

HM GOVERNMENT

---

Department for Energy Security & Net Zero  
jointly with HM Treasury and the Department for Business & Trade

# Carbon Free Future

A National Energy Sovereignty Programme

White Paper — Proposals for Legislation

Presented to Parliament by the Secretary of State  
for Energy Security and Net Zero  
by Command of His Majesty

April 2026

Cm 0000 | ISBN 000-0-00-000000-0 | Crown Copyright 2026

# Contents

---

|  |           |
|--|-----------|
| <b>Ministerial Foreword</b>  | <b>3</b>  |
| <b>Executive Summary</b>   | <b>5</b>  |
| <b>Chapter 1 The Case for Change</b>                                     | <b>7</b>  |
| <b>Chapter 2 The Concept: Circular Sovereignty</b>                       | <b>10</b> |
| <b>Chapter 3 The Execution: A Rolling National Programme</b>             | <b>14</b> |
| <b>Chapter 4 Replacing Fragmentation with Integration</b>                | <b>18</b> |
| <b>Chapter 5 Firm Power as the Foundation for Industrial Renaissance</b> | <b>22</b> |
| <b>Chapter 6 The Full System Upgrade</b>                                 | <b>26</b> |
| <b>Chapter 7 Implementation Roadmap</b>                                  | <b>30</b> |
| <b>Chapter 8 Governance, Legislation, and Consultation</b>               | <b>34</b> |
| <b>Annex A Summary of Current Fragmented Programmes</b>                  | <b>36</b> |
| <b>Annex B Rolls-Royce SMR Technical Summary</b>                         | <b>38</b> |
| <b>Annex C Glossary of Terms</b>   | <b>39</b> |

---

This White Paper is published as a Command Paper by HM Government. It represents firm government proposals for future legislation and is presented to Parliament for debate. A formal public consultation period of twelve weeks will follow publication. Responses should be directed to the Department for Energy Security and Net Zero.

# Ministerial Foreword

*Britain built the modern world on energy. The steam engine, the national railway, the electricity grid — each was an act of industrial imagination that transformed not just our economy but our society. Today, we face a moment of equivalent magnitude. Our energy system is fragmented, expensive, and dangerously dependent on volatile global markets over which we exercise no control.*

*We pay billions each year to import fuel from nations whose interests do not always align with our own. We pay generators not to generate. We run dozens of disconnected pilot schemes — each well-intentioned, none capable on its own of delivering the systemic transformation the country requires. Meanwhile, families struggle with energy bills, industries face uncertain power costs, and our net zero targets remain at risk.*

*This White Paper sets out a different path. The Carbon Free Future programme is not merely an energy policy; it is a national sovereignty programme. At its core is a simple but powerful proposition: the United Kingdom possesses, within its own territorial waters, an inexhaustible, sovereign fuel source — seawater. Through a fleet of standardised Rolls-Royce Small Modular Reactors, we can convert that resource into firm, baseload electricity, green hydrogen, desalinated water, district heat, oxygen, and zero-waste brine products — all owned by the British state, all operated for the British people.*

*This is not without precedent. Bazalgette's sewers, Stephenson's railways, the Central Electricity Board's National Grid — each required the courage to think in systems, not in fragments. Each was opposed by those who could not see beyond the status quo. History vindicated every one of them.*

*The programme we outline here is designed to be delivered — not as a single monolithic project, but as a rolling, phased, industrial programme that creates jobs and delivers returns within a single parliamentary term, while building permanent national infrastructure designed to serve the country for centuries — like the Victorian sewers and railways we still depend on today. It is, in essence, an NHS for energy: publicly owned, universally available, and built to endure forever.*

*I commend this White Paper to Parliament and to the country.*

**The Rt Hon [Secretary of State]**



# Executive Summary

The United Kingdom's energy system suffers from three structural failures: **dependence** on imported fossil fuels subject to geopolitical disruption; **fragmentation** across dozens of uncoordinated pilot programmes; and **intermittency** from an over-reliance on weather-dependent generation without adequate firm power to underpin it.

This White Paper proposes the **Carbon Free Future (CFF) programme** — a state-owned, nationally integrated energy sovereignty system based on the blueprint developed by David Waugh. The programme rests on six pillars:

## THE SIX PILLARS OF CFF

1. **Sovereign Fuel Source.** UK territorial waters (Crown Estate seawater) provide an inexhaustible, zero-cost, circular input — borrowed, used, and returned.
2. **Standardised Generation.** A fleet of Rolls-Royce Small Modular Reactors (SMRs), factory-built to identical specifications, deployed on brownfield industrial sites with existing grid connections.
3. **Multi-Output, Zero-Waste Production.** Each site produces six outputs: baseload electricity, green hydrogen (via electrolysis), desalinated water, district heat, medical and industrial oxygen, and zero-waste brine products — every by-product is used or sold; nothing is dumped into the sea or sky.
4. **State Ownership.** The entire system is publicly owned and operated — revenues return to HM Treasury, not to foreign shareholders or private equity.
5. **Rolling Programme Delivery.** A phased, replicable build — expanding as units are completed and revenues generated — not a single mega-project dependent on a single budget decision.
6. **Firm Power Foundation.** Guaranteed 24/7/365 baseload power provides the stable, predictable energy supply required to attract advanced manufacturing, data centres, and heavy industry back to the UK.

