

# Technical Primer: Project Britannia – Powering the Future with Offshore Nuclear Hydrogen

## 1. Introduction: The Magic of 'Borrowed Molecules'

For millions of years, the Earth's climate and biosphere evolved in equilibrium. Project Britannia proposes a circular energy system to restore balance by replacing carbon combustion with a continuous water-based hydrogen cycle.

Core Idea: Use low-carbon electricity to split water into hydrogen and oxygen. Hydrogen becomes the energy carrier for industry, shipping, heavy transport, and power. After use, it recombines with oxygen and returns to water.

Water Loop Stages:

- Abstraction – Seawater is taken and desalinated.
- Splitting – Electricity separates purified water into hydrogen and oxygen.
- Eventual Return – Hydrogen use returns water to the hydrological cycle.

## 2. The Architecture of a Cluster: The '1+4' Model

The UK North Sea contains ~470 platforms (~600 basin-wide, 1,500+ subsea structures). Project Britannia selectively repurposes viable installations into modular clusters.

Cluster Components:

- Power Hub (Rig 1) – Offshore SMR providing electrical generation only.
- Hydrogen Satellites (Rigs 2–5) – Repurposed platforms hosting desalination, PEM electrolyzers, compression, and metering equipment.

## 3. The Power Hub: A Clean Engine at Sea

The Power Hub houses a Small Modular Reactor (SMR) providing firm 24/7/365 baseload power.

Power Output: 300–350 MWe

Environment: Purely electrical (no hydrogen production onsite)

Safety Posture: Strict nuclear security and safety controls

## 4. The Satellite Platforms: Turning Seawater into Energy

Hydrogen production uses Proton Exchange Membrane (PEM) electrolysis.

Engineering Ratios:

- 12–15 kg purified water required per 1 kg hydrogen
- ~55 kWh electricity per kg hydrogen (SEC)
- ~8 kg oxygen co-product per kg hydrogen

Oxygen can be captured for industrial or medical applications.

## **5. The Safety Firewall: Why Separation Matters**

Power Hub and hydrogen satellites are separated by 2–5 km.

Hazard Isolation Benefits:

- Keeps high-pressure gas hazards away from nuclear clean zone
- Enables clear ONR and HSE regulatory separation
- Demonstrates ALARP principles
- Independent emergency shutdown capability

## **6. Connecting to the Coast: Teesside and the Humber**

Compressed hydrogen is exported via repurposed subsea pipelines.

Landing Zones:

- Teesside – Chemicals, refining, green shipping fuel
- Humber – Steel production and power generation

The project supports a Just Transition using a Skills Passport to bridge offshore oil & gas expertise into hydrogen operations.

## **7. Summary: A Blueprint for a Green Legacy**

Each cluster produces approximately 131–153 tonnes of hydrogen per day.

Triple Win:

- Environmental – Net Zero via circular water loop
- Energy Security – Firm domestic fuel supply
- Human Impact – 10,000–16,000 jobs supported

Project Britannia transforms the North Sea into a Global Hydrogen Operations Center.