FLASC

Renewable Energy Storage

www.offshoreenergystorage.com

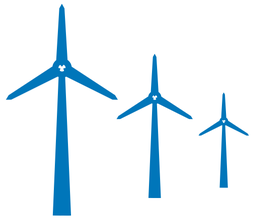
FLASC B.V., Paardenmarkt 1, 2611 PA Delft, The Netherlands

Investor Deck - EUR
10-10-2022

The Problem

FLASC is solving a fundamental clean energy problem:

▸ **Renewable energy supply and consumer demand do not match**, causing major **pain-points** across the energy system:

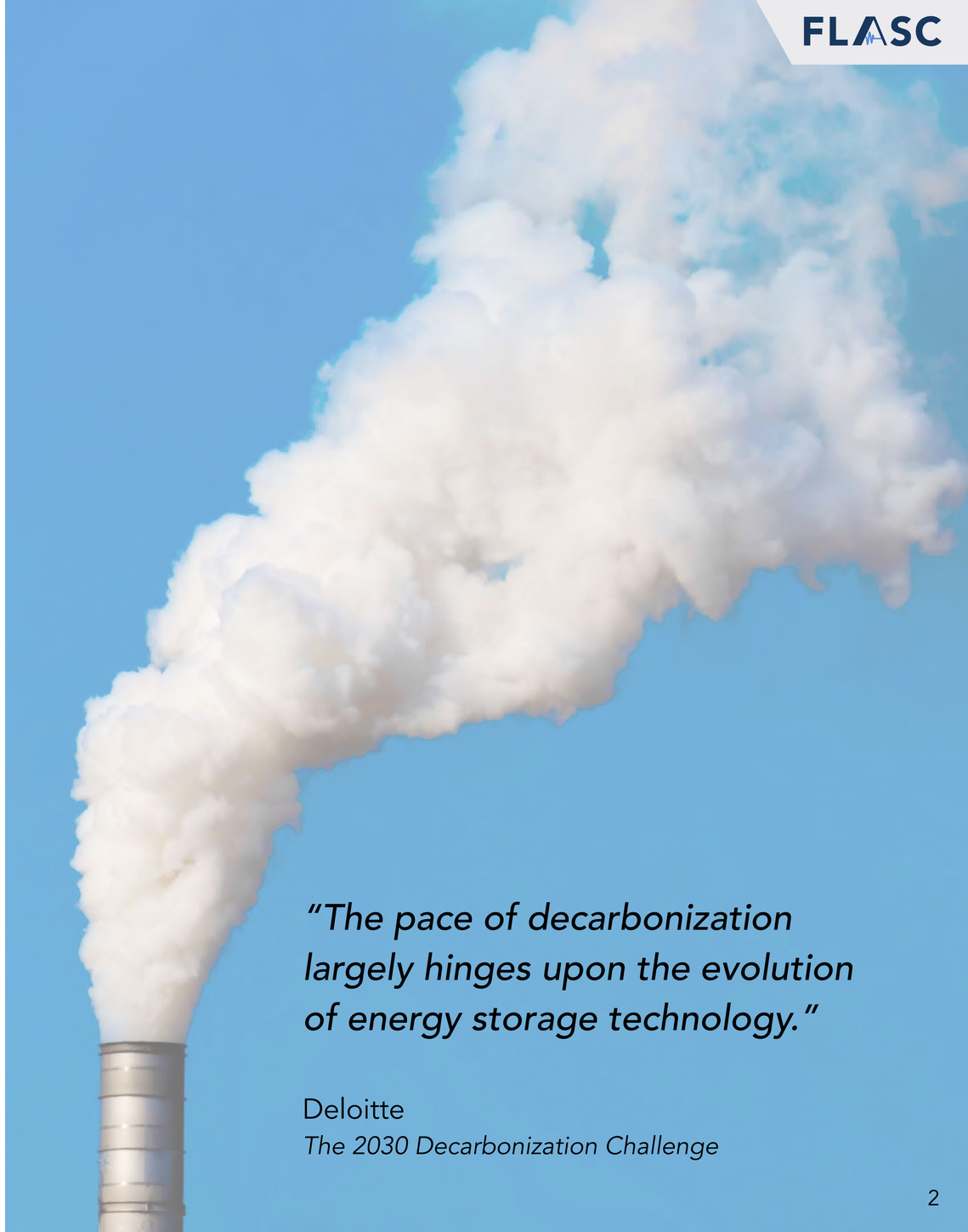


Utility-scale renewables suffer curtailment and negative pricing

Heavy industries need a dependable supply of clean power to fully decarbonise

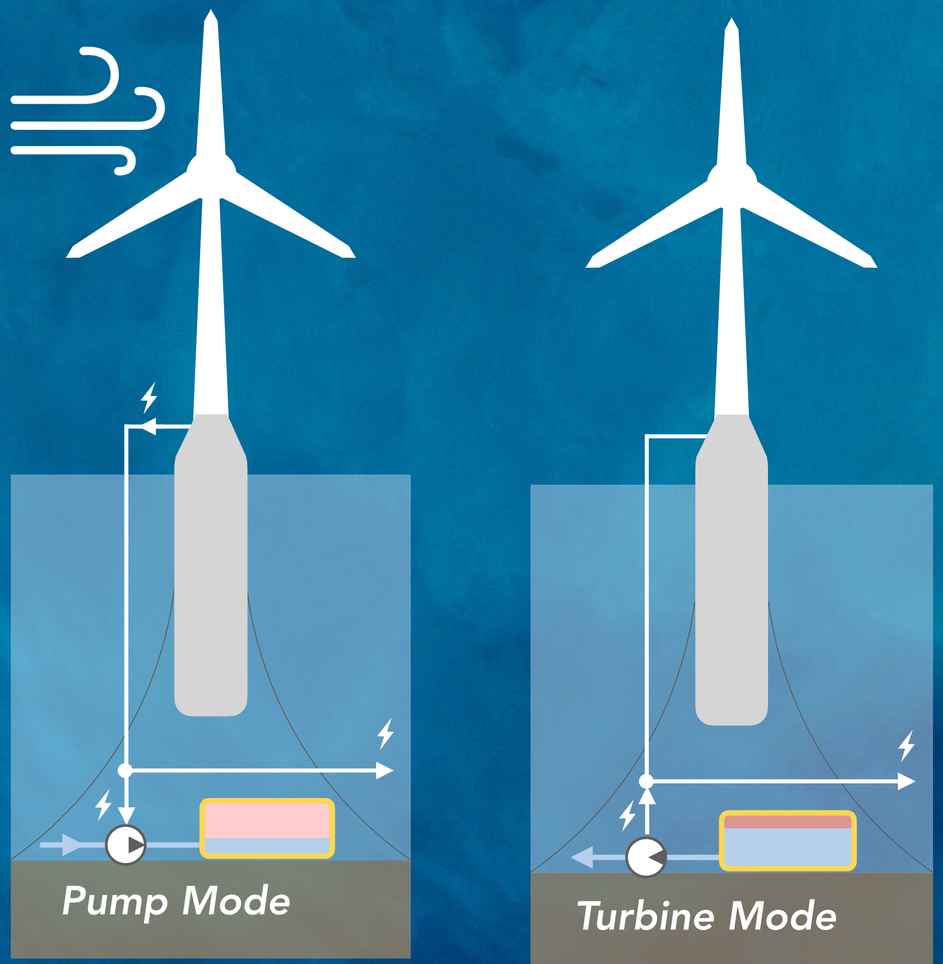
Off-grid applications need high levels of flexibility but space is often limited