The CFF programme replaces the current scatter of disconnected green energy experiments — from hydrogen blending trials to floating wind demonstrations to heat pump pilots — with a single, integrated, national system that addresses all of their objectives simultaneously.

400k+

∞

6

£0

## What This White Paper Proposes

The Government proposes to:

1. Establish a new public body — the **National Energy Sovereignty Corporation (NESC)** — to own, build, and operate the CFF system.
2. Legislate for a **60-year rolling build-out programme** — the initial construction and expansion phase — with statutory protection from short-term political interference, establishing permanent national infrastructure designed to operate and be maintained in perpetuity.
3. Enter a strategic partnership with **Rolls-Royce SMR Ltd** for the design, manufacture, and deployment of a standardised reactor fleet.
4. Designate an initial tranche of **brownfield sites** across the United Kingdom for Phase 1 deployment.
5. Consolidate and redirect funding from existing fragmented programmes into the integrated CFF system.
6. Introduce a **National Energy Sovereignty Act** to provide the legislative framework for state ownership, land acquisition, and regulatory fast-tracking.

The following chapters set out the case for change, the concept, the execution plan, the economic case, and the implementation roadmap in full detail.

# Chapter 1

## The Case for Change

---

### 1.1 A System in Crisis

The United Kingdom's energy system has reached a point of structural failure. It is not merely inefficient — it is incoherent. The country faces simultaneous crises of cost, security, and environmental sustainability that cannot be resolved by incremental adjustments to the existing framework.

#### Import Dependency

The UK currently imports approximately 36% of its primary energy, predominantly as natural gas and petroleum products. These imports are sourced from global markets subject to price shocks, supply disruption, and geopolitical coercion. The 2022 energy crisis, triggered by the conflict in Ukraine, demonstrated the acute vulnerability of this dependency: average household energy bills doubled, industrial energy costs rose by over 100%, and HM Treasury was forced to deploy over £40 billion in emergency support through the Energy Price Guarantee.

#### Constraint and Curtailment Costs

The UK electricity system routinely pays renewable generators *not to generate*. In 2023, constraint payments to wind farms exceeded £1.1 billion — a figure that has risen annually as renewable capacity has outpaced grid infrastructure. This represents a fundamental design failure: the nation is paying twice — once to build the turbines, and again to switch them off. The consumer bears these costs through higher network charges, while the underlying grid congestion remains unresolved.

#### Intermittency Without Firm Power

Wind and solar generation are inherently intermittent. On the calmest winter days — precisely when demand peaks — wind output can fall below 5% of installed capacity. Without a firm power baseload to underpin the system, the UK relies on gas-fired peaking plants (with their associated carbon emissions and import dependency) and emergency interconnector imports from continental Europe. This is not energy sovereignty; it is energy contingency.

### 1.2 The Failure of Fragmentation

The Government's response to these challenges has, to date, been characterised by a proliferation of disconnected pilot programmes and demonstration projects. Each addresses a narrow segment of the energy transition; none provides an integrated solution.

**As of 2026, the UK funds or supports no fewer than twelve separate trial programmes** — from hydrogen blending experiments to floating wind demonstrations to heat pump rollouts to carbon

capture pilots — each operating in isolation, each with its own governance, timeline, and budget. The total annual expenditure on these fragmented initiatives exceeds £2 billion, yet no single programme is capable of delivering national-scale transformation.

This White Paper contends that the fragmented approach is not merely inefficient — it is structurally incapable of achieving the Government's stated objectives. What is required is not more pilots, but a single, integrated, national system.

## 1.3 Historical Precedent

Britain has faced comparable moments of systemic crisis before, and has responded with transformative national infrastructure programmes:

- **The Metropolitan Sewerage System (1858–1875).** Joseph Bazalgette's integrated sewerage network replaced a chaotic patchwork of local systems that had produced recurring cholera epidemics. The project required state intervention, compulsory land acquisition, and a 16-year construction programme. It remains in operation 160 years later.
- **The National Railway Network (1830–1860).** A rolling programme of construction that connected every major British city, created hundreds of thousands of jobs, and enabled the Industrial Revolution to reach its full potential.
- **The National Grid (1926–1934).** The Central Electricity Board standardised and interconnected over 600 disparate local power stations into a single national system in just eight years, delivering universal access to reliable electricity.

