

S U B S E A

POW RHUB

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Subsea Power Hub
6th November 2018

Prepared for: Society for Underwater Technology
Prepared by: Paul Slorach

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Agenda

- + Company Overview
- + SPH Technology Details
- + Marginal Fields
- + SPH Sea Trials
- + Development Programme
- + Technology Applications
- + Future Developments



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The background of the slide is an underwater photograph. Sunlight rays are visible, filtering down from the surface, creating a dramatic, ethereal effect. The water is a deep blue-green color, and the light rays are a lighter, yellowish-green. The overall mood is serene and professional.

COMPANY OVERVIEW

Company Overview



- + Established in 2013
- + At the forefront of subsea technology
- + Specialists in subsea engineering & product creation
- + Leaders in Subsea Energy Conversion, Storage and Delivery
- + First-class technology provider in both the subsea market and Renewable energy market



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TECHNOLOGY DETAILS

Subsea Power Hub

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WIND TURBINE WEIGHT 220 KG
WIND TURBINE WEIGHT 275 KG
WIND TURBINE WEIGHT 275 KG
WIND TURBINE WEIGHT 275 KG

Technology Summary

KEY FEATURES

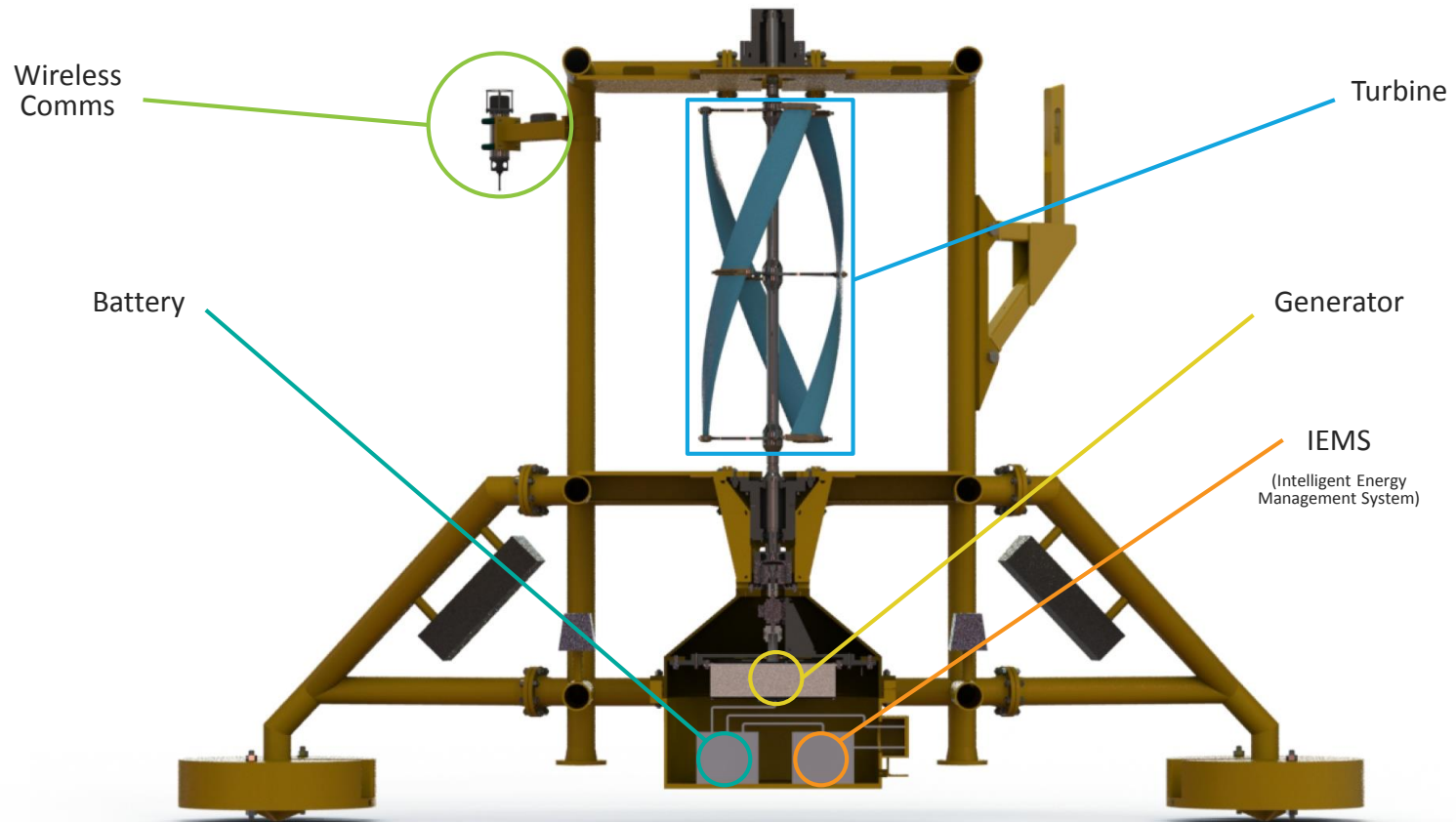
- + Harness energy from seabed currents
- + Integrated energy storage system

KEY BENEFITS

- + Operating subsea assets autonomously
- + Monitor subsea equipment
- + Communicate wirelessly with a host
- + Rapid order to installation



How it works



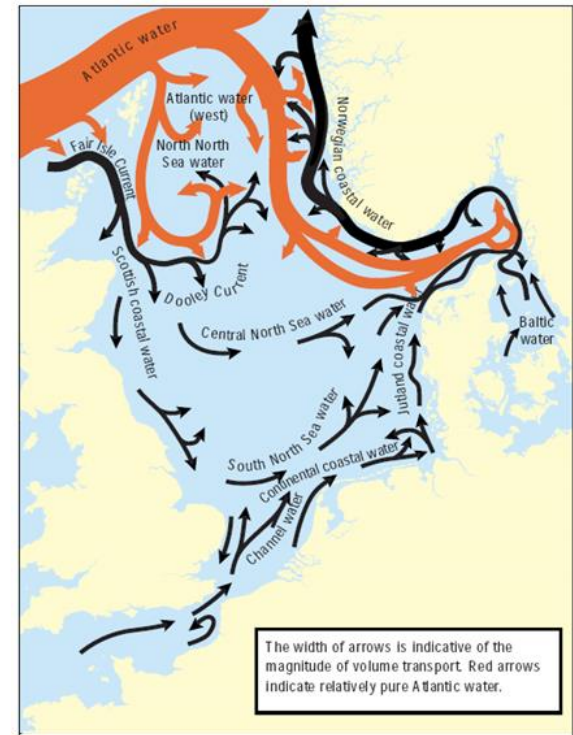
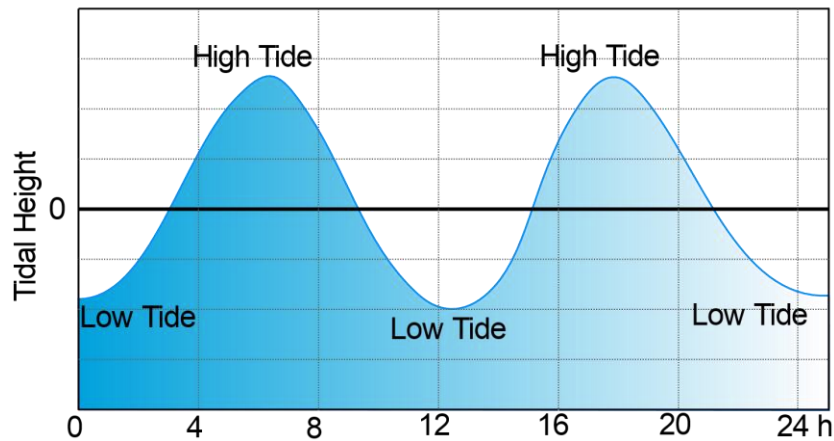
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Energy Conversion

