POLICY TECHNOLOGY MARKET
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Economics of energy storage today- a technology provider's view

Session 3.3:

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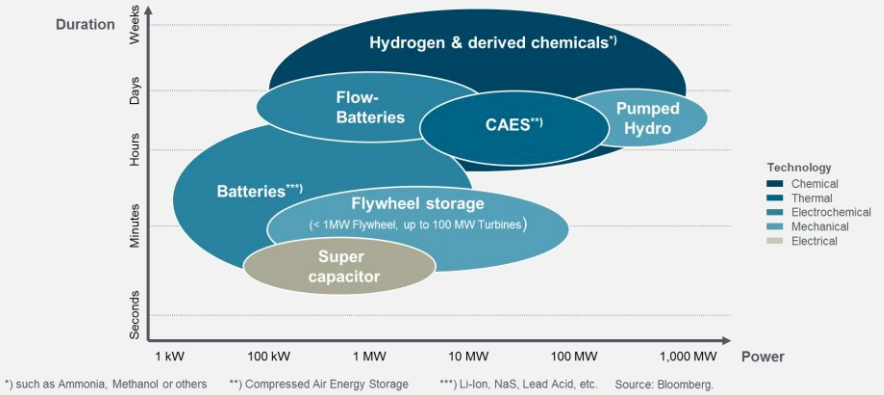
Energy storage for the now and tomorrow



Battery Storage

FLUENCE
A Siemens and AES Company

Energy Storage Technology Platforms

Siestorage®

Lightning fast energy. Trusted for critical loads.

- Essential fast response for power quality, black start, frequency response, backup applications
- Grid forming capability enables customers to operate in islanded mode when network becomes unavailable

Advancion®

Unmatched dependability. Designed to evolve.

- Industry-leading reliability and uptime
- Architecture reflects 10 years of owner/operator experience in power sector and storage
- Open architecture incorporates best available technology now and in the future

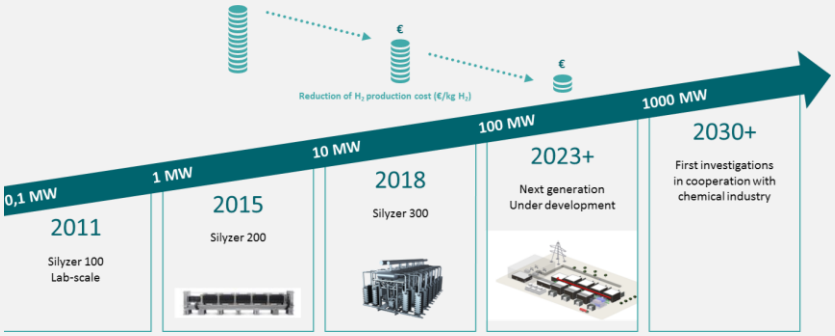
SunFlex Energy Storage™

Maximum solar yield. Delivered when you want it.

- Increased solar capacity
- Eliminates solar variability
- Stack additional grid services
- Deliver firm capacity
- Add more solar to same interconnection

Electrolyzer:

SIEMENS
Ingenuity for life



Electric Thermal Energy Storage

SIEMENS Gamesa
RENEWABLE ENERGY

ETES Base

Universal stand-alone storage

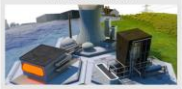
- Ability to store and supply **electricity, steam and heat**
- **Broad variety** of input and output **power** (10 MW…500 MW)
- Unlimited **scalability of storage capacity** (100 MWh….500 GWh)

ETES Add

Added storage to existing heat cycles

- **Reuse 100%** of existing conventional **components**
- **Increasing** heat cycle **efficiency**
- **Additional revenue** streams.

ETES Switch



Full conversion of power plants

- **Second-life option** for power plant **infrastructure**
- **Utilization** of **existing steam cycle** and **O&M processes**
- **Mitigation of negative effects from closing** power plants

Case Battery Storage: Drivers, Applications and

Rationale: SDGs, 3D road to fight CC

Drivers

- **Earning Potential**
- **Cost Avoidance**

Applications

- Frequency Regulation
- Capacity Peak Power
- Renewable Hybrid
- Conventional Hybrid+ Blackstart
- T&D Deferral
- Critical Power
- Microgrids
- Peak Shaving

Revenue Streams

- System Services (Frequency and Reserve, T&D)
- Whole Sale Market (Cycling issue)
- Capacity Markets
- T&D UoS revenues and investment avoidance
- Back up power
- Grid Fee Reduction

Revenue stacking depends on asset operating parameters and market/contract specific requirements

How costs impact success in Battery Storage Projects

Cost Considerations

Initial costs (Dev+CAPEX)
Operating
Maintenance costs
Recycling costs
Inflation
Financing costs

Cost Impacts on operating cashflow

Long-term lifetime forecast costs
Management costs
Representation of contract/assumptions→ Performance
Cost inflation relative to revenue inflation
Correlation to usage of asset (Wear and Tear costs)
Debt service cost

What about the benefits?

