



# Coastal Hydrogen Hub

3.29 GWe per site

## Carbon Free Future

THE UK NATIONAL VISION 2055

*A State-Owned National Wealth Engine: 25 Coastal Mega-Sites  
Delivering Clean Power, Green Hydrogen, Free Heating, Free NHS  
Oxygen, and Permanent British Prosperity.*

**82**

GW NUCLEAR

Backbone Power

**35k**

TONNES/DAY

Green Hydrogen

**25k**

TONNES/DAY

Free NHS Oxygen

**100k+**

BRITISH JOBS

Skills Passport

**BUILT BY THE STATE • OWNED BY THE PEOPLE**

# What CFF Is — In Plain English

One Programme. Total National Transformation.

*CFF isn't just a power project; it's a National Wealth Engine. By funding this through the state, we cut out foreign middlemen and private dividends. We use the by-products to run our NHS and grit our roads for free, and we use the massive earnings to set a fixed, low-cost British price for energy. We aren't just building reactors; we're building a future where the UK is the cheapest, cleanest place in the world to live and do business.*

— The "Grand Slam" Pitch

Carbon Free Future (CFF) is a plan to rebuild the United Kingdom's energy system around a new kind of coastal infrastructure. Instead of a handful of giant nuclear plants and a patchwork of gas stations, the country would build a **fleet of 25 identical coastal hubs**. Each hub combines small modular reactors (SMRs), large-scale electrolysers, desalination, hydrogen processing and industrial facilities. Together, these hubs provide the backbone for a **hydrogen-based, fossil-free Britain**.

CFF is a **National Utility**. It treats energy and water as foundations for the economy, not commodities to be traded. By owning the means of production, the British state can guarantee energy security, water security, and price stability for generations.



#### Nuclear Backbone

175 SMRs across 25 sites. 82 GW of clean, firm power.



#### Hydrogen Economy

35,000 tonnes/day green H<sub>2</sub> for heat, transport & industry.



#### Free Heating

10-Mile Heat Halo: zero-cost warmth for host communities.



#### State-Owned

100% British. Funded by 50-year National Mission Bonds.

25

#### Mega-Sites

Identical coastal hubs around the UK

7

#### SMRs Per Site

470 MWe each — 3.3 GWe per site

2,000

#### TWh / Year

Total CFF nuclear output

# Sea-to-Street: The CFF Site

Every site is a complete "sea-to-street" industrial ecosystem

Think of one CFF site as a "**sea-to-street**" factory. It takes in seawater and uranium fuel. It sends out hydrogen, oxygen, desalinated water, critical minerals, and — when needed — electricity. Each site is self-contained but connected to a national hydrogen and electricity grid.