FLASC has developed a unique offshore energy storage technology to deliver **renewable power on demand**.



"The pace of decarbonization largely hinges upon the evolution of energy storage technology."

Deloitte
The 2030 Decarbonization Challenge



HPES: Hydro-Pneumatic Energy Storage

Combining **pumped hydro** with **compressed air**

- Patented Innovations:

Pneumatic Pre-Charging
→ **High Energy Density in Shallow Water**

Ocean as a Natural Heatsink
→ **High Thermal Efficiency**

- Scalability: **>100 MWh**
- Roundtrip Efficiency: **70-75%**
- Storage Duration: **4-12 hours**
- Operational Lifetime: **+30 years**

Small-Scale Marine Prototype

▲ TRL 5 Prototype (2018)
Grand Harbour, Malta

+400
Charging Cycles

+15 Months
Continuous Operation

>96%
Thermal Efficiency

+98%
System Availability


(photo: Nicholas Doherty)


(photo: Hawaii Tourism Authority)

(image: Fuel Cell Works)

Delivering value by storing energy at sea

1. **Offshore Generation + Storage Projects:** FLASC is the only utility-scale solution suitable for tenders[1] requiring co-location of offshore wind and energy storage.

2. **Small-Islands and Sensitive Regions:** FLASC storage does not take up precious land and provides flexibility as a sustainable and socially-positive solution.

3. **Decarbonisation of Heavy Industry:** FLASC drives deeper decarbonisation of energy-intensive industries (e.g. oil & gas) by safely delivering stable clean power.

4. **Green Hydrogen Production:** FLASC storage safely absorbs intermittency and improves electrolyser utilisation.[2]

5. **Repurposing Offshore Infrastructure**: FLASC can be used to repurpose existing offshore pipelines approaching end of life[3], deferring abandonment costs and transforming an ageing asset into a lucrative energy storage system.

[1] AFRY (2020)*: The business case and supporting interventions for Dutch offshore wind*

[2] A. Weiß *et al* 2019 *Journal of the Electrochemical Society* 166 F487

[3] https://jpt.spe.org/ropes-offers-an-energy-transition-solution-to-pipeline-decommissioning

Versatility & Scalability

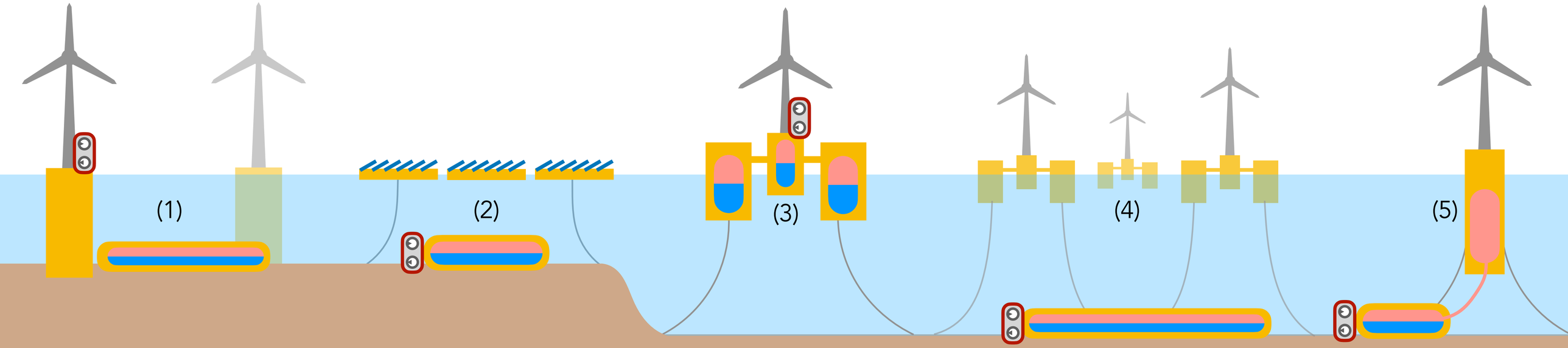
The FLASC solution can be deployed or integrated in a range of configurations.

- Each **embodiment** has two independent elements:

Pressure Containment System (PCS): Storage volume housing pressurised seawater and compressed air.
(1) fixed-bottom wind; (2) offshore PV; (3) floater-integrated; (4) stand-alone centralised unit; (5) dual-chamber configuration.

Energy Conversion Unit (ECU): Modular electrical interface housing pumps, turbines and power conversion equipment.
Converts electricity to hydraulic power during charging and back to electricity during discharging.