Key Points:

- + Energy available for conversion is very predictable
- + Unit sizing and redundancy are project specific using modular building blocks

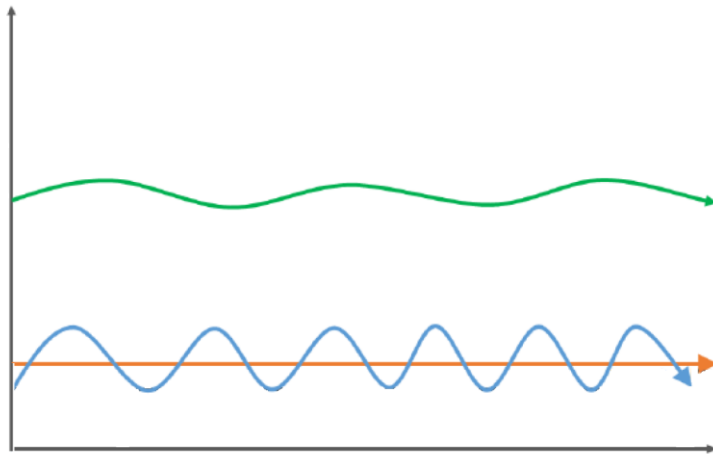


Turrell *et al.* (1992).

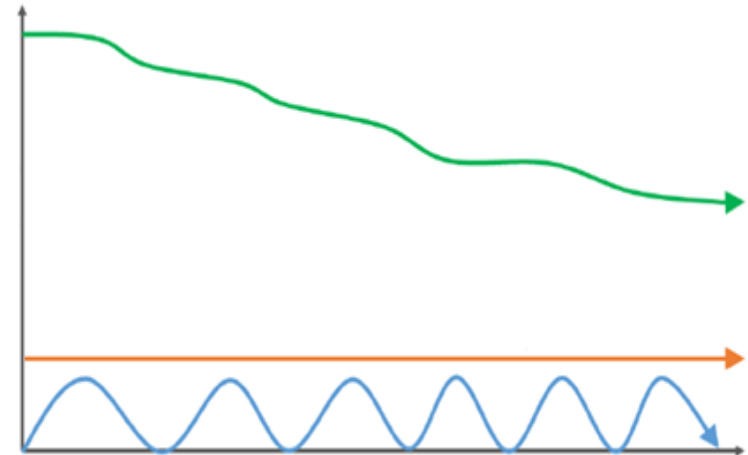


Energy Storage

BALANCE



EXTEND



- Battery Capacity
- Energy Required by Device
- Energy Converted from Ocean Currents



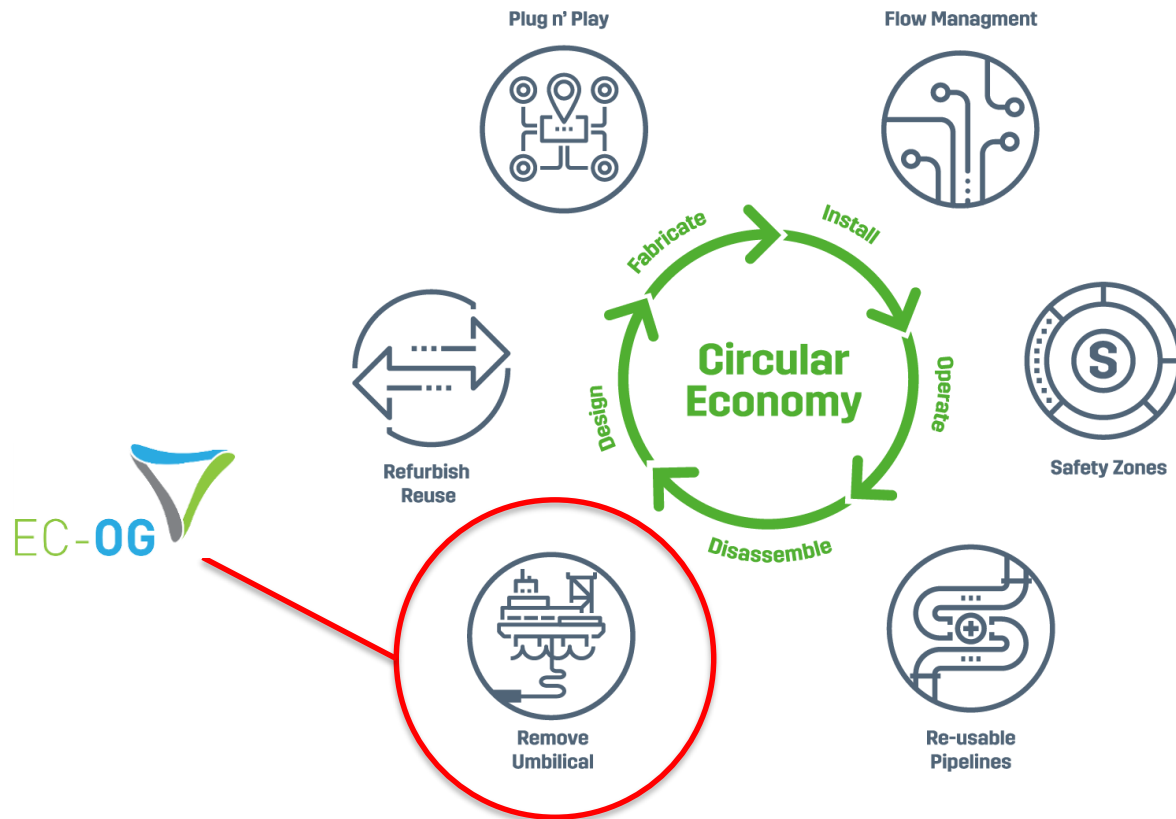
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An underwater photograph showing sunlight rays (crepuscular rays) filtering down from the surface, creating a dramatic, ethereal atmosphere. The water is a deep blue-green color, and the light rays are bright and distinct.