Each of these programmes was opposed at the time as too expensive, too ambitious, or too disruptive. Each proved to be among the most consequential investments in the nation's history. **Crucially, each created permanent national infrastructure that endures to this day.** We still use Bazalgette's sewers. We still ride Stephenson's railways. We have added to them, maintained them, upgraded them — but we have never destroyed them. They were built to last forever, and they have. The CFF programme is their direct successor — permanent infrastructure for centuries, not a temporary project with an expiry date.

# Chapter 2

## The Concept: Circular Sovereignty

---

### 2.1 The Sovereign Fuel Source

At the centre of the CFF proposition is a fundamental reframing of the energy question. The United Kingdom does not lack energy resources. It possesses, within its own territorial waters, an effectively inexhaustible fuel source: **seawater**.

UK territorial waters — extending 12 nautical miles from the coastline and managed by the Crown Estate — encompass approximately 750,000 square kilometres of sovereign maritime territory. Seawater is the input for multiple CFF system outputs: desalinated freshwater, green hydrogen (produced via electrolysis), oxygen, and zero-waste brine products. The nuclear fuel cycle itself, powered by uranium, requires only minimal fuel input relative to output — a single Rolls-Royce SMR fuel load can power 470 MW(e) of generation for years before replacement.

#### THE "SEA-TO-STREET" CYCLE

The CFF model operates as a closed loop:

1. **Intake:** Seawater is drawn from UK territorial waters (Crown Estate asset).
2. **Process:** The Rolls-Royce SMR provides thermal and electrical energy to split seawater into hydrogen and oxygen (electrolysis) and to produce desalinated freshwater (reverse osmosis / thermal distillation).
3. **Output:** Six products are generated — electricity (to the grid), hydrogen (to transport and industry), freshwater (to municipal supply), heat (to district heating networks), oxygen (to the NHS and industrial buyers), and zero-waste brine products (to councils as road de-icer and to industry as chemical feedstocks).
4. **Zero Waste:** CFF is a zero-waste system. Every by-product has commercial or public-service value and is used or sold accordingly. Brine is concentrated and supplied first to councils as road de-icer, with surplus sold onward as chemical feedstocks for chlor-alkali, water-treatment chemicals, and industrial process salt. Recovered minerals support building materials and aquaponics. Oxygen is supplied first to the NHS for medical use, with industrial surplus sold onward. **Nothing is dumped into the sea. Nothing is released unused into the atmosphere.**

**This is a circular, zero-waste sovereign economy.** Unlike fossil fuels — which are extracted, burned, and permanently depleted — the CFF system borrows its input and converts every

fraction of it into a useful, saleable product. The source fuel belongs to the British Crown. It cannot be sanctioned, embargoed, or subject to price manipulation by foreign powers.

## 2.2 From Extraction to Infrastructure

The conceptual shift is fundamental. For two centuries, the UK energy model has been **extractive**: dig coal, drill oil, pipe gas — each a depleting resource that, once consumed, is gone. The entire geopolitical architecture of the modern world — from the wars of the Middle East to the leverage exercised by petrostate regimes — is a consequence of this extractive dependency.

CFF replaces extraction with **infrastructure**. The capital expenditure is in building the system — reactors, electrolysers, desalination plants, hydrogen pipelines — not in buying the fuel. Once built, the marginal cost of energy production falls to near-zero on the input side. The operating costs are labour, maintenance, and fuel-rod replacement — all domestic expenditures that recirculate within the UK economy.

## 2.3 The Six Outputs — A Zero-Waste System

| OUTPUT                           | PRODUCTION METHOD  | NATIONAL FUNCTION   |
|----------------------------------|--|---|
| <b>Electricity</b>               | Direct generation from Rolls-Royce SMR (470 MW per unit)                       | Firm, 24/7 baseload power for grid, industry, and domestic supply. Eliminates intermittency risk and gas-peaking dependency.  |
| <b>Green Hydrogen</b>            | Electrolysis of desalinated seawater using surplus/dedicated electrical output | Zero-carbon fuel for heavy transport, shipping, aviation, steelmaking, and chemical feedstock. Distributed via pipeline network.  |
| <b>Desalinated Water</b>         | Reverse osmosis and/or thermal distillation powered by reactor waste heat      | Climate-resilient freshwater supply, reducing dependency on rainfall-dependent reservoirs and aging Victorian water infrastructure.   |
| <b>District Heat</b>             | Low-grade waste heat from reactor cooling circuit piped to local networks      | Direct heating for homes, hospitals, schools, and businesses in surrounding communities. Eliminates gas boiler dependency.  |
| <b>Oxygen</b>                    | Co-product of SOEC electrolysis — 1,000 t/day per site                         | Public services first: NHS medical oxygen supply. Industrial surplus sold onward to chemical, pharmaceutical, steelmaking, and water-treatment sectors.   |
| <b>Zero-Waste Brine Products</b> | RO brine concentrated to ~23%; recovered salts and mineral streams extracted   | Public services first: council road de-icer. Surplus sold as chemical feedstocks (chlor-alkali, water-treatment chemicals, industrial process salt). Recovered minerals (Mg, Ca) support building materials and aquaponics. Nothing goes back to sea. |