- **FLASC supplies the common ECU hardware across all installations**
- **Deploy full energy storage system via strategic collaborations with leading industrial partners**



Key Benefits of FLASC Energy Storage

Safe: no flammability risks or chemical hazards

Long Lifetime: predictable asset life with no cycling degradation

Sustainable: no consumable elements and no hazardous waste

Reliable: proven and established components with low OPEX

Circular: safely decommissioned and fully-recycled at end of life

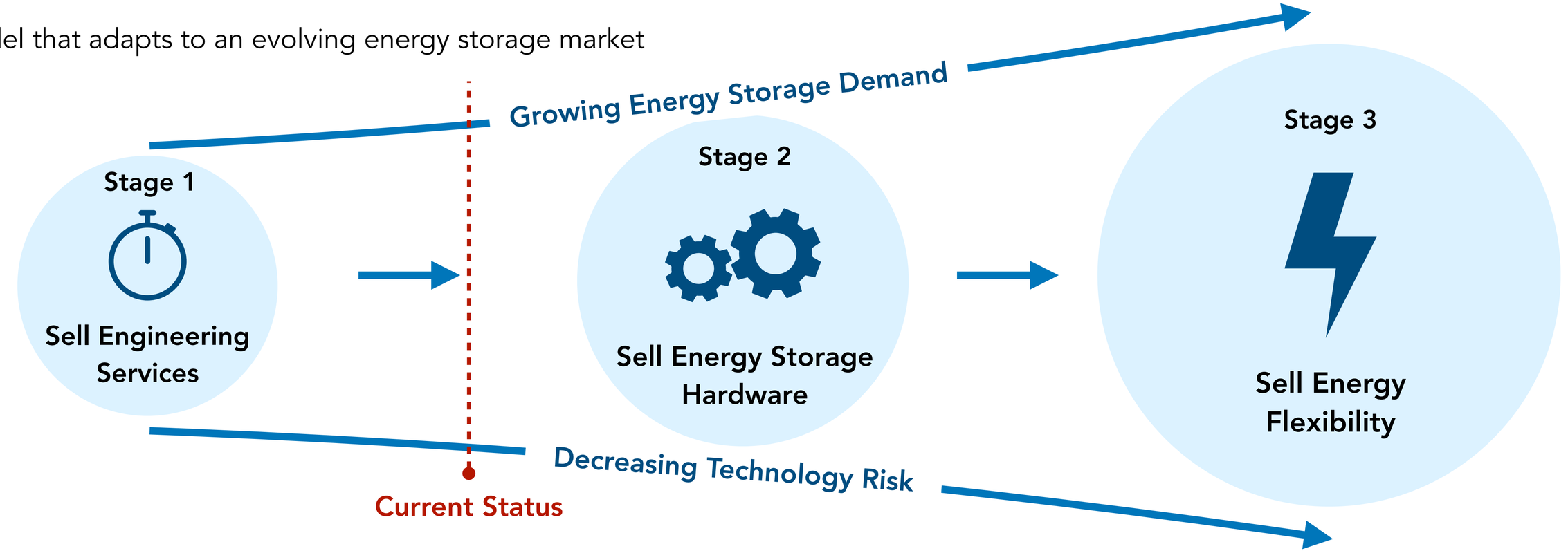
Unrestricted: rapidly scalable supply-chain with no rare-earth bottlenecks

*"**Sustainability:** meeting the needs of the present without compromising the ability of future generations to meet their own."*

WCED - The Brundtland Report

Business Model

- A model that adapts to an evolving energy storage market



- Deliver engineering services to design and size HPES systems
- **Revenue:** engineering hours and technical services [**€/hr**]
- Generate early revenue, build a network of partners and prospects

- Sell HPES system hardware through strategic SPVs
- **Revenue:** ECU hardware units and SPV margins [**€/unit**]
- Build industrialisation capabilities to deliver critical hardware

- Deploy and operate HPES systems to provide energy system flexibility
- **Revenue:** arbitrage, flexibility services and grid support [**€/kWh**]
- **Become the leading flexibility provider for offshore applications**

Go-To-Market

Entry Market

North Sea Offshore Wind Farm Tenders

Why?

- Significant ramp up of offshore wind projects by 2030
- Grid integration is the biggest challenge
- Innovation criteria becoming key differentiator in tenders

What?

- Pilot projects within offshore wind farm projects

How?

✓ Strategic collaboration with leading industrials

✓ Combine FLASC's ECU with established PCS technology

✓ Sell tailored projects within the North Sea:

- Netherlands
- United Kingdom
- Belgium

Mainstream Market

Global Utility-Scale Renewables

Why?

- Utility-scale storage essential for clean energy targets
- 30% of energy consumers located within 100 km of the sea
- Clients favour sustainable solutions with a long lifetime

What?

- Robust and validated solution in utility-scale applications

How?

1. Leverage track record from initial pilot projects
2. Set up SPVs based on market/application/region
3. Sell industrialised solutions to major developers:

Strategic Collaboration

▸ Eliminating Offshore Execution Risk

subsea 7

▸ **Tier 1** market player in offshore renewables and oil & gas

"FLASC's solution is an innovative technology with significant potential, offering a competitive and more sustainable alternative to Li-ion battery farms.

The collaboration with FLASC will allow us to leverage Subsea 7's world-class technical expertise in the development of offshore subsea solutions to accelerate the deployment of utility scale, low maintenance, storage solutions."