MARGINAL FIELDS

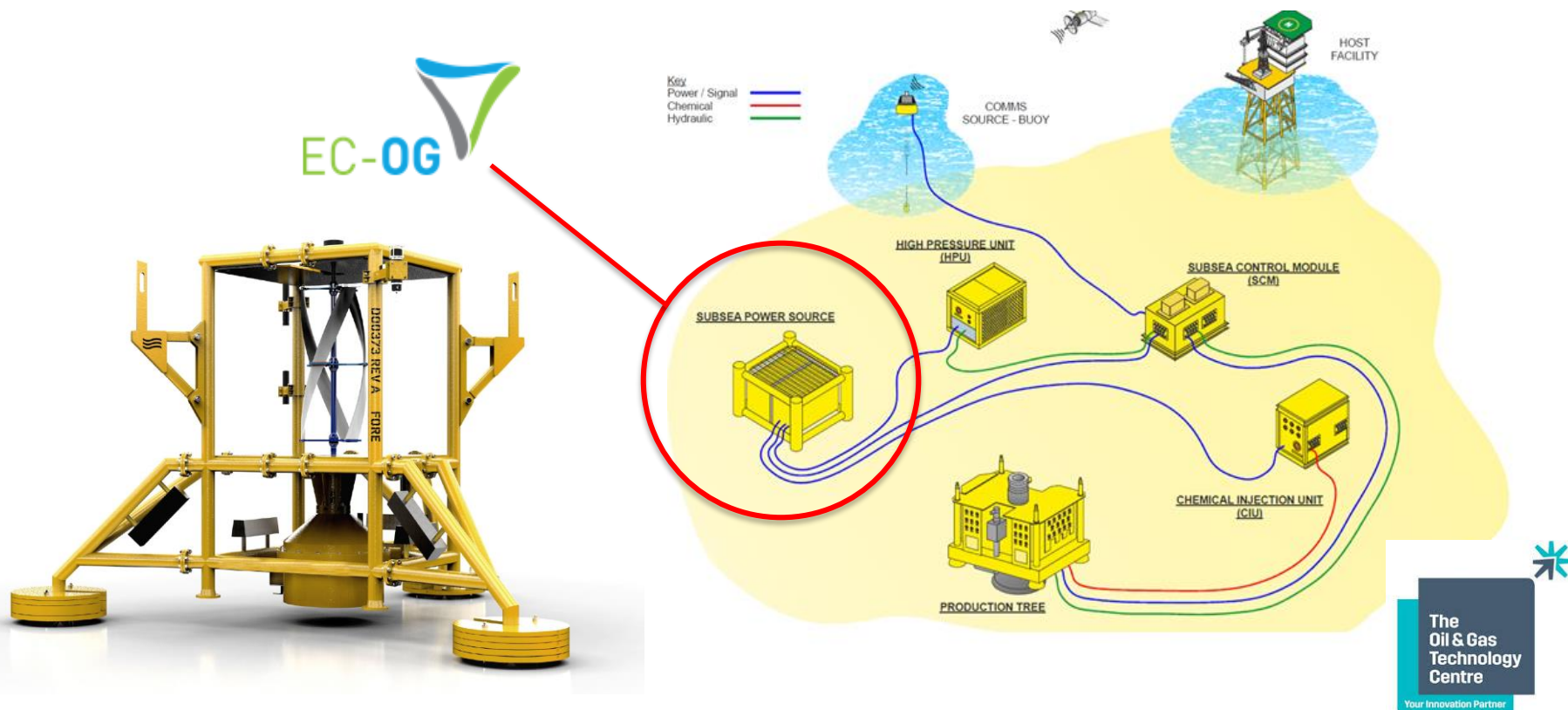
Tie-back of the Future



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Tie-back of the Future



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Technology Adoption Opportunities

Development

R&D PROGRAMME

May 2013 – Present



£3.5M



COMMERCIAL

Q1 2019



Commercial Applications

01100
10110
11110

DECOMMISSIONING

- MONITOR ASSETS
- PRE-PA WELL MONITOR

350

POWER SOURCE REMOTE WELL SITES



ALTERNATIVE REMOTE POWER SOURCE

- WELL DIAGNOSTICS
- R-ROV / AUV DOCKING



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An underwater photograph showing sunlight rays (crepuscular rays) filtering down from the surface, creating a dramatic, hazy blue-green atmosphere. The rays are most prominent in the upper half of the frame, where they appear as bright, diverging beams of light against the darker water.

SUBSEA POWER HUB

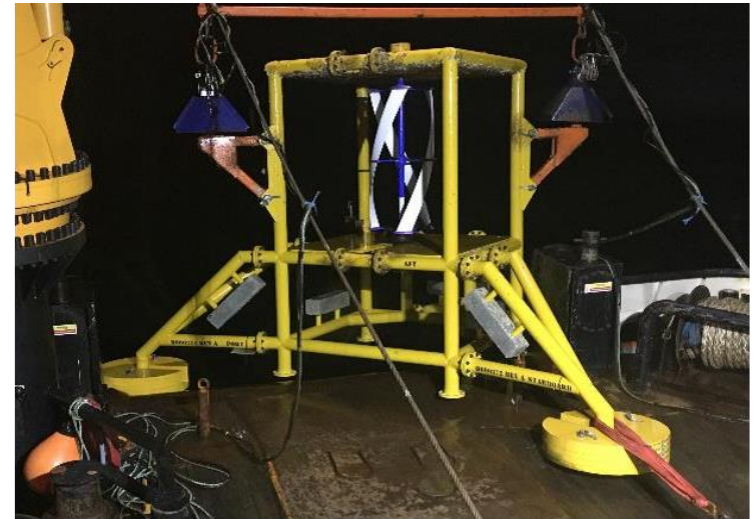
SEA TRIALS

Development Milestones

- + Turbine trials, 3D printed scale model: 2013
- + Aggressive media drive train tests: 2016
- + Sea trial, EMEC: 2017



Subsea Power Hub Deployment – April 2017



Subsea Power Hub Post-Deployment – November 2017



EMEC Testing Programme



The Subsea Power Hub Story



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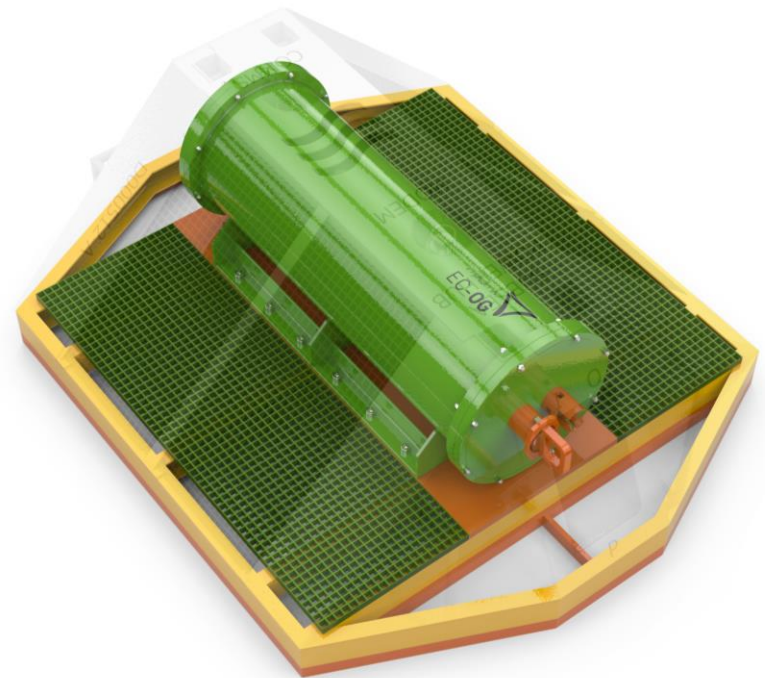
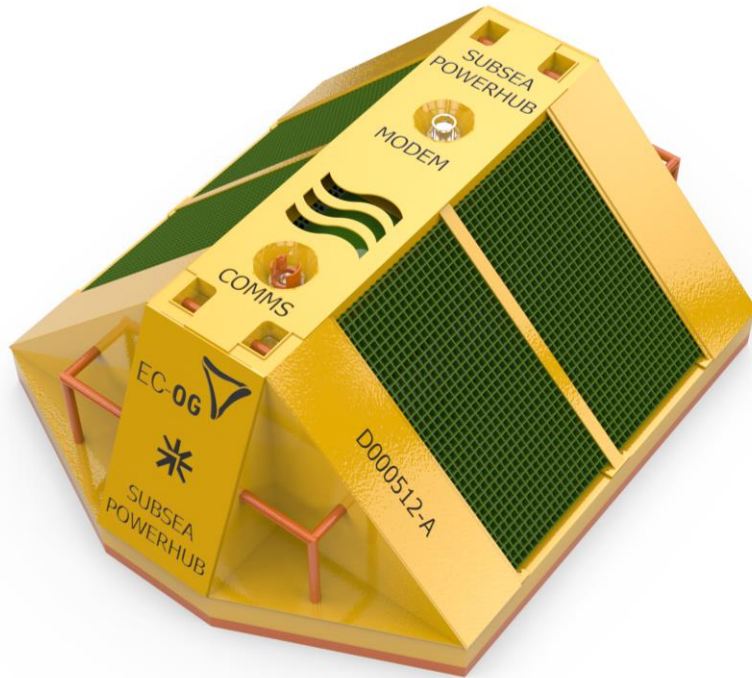
ONGOING DEVELOPMENT PROGRAMME