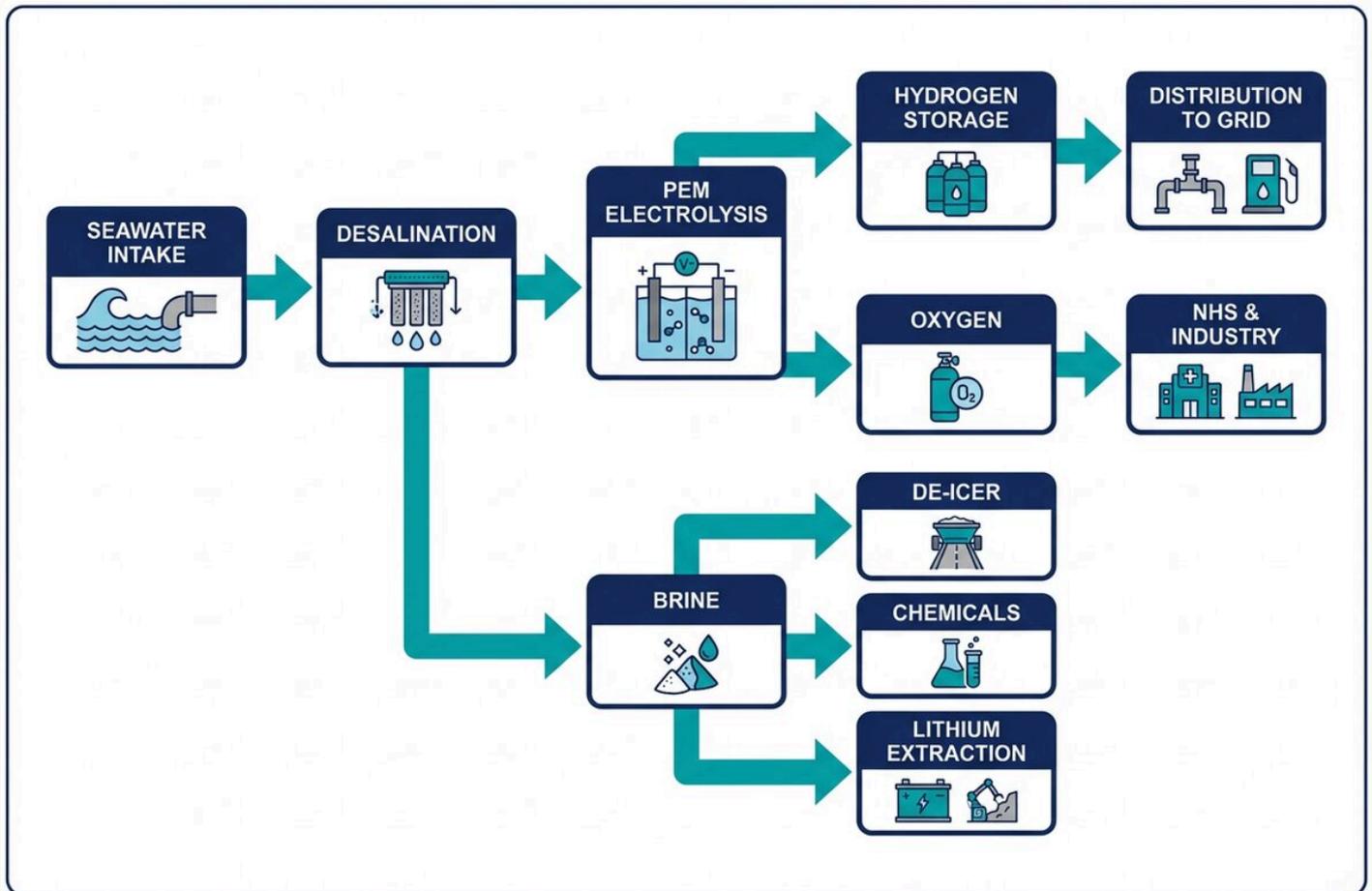


Figure 1: The CFF Sea-to-Street System — From Seawater Intake to National Distribution

## Core Components



### 7 × SMRs (470 MWe each)

Steady, low-carbon electricity day and night. N+1 resilience — losing one unit only reduces output by 14%.



### Desalination + Ultra-Pure Polishing

Seawater → PEM-grade ultra-pure water for electrolysis, plus strategic freshwater reserve.



### Industrial-Scale Electrolysers

Split water into hydrogen and oxygen at volumes never before attempted.



### Export Infrastructure

Pipeline, ship, rail and road distribution of hydrogen, ammonia and synthetic fuels.

## The 3-Mile Separation Ring

Each site is laid out with a deliberate **3-mile buffer** between the nuclear island and the hydrogen-processing area. The reactors sit in a secure inner zone; hydrogen production, storage and loading happen in an outer industrial zone.

This keeps hazardous inventories physically separated from the reactors and gives regulators and the public a clear, conservative safety case.

**175**

Identical SMR units across 25 sites — factory learning drives costs down **47%** over the rollout



# Six Essential Tools. Total UK Resilience.

Because the British People own the "Knife," the government can choose which tool to deploy every morning based on the nation's needs — not a shareholder's profit margin.