## 2.4 Ownership and Revenue

Every output is produced by a state-owned asset, from a sovereign resource, and sold to domestic consumers. Revenue flows to HM Treasury — not to foreign shareholders, not to private equity, not to offshore holding companies. This is the critical distinction between CFF and the current privatised energy model: **the British public are not merely the customers; they are the owners.**

# Chapter 3

## The Execution: A Rolling National Programme

---

### 3.1 Design Principles

The CFF programme is designed to avoid the failures that have characterised previous large-scale UK energy projects (notably the delays and cost overruns of Hinkley Point C). It is governed by four execution principles:

1. **Standardisation.** Every CFF site is built to an identical design. The Rolls-Royce SMR is factory-manufactured in modules, transported to site, and assembled. There is one design, one regulatory approval, one supply chain. This eliminates the bespoke engineering that inflated costs at Hinkley.
2. **Brownfield Siting.** All CFF sites are located on existing brownfield industrial land — former power stations, decommissioned industrial sites, and disused coastal infrastructure — that already possess grid connections, road access, and planning history. This minimises land acquisition costs, environmental objections, and connection delays.
3. **Rolling Deployment.** The programme does not require a single, upfront commitment of total capital. It operates as a rolling build: each completed site generates revenue that funds the next. The programme expands as SMR production capacity increases and as each tranche demonstrates delivery.
4. **State Ownership.** The National Energy Sovereignty Corporation (NESC) owns and operates every site. There is no complex PFI/PPP structure, no contract-for-difference negotiation with private developers, no dividend leakage. The model is closer to the NHS or the BBC than to a privatised utility.

### 3.2 The Rolls-Royce SMR Partnership

The Rolls-Royce SMR is a 470 MW(e) pressurised water reactor designed specifically for modular, factory-based construction. Key characteristics relevant to the CFF programme include:

- **Factory Build:** Approximately 90% of the reactor is manufactured in a UK factory facility, with final assembly on site taking an estimated 4–5 years per unit.
- **UK Supply Chain:** Rolls-Royce has committed to 80%+ UK content in the SMR supply chain, directly supporting domestic manufacturing employment.
- **Regulatory Progress:** The Generic Design Assessment (GDA) is underway with the Office for Nuclear Regulation (ONR), with completion expected by 2029.

- **Design Lifespan:** Each individual SMR unit has a 60-year operational design life, with potential for life extension. As units reach end-of-life, they are replaced on the same permanent site infrastructure — ensuring continuous operation in perpetuity. Sites are future-proofed for eventual SMR-to-fusion reactor transition when that technology becomes commercially available.
- **Estimated Unit Cost:** £1.8–2.2 billion per unit at first-of-a-kind; declining to £1.4–1.7 billion through fleet learning rates.

### 3.3 Site Selection Criteria

CFF sites will be selected according to the following mandatory criteria:

| CRITERION            | REQUIREMENT   | RATIONALE   |
|----------------------|---|---|
| Land Classification  | Previously developed (brownfield) land              | Avoids greenfield objections; utilises existing infrastructure      |
| Coastal Access       | Within 5 km of coastline or tidal water             | Seawater intake for cooling, desalination, and electrolysis         |
| Grid Connection      | Existing high-voltage connection point within 10 km | Minimises transmission infrastructure costs and delays              |
| Population Proximity | Within 20 km of urban population centre (50,000+)   | Enables district heat distribution and local employment             |
| Transport Links      | Road and/or rail access for modular delivery        | Supports factory-to-site logistics for SMR modules                  |
| Regional Balance     | Sites distributed across all UK nations and regions | Ensures equitable economic benefit; avoids geographic concentration |

Initial analysis indicates at least 25–35 candidate sites meeting all criteria, many of which are former coal or gas power station sites already designated for energy use in local development plans.

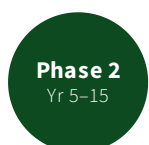
### 3.4 The Rolling Build Model

Unlike a conventional mega-project, CFF is designed as a self-funding rolling programme:



#### Pathfinder (4–6 sites)

First tranche funded by sovereign green bonds and redirected fragmented programme budgets. Establishes supply chain, workforce training pipeline, and regulatory precedent. First units operational by Year 5–7.