SCM Integration

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Subsea Power Hub beta



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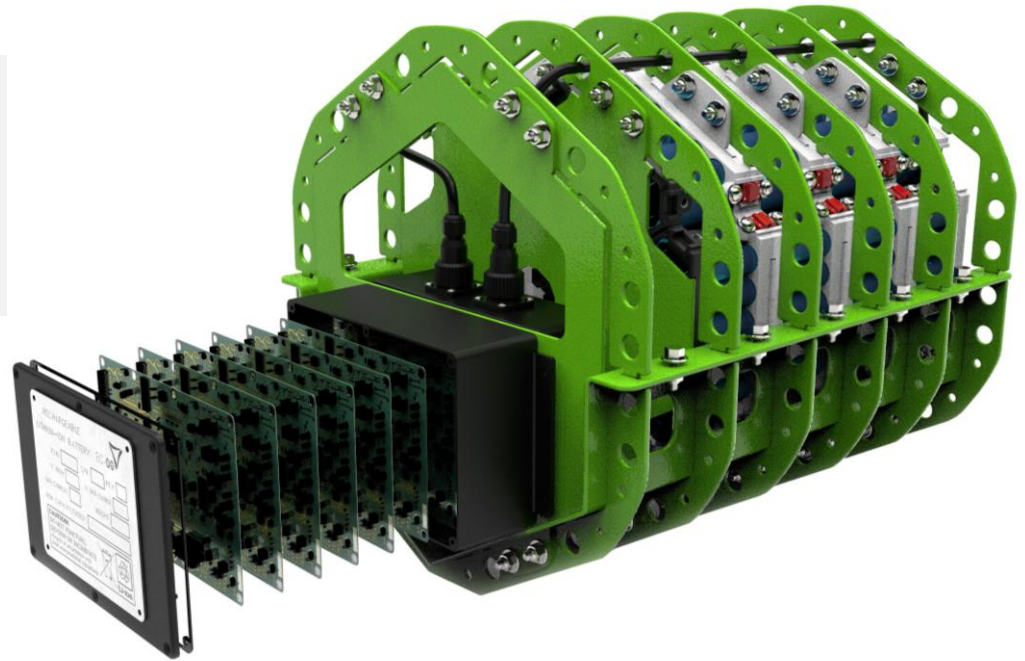
EC-OG Proprietary Battery



KEY FEATURES

| | |
|---------------------------|--|
| Nominal Battery Capacity | 5 – 750 kWh+ |
| Peak System Output | 6 kW (customisable) |
| Specific Output Condition | 0 – 500V DC / AC (50 – 400 Hz) (customisable) |

- + Scalable – for varying housing sizes and geometry
- + Modular – allows large energy capacities
- + Primary / Secondary – flexible design
- + SAFETY – Intelligent Energy Management System



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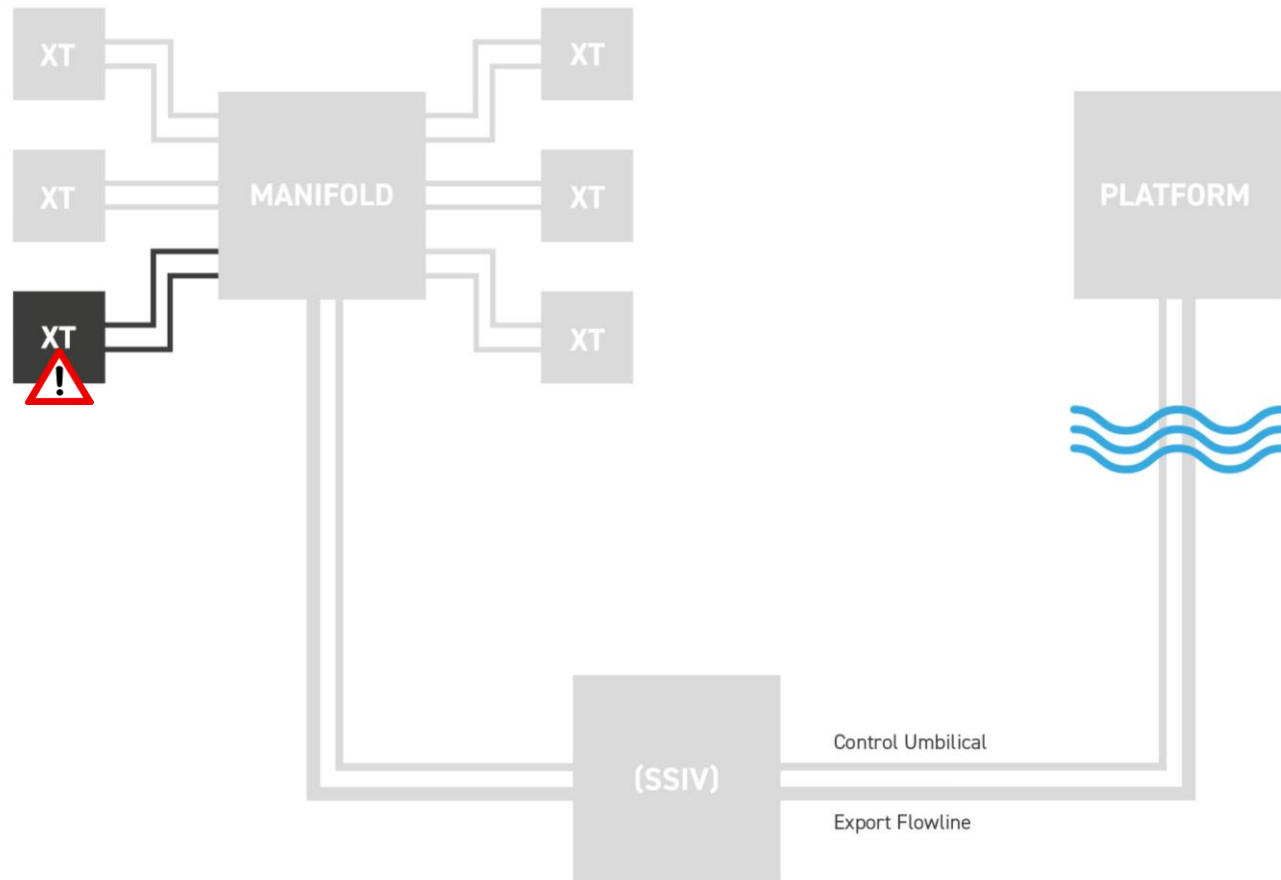
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APPLICATION ENGINEERING & REVENUE BENEFITS