## The Grid Blade

### 40 GW Instant Power

**Scenario:** Dunkelflaute — no wind, no sun, cold spike.  
**Action:** "Safe-Flex" ramp-down of PEM units to 50% load.  
**Result:** Enough firm nuclear power to cover the entire UK peak demand.



## The Water Saw

### 1.25M m<sup>3</sup>/day

**Scenario:** National drought / crop failure.  
**Action:** Activate "Unit 8" Strategic Water Reserve.  
**Result:** Fresh water for 10 million people. De-couples food production from rainfall.



## The Fuel File

### 35,000 Tonnes/day H<sub>2</sub>

**Scenario:** Global oil/gas price shock.  
**Action:** Maintain 100% British-made hydrogen production.  
**Result:** Fixed "British Standard Price" decouples the UK from foreign energy markets.



## The Health Needle

### 25,000 Tonnes/day O<sub>2</sub>

**Scenario:** Pandemic or medical oxygen shortage.  
**Action:** Divert electrolysis by-product to the state.  
**Result:** FREE high-purity oxygen to every NHS hospital and clinic.



## The Winter Scraper

### Free Road Salt

**Scenario:** Severe freeze / motorway gridlock.  
**Action:** Process desalination brine into road-salt.  
**Result:** FREE grit and salt for every council. Keeps Britain moving.



## The Industry Pliers

### Critical Minerals

**Scenario:** Global critical mineral scarcity.  
**Action:** Extract Lithium & Magnesium from brine effluent.  
**Result:** Domestic battery-grade mineral supply. Powers the UK tech sector.

82 GW

Total Power

40 GW

Grid Flex

1.25M m<sup>3</sup>

Daily Water

100%

British Made

# More Than Power: A National Industrial Strategy

Every by-product is a public asset. Every output serves the nation first.

## The Quadruple Dividend



### The Energy Dividend

Energy sold at "Cost + 5%" once debt is serviced. A fixed "British Standard Price" decouples the UK from volatile global markets. Social Tariff guarantees low-cost hydrogen for homes. Industrial Tariff offers fixed 20-year energy prices to attract global manufacturing.



### The Industrial Dividend

Surplus oxygen, lithium, magnesium and brine by-products generate revenue streams worth billions annually, directly subsidising consumer energy costs.



### The Treasury Dividend

Billions saved in NHS/Council procurement. Billions gained in tax from a high-wage domestic workforce of 100,000+ skilled workers.



### The Water Dividend

Avoided costs from drought damage, crop failures and water trucking. UK agriculture decoupled from rainfall.



The CFF Circular Economy — Zero Waste, Maximum Value

### Free Public Services from CFF

- ✓ Free NHS Oxygen — 25,000 tonnes/day of high-purity O<sub>2</sub>
- ✓ Free Road Salt — Brine processed for councils
- ✓ Free District Heating — 10-Mile Heat Halo
- ✓ Free Strategic Water — Unit 8 drought reserve

**W**Because the state owns the infrastructure, it can set the price of energy based on the cost of production, not global market speculation. This is the "British Standard Price" — a guarantee of stability in an unstable world.

# Free Heating for Every Host Community

A National Social Covenant for Energy-Host Communities

## The Policy Guarantee

"Any residential or community building located within a 10-mile (16km) radius of a CFF Mega-Site perimeter is entitled to a **Permanent Zero-Cost Connection** to the District Heat Network. This includes 100% free space heating and domestic hot water for the life of the facility."

— CFF Policy Document Ref: HALO-10-2055

**£2,000+**

Average annual saving per home

**£50,000**

25-year tax-free grant equivalent

**85,000**

Homes served per site (10-mile radius)

**21°C**

Guaranteed minimum for vulnerable

### Why 10 Miles? Engineering Logic

**Thermal Integrity:** Vacuum-insulated mains lose <0.5°C per km. At 10 miles, water arrives at 85°C — perfect for standard radiators.

**The Visual Zone:** Covers the entire impact zone where the site is visible, ensuring those most affected are most rewarded.

