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A Vision For Scotland's Future Energy Mix

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Introduction

Scotland has a wealth of skills and natural resources from which to develop a clean, sustainable and prosperous energy future. Scotland's future energy mix will be born out of a pragmatic combination of the historical choices made by the UK Government, Scotland's future opportunities (in particular in the field of renewables), and the synergies with neighbouring countries energy systems.

This paper, produced by Energy Scotland, gives a vision for what Scotland's energy mix – focused on electricity – may look like in 2045.

Vision

Our vision for the energy mix in 2045 is that electricity will be the dominant source of energy for use by business and domestic consumers. Electricity from wind will be by far the largest source of power over a year. However, a wider diversity of sources than is currently deployed will provide back-up "firm" and flexible power to secure national supply. Excess electricity from periods of high wind will be used to store electricity and heat for low wind periods, and to produce hydrogen. Local government entities will own enough generation plant to ensure prices are stable and will reinvest profits in local communities. Community / local authority ownership of energy will become a greater percentage of the total generation capacity.

A regulated market will ensure the price of electricity to the consumer is close to the cost of generating electricity in Scotland, and not dictated by more expensive market prices elsewhere. Excess power will be exported to England and international markets via interconnectors to increase revenues and provide CO_2 savings to others. The use of oil and gas from the North Sea will be reduced progressively through a managed "just transition" period, avoiding the need to import oil and gas from other countries.

Scotland will become the main CO_2 storage hub for Europe, via an international network of gas pipelines into depleted North Sea oil wells.

Nuclear Power

We expect that England and other European countries with limited renewable energy resources and high demand will build new nuclear power plants, to provide large volumes of firm power that are low CO_2 and in the long run reduce reliance on ageing Combined Cycle Gas Turbine (CCGT) fleets. To make their nuclear program more economic, England will build to a standard design based on Hinkley Point C. Should small modular reactors (SMRs) quickly become a realistic prospect then they may become the preferred solution and replace these bigger projects prior to development, but at the moment there is no such thing as a commercially viable SMR.

Scotland will not be part of this nuclear expansion for obvious reasons. Remaining interconnected with England, Scotland will benefit from the grid stability provided by the much larger England and Wales network and they will also be an important customer for the sale of our excess renewable electricity.

Renewable Energy

Scotland has an abundance of renewable energy that in 2025 already supplies in excess of 100% of the countries electricity demand over a year. UK Government projections are that this will grow a further 2 to 3 times, enough to fully utilise planned interconnectors and provide significant levels of power to England, Wales and Northern Ireland, and on to Europe.

Scotland will use excess electricity in a hierarchy of consumption, to maximise value to the country as follows:

- Supply domestic and industrial electricity demand;
- Supply electricity for heat and heat storage;
- Supply electricity for hydrogen generation.

Only once these primary objectives have been met, will hydrogen and electricity then be made available for export.

Scotland's strategic imperative is to create GDP growth and high-quality manufacturing and operational jobs from its energy choices. It will be sceptical about projects such as more wind, solar and batteries, which are currently almost exclusively imported products, unless there is a compelling GDP or system benefit to Scotland. It will use the current devolved planning powers to achieve this in the short term.

Due to the intermittency of wind and the closure of Torness nuclear power station in circa 2030, the Scottish government will build a strategically-located CCGT to provide back-up power and to ensure security of supply, thus ensuring that Scotland's electricity prices remain decoupled from the English market. It is not envisaged that this CCGT will have Carbon Capture, Utilisation and Storage (CCUS) as the plant will run peak / low wind periods only, so CO_2 emissions will be relatively low. Investment in hydro pumped storage generation, limited battery projects and load management will also help smooth the peaks of supply and demand.

Oil and Gas

Scotland will continue to develop oil and gas, but in a transitional manner to achieve the wider climate objective, thus avoiding the need to import oil and gas from abroad, which would simply result in off-shoring of emissions, lost jobs, skills, GDP and energy security.

Carbon Capture Utilisation and Storage (CCUS)

Scotland has a significant opportunity with CCUS, should the technology develop into a viable option for use in industry and transport. Scotland's excess wind will be converted into some hydrogen but additional blue hydrogen will also be generated from North Sea methane. The by-product of the process (CO_2, which is stripped from the chemical processing) will then be re-injected into depleted oil wells. The Scottish North Sea sector is the best place in Europe for this storage due to its favourable geology and the availability of already-depleted oil wells. It is not envisaged that blue hydrogen will be widely used to generate electricity due to the inefficiency of conversion (circa 10% to

20%). Export of hydrogen, based on the hierarchy above will be provided to the wider European market. The Scottish Government need to ensure that blue hydrogen life cycle emissions are low, avoiding methane leakage during production.

Timeline

A table showing the timeline of expected changes to the electricity mix in Scotland is shown below.

Year	Build	Decommission	Security of supply	Ownership
2025	Ongoing build-out of wind, solar, batteries	-	Batteries	Prioritise GDP-adding projects. Community and Local Authority ownership enabled. Run-off of ROCs (2022 to 37)
2030	CCGT, Tidal District heating/ heat pumps. Large Pumped Storage.	Torness Oil and Gas transition.	DSR Grid stability – synch condensers, flywheels, reactors, capacitors	Incremental prioritisation of local ownership
2035	Generate and export hydrogen	-	Large Pumped storage. CCGT.	Run-off of CFDs (from 2036)
2040 to 2045	CCUS	-	-	Run-off of CfDs