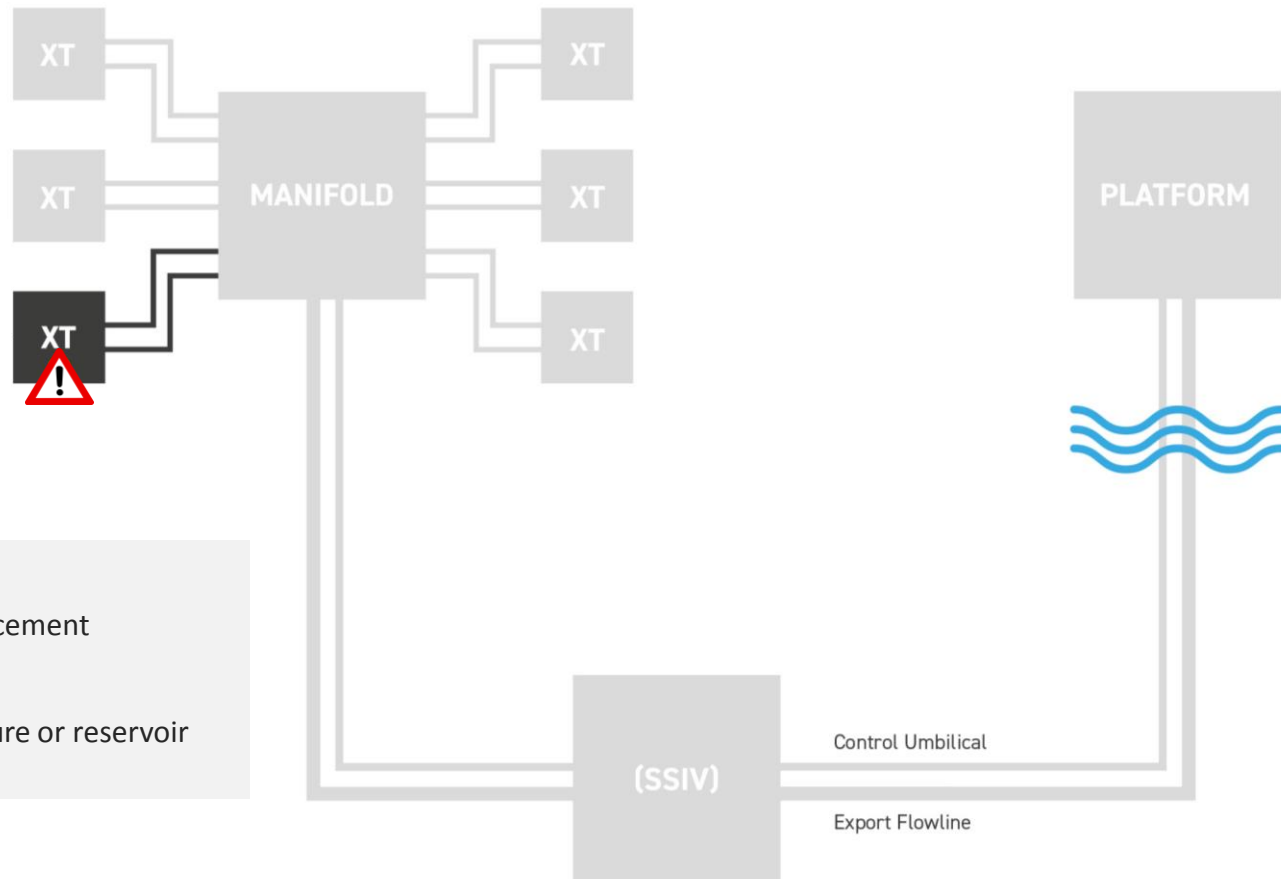
Application Engineering



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Application Engineering



TRADITIONAL RESPONSE

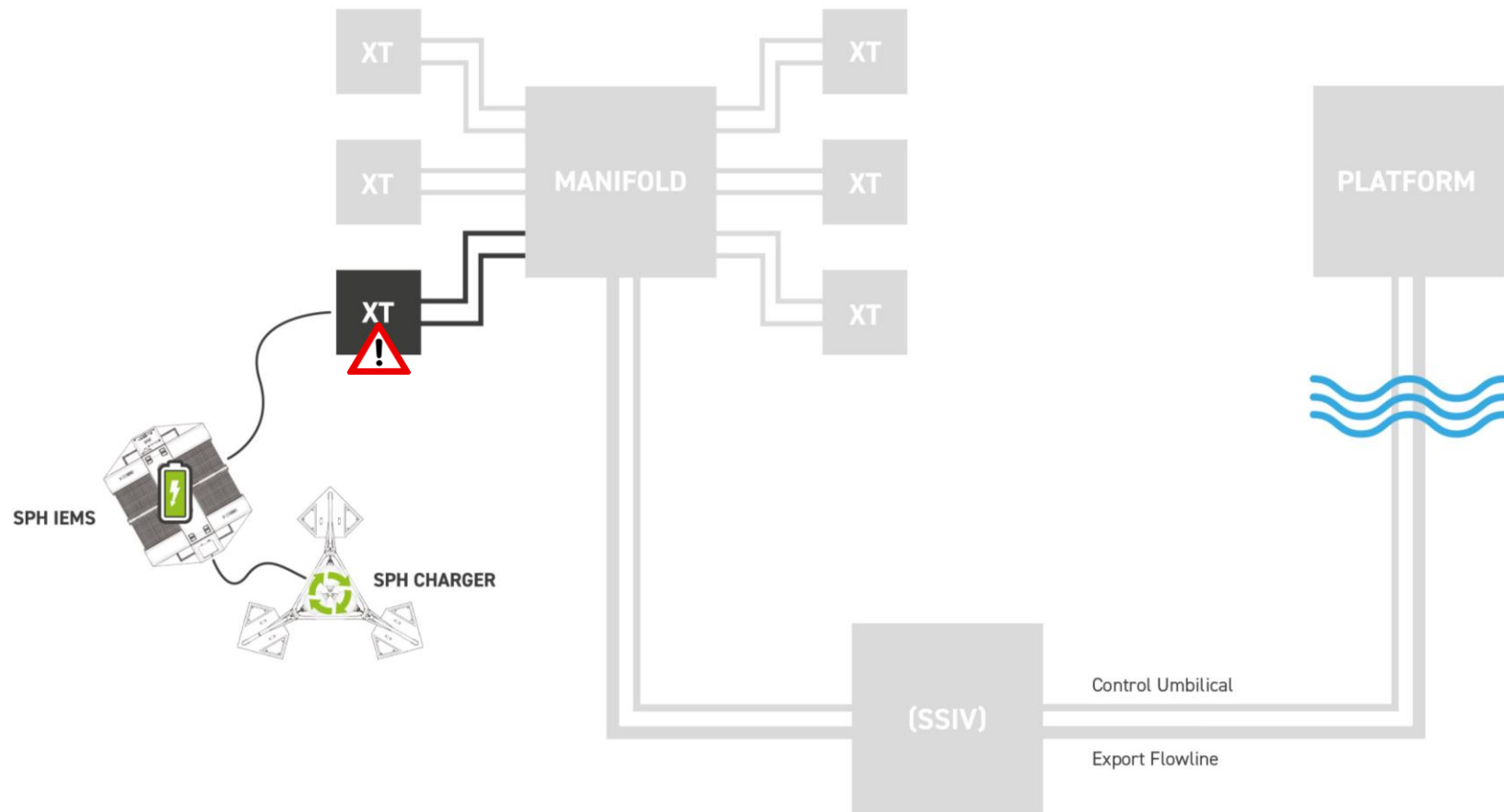
- + Umbilical or jumper replacement
- + 18 – 24 month lead time
- + Risk of further infrastructure or reservoir degradation