**The Enclave Effect:** Creates a high-demand "Energy Gold Zone" turning local opposition into local advocacy.

## Community Impact

- ✓ **Household Dividend:** Total elimination of heating bills. Over 25 years, this represents £50,000 per family in avoided costs — tax-free.
- ✓ **Property Value Protection:** "Zero-Bill" status acts as a permanent floor for property prices, neutralising NIMBY concerns.
- ✓ **Warm Home Guarantee:** Elderly and vulnerable residents guaranteed 21°C home regardless of gas prices or income.
- ✓ **Industrial Magnetism:** Schools, hospitals and businesses receive free thermal energy, attracting jobs and reducing public sector overheads.
- ✓ **Fuel Poverty Elimination:** Total and permanent elimination of fuel poverty within every Heat Halo zone.

THERMAL BUDGET PER SITE	VALUE	NOTES
Total Waste Heat Available	5,870 MWth	From 7 SMR cooling circuits
10-Mile Radius Housing Density	85,000 homes	Average across all 25 sites
Peak Heat Demand Per Home	8 kWth	Standard UK radiator demand
<b>Total Halo Demand</b>	<b>680 MWth</b>	<b>Only 11.6% of available heat</b>
Surplus for Industry/Agriculture	5,190 MWth	Greenhouses, aquaculture, industrial



# "Safe-Flex" & Strategic Water Reserve

Dynamic grid support and drought-proof water security — from the same infrastructure

## ⚡ Safe-Flex Grid Operation

The key difference between CFF and conventional nuclear is how it connects to the grid. CFF sites keep reactors steady at **100% output** and **flex the load beneath them**, using electrolysers as a controllable sink.

PEM electrolysers operate with a **Minimum Stable Load of 50%**. This protects membranes while providing huge flexibility. When the grid is stressed, electrolysers ramp down and freed power flows to the grid.

**National Safe-Flex Capacity**

<b>82 GW</b> Total SMR Nuclear	<b>~40 GW</b> Emergency Grid Injection
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Equivalent to the **entire UK peak demand** on a typical winter's day. Available on short timescales without shutting anything down.

Even in maximum grid-support mode: hydrogen production continues at ~50%, oxygen and brine flows continue for NHS and councils, desalination and SWR remain online.

## 💧 Strategic Water Reserve

Each CFF site includes a dedicated **"Unit 8" Desalination Train** — not tied to hydrogen production. A standby asset designed solely for national water supply.

**Unit 8 — Per Site**

<b>50,000</b> m <sup>3</sup> /day fresh water	<b>10 MW</b> of 3,300 MW (0.3%)
<b>1.25M</b> m <sup>3</sup> /day across 25 sites	<b>8–10M</b> people supplied

## Water-for-Food Security

In drought, Unit 8 pumps water into a dedicated "Agricultural Spine" pipeline. UK vegetable and grain belts never fail — food production is **de-coupled from rainfall**.

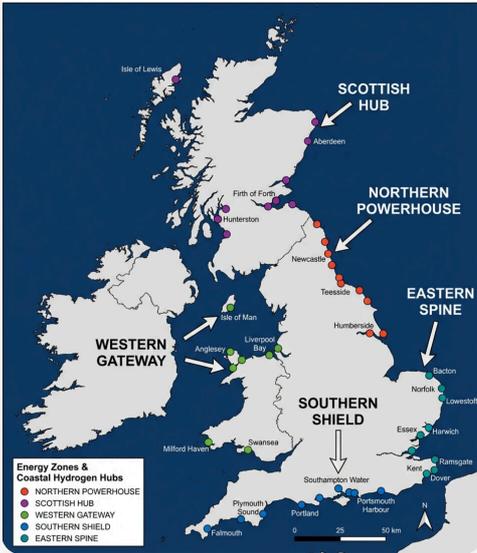
## Emergency Water Pivot

Just as CFF pivots from hydrogen to electricity in a grid emergency, it pivots from hydrogen to water in a drought. Electrolysis ramps down; desalinated flow diverts to potable or irrigation systems.