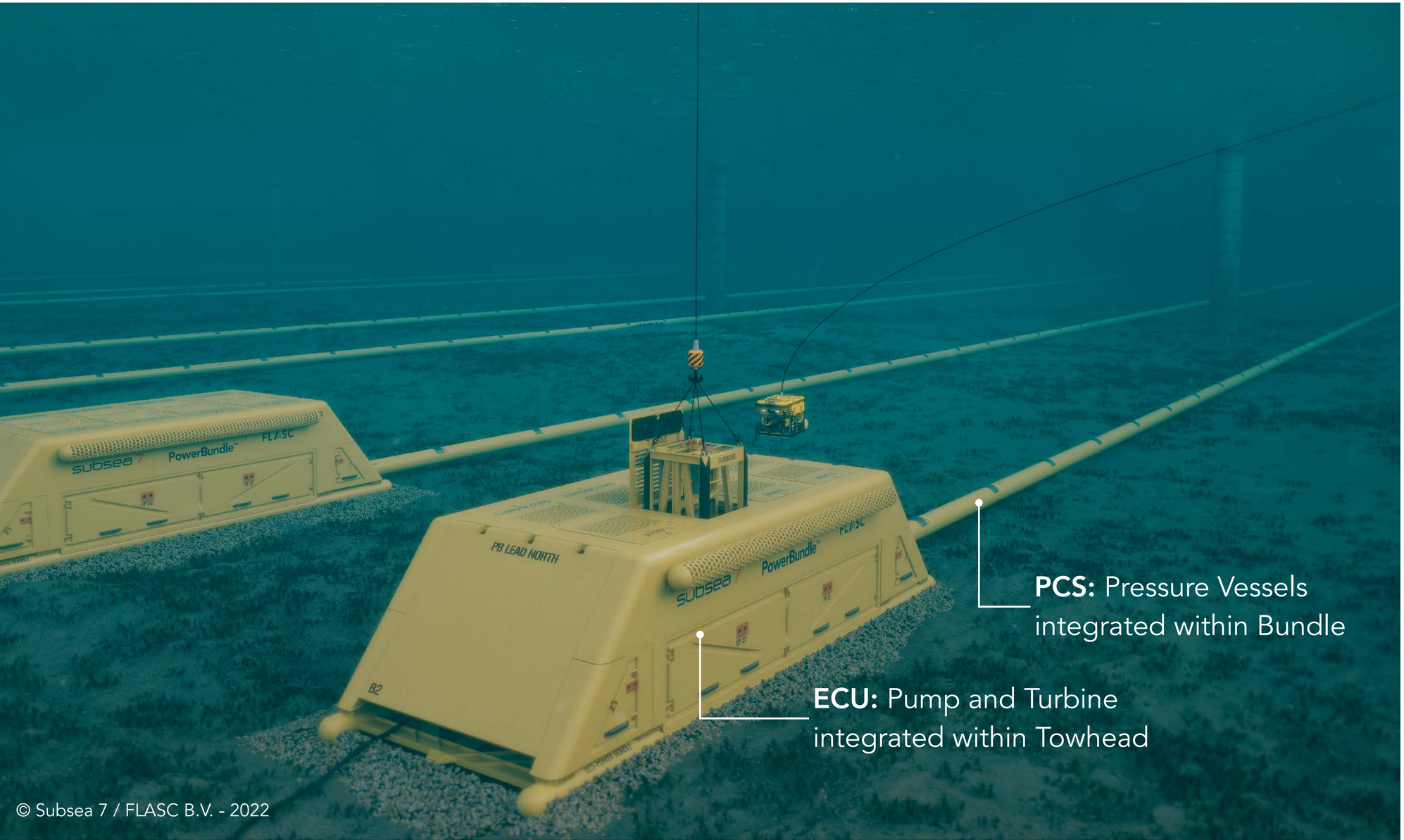
Thomas Sunde
VP Strategy and Technology, Subsea 7


(image: Subsea 7)


(image: Subsea 7)


(image: Subsea 7)

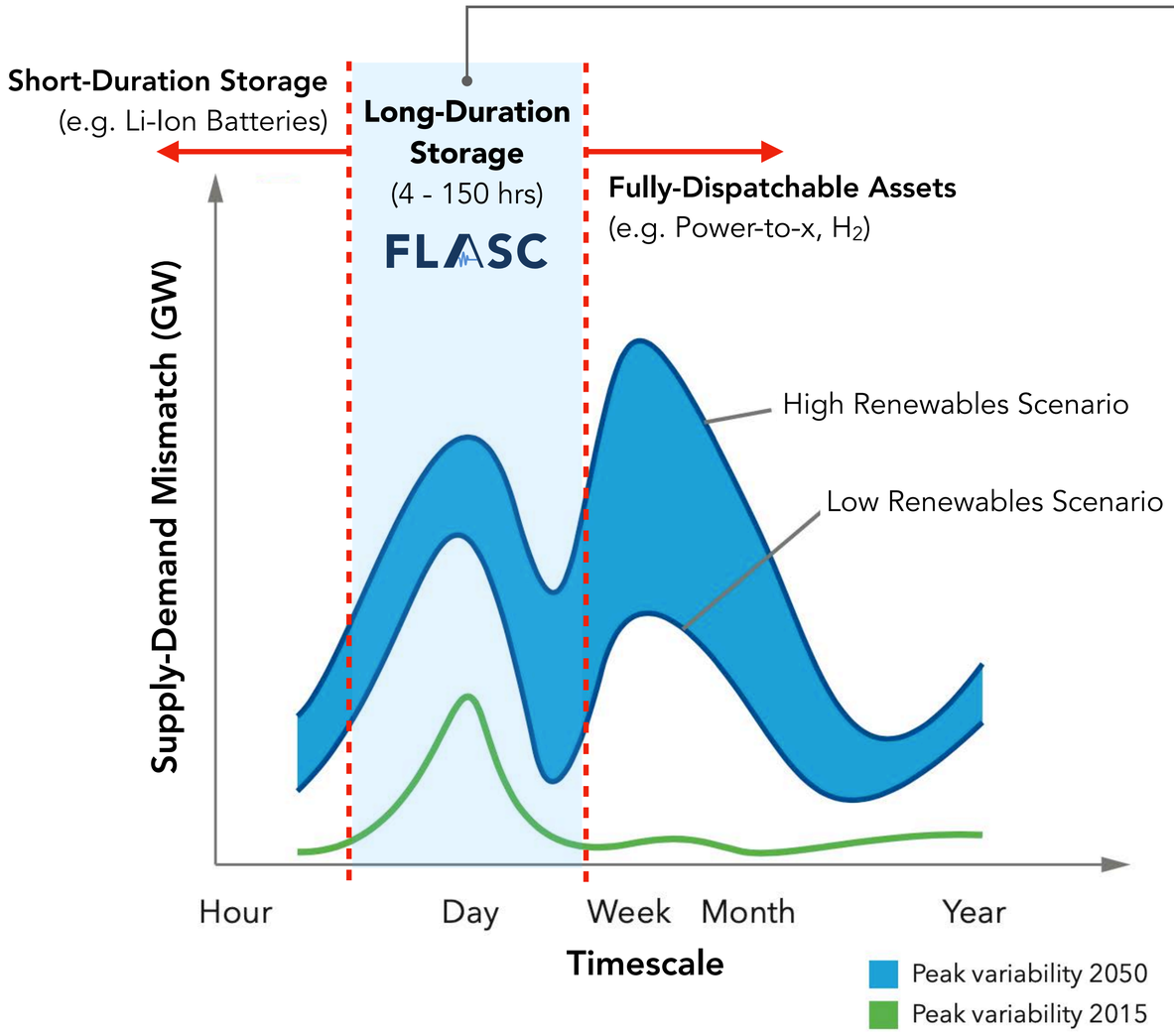
The PowerBundle - Offshore Long-Duration Energy Storage



Applications:

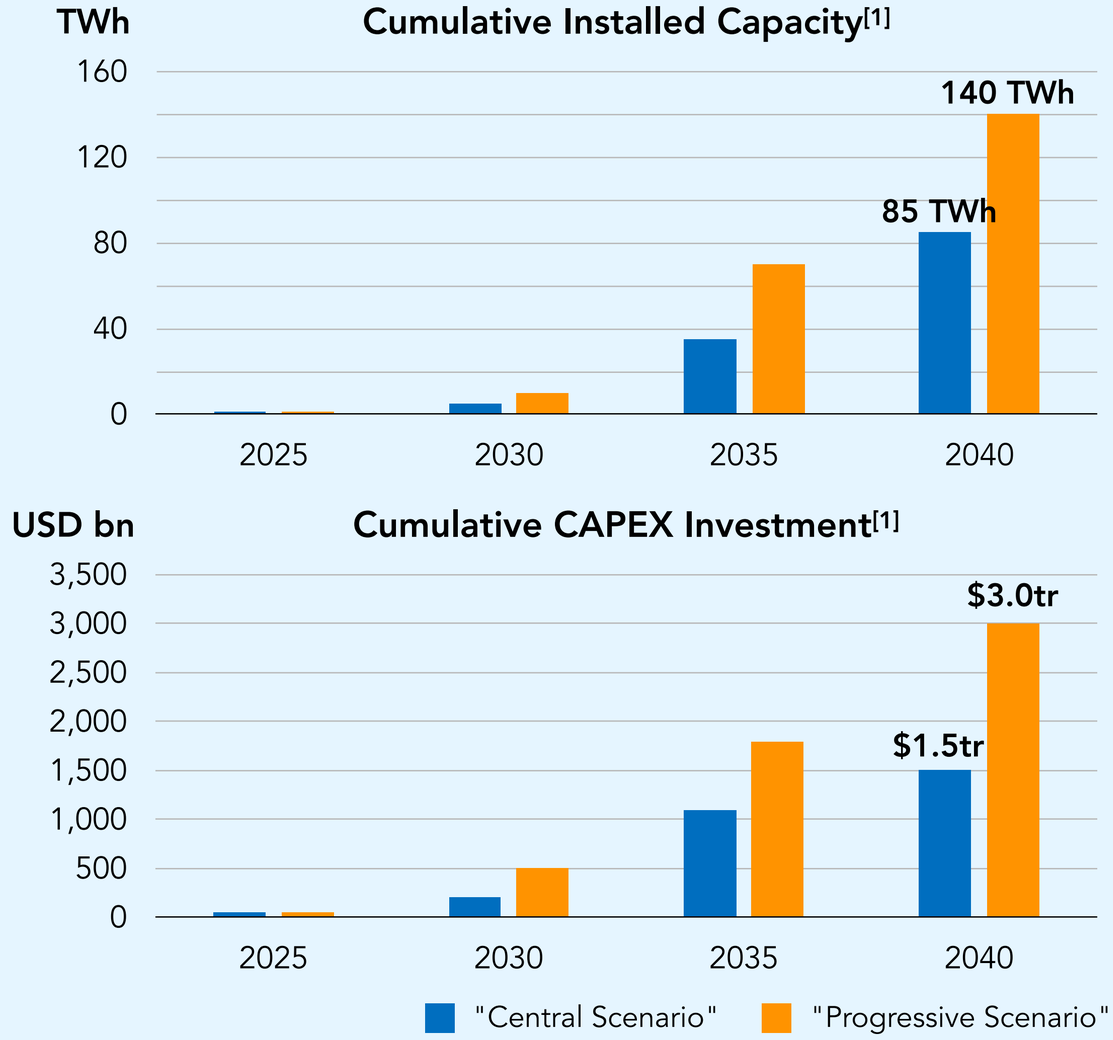
- Large-Scale Offshore Wind
- Small-Islands & Sensitive Regions
- Offshore Green H_2 Production
- Decarbonisation of Oil & Gas
- Repurposing Offshore Infrastructure

Market Prospects



Peak variability of *residual load* at different time scales in a European electricity grid in 2015 and expected in 2050 (source: DNV-GL)

Long Duration Storage Uptake

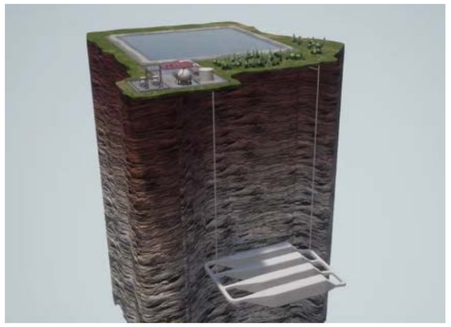


[1] McKinsey & Company, *Net-Zero Power: Long Duration Energy Storage for a Renewable Grid* (Nov 2021)

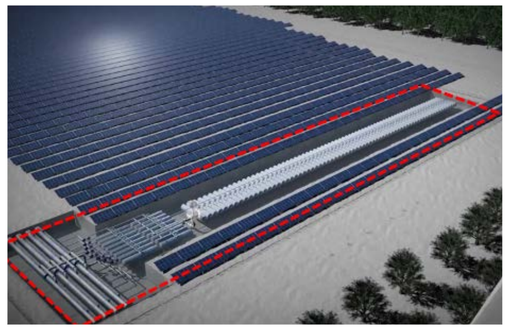
Competitive Landscape: Long-Duration Technologies

Onshore Long-Duration Storage

- Wide range of solutions attracting significant investment
- Large-scale infrastructure requiring considerable space or repurposing of existing facilities



