



CLEANHORIZON

Clean Horizon's training services — Multi-session Program

www.cleanhorizon.com



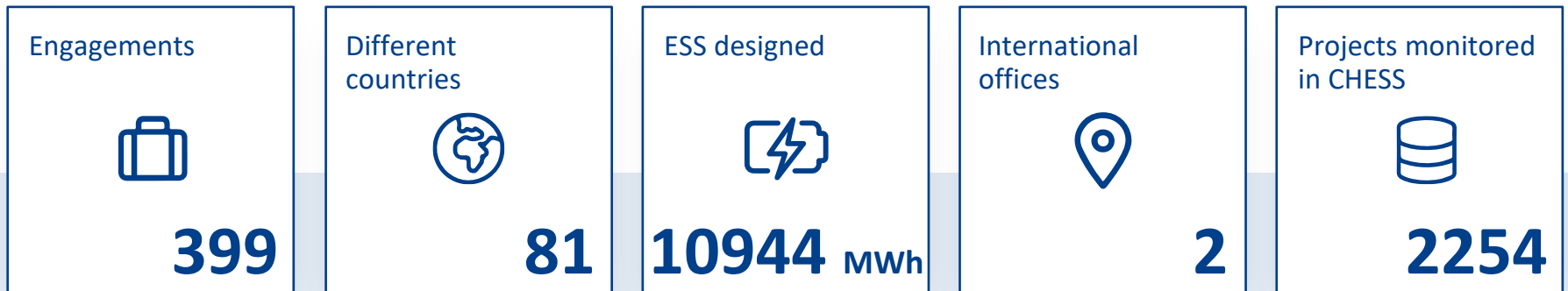
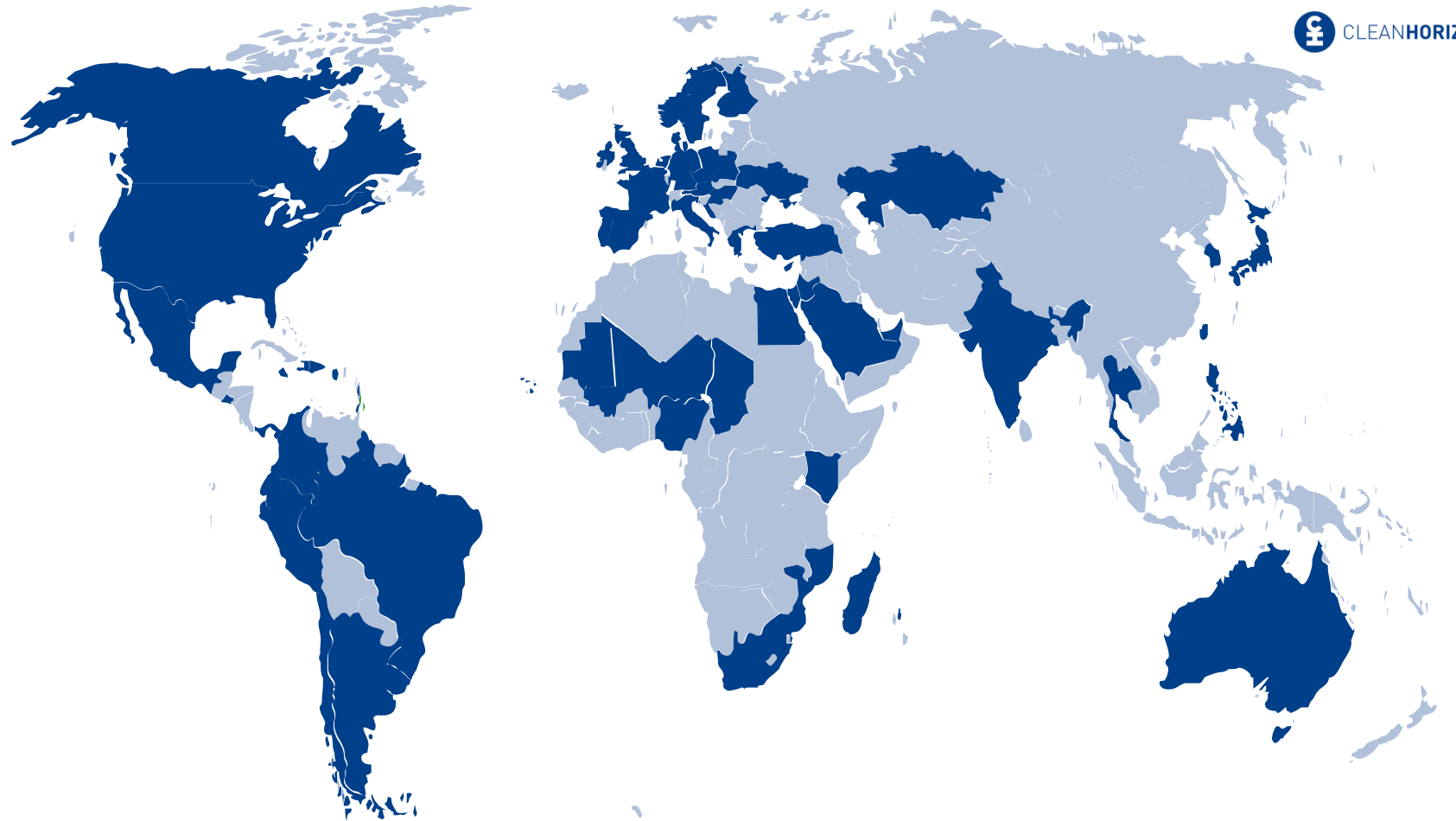