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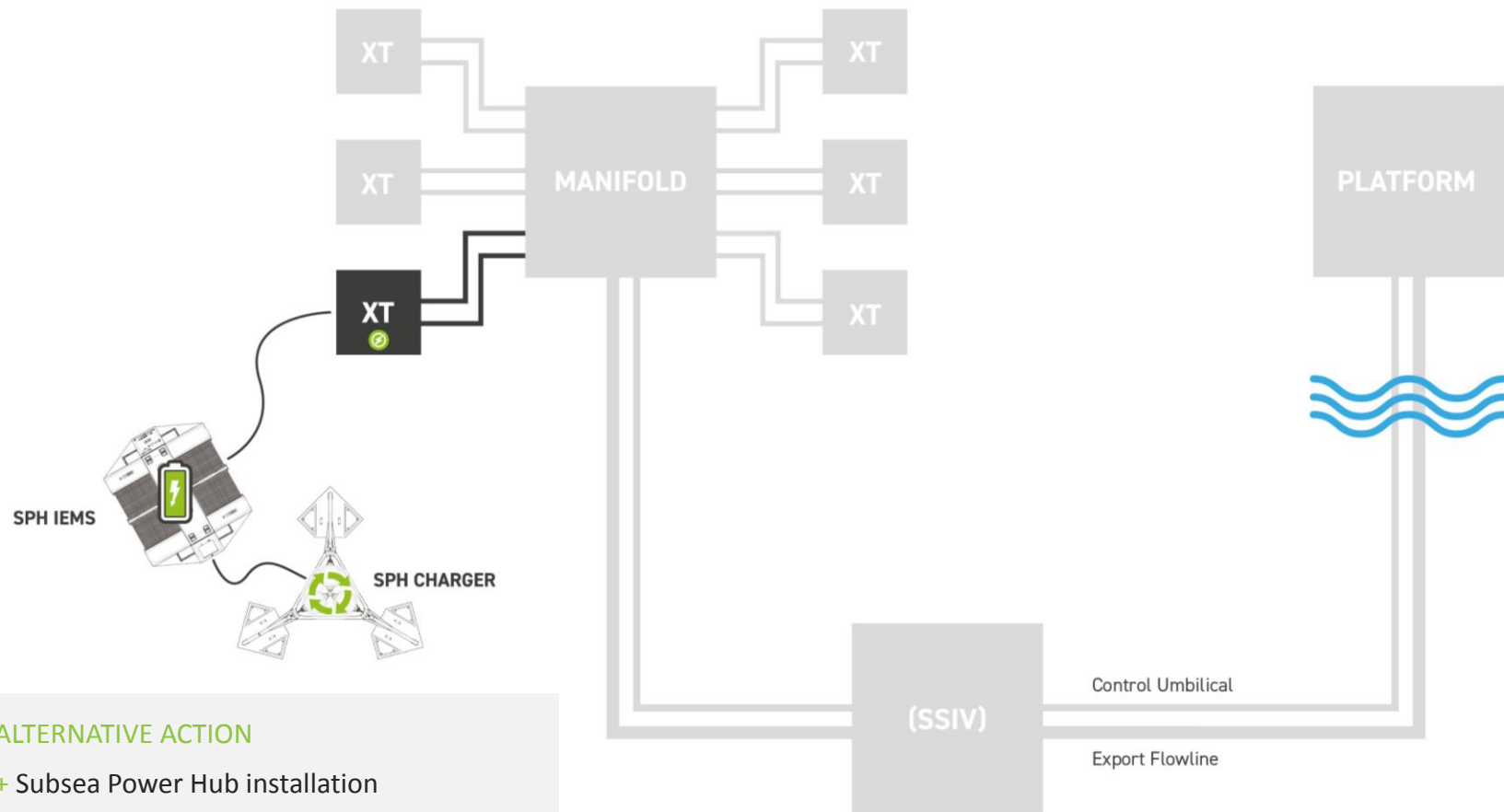
Application Engineering



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Application Engineering



ALTERNATIVE ACTION

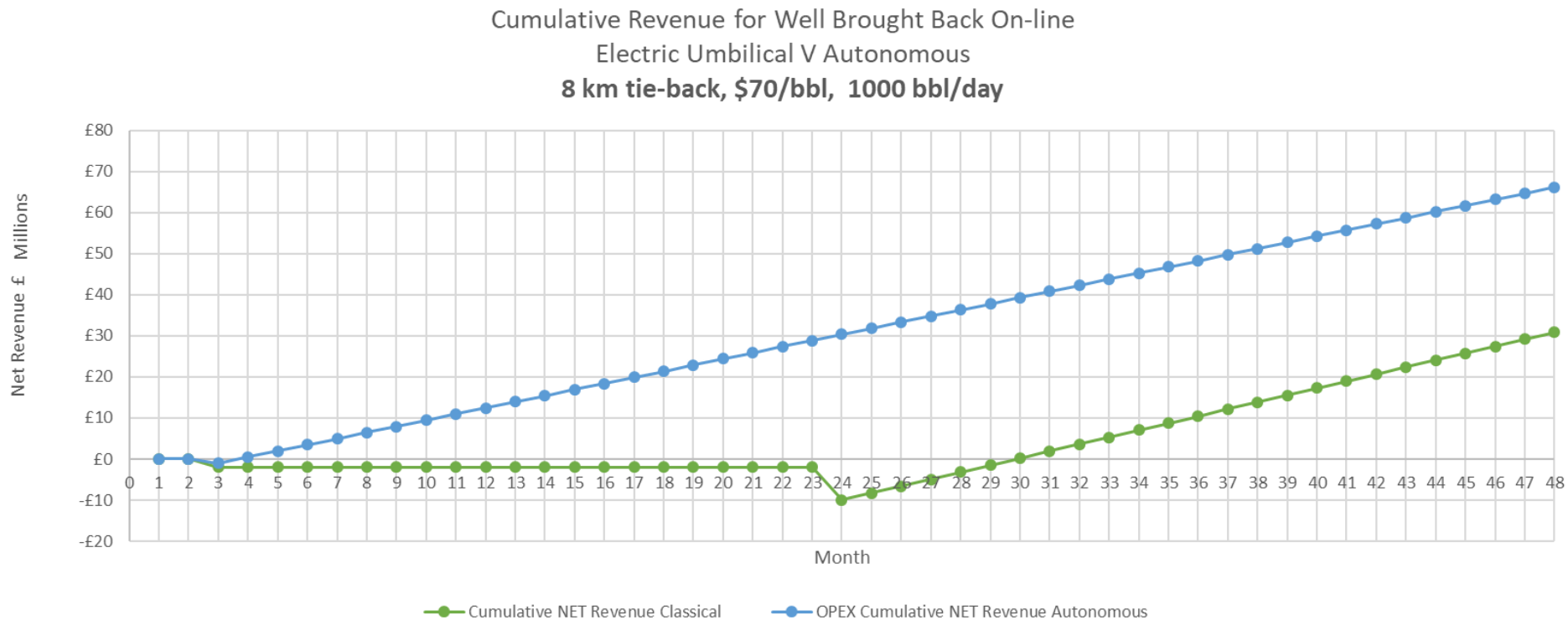
- + Subsea Power Hub installation
- + 3 month lead time
- + Additional revenue



