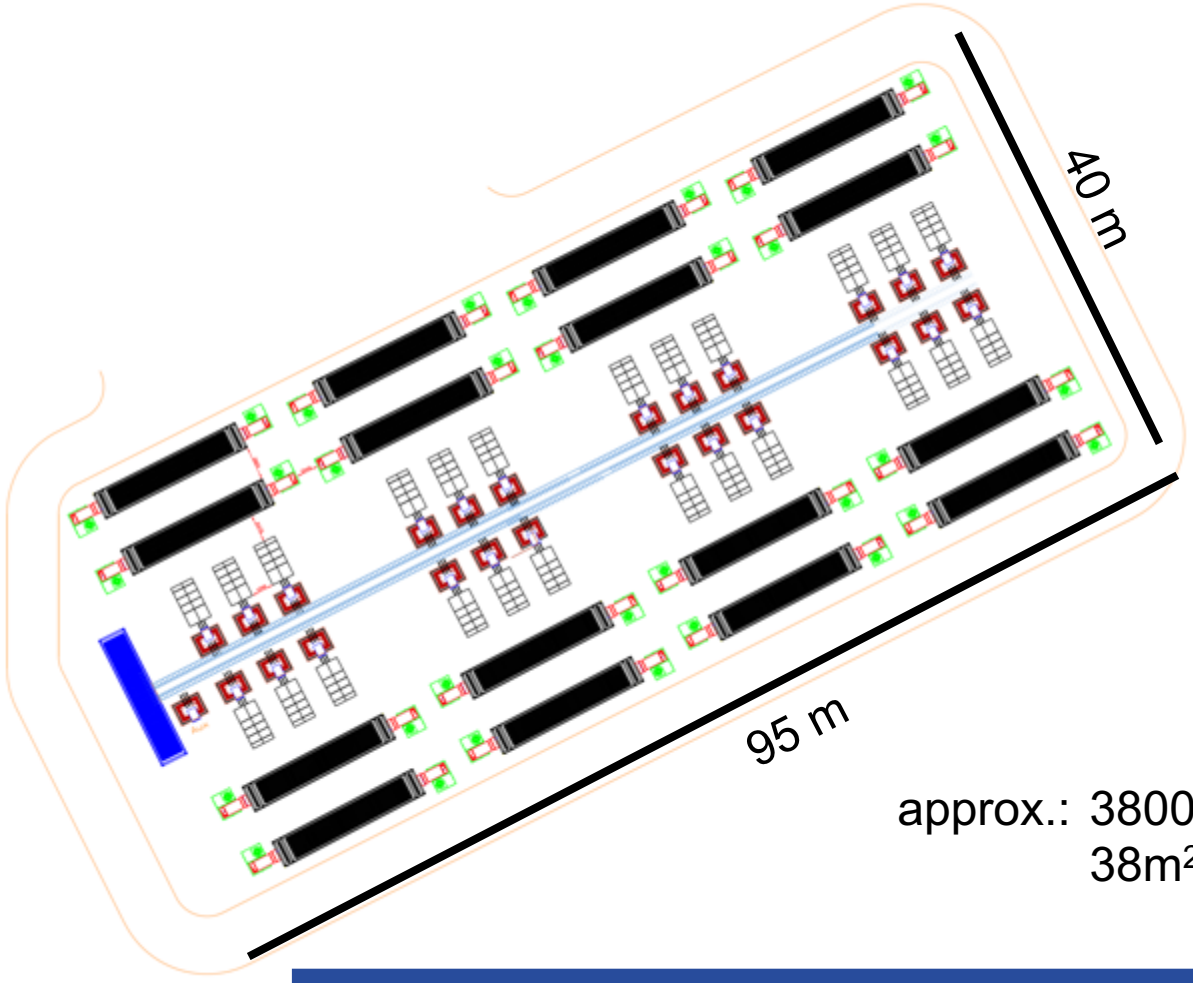
Modular, scalable arrays of proven technologies integrated at utility and industrial scale.