CLEANHORIZON

Presentation of Clean Horizon

CLEAN HORIZON

is active
on energy storage
worldwide



COMPREHENSIVE ENERGY EXPERTISE



MICHAEL SALOMON, Ph.D
CEO

Expertise:

Global storage markets, ESS strategy

Languages:



Countries and areas:

Israel



RACHEL LOCQUET, MSc.
SENIOR ANALYST

Expertise:

Price forecast; RE+ storage business models; COSMOS trading tool development; market analysis; due diligence

Languages:



Countries and areas:

Southern Asia, Nordics, Baltics, Austria, Germany, Switzerland, Slovenia



BEATRIZ BARROS, MSc.
ENERGY STORAGE ENGINEER

Expertise:

Feasibility studies, technical due diligence, market analysis

Languages:



Focus countries/area :

LATAM, Ibéria, The Caribbeans



SAMUEL PORTEBOS, MSc.
HEAD OF ENGINEERING

Expertise:

Feasibility and sizing studies, technical due diligence, system design and audits

Languages:



Countries and areas:

Eastern Africa, Middle Africa, France, Belgium



MOHAMED AMINE BENCHRIFA, MSc.
SENIOR ANALYST

Expertise:

COSMOS trading tool development, RE+storage business models, prices forecast, market analysis

Languages:



Countries and areas:

Northern Africa, Southeast Asia, UK, Ireland, Austria, Germany, Switzerland, Slovenia, Nordics



OKSANA SHKIRAY, MSc.
SENIOR ANALYST

Expertise:

Market analysis, regulatory studies, marketing and communication

Languages:



Focus countries/area :

Central and Eastern Europe



CORENTIN BASCHET, MSc.
HEAD OF MARKET ANALYSIS

Expertise:

Market analysis, revenue stream forecast, economic due diligence, trading strategies, market forecasts

Languages:



Countries and areas:

Southern Africa, UK, Ireland, Moldova, Ukraine, Turkey, Georgia, Armenia, Azerbaidjan



KEILA SANTIAGO, MSc.
SENIOR ANALYST – SENIOR ELECTRICAL ENGINEER

Expertise:

Electric system design and protection

Languages:



Focus countries/area:

Portugal



AMIRA BELAZOUGUI, MSc.
SENIOR ANALYST

Expertise:

Market analysis, sizing of standalone and hybrid systems

Languages:



Countries and areas:

Australia, New Zealand



KREHI SERGE AGBLI, Ph.D
SENIOR ANALYST

Expertise:

Power systems modeling and analysis, storage- and hydrogen-based hybrid systems techno-economic analysis, hydrogen projects deployment

Languages:



Focus countries/area :

Western Africa (WAPP), Canada



ROSEMARY COLAERT, MSc.
SENIOR ANALYST

Expertise:

Sizing of standalone / hybrid storage systems, market analysis

Languages:



Countries and areas:

Greece, Poland, Central Asia



GUILLAUME DENIZART, MSc.
CONSULTANT

Expertise:

Economic and technical due diligence, trading strategies, market analysis, market forecasts

Languages:



Countries and areas:

Belgium, the Netherlands



NAIM EL CHAMI, MSc.
SENIOR ANALYST

Expertise:

Technology monitoring, financial and regulatory assessment, market forecast, procurement management, market analysis

Languages:



Focus countries/area:

USA, Middle East



VITOR CARVALHO, MSc.
ANALYST

Expertise:

Market analysis, optimization, prices forecast, sizing of standalone/hybrid projects

Languages:



Countries and areas:

Italy, Baltics, Nordics



ROBERTO DIAS, Ph.D
CONSULTANT

Expertise:

Power system modeling and analysis, power system automation and control and technical analysis of energy storage systems

Languages:



Countries and areas:

Latin America

SINCE 2009, CLEAN HORIZON HAS BEEN A ONE-STOP SHOP ENERGY STORAGE CONSULTANCY



MARKET ANALYSIS

Deep expertise at providing energy storage market study worldwide.

Our experts have technical, economic, regulatory knowledge, and cover different geographies, constantly tracking market evolutions.



TECHNICAL CONSULTING

We act as owner's engineer and lender's technical advisors for IPPs, utilities and lenders worldwide.

We support our clients at all stages of development, from feasibility and design, to procurement, construction and commissioning.