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Revenue Benefits

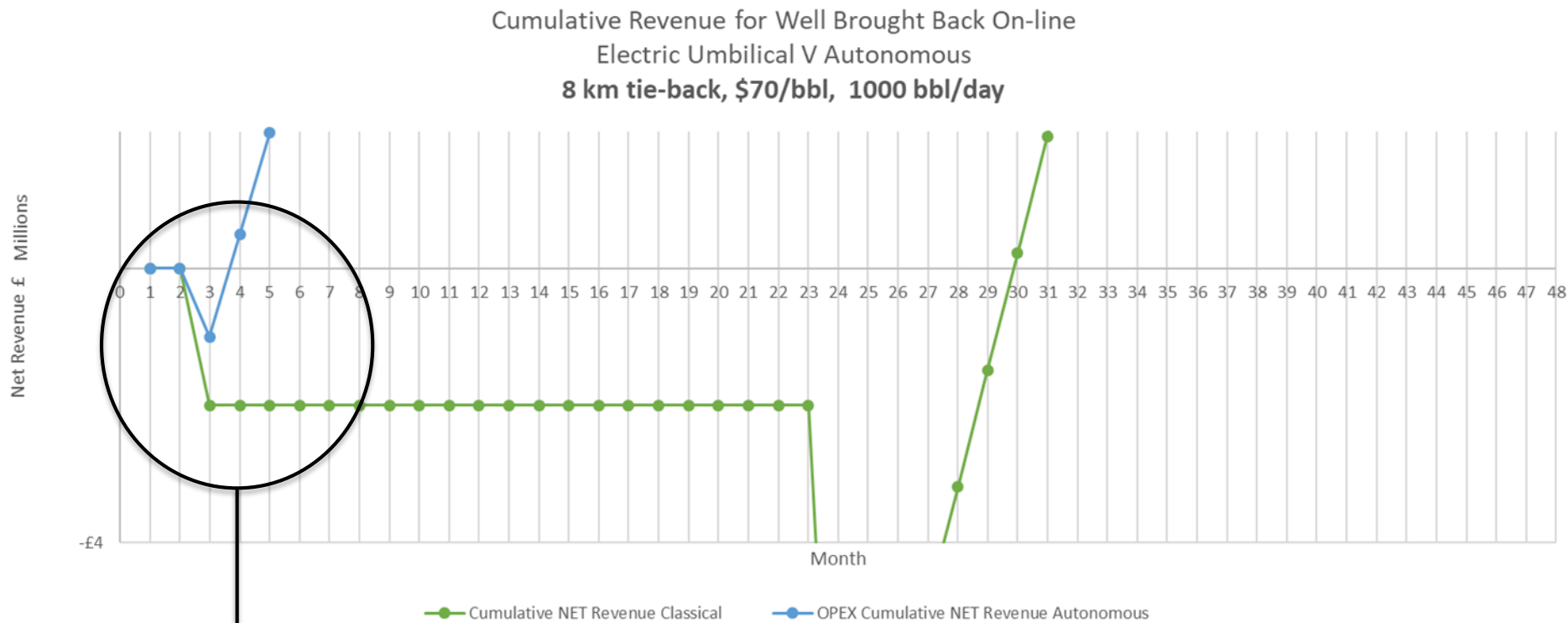


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Revenue Benefits



+ **Subsea Power Hub:** DSV £1M to install, 4 hours per SPH

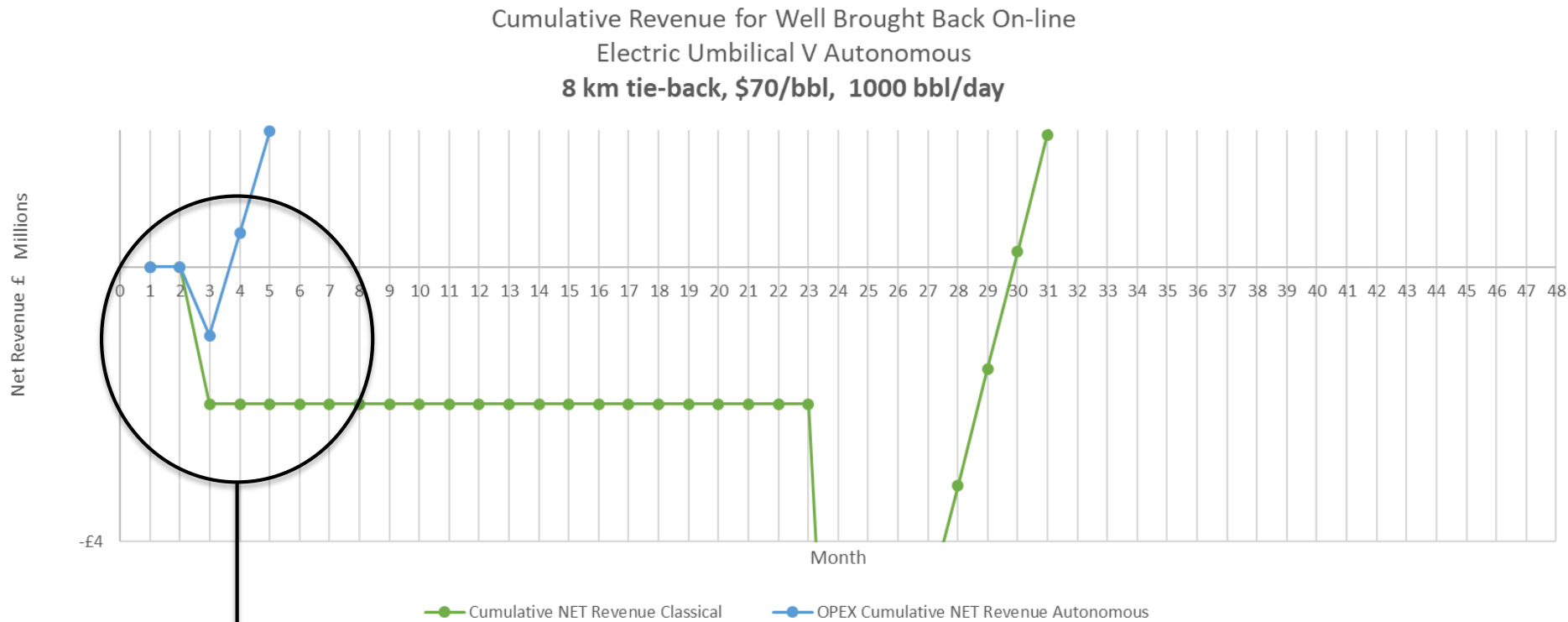
- **Umbilical Replacement:** DSV £2M+ to confirm electrical fault location



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Revenue Benefits

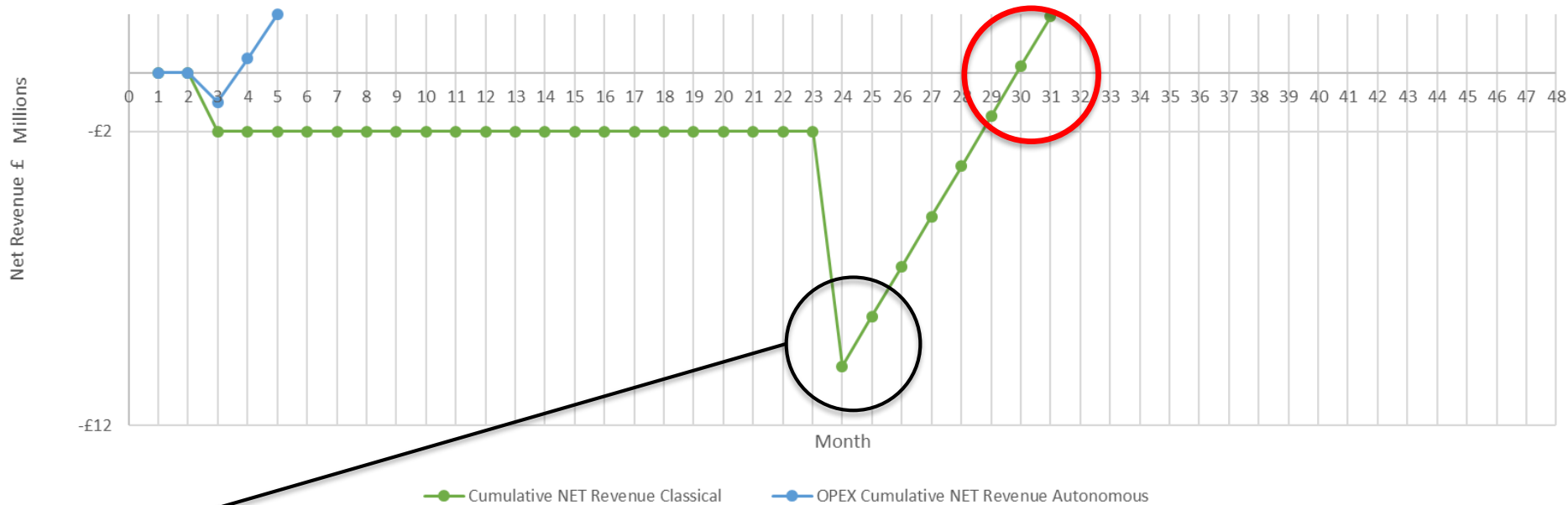


- + **Subsea Power Hub:** Production resumes, £1.7M monthly revenue
OR
- + **Subsea Power Hub:** No production, well monitoring commences defer P&A
- **Umbilical Replacement:** Order 8 km umbilical



Revenue Benefits

Cumulative Revenue for Well Brought Back On-line
Electric Umbilical V Autonomous
8 km tie-back, \$70/bbl, 1000 bbl/day



Procurement & Installation of Umbilical **RISKS**

- Late delivery
- Availability of suitable vessel
- Weather windows & summer installation requirement