How non-financial risks impact costs

Performance Risk

- •Construction (Delivery and Technology)
- Operation

Regulatory Risk

- Lack of policy
- Institutional risks not quantifiable

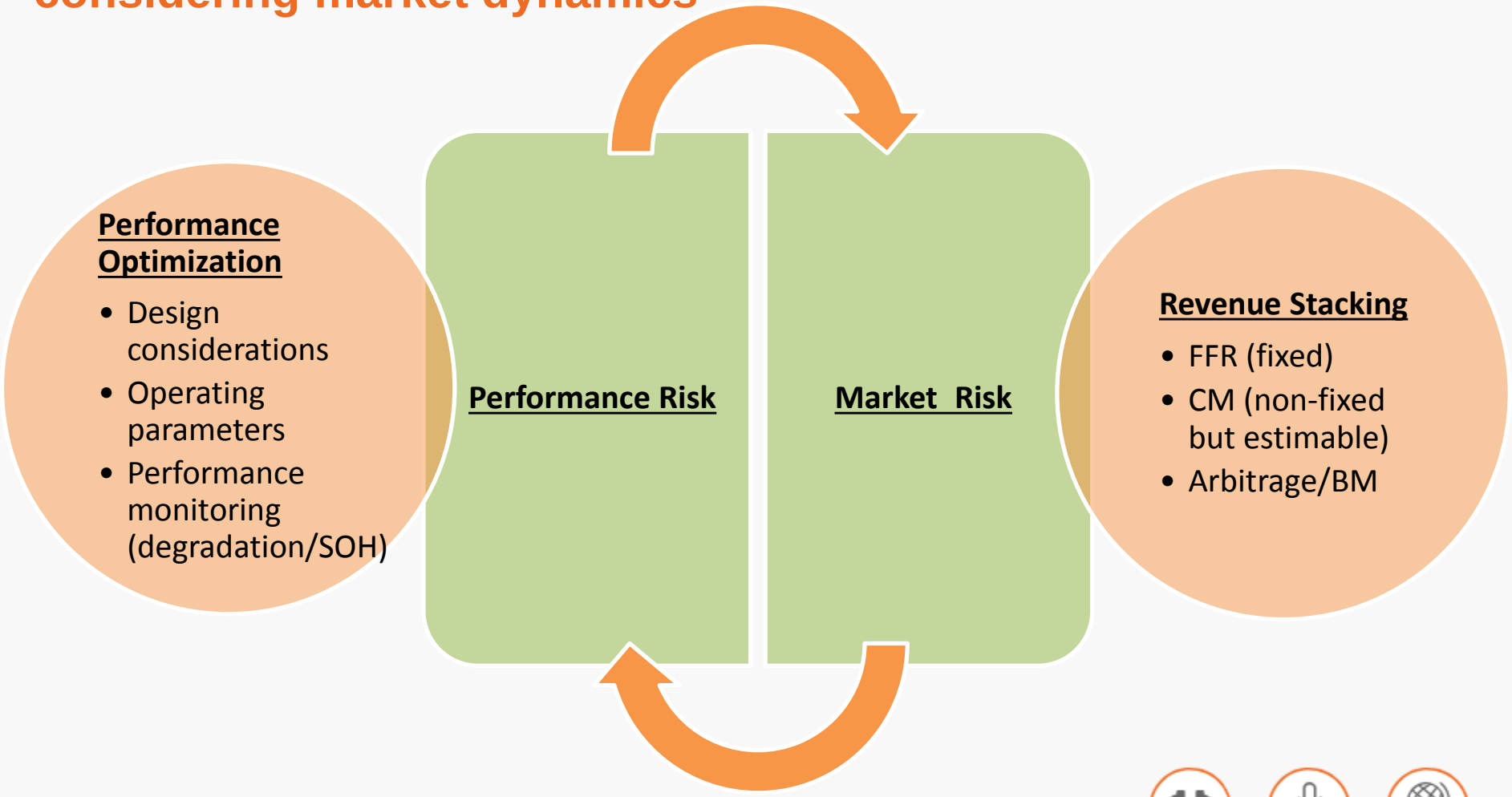
Macroeconomic Risk

- Currency
- Inflation

Commercial Risk

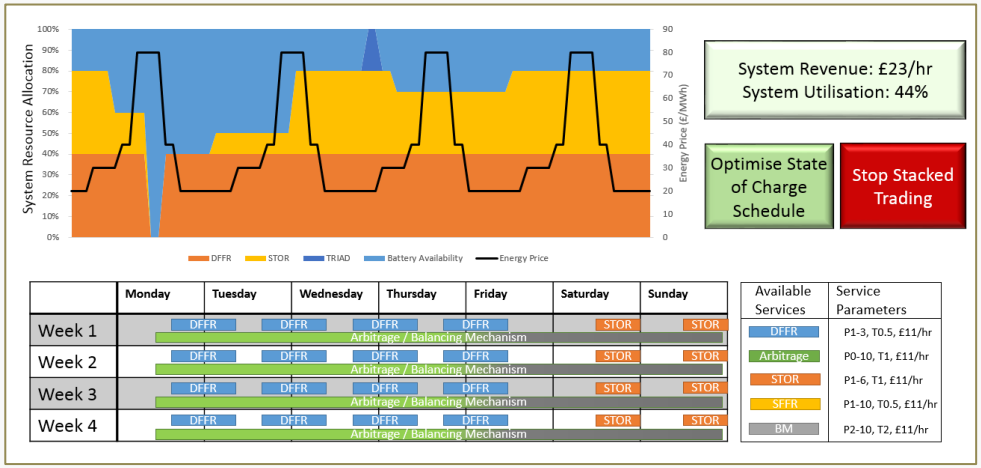
- Revenue Risk (the today vs. yesterday)
- Supply Risk (long-lead items)

Risk Management needs to address the optimization questions considering market dynamics



Risk Management via Technology

Provide an optimisation based on the real time battery system status and a data based prediction of the future



Market trading information feeds analytical engines that link battery degradation to enable optimum timing of charge and discharge cycles.

Revenue Stacking

Multiple and dynamic market place signals fed into trading optimiser to reveal stacked revenue potentials, wholesale energy cost and balancing mechanism values provide ongoing savings

Marginal cost of traded energy

Each trade/use of the battery has a degradation associated with it and therefore a marginal cost which needs to be accommodated