▲ *A-CAES (Hydrostor)*



▲ *Land-based HPES (Augwind)*

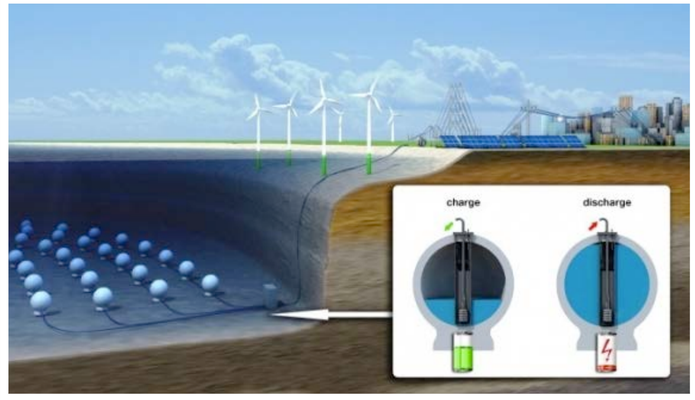
▲ *ETES (Siemens Energy)*

▲ *Gravity Storage (Energy Vault)*

▲ *LAES (Highview Power)*

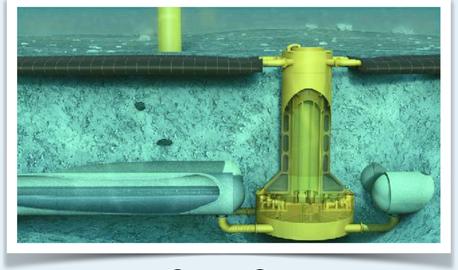
Offshore Storage: Deep Water

- Solutions using hydrostatic pressure require deep water

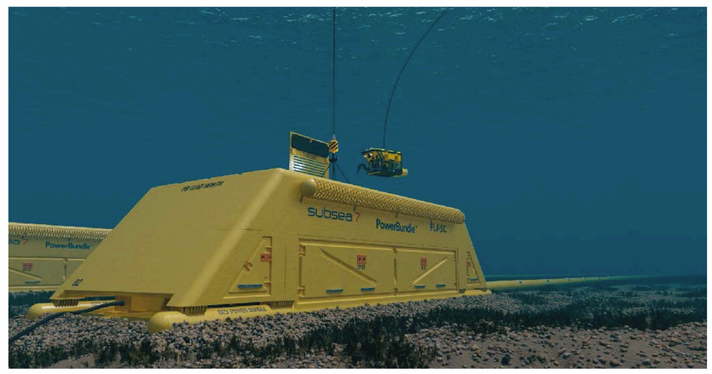


▲ *StEnSea (Fraunhofer)*

StEnSea Testing Campaign ▶



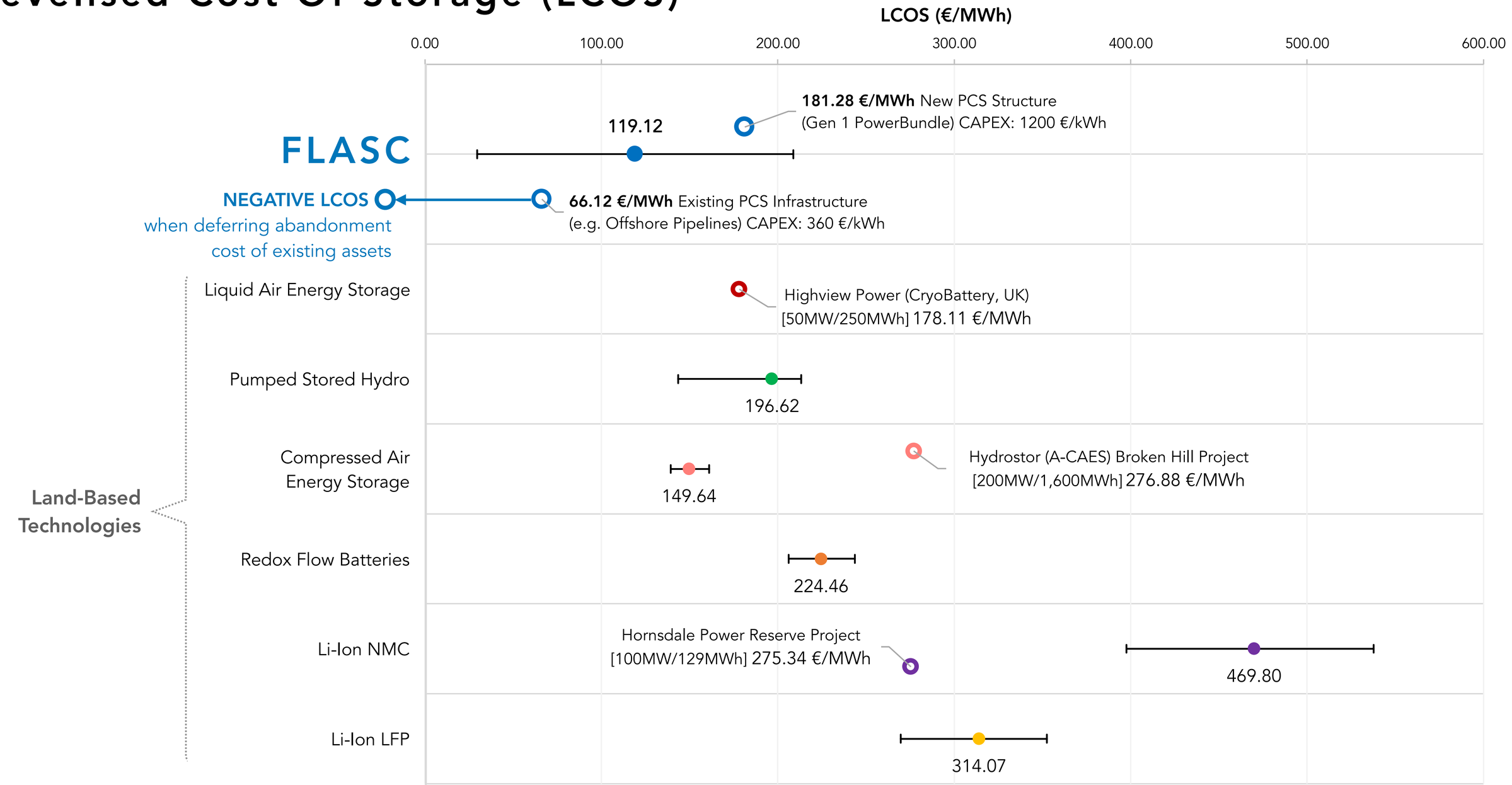
▲ *Ocean Grazer*



Offshore Storage: Shallow Water (<400m)

✓ **FLASC** is uniquely positioned for co-location with offshore wind

Levelised Cost Of Storage (LCOS)



4-Hour Discharge Time / +100MW Systems

Technology Ranges & LCOS Methodology: DOE/OA-0204; 2020 Grid Energy Storage Technology Cost and Performance Assessment; US Dept. of Energy