#### Scale-Up (8–12 sites)

Revenue from Phase 1 operations funds Phase 2 construction. Factory production rate increases. Fleet learning reduces unit cost by 15–25%. Hydrogen pipeline network begins connecting sites.

**Phase 3**  
Yr 12–30

### **National Coverage (15–20+ sites)**

Full national system operational. All regions connected. Hydrogen grid complete. District heating networks serving major urban centres. Energy import dependency approaches zero.

**Phase 4**  
Yr 25–60

### **Maturity and Perpetual Revenue**

Capital costs amortised. System operates as net revenue generator for HM Treasury. Fleet maintenance and periodic refuelling continue. First-generation SMR units approaching end of their 60-year design life are replaced or upgraded on the same permanent site infrastructure. Export of expertise and technology to allied nations.

**Phase 5**  
Yr 60+

### **Perpetual Operation and Renewal**

Like Bazalgette's sewers and Stephenson's railways, CFF infrastructure continues operating indefinitely — maintained, renewed, and expanded across generations. Second-generation SMR units or fusion reactors replace first-generation units on permanent sites. The infrastructure is never decommissioned — only upgraded. Rolling programme legislation provides for continuous renewal and technological transition, including future SMR-to-fusion reactor conversion when that technology is ready. This is permanent national infrastructure for centuries.

# Chapter 4

## Replacing Fragmentation with Integration

### 4.1 The Current Landscape

The UK currently funds or supports no fewer than twelve major separate green energy trial programmes. Each was launched with good intentions. None is connected to the others. The result is a patchwork of isolated experiments that cannot, individually or collectively, deliver a national energy system.

| CURRENT PROGRAMME                         | WHAT IT ADDRESSES  | HOW CFF INTEGRATES IT   |
|---|--|---|
| Green Home Finance Accelerator            | Home retrofit and green finance for domestic energy efficiency | District heat from CFF sites eliminates gas boiler dependency; firm electricity enables efficient heat pump operation |
| Energy Systems Catapult Innovation Trials | Public estate decarbonisation                                  | CFF provides the firm, zero-carbon power source that public buildings require — not trials, but supply                |
| Hydrogen Innovation Initiative            | Hydrogen demonstration projects                                | CFF produces green hydrogen at industrial scale as a core output, not as a standalone experiment                      |
| Centrica Brigg Hydrogen Blending Trial    | Hydrogen blending into gas networks                            | CFF's dedicated hydrogen pipeline network supersedes blending; delivers 100% hydrogen to end users                    |
| Teesside Airport Hydrogen Pilot           | Airport and transport hydrogen                                 | CFF hydrogen distributed via national pipeline serves all transport hubs — airports, ports, rail depots               |
| Clean Maritime Demonstration Competition  | Clean shipping fuel  | CFF coastal sites produce hydrogen and ammonia directly at port locations for maritime fuelling                       |
| Floating Offshore Wind Demonstration      | Next-generation wind technology                                | CFF provides firm baseload that makes intermittent wind viable as surplus, not as the foundation                      |
| Net Zero Innovation Portfolio             | Long-duration storage and energy innovation                    | Hydrogen itself serves as long-duration storage; firm nuclear baseload reduces storage requirement                    |

| CURRENT PROGRAMME                     | WHAT IT ADDRESSES                    | HOW CFF INTEGRATES IT  |
|---------------------------------------|--------------------------------------|--|
| Local Net Zero Accelerators           | Local authority and community energy | Each CFF site is a local economic anchor: heat, power, water, and employment for surrounding communities           |
| Electrification of Heat Demonstration | Heat pump rollout                    | CFF firm power makes heat pumps reliable; district heat provides alternative where heat pumps are impractical      |
| Drax CCUS Pilot                       | Carbon capture and storage           | CFF eliminates the need for CCUS on power generation by removing fossil fuels from the generation mix entirely     |
| £271m Maritime Decarbonisation Fund   | Maritime sector transition           | CFF coastal hydrogen and ammonia production provides the actual fuel that maritime needs — not a study, but supply |

## 4.2 The Integration Principle

CFF does not reject the objectives of these programmes — it **subsumes** them. Each trial is asking a question that CFF answers at system level:

### FROM TWELVE QUESTIONS TO ONE ANSWER

*"How do we produce green hydrogen?"* — CFF produces it.

*"How do we decarbonise heat?"* — CFF supplies district heat and firm power for heat pumps.

*"How do we fuel clean shipping?"* — CFF produces hydrogen and ammonia at coastal sites.

*"How do we store energy long-duration?"* — CFF produces hydrogen, which is stored energy.

*"How do we finance home retrofits?"* — CFF makes retrofits viable by providing the clean energy they require.