# The 2055 National Energy Architecture

82 GW nuclear backbone integrated with 80 GW offshore wind, 50 GW solar, and a complete hydrogen distribution network

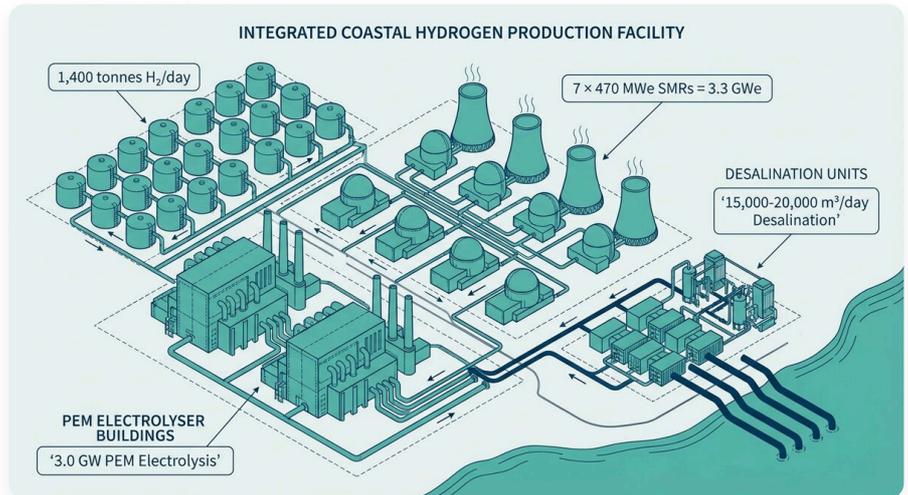
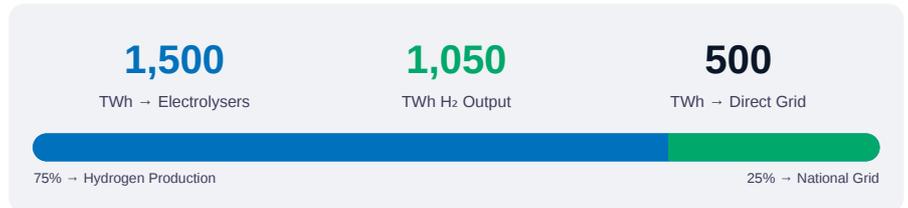
## 'Carbon Free Future - 25 Coastal Hydrogen Hubs'



UK CFF Energy Zones — 25 Coastal Mega-Sites

SOURCE / TECHNOLOGY	CAPACITY	ANNUAL OUTPUT
CFF SMR Nuclear (25 sites)	82 GW	2,000 TWh
Other Nuclear (Hinkley, Sizewell)	10 GW	100 TWh
Offshore Wind	80 GW	220 TWh
Onshore Wind	20 GW	40 TWh
Solar PV	50 GW	40 TWh
Hydro + Tidal + Other	5 GW	10 TWh

## How CFF Power Is Used



CFF Technical Systems Integration

# A Hydrogen-First Britain by 2055

1,050 TWh of green hydrogen powering every sector of the economy — with 100,000+ skilled British workers

## Hydrogen Use Breakdown

SECTOR	TWH/YR	SHARE
Residential & Commercial Heat	250	24%
Industrial Heat & Feedstock	220	21%
Shipping & Maritime Fuels	150	14%
Heavy Road Transport (HGVs)	120	11%
Light Road Transport (FCEVs)	80	8%
Aviation Synthetic Fuels	80	8%
H <sub>2</sub> -to-Power (Peaking)	50	5%
Exports / Chemicals	40	4%
System Losses	50	5%
<b>Total</b>	<b>1,050</b>	<b>100%</b>

### The 2055 Transport Mix

- 70% of cars and vans: hydrogen fuel cells
- 30% of cars and vans: battery electric
- ~100% of HGVs, rail (non-electrified), shipping: hydrogen or H<sub>2</sub>-derived fuels
- 70% of space/water heating: hydrogen boilers
- 20% of heating: electric heat pumps



The CFF Skills Passport — A Just Transition for British Workers

## 🇬🇧 The Skills Passport

The "Skills Passport" transitions 100,000+ North Sea workers into high-wage, long-term roles in the CFF fleet. Oil rig welders become SMR fabricators. Pipeline engineers become hydrogen network builders. Offshore safety officers become nuclear safety leads.