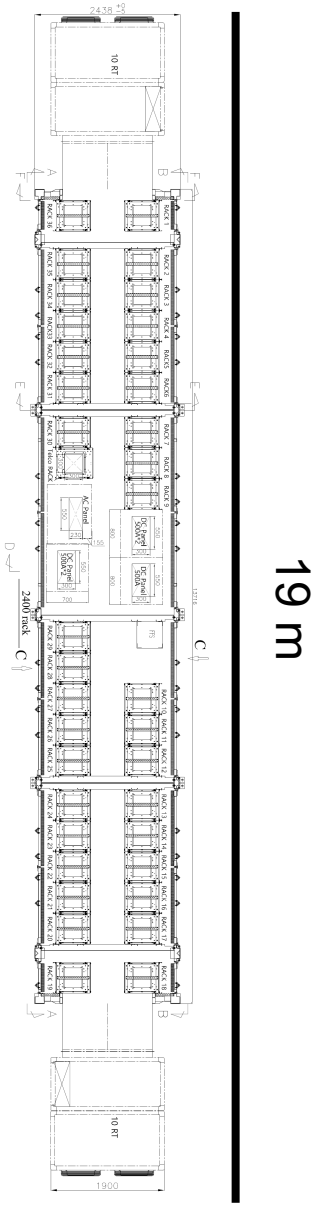
Intelligence:
Array Controls & Application Software

Connection:
Electrical & Other Balance of Plant

Site Layouts (example)