*"How do we capture carbon?"* — CFF eliminates the need by not producing carbon in the first place.

## 4.3 Fiscal Consolidation

The Government proposes to consolidate funding currently distributed across these fragmented programmes into the CFF delivery vehicle. This is not a cut to green energy spending — it is a **reallocation** from scattered experiments to integrated delivery. Estimated annual savings from

eliminating duplication of governance, administration, and evaluation across twelve programmes:  
**£200–400 million per year.**

# Chapter 5

## Firm Power as the Foundation for Industrial Renaissance

### 5.1 Why Firm Power Changes Everything

The single most important product of the CFF system is not hydrogen, not water, not heat. It is **firm power** — guaranteed, 24/7/365, baseload electricity that does not depend on the weather, the time of day, or the geopolitical situation in any other country.

Firm power is the precondition for industrial investment. No advanced manufacturer, no data centre operator, no chemical plant, no steelworks will locate in a jurisdiction where the power supply is intermittent, expensive, or subject to sudden price spikes. The UK has lost industrial capacity over four decades in part because energy costs are uncompetitive. CFF reverses this.

### 5.2 The Industrial Magnetism Effect

A nation with abundant, cheap, firm, zero-carbon power becomes a magnet for the industries of the 21st century:

| SECTOR                               | REQUIREMENT   | CFF PROVISION  |
|--------------------------------------|---|--|
| <b>Advanced Manufacturing</b>        | Reliable, cost-stable electricity for precision processes     | Firm baseload at predictable long-term price                     |
| <b>Data Centres &amp; AI</b>         | Massive, continuous power supply with zero-carbon credentials | 470 MW per SMR unit; zero operational carbon                     |
| <b>Green Steel</b>                   | Green hydrogen for direct reduction ironmaking                | Industrial-scale H <sub>2</sub> production co-located with power |
| <b>Semiconductor Fabrication</b>     | Ultra-reliable power, ultra-pure water                        | Firm power + desalinated water from same site                    |
| <b>Chemical &amp; Pharmaceutical</b> | Process heat, hydrogen feedstock, reliable electricity        | All three from a single CFF installation                         |
| <b>Maritime &amp; Aerospace</b>      | Green hydrogen and ammonia fuels                              | Coastal CFF sites produce and distribute directly                |

### 5.3 The Competitive Advantage

The UK would become one of the few nations on Earth offering all six of the following simultaneously: firm zero-carbon electricity, industrial-scale green hydrogen, climate-resilient freshwater, district heat, medical and industrial oxygen, and zero-waste brine products — all from a single, state-owned, domestically fuelled, zero-waste system. This is an industrial proposition that no competitor currently matches.

## 5.4 From Deindustrialisation to Reindustrialisation

The narrative of Britain's last half-century has been one of deindustrialisation — the closure of mines, mills, shipyards, and factories that once formed the economic backbone of entire regions. CFF offers the material basis for reversing this trajectory. The programme is not a nostalgic return to heavy industry; it is the creation of a **21st-century industrial commons** — a shared national infrastructure of power, hydrogen, water, and heat upon which new industries can be built.

The brownfield sites selected for CFF deployment are, in many cases, the same sites where previous industries once stood. The programme therefore delivers not just energy and industrial capacity, but **geographic justice** — returning productive economic activity to the communities that have been most affected by decades of industrial decline.

### THE FIRM POWER GUARANTEE

The Government proposes to legislate a **National Firm Power Guarantee**: a statutory commitment that the UK will maintain firm, baseload, zero-carbon generation capacity sufficient to meet at least 80% of peak national demand, independent of weather conditions and import interconnectors. This guarantee will provide the long-term certainty that industrial investors require.

# Chapter 6

## The Full System Upgrade

---

CFF is not merely an energy programme. It is a **full system upgrade for the United Kingdom**. The effects of firm, sovereign, multi-output energy infrastructure cascade through every dimension of national life.

### 6.1 Employment: Towards Full Employment

The CFF programme represents the largest peacetime industrial mobilisation since the post-war reconstruction. Employment impacts cascade across three tiers:

- **Direct Employment:** Reactor construction, operation, maintenance; electrolysis plant operation; desalination facility management; hydrogen pipeline construction and operation; district heating network installation. Estimated: **80,000–120,000 direct roles** at programme maturity.
- **Indirect Employment (Supply Chain):** Steel, concrete, electrical components, precision engineering, specialist manufacturing, transport, logistics. Estimated: **150,000–250,000 supply chain roles**.
- **Induced Employment (Spending Multiplier):** The wages of direct and indirect workers circulate through local economies — retail, hospitality, education, housing. Estimated: **100,000–200,000 induced roles**.

The programme's vision is not merely to "create jobs" but to move towards a condition in which **everyone who wants a job can get one** — not 500 people competing for a single vacancy, but a labour market in which employers compete for workers, driving up wages, conditions, and investment in training.