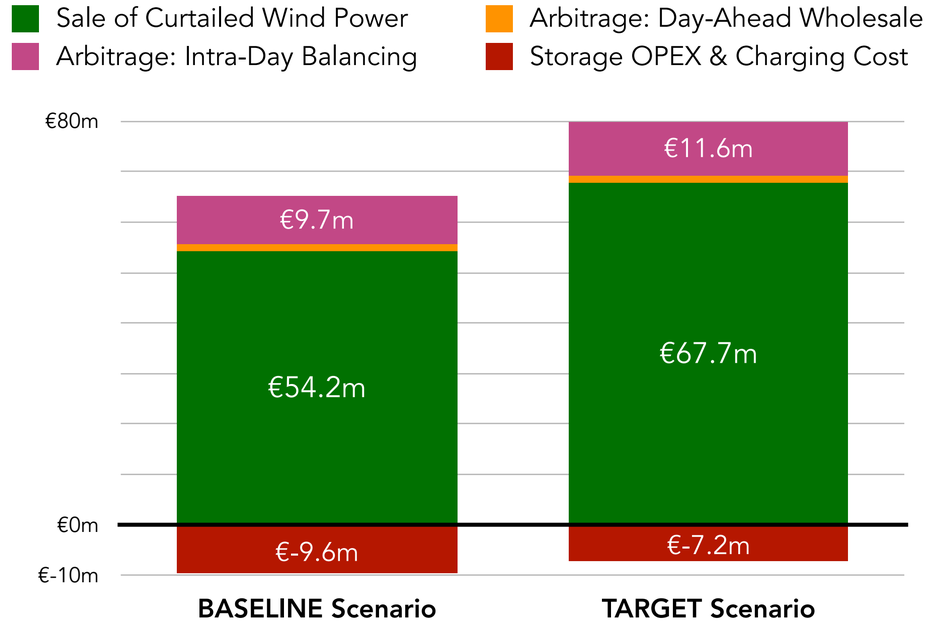
(image: Wikimedia Commons)

Business Case: UK Offshore Wind

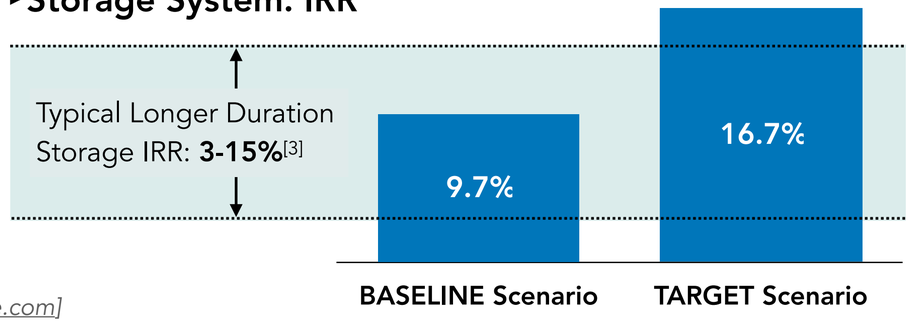
- Co-locating storage to mitigate curtailment and create new revenue streams

BASELINE Scenario	
Wind Farm Power Rating	**1000 MW**
Storage System Power Rating	**100 MW**
Storage System Capacity	**400 MWh**
Wind Farm Cost	**2,500 m€**
Storage System Cost	**480 m€**
Wind Farm Capacity Factor	**42.2 %**
Curtailment Rate[1]	**13 %**
Selling Price for Curtailed Power[2] (2021 - 2022)	**€250 /MWh**
TARGET Scenario	
-25% Storage System Cost	
+20% Selling Price for Curtailed Power	