approx.: 3800m²
38m² / MWh

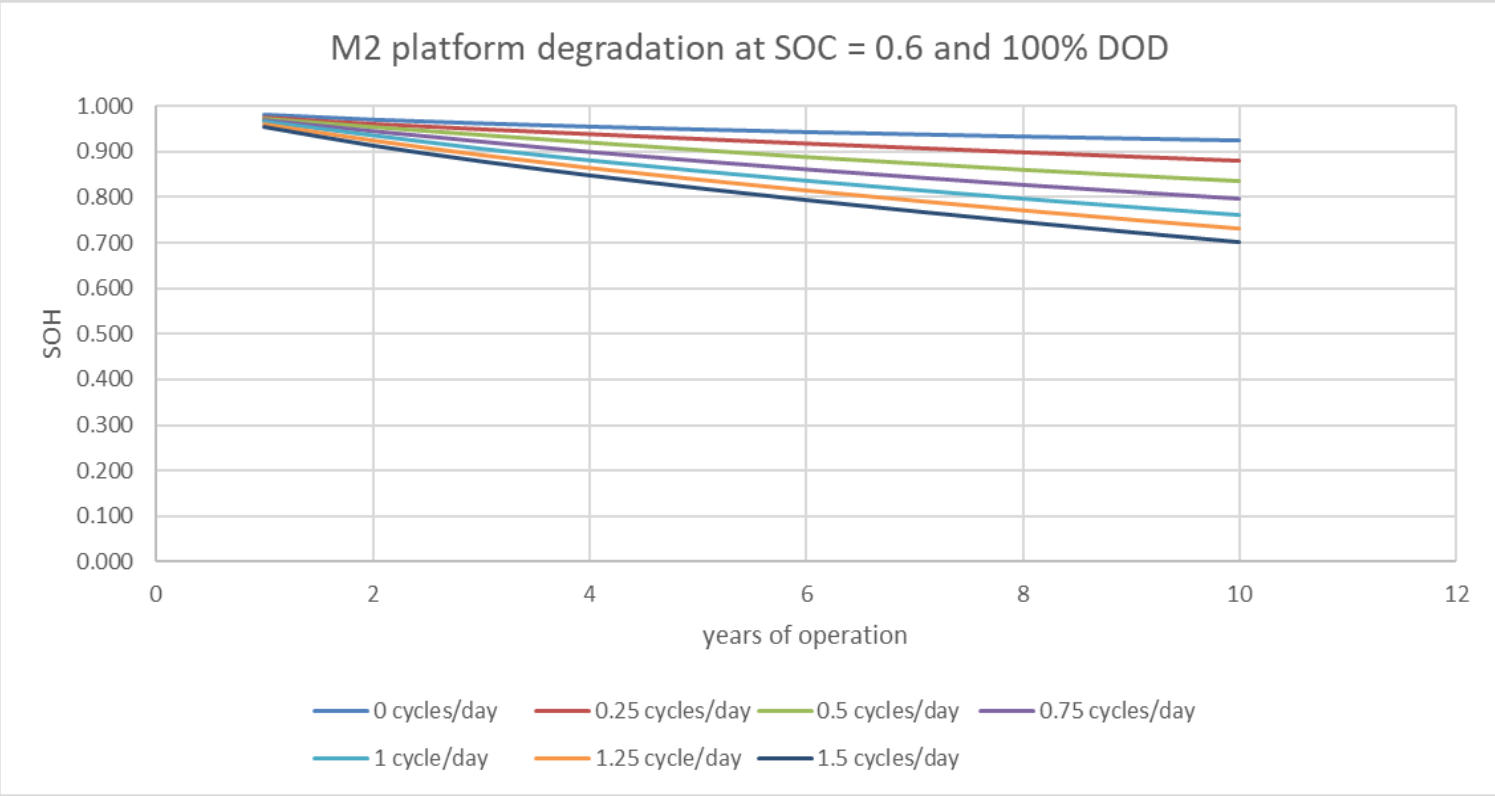


2hr (16 containers) – 50MW/100MWh(installed)

Aging of battery for different applications

Detailed know-how of battery degration will allow a broab field of applications

- ranging from Back-up functionality up to high energy throughput



System Services & Trading

UK Power Reserve

United Kingdom

120MW / 120MWh fleet

CHALLENGE:

- Largest energy storage portfolio transaction in world with UK's #1 flexibility provider
- Flexible warranty structure to enable maximum asset revenue agility

SERVICES:

- Frequency Regulation
- Balancing Mechanism
- Fast Reserve

Capacity Peak Power

Long Beach, California, United States

100 MW, 4-hour (400 MWh)

AES Alamitos, COD Jan 1, 2021

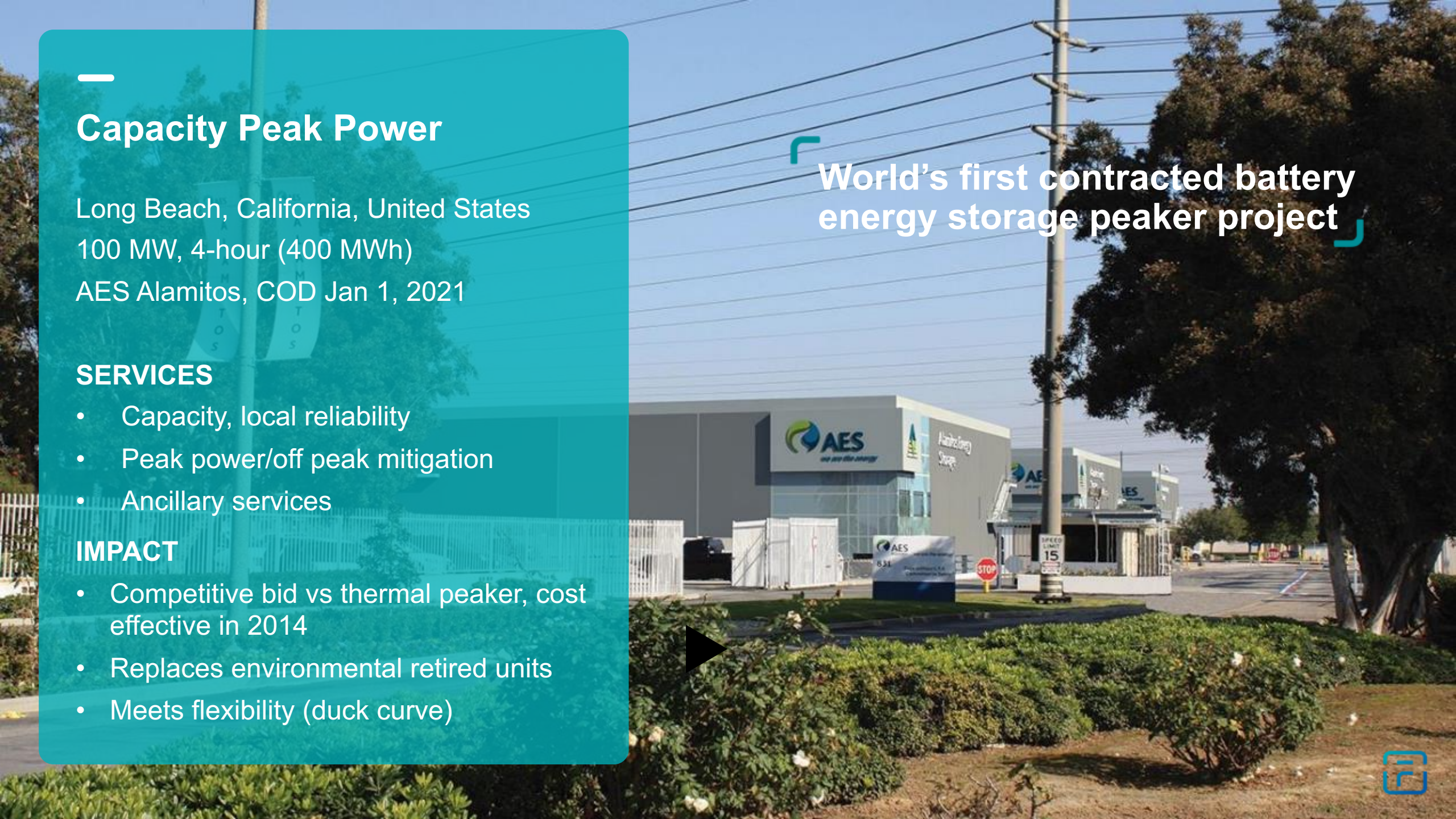
SERVICES

- Capacity, local reliability
- Peak power/off peak mitigation
- Ancillary services

IMPACT

- Competitive bid vs thermal peaker, cost effective in 2014
- Replaces environmental retired units
- Meets flexibility (duck curve)

World's first contracted battery energy storage peaker project



Generation Enhancement

Eisenhüttenstadt, Germany

2.8 MW / 1.1 MWh

The Steel Plant / VEO

Impact:

- High rate of availability and reliability to guarantee Gas Turbine start-up process.

Renewable Integration

EDPR

Romania

1.4 MW / 1 MWh

Wind Farm

Services:

- Output Stabilization & Peak Shaving

Impact:

- Reduction of forecast errors
- Reactive power compensation
- Grid code compliance

System Services

ENGIE Hydroelectric Power Plant

Germany

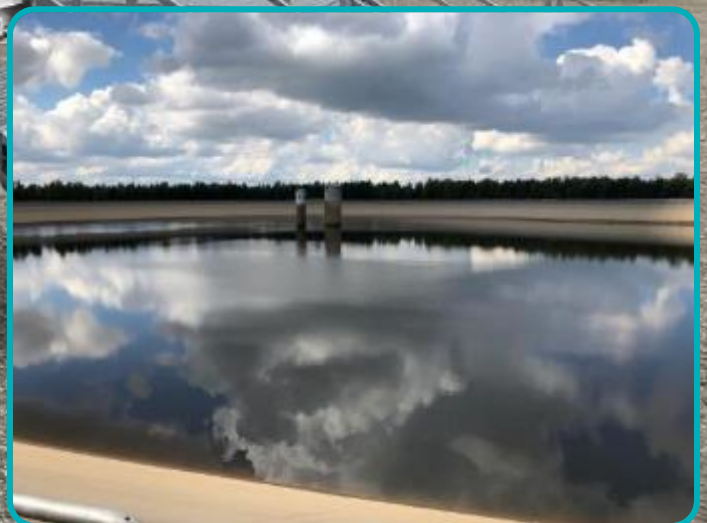
12.5 MW / 12.5 MWh

SERVICES

- Frequency Regulation/Control

IMPACT

- Network stabilization for decentralized power



Transmission Enhancement / Trading

AusNet / Energy Australia

Ballarat, VIC, Australia ,

30 MW / 30 MWh

SERVICES

- Local Capacity
- Peak/Off-peak Management
- FCAS/ Ancillary Services

IMPACT

- Competitive selection
- Maximizes transmission
- Strengthens Network

Capacity Peak Power

California, USA

30 MW / 120 MWh

Advancion System

Client: San Diego Gas & Electric

SERVICES

- Capacity in response to emergency procurement

IMPACT

- Largest operational storage project in Americas
- Contract to online in 6 months
- Sited on 1 acre where plant could not be permitted

Solar + Storage

Lāwa‘i 28 MW solar + 20MW/100 MWh storage

AES Distributed Energy

United States

CHALLENGE:

- Excess solar generation in the day and shortfall at night requires expensive peaker plants to run

IMPACT:

- Solar + storage system enables dispatchable power into evening for $0.11/kWh
- Displacing 3.7m gallons of diesel / year

World’s largest solar plus storage peaker plant

Microgrids & Islands

Isle of Ventotene, Italy

0.5MW / 0.6MWh

ENEL

IMPACT:

- Complex control developments for stable operation with existing gen sets.
- 15% Fuel savings demonstration on-islanded grids.
- Approx 55% reduction in genset operating hours
- Enable further integration of renewables.

Fluence

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