UK Government

Clean Power 2030: A new era of clean electricity

Technical annex

December 2024

Contents

Introduction

This annex provides an overview of the methodological approach taken to analysis within the Clean Power 2030 Action Plan.

This includes our approach to assessing actions (our 'options assessment'), further detail on the system modelling and investment impacts included in the Action Plan and further background to the definition of Clean Power 2030.

Options assessment

Our options assessment aimed to support policy development in providing a structured framework for considering how far different actions might contribute to the delivery of our 2030 Mission. Given the wide-ranging scope of the Action Plan, the assessment focused on measures expected to have the most significant implications for the future electricity system and is compliant with Green Book standards.

Table 1 sets out the four criteria used to structure the assessment. Whilst these criteria are predominantly focused on pre-2030 impacts, due regard was also given to actions' potential impacts post-2030.

Table 1: Assessment criteria

Criterion	Definition
Decarbonisation	Actions should accelerate power sector decarbonisation by supporting deployment of low carbon (intermittent, firm and flexible) assets at scale, either directly or indirectly, prior to 2030. Assets should have a positive impact on carbon emissions and provide investors and industry with the necessary support, infrastructure and regulatory certainty.
Value for money	The benefits of an action should outweigh its costs. Actions should either reduce or at minimum avoid increasing system costs, particularly consumer costs. Actions should also seek to drive economic growth where possible.
Deliverability	Actions should be deliverable within timeframes such that they can meaningfully contribute to 2030 delivery. Actions should create minimal disruption during implementation (i.e. avoid creating uncertainty for market participants/lengthy transitional periods).
Security of supply	Actions should positively contribute or (at minimum) avoid introducing any risks to security of supply and either minimise our reliance on international energy markets by importing a diverse range of energy sources.

The assessment included two main stages: a longlist stage and a shortlist stage. At the longlist stage, actions were assessed on a pass/fail basis against the criteria in Table 1. DESNZ policy and analytical officials set out the rationale for intervention for each action and performed a light-touch stocktake of available evidence against each criterion. In some areas, where policy development occurred at pace, officials conducted an abbreviated longlist stage. An assessment of 'fail' against any single criterion was sufficient to discount an action.

The remaining actions were progressed to the shortlist stage and were assessed on a 1-5 scale against the criteria (set out in Table 2). This assessment built on the initial pass/fail judgements made at the longlist stage and involved policy and analytical officials across government who initially assessed actions on an individual basis before agreeing a consensus score for each action against each criterion.

The shortlist stage ultimately provided a relative assessment of how potential actions performed against the criteria. A score of '1' against any criterion was sufficient to discount a potential action.

Table 2: Shortlisting assessment scale

Score	Definition
1	The action does not meet the given criterion. There are substantial risks or potential adverse effects.
2	The action does not wholly meet the given criterion. There may be some potential risks.
3	The action may meet the given criterion. If risks exist, they are not substantial.
4	The action is likely to meet the given criterion.
5	There is a high level of confidence that the action meets the given criterion.

The options assessment process was carried out for each policy area included in the Action Plan (planning, networks, supply chains and workforce, short- and long-duration flexibility, renewables, and markets). Each of these areas used the criteria and scoring approaches set out above.

System modelling

We have modelled a credible power sector pathway to reach Clean Power in 2030 using DESNZ's 'Dynamic Dispatch Model' (DDM[1]). This scenario feeds into the DESNZ 'Clean Power Capacity Range' in Table 1 in 'Clean Power 2030: Action Plan'.

The DDM simulates the operation of the electricity generation market and the investment decisions of market participants in response to a given demand profile, power sector policies, and other market conditions. It is a profit-maximisation model and projects total generating capacity, plants built, and the economics of their operations. A model run may typically project 25 years into the future in half-hourly demand segments. For every half-hour it determines which plants will be generating, the amount of greenhouse gas emissions they will produce, the wholesale electricity price, and other econometric metrics.

Investment impacts

We estimate that Clean Power 2030 could require around **£40 billion** of investment on average per year between 2025-2030. This includes around **£30 billion** of investment in generation assets per year, estimated by DESNZ, and around **£10 billion** of investment in electricity transmission network assets per year, estimated by NESO[2]. These estimates are in 2024 prices, undiscounted, and rounded to the nearest 10 billion. Figures include imports where inputs are purchased from overseas.

Investment in generation assets were estimated based on an internal illustrative clan power scenario. This includes capital expenditure (CAPEX) – pre-development, construction, and infrastructure costs – but excludes financing and operating costs (OPEX). This estimate is based on one possible Clean Power 2030 scenario, and may differ across scenarios. However, NESO also estimate around £30 billion of investment in generation assets on average per year between 2025-2030 , based on the NESO 'Further Flex and Renewables' and 'New Dispatch' scenarios set out in Table 1 in the Clean Power 2030 Action Plan. This suggests investment could be broadly similar across scenarios.