### 6.2 Health: The Upstream Intervention

The relationship between unemployment, poverty, and poor health is among the most robustly evidenced findings in public health research. CFF addresses the upstream determinants of health:

- **Fuel Poverty Elimination:** Affordable, state-owned district heat and electricity end the scandal of households choosing between heating and eating.
- **Employment and Mental Health:** Secure, well-paid employment is the single most effective intervention for anxiety, depression, and substance misuse.
- **Air Quality:** Elimination of gas boilers and fossil-fuel generation in urban areas reduces respiratory disease, particularly in children and the elderly.
- **Water Security:** Desalinated water supplements supply in water-stressed regions, improving public health resilience against drought and infrastructure failure.

The estimated reduction in NHS and social care costs from these upstream improvements is **£3–8 billion per year** at programme maturity — a figure that dwarfs the cost of most dedicated public health interventions.

## 6.3 Economic Regeneration

The economic model shifts fundamentally. Instead of a nation that *imports* energy, *exports* capital, and *recycles* poverty through welfare payments, CFF creates a nation that *produces* its own energy, *retains* its revenues, and *circulates* prosperity through wages.



## 6.4 Social Cohesion and National Purpose

Perhaps the least quantifiable — but most important — effect of CFF is the restoration of **national purpose**. A generation of young people currently sees limited prospects in post-industrial regions. CFF offers visible, tangible evidence that the state is building something real — not managing decline, but constructing a future. The programme creates apprenticeships, engineering careers, operational roles, and research positions across every region of the United Kingdom.

When children can see cranes on the skyline and their parents coming home from well-paid work on a national construction programme, the psychological and social effect is transformative. This is not sentimentality; it is the same dynamic that powered the post-war consensus and the Victorian civic pride that built the infrastructure we still depend on today. And like that Victorian infrastructure, CFF is permanent. It is not a programme with an end date — it is a national asset that will be maintained, renewed, and expanded across centuries, providing energy sovereignty and employment for generations yet unborn.

# Chapter 7

## Implementation Roadmap

---

### 7.1 Legislative Programme (Year 1)

1. **National Energy Sovereignty Act 2027.** Establishes the legal framework for NESC, provides compulsory purchase powers for brownfield sites, and creates the statutory Firm Power Guarantee.
2. **Nuclear Regulatory Fast-Track Order.** Directs ONR to complete the Rolls-Royce SMR Generic Design Assessment on an accelerated timetable, applying the single-design, fleet-approval model.
3. **Consolidated Energy Programme Order.** Redirects funding from fragmented pilot programmes into the CFF delivery vehicle, with transitional provisions for existing contractual commitments.

### 7.2 Institutional Establishment (Years 1–2)

1. Establish the **National Energy Sovereignty Corporation (NESC)** as a statutory body reporting to Parliament, with an independent board, a Chief Executive recruited from major infrastructure delivery, and regional delivery offices in each UK nation.
2. Execute a **Strategic Partnership Agreement** with Rolls-Royce SMR Ltd covering fleet procurement, UK content requirements, factory establishment, and technology transfer.
3. Launch the **CFF National Workforce Programme** in partnership with Further Education colleges, universities, and the Construction Industry Training Board — target: 10,000 apprenticeship starts in Year 2.

### 7.3 Phase 1 Delivery (Years 2–7)

- Site selection, acquisition, and environmental assessment for 4–6 Pathfinder sites.
- Construction commencement on first two sites by Year 3.
- Rolls-Royce SMR factory facility operational, producing modules for fleet deployment.
- First reactor reaches criticality and begins electricity generation by Year 5–7.
- District heating networks commissioned in surrounding communities.
- Electrolysis plant commissioned; first green hydrogen delivered to local industrial users.

### 7.4 Phase 2 Delivery (Years 5–15)

- 8–12 additional sites under construction or operational.
- National hydrogen pipeline backbone connecting major industrial centres.
- Revenue from operational sites funding ongoing construction.

- Fleet learning rate reducing per-unit costs by 15–25%.
- First export of CFF expertise and design to allied nations.

## 7.5 Phase 3: National Coverage (Years 12–30)

- Full national system: 25–40 operational CFF sites across all UK regions.
- Energy import dependency approaches zero.
- System transitions from capital expenditure phase to net revenue generation.
- NESC becomes a significant contributor to Exchequer revenue.
- UK established as a global leader in integrated nuclear-hydrogen energy systems.