**100k+**

Transitioned Workers

**175**

Identical SMR Units

## Why British Kit & British Workers

Building SMR modules, electrolysers and valves at home keeps value in the domestic economy. The fleet effect — 175 identical units — allows UK factories to perfect the process, driving costs down by up to 47%. CFF becomes not only an energy strategy but a full industrial and employment strategy.



# The National Mission Bond

State-funded, sovereign-backed, and structured to eliminate private equity drag

The project is funded by **50-year Sovereign CFF Bonds**. Because the state is owner and primary customer, risk is minimal. This allows borrowing at the lowest rates, cutting out the 10–15% "private equity tax" seen in traditional projects. This mirrors the successful funding of the National Grid and the 1960s Gas Conversion Programme.

### Social Tariff

Guaranteed low-cost hydrogen for home heating. Permanent end to fuel poverty.

### Industrial Tariff

Fixed 20-year energy prices to attract global manufacturing back to Britain.

## Risks & Mitigations

### Supply Chain Scale-Up

175 SMRs require massive UK manufacturing growth. Mitigated by phased rollout and fleet standardisation.

### Regulatory Approval

Fleet approach relies on Generic Design Assessment. Standardisation must be locked early.

### Public Acceptance

25 sites + pipelines require national consensus. Heat Halo policy turns NIMBYs into advocates.

### Political Continuity

25-year build-out needs cross-party support. National Mission Bond structure provides continuity.

### Skills Gap

100,000+ worker transition needs flawless execution. Skills Passport begins years before construction.

### Integration at Scale

Components exist individually; integration at this scale is unprecedented. Phased approach de-risks.

## Indicative Delivery Timeline



### 2028–2030

Enabling legislation, GDA completion, site acquisition. Skills Passport launched. First National Mission Bond issuance.



### 2030–2033

First 3 pathfinder sites under construction. UK SMR factory commissioned. Supply chain mobilised.



### 2033–2037

First pathfinder sites operational. First hydrogen to grid. First free oxygen to NHS. Heat Halo activated.



### 2037–2045

Full fleet rollout: 4–5 sites commissioned per year. Factory learning drives costs down 47%. Hydrogen pipeline network expands.



### 2045–2050

All 25 sites operational. British Standard Price in effect. Full Safe-Flex grid support. Strategic Water Reserve at capacity.



### 2050–2055

Full hydrogen economy. Fossil fuel phase-out complete. UK is the cheapest, cleanest place in the world to live and do business.

Funded by

# 50-Year Sovereign CFF Bonds

100% UK sovereignty • Zero economic leakage • Lowest borrowing costs



# This Is What Determination Looks Like.

Carbon Free Future is not a wish list. It is an engineering programme with a defined scope, costed delivery plan, and clear public dividend. Every component exists today. The only missing ingredient is the national will to begin.

**The United Kingdom has done this before — with the National Grid, the motorway network, the NHS. Each time, the doubters said it was impossible. Each time, determination proved them wrong.**

**82 GW**

NUCLEAR BACKBONE

**25**

COASTAL MEGA-SITES

**100k+**

BRITISH JOBS

**Free Heating**

10-Mile Heat Halo

**Free Oxygen**

NHS — Zero Cost

**Free Road Salt**

Every UK Council

**Free Water**

Strategic Reserve

**BUILT BY THE STATE • OWNED BY THE PEOPLE**

CFF 2055 Blueprint — UK National Vision Document — Ref: CFF-NV-2055-MASTER

Carbon Free Future © 2055 — A State-Owned National Wealth Engine