Storage System: Annual Revenue Stack



Storage System: IRR

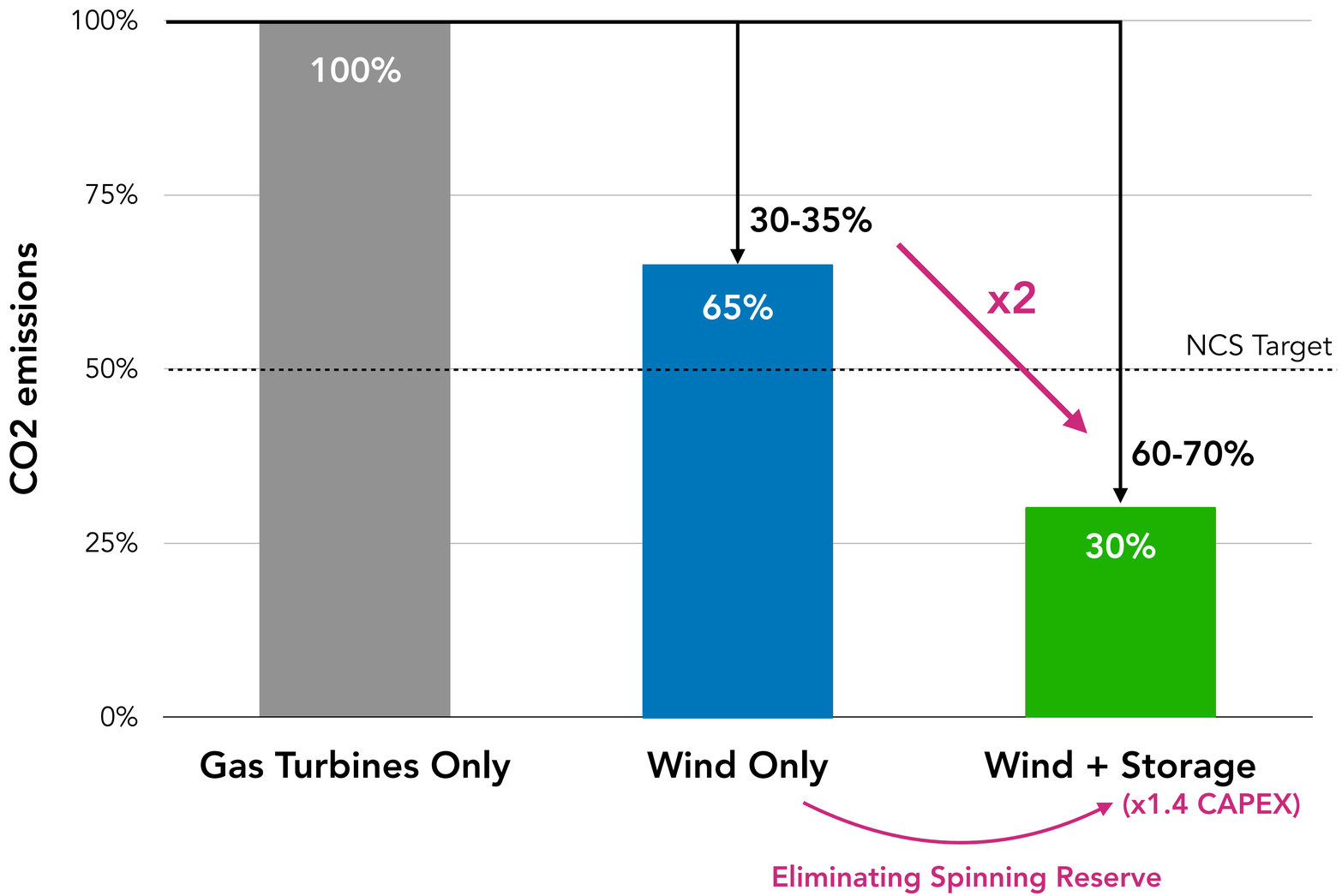


[1] *"Renewable energy is being expensively wasted" [www.zenobe.com]*
[2] *Based on average wholesale price (2021 + 0.5x2022): [www.casita.com]*
[3] *McKinsey & Company, "Net-Zero Power: Long Duration Energy Storage for a Renewable Grid" (Nov 2021)*

(image: Equinor)

Business Case: Decarbonisation of Oil & Gas

- Eliminating Gas Turbine Emissions with **Wind + Storage**



Founding Team

Daniel Buhagiar

Co-Founder / CEO

- **Commercialisation and business development**
- Ph.D. in offshore energy storage (origin of the FLASC technology).
- Designed and executed first marine prototype experimental campaign.
- Experience in offshore projects, leading technical teams and interfacing with international clients.

Tonio Sant

Co-Founder / CTO

- **Research and technical development**
- Award-winning Ph.D. in wind turbine aerodynamics from TUDelft.
- Full Professor of Mechanical Engineering at the University of Malta, contributed to over 120 peer-reviewed publications in the field.
- Manages a wide portfolio of renewable energy and storage projects.

Robert Farrugia

Co-Founder / Technical Advisor

- **Specialist advisor on R&D projects and wind resource assessment.**
- Ph.D. in wind measurement and flow modelling.
- Resident academic and researcher at the University of Malta.
- 25 years experience in wind measurement and data analysis. Co-ordinated early studies on short-term energy storage for green hydrogen production.

Anton Bartolo

Director / IP Advisor

- **Intellectual property and technology transfer**
- Track record in successful valorisation of academic research.
- Founder and Director of the Knowledge Transfer Office at the University of Malta.
- Experienced in intellectual property management and industrial collaborations.

2017 1st Generation Prototype [TRL 5]

2018 International Patents Granted

2019 DNV Statement of Feasibility

2020 Strategic Collaboration with Subsea 7

2023 Demo Project (in progress)[1] [TRL 7]

2024 Large-Scale Demonstrator[2] [TRL 8-9]

2025/26 Wind Farm Integrated Pilot

▸ Patents Granted

Europe, US, China, Japan

DNV

▸ Third-Party Validation

Statement of Feasibility

2020 Best Offshore Innovation Award

1 of 1000 Solutions to Change The World

WIPO Medal for Inventors

Small-Scale Marine Prototype (Malta)

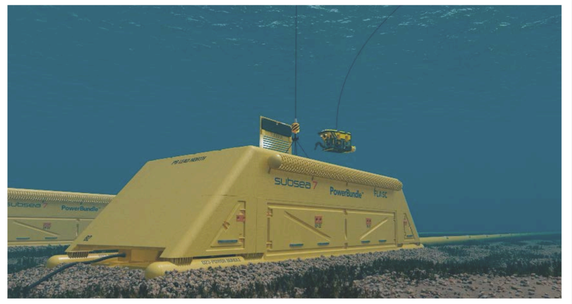
L-Università ta' Malta · MEDSERV · Xjenza · The Malta Council for Science & Technology · MALTA MARITTIMA · RIDT

ECU for Floating Wind Demo (Greece)

Part of ~€10m EU-funded project (H2020 BG-05-2019)

L-Università ta' Malta · MUSICA

FLASC is part of a bid submitted for the HKW offshore wind farm in The Netherlands



PowerBundle Demonstrator (UK)

Subsea 7 + FLASC consortium secured funding support from the *UK BEIS Long Duration Energy Storage Competition*[2] to prepare for potential deployment in the UK energy system.

Department for Business, Energy & Industrial Strategy · subsea 7

[1] *Funding secured through University of Malta as part of H2020 BG-05-2019*

[2] *https://www.subsea7.com/en/media/company-news/2022/subsea-7-and-flasc-secure-uk-beis-funding--for-offshore-energy-s.html*

Timeline & Financial Projections

2020 - Incubation Phase
- Joined Buccaneer Delft Accelerator (NL)
- 1st Strategic Collaboration (Subsea 7)
- 1st FLASC Product: PowerBundle™

2021-22 - Acceleration Phase
- Consolidate team to deliver ECU scope
- Establish key supply-chain relationships
- Secure early demo prospects

2023-24 - Growth Phase (Series A)
- Standard ECU module qualified
- Deliver first full-scale demo
- Deploy wind farm-integrated pilot

2025-30 - Industrialisation (Series B+)
- Mass-production of ECU hardware
- Grow market share across all key segments
- Target: +€300m revenue by 2030

000 €	2017-2021	2022	2023	2024
MWh Committed (cumm.)	-	1	2	22
Headcount (EoY)	6	8	17	22
Revenues	-	146	604	1,146
Expenses - CAPEX	(98)	(212)	(11,587)	(4,625)
Expenses - OPEX	(856)	(285)	(1,478)	(1,647)
Grant Funding	776	510	5,326	2,448
Seed	220	-	-	-
Series A	-	-	**10,000**	-
Cashflow from Financing	996	510	15,326	2,448
Net Cash Position (EoY)	42	201	3,066	389

Seeking **€10m Series A** for:

- **Qualification:** Complete system qualification of a standard ECU module ready for deployment in commercial systems.

- **Demonstration:** Deliver first full-scale demonstration project via one of our existing prospects.

- **Team:** Consolidate our team to meet growing commercial demand.

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FLASC B.V. is a spin-off from the University of Malta, established in The Netherlands with registration number: 76566404. The company is part of the Buccaneer Delft energy & offshore accelerator.