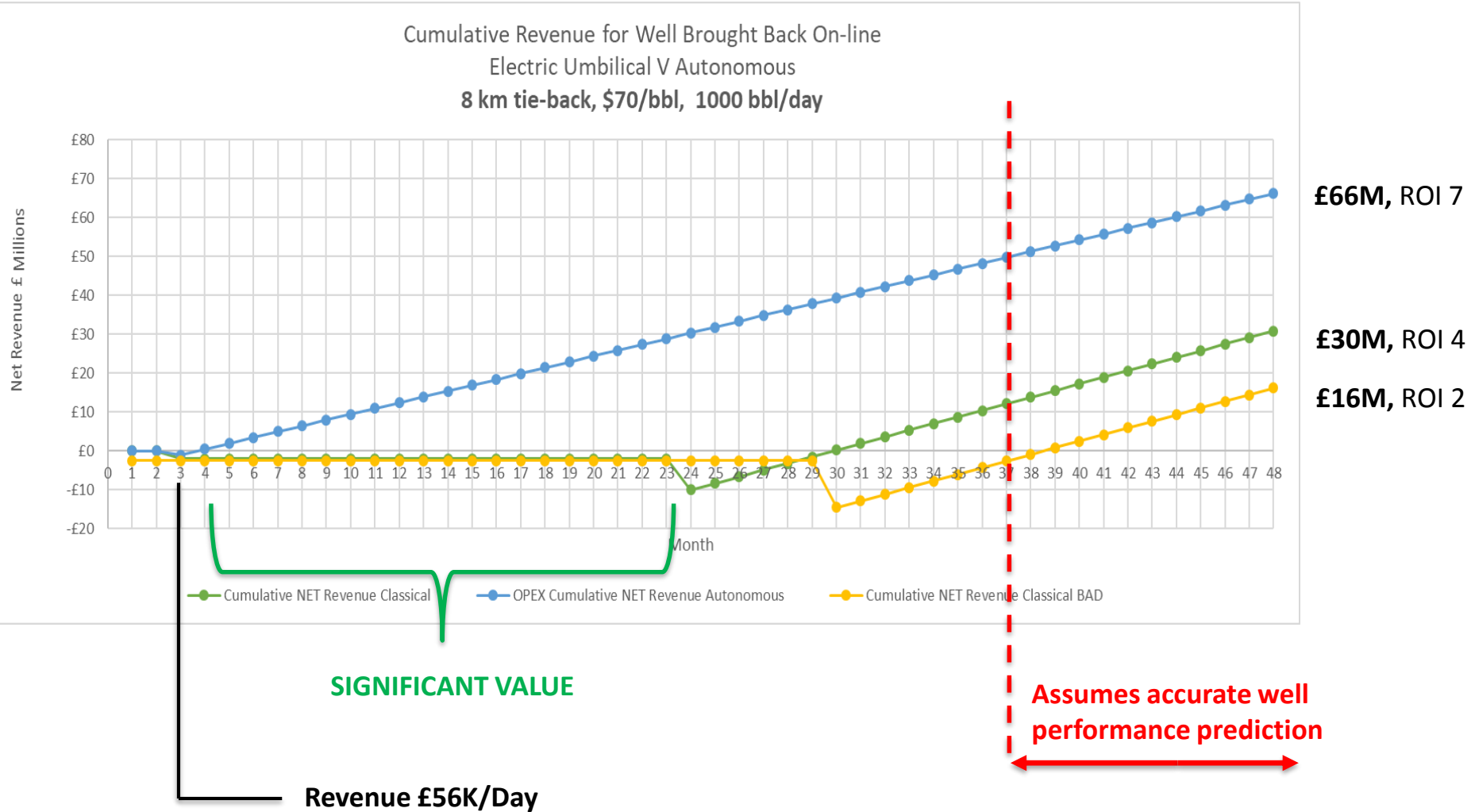
- Further degradation of electrical distribution system
- SCM Failure
- Pipeline degradation
- Well degradation
- Reservoir degradation, well stimulation required etc.



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Revenue Benefits



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FUTURE DEVELOPMENTS **THE ENERGY TRANSITION**

Future Developments



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The Energy Mix



ENERGY TRANSITION OUTLOOK 2018

A global and regional forecast of the energy
transition to 2050



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The Challenge of Scale

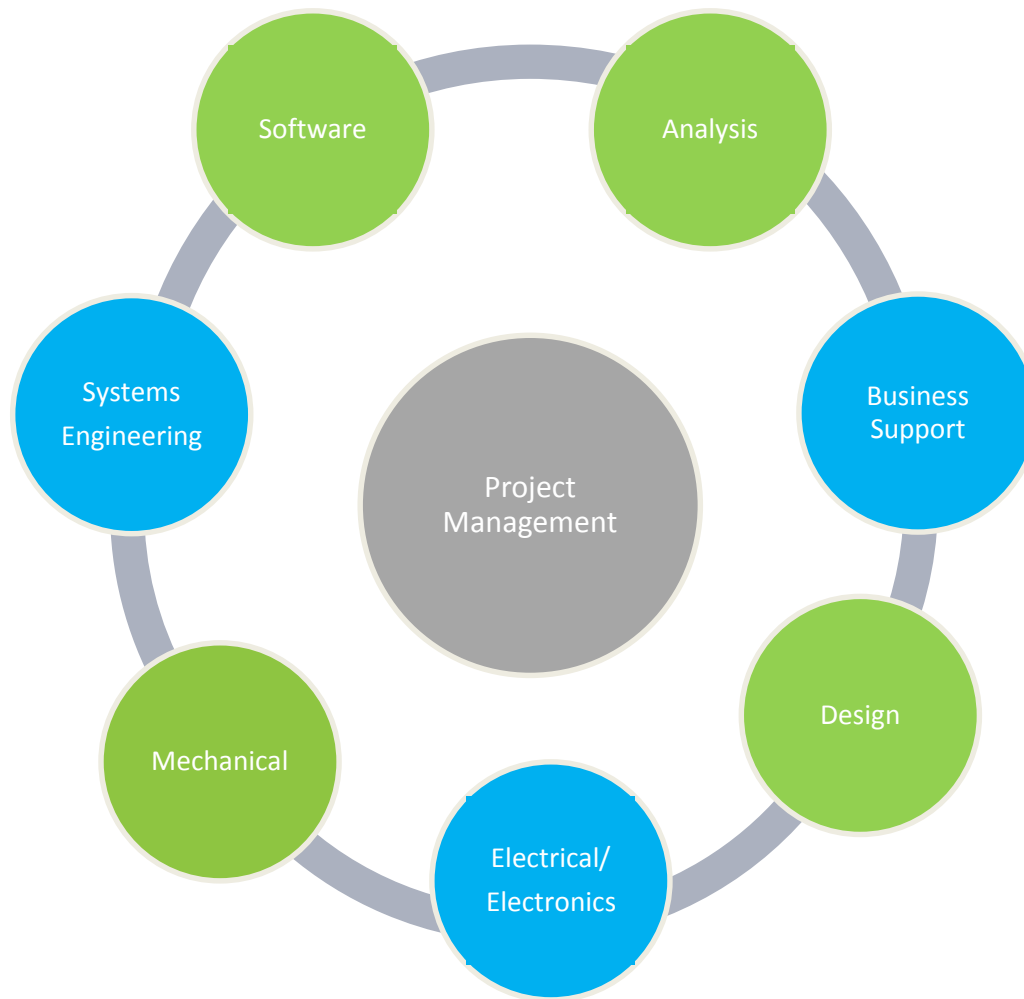
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ENGINEERING SERVICES

Disciplines



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An underwater scene with sunlight rays filtering down from the surface, creating a serene and ethereal atmosphere. The water is a deep blue-green color, and the light rays are visible as bright, diagonal streaks of light. The overall mood is peaceful and contemplative.

**THANK YOU
FOR LISTENING**