## 7.6 Permanent Operation and Renewal (Year 30 onwards — in perpetuity)

- CFF infrastructure operates as permanent national infrastructure — maintained, renewed, and expanded across generations, like the Victorian sewers and railway network before it.
- Individual SMR units replaced or upgraded at end of their 60-year design life; site infrastructure is permanent.
- Sites future-proofed for SMR-to-fusion reactor transition when fusion technology becomes commercially viable.
- Rolling programme legislation provides statutory framework for continuous renewal, expansion, and technological transition.
- The 60-year rolling programme is the build-out and legislative protection horizon — the infrastructure itself is forever.

## 7.7 Key Milestones Summary

| YEAR    | MILESTONE   |
|---------|---|
| 2027    | National Energy Sovereignty Act receives Royal Assent   |
| 2027    | NESC established; Chair and CEO appointed   |
| 2028    | Pathfinder sites designated; workforce programme launches 10,000 apprenticeships                        |
| 2029    | Rolls-Royce SMR GDA completed; construction begins on first two sites                                   |
| 2031–33 | First reactors operational; electricity, heat, hydrogen, water, oxygen, and brine product output begins |
| 2035    | Phase 2 sites under construction; hydrogen pipeline network commissioned                                |
| 2040    | 15+ sites operational; measurable reduction in energy imports   |
| 2045    | National coverage achieved; firm power guarantee fully met  |

| YEAR  | MILESTONE   |
|-------|---|
| 2050  | Net zero target met through integrated CFF system   |
| 2060+ | System in mature perpetual-revenue phase; first-generation SMR unit replacement programme begins                |
| 2080+ | Second-generation units operational; fusion reactor transition assessed; infrastructure continues in perpetuity |

---

# Chapter 8

## Governance, Legislation, and Consultation

---

### 8.1 Governance Structure

The CFF programme requires a governance structure that is robust enough to endure across multiple parliamentary terms, while remaining democratically accountable. The proposed structure draws on the models established for the Bank of England, the BBC, and the NHS:

- **National Energy Sovereignty Corporation (NESC):** A statutory body established by Act of Parliament, independent of day-to-day ministerial direction, with a board appointed for fixed terms and a statutory duty to deliver the CFF programme.
- **Parliamentary Oversight:** NESC reports annually to a dedicated Select Committee. The National Audit Office conducts regular value-for-money assessments.
- **Ministerial Strategic Direction:** The Secretary of State retains power to set strategic direction and approve major programme milestones, but cannot direct individual commercial or operational decisions.
- **Regional Delivery Boards:** Each UK nation and English region has a delivery board ensuring local engagement, workforce development, and community benefit.

### 8.2 Legislative Requirements

The Government intends to introduce the following primary legislation:

1. **National Energy Sovereignty Act 2027** — establishes NESC, confers compulsory purchase powers, creates the Firm Power Guarantee, and provides the framework for state ownership of CFF assets.
2. **Nuclear Regulation (Fleet Licensing) Act 2027** — enables fleet-wide licensing of standardised reactor designs, reducing per-site regulatory timelines from years to months.

### 8.3 Public Consultation

This White Paper opens a **twelve-week public consultation period**. The Government invites responses from:

- Local authorities and devolved administrations
- Industry bodies and energy sector stakeholders
- Trade unions and workforce representatives
- Environmental organisations
- Academic and research institutions

- Members of the public

Consultation responses should address the following questions:

1. Do you support the principle of a state-owned, integrated national energy system?
2. What are your views on the proposed brownfield site selection criteria?
3. How should the Government ensure equitable regional distribution of CFF benefits?
4. What workforce and skills provisions are most important for your sector or region?
5. Are there additional outputs or capabilities that the CFF system should incorporate?

## 8.4 Risk Management

The Government recognises the following principal risks and proposes the following mitigations:

| RISK                      | LIKELIHOOD | MITIGATION   |
|---------------------------|------------|--|
| SMR regulatory delay      | Medium     | Fleet licensing legislation; early engagement with ONR; GDA acceleration               |
| Construction cost overrun | Medium     | Standardised design eliminates bespoke risk; factory build reduces site variability    |
| Political discontinuity   | Medium     | Statutory body with fixed-term board; cross-party support building; self-funding model |
| Supply chain bottleneck   | Low-Medium | 80%+ UK content; early supply chain development; phased deployment                     |
| Public opposition         | Low        | Brownfield siting; community benefit packages; transparent consultation                |

*This White Paper presents firm government proposals based on the Carbon Free Future blueprint by **David Waugh**. It is presented to Parliament for debate and to the public for consultation. The Government believes that the CFF programme represents the most significant opportunity for national renewal since the post-war reconstruction, and invites the country to help shape its delivery.*

Crown Copyright 2026. This publication is licensed under the terms of the Open Government Licence v3.0. To view this licence, visit [www.nationalarchives.gov.uk/doc/open-government-licence/version/3](http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3).

Any enquiries regarding this publication should be sent to the Department for Energy Security and Net Zero.