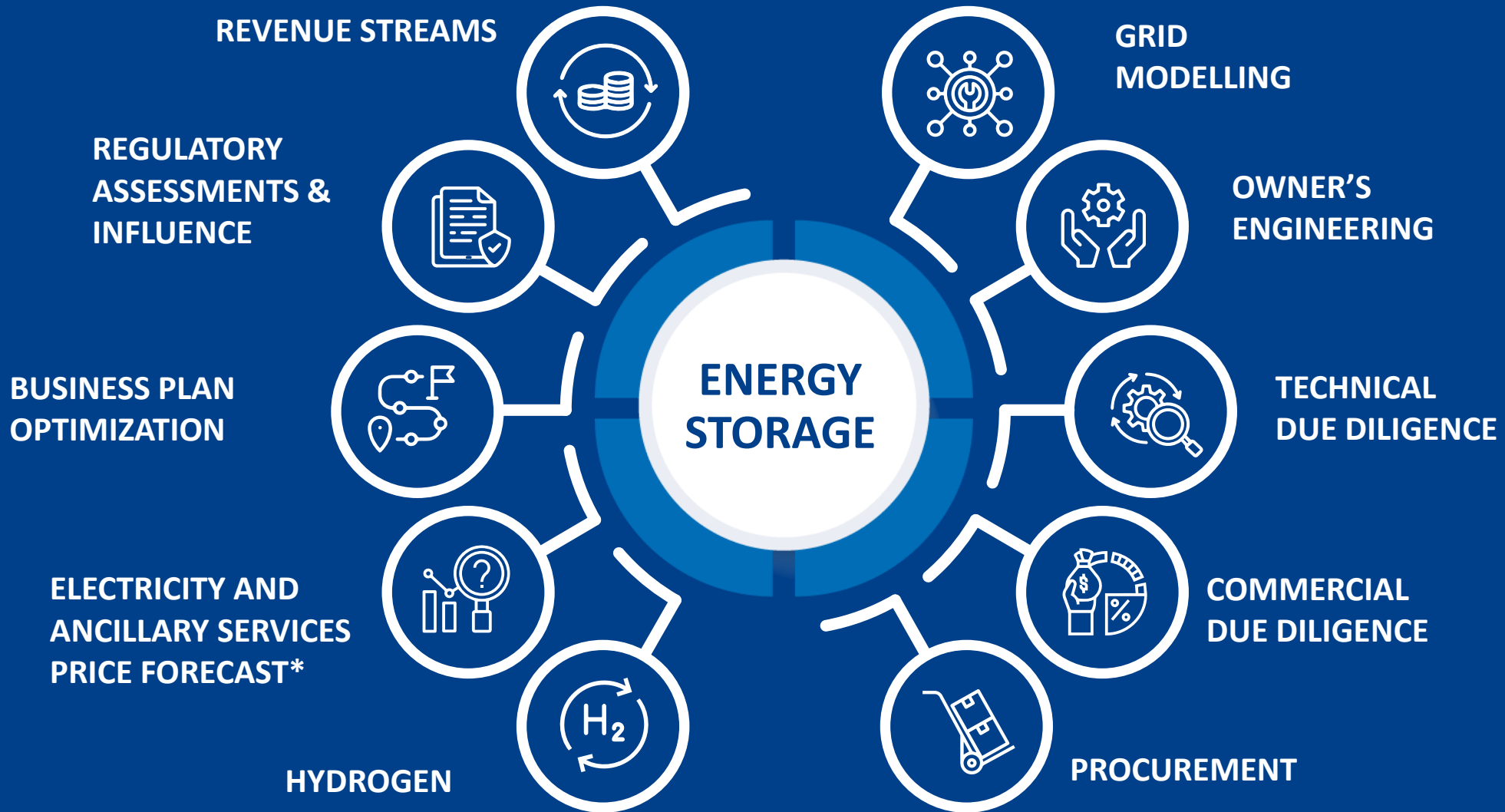
OUR UNIQUE OFFERING

Realistic assumptions & accountability for results

We accompany your projects from design to commissioning

Reliable forecasting

COMPREHENSIVE ENERGY STORAGE EXPERTISE



*IN EUROPE

OUR SCOPE OF WORK FOR ENERGY STORAGE OR HYDROGEN PROJECTS

Supporting your projects from design to commissioning



Market analysis



Energy and ancillary
services price forecast



Business plan
optimisation
COSMOS
simulation tool



Commercial due
diligence



Feasibility studies and
development support



Supplier selection and
contract negotiation

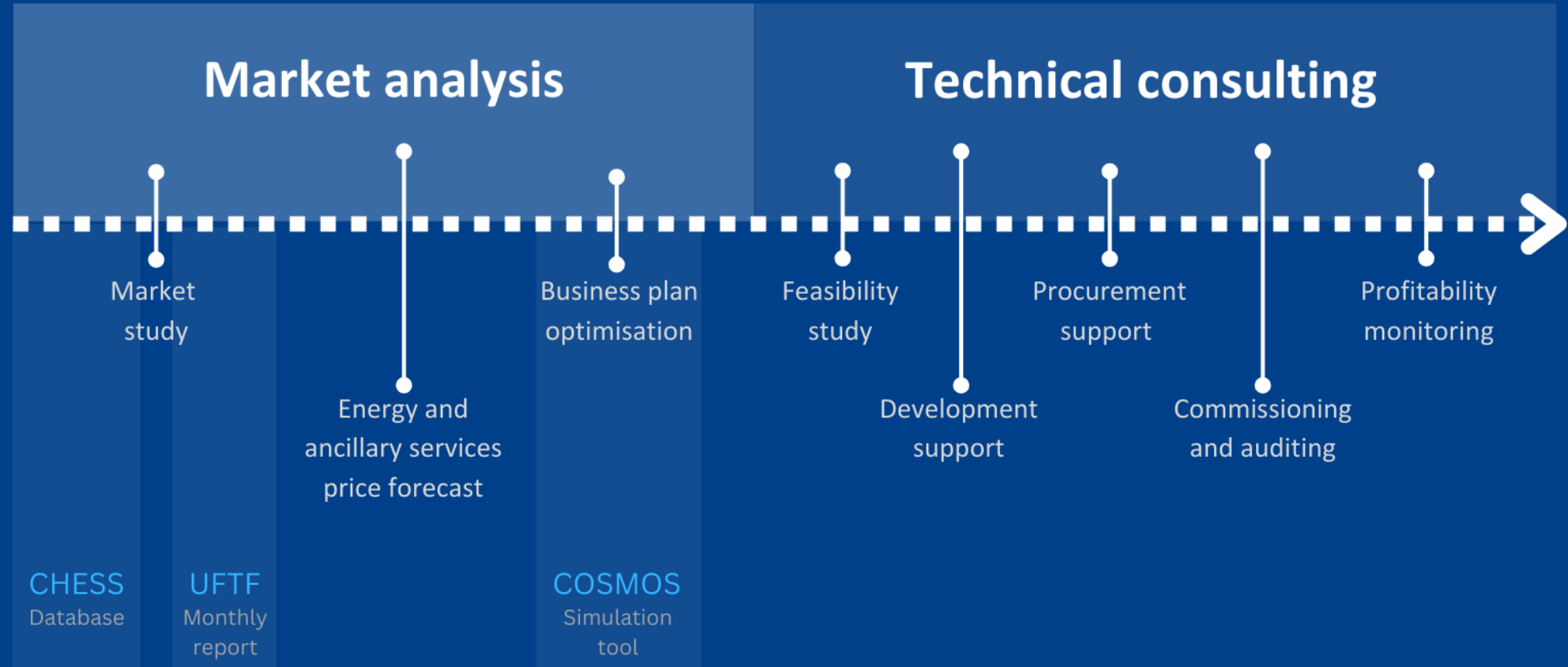


Storage system site
commissioning and
auditing



Technical due
diligence

FROM DESIGN TO COMMISSIONING





CLEANHORIZON

Training Program

- Sessions can be presented in English, French, Spanish or Portuguese
- Sessions can be presented online or in-person
- Clean Horizon should be informed of the Client's intent to pursue one or all sessions at least three weeks in advance.
- All presentation slides will be provided to session participants

Session #1 - Introduction to energy storage

1. Introduction to global markets and applications of energy storage systems

- a. Energy storage leaderboard : top countries and technologies
- b. Brief overview of energy storage technologies
- c. How is the value chain organized ? – Stakeholders involved in a storage project with a ranking of top energy storage developers and integrators. A ranking of top battery & battery inverter manufacturers will also be presented based on data from the Clean Horizon CHESS database.
- d. Side note regarding electric mobility: preferred chemistries and high-level evolution perspectives
- e. Cost drivers/key aspects to aim for to achieve a competitive solution

2. Main applications of utility-scale energy storage

- a. Spinning Reserves
- b. Synthetic inertia
- c. Load Shifting
- d. Renewable Energy Integration
- e. Voltage Control
- f. Virtual transmission (non-wires alternatives)