We have not developed our own estimate of investment in transmission network assets. However, NESO estimate that the transmission network could require around £10 billion of investment on average per year between 2025-2030 under their 'Further Flex and Renewables' and 'New Dispatch' scenarios.[4] Given similarity between NESO and DESNZ scenarios, we added the NESO network investment estimate to our estimated investment in

[1] Department of Energy and Climate Change (DECC) (2012), 'Dynamic Dispatch Model (DDM) - May 2012' (viewed in December 2024).
[2] National Energy System Operator (NESO) (2024), 'Clean Power 2030' (viewed in December 2024), £60 billion over 6 years between 2025-2030.
[3] NESO (2024), 'Clean Power 2030' (viewed in December 2024), Figure 19: Average annual investment system costs in clean power pathways 2025-2030.
[4] NESO (2024), 'Clean Power 2030', Figure 19: Average annual investment system costs in clean power pathways 2025-2030.

generation assets to arrive at total of around £40 billion on average per year between 2025-2030. We do not expect distribution network investment to the same scale before 2030.

Definition of Clean Power 2030

Setting a target of clean sources producing at least 95% of Great Britain's generation means that by 2030 we expect 5% of generation to come from unabated gas. Generation from energy from waste (EfW) and combined heat and power (CHP) (except CHP major power producers (MPPs) are primarily solutions for waste management and industrial use and therefore do not neatly fit into distinct categories due to how they operate.

Unabated gas generation is by definition high carbon, but when paired with CHP technology it presents the most energy efficient way of meeting industrial, commercial or public sector needs in certain cases. Evidence on how emissions lowering gas CHP can be is relative to the electricity grid and something under review which could impact how we define some elements of gas CHP generation for the CP target, namely Biomass Combined Heat and Power. We are removing gas CHP generation (except gas CHP MPPs) from our calculation of the three metrics because these are not primarily power sector solutions and the emissions are accounted for in the industry effort share under carbon budgets. CHP from major power producers will be included in the clean power definition, as these are already included in the unabated gas element of our analysis.

Energy for Waste (EfW) is primarily a waste management solution and will not be included in our definition of the power sector for the purposes of Clean Power 2030. As EfW is a by-product of the waste management process, we are excluding all forms of EfW, including EfW Combined Heat and Power (CHP) and EfW with Carbon Capture Utilisation and Storage (CCUS) from our Clean Power calculations.

EfW safely treats residual wastes, i.e. those that cannot be prevented, prepared for reuse, or recycled, and that would otherwise go to landfill or be incinerated without energy recovery. EfW has an important role in minimising emissions from the waste management system, in accordance with the Waste Hierarchy, by diverting residual waste from landfill. It is not primarily a method for energy generation. Rather, electricity is a by-product to maximise the value of the necessary sanitary function. This electricity is projected to account for ~3% of total generation in 2030[5].

A significant fraction of the residual waste incinerated is fossil-based, particularly plastics. These fossil-based materials produce significant CO2 emissions when burned. We are not treating EfW as low carbon because of these significant CO2 emissions.

We regard EfW as a 'must-run' form of electricity generation, because of its current necessity as a waste management solution. We define the scope for clean power to exclude this must-run generation, to focus on minimising reliance on other fossil-based power generation without interfering with the waste management system.

[5] DESNZ (2024), Estimated using internal DESNZ modelling

Energy from Waste facilities play an important role in destroying Persistent Organic Pollutants (POPs) that are present in municipal and other wastes and their role is likely to increase over time. While Persistent Organic Pollutants can be present in mixed municipal waste, some waste incinerators also accept segregated Persistent Organic Pollutants waste streams, such as waste upholstered domestic seating (WUDS) and plastic from waste electrical and electronic equipment (WEEE). However, arisings of waste containing Persistent Organic Pollutants are likely to increase as waste producers and regulators identify more wastes containing Persistent Organic Pollutants.

Whilst treating residual waste in EfW plants results in better overall environmental outcomes, relative to the alternative of landfilling waste, we still acknowledge that waste incineration will account for an increasing share of power sector residual emissions by 2030 as we undergo power sector decarbonisation.

Over time, emissions from EfW will need to be reduced. Government has set out longer term solution to address these emissions through policy levers such as expanding the scope of the UK ETS to cover the fossil carbon emissions from waste incineration and EfW, in addition to supporting EfW CCUS projects through the Waste Industrial Carbon Capture Business Model.

Additionally, we acknowledge that when EfW is paired with Combined Heat and Power (CHP) technology, this provides an efficient means of generating energy requirements on site, in a variety of industrial, commercial, or public sector settings. CHP is the simultaneous generation of heat and power from the same fuel source. By cogenerating heat and power from the same fuel, CHP can achieve fuel efficiencies of up to 30% relative to the separate generation of heat from a boiler and electricity from a power station via the national grid[6]. This increased efficiency leads to reduced emissions.

We are also taking action to ensure that less residual waste is being generated in the first instance, which will reduce our reliance on EfW. There is a statutory target which seeks to ensure that the total mass of residual waste (excluding major mineral wastes) does not exceed 287 kg per person for 2042[7]. This is approximately equivalent to a 50% reduction from 2019 levels. The government is committed to delivering on our packaging reforms and transitioning to a circular economy, which will support economic growth, deliver green jobs, promote efficient and productive use of resources, minimise negative environmental impacts, and help us accelerate to Net Zero.

[6] Department for Business, Energy & Industrial Strategy (BEIS) (2020), 'Combined heat and power' (viewed in December 2024).
[7] Defra (2023), 'The Environmental Targets (Residual Waste) (England) Regulations 2023' (viewed December 2024).

This publication is available from: www.gov.uk/desnz

If you need a version of this document in a more accessible format, please email alt.formats@energysecurity.gov.uk. Please tell us what format you need. It will help us if you say what assistive technology you use.