- g. Notions on grid-forming applications (real life projects using the technology, technical recommendations regarding the procurement and use of grid-forming inverters, leading suppliers, etc.)
 - Control logic implemented in power inverters for grid-forming applications and island operation detection logic

Session duration: 4 hours

1. Cost breakdown, architecture and main chemistries

- a. Breakdown of Li-ion system costs
- b. Common solution architectures (containers, pods)
- c. NMC vs LFP, what is at stake ?
- d. Key BESS characteristics

Session duration: 4 hours

2. Degradation of useable energy capacity

- a. Degradation causes
- b. The number of cycles and its impact on degradation
- c. Recommended operations to reduce degradation
- d. Capacity degradation mitigation strategies: oversizing vs. repowering
- e. Practical examples on the calculation methodology for useful capacity mitigation

1. Key characteristics of a battery storage system

- a. Voltage
- b. Temperature
- c. C-rate
- d. Characteristic curves
- e. Relation between voltage and state of charge
- f. Voltage balancing in the system
- g. Topological configurations for connecting step-up transformers (transformer connection groups, ring connection, radial, etc.)

Session duration: 4 hours

2. Operation, maintenance, commissioning and decommissioning

- a. Operating procedures
- b. Control strategies and sizing recommendations for performing different services with the same system
- c. Preventive maintenance
- d. Corrective maintenance
- e. Operation in degraded mode
- f. Project commissioning: main considerations
- g. Recommendations for end-of-life management (disposal strategies and top recycling methods)

1. Applicable standards

2. Fire prevention

- a. Role of the BMS
- b. System architecture
- c. System grounding

3. Firefighting

- a. Fire detection
- b. Alarms
- c. Automatic Extinction
- d. Role of firefighters

Session duration: 4 hours



CLEANHORIZON

We look forward
to your feedback!

Any questions welcome

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