NIA response to the Department of Transport's inquiry on Amending the Renewable Transport Fuels Obligation (RTFO) to increase carbon savings on land, air and at sea

The Nuclear Industry Association (NIA) welcomes the chance to respond to the Department of Transport's inquiry on Amending the Renewable Transport Fuels Obligation (RTFO) to increase carbon savings on land, air, and at sea.

The NIA is the trade association and representative body for the civil nuclear industry in the UK. We represent more than 200 companies operating across all aspects of the nuclear fuel cycle. This includes the current and prospective operators of nuclear power stations, the international designers and vendors of nuclear power stations, and those engaged in decommissioning, waste management and nuclear liabilities management.

Our members may choose to make their own detailed submissions. The focus of this submission is therefore on high-level, industry-wide matters.

Executive summary of recommendations

1. Remove anomaly in which nuclear-hydrogen is not eligible for RTFO support
2. Collaboratively work with industry to establish parameters of nuclear-hydrogen inclusion in RTFO
3. Meet with the nuclear industry and establish regular dialogue

The potential of nuclear-hydrogen

Today, the UK depends on fossil fuels for more than three-quarters of its energy. Over the next thirty years, we must transition to a net zero economy. The challenge is immense. The Climate Change Committee has estimated that we need to generate four times as much clean power by 2050, as well as 225 TWh of low-carbon hydrogen to complete our decarbonisation. Faced with this task, we will need to deploy every low-carbon technology at our disposal to produce clean hydrogen, especially "green hydrogen" from zero-carbon sources. Nuclear, as a proven zero carbon generator, should be a key part of the clean hydrogen mix.

Our ambition is for nuclear to produce 75 TWh of hydrogen by 2050, approximately one-third of the total requirement, which equates to 12-13 GW of dedicated nuclear capacity. This vision is predicated on the successful establishment of a nuclear financing mechanism to deliver extra capacity, and we are encouraged that the Government is actively considering several options to reduce the cost of capital.

The UK nuclear industry already has existing supply chain capability that can help facilitate the development of these hydrogen capabilities in the UK, including nuclear research facilities which have transferable skills that could be used for hydrogen chemistry and materials research.

Nuclear-hydrogen production would support the Government's ambition to 'level-up' regions of the UK facing economic challenges. In the UK alone, the development of a hydrogen market could contribute up to £18 billion in Gross Value Added (GVA) annually and as stated in the *Ten Point Plan*, could add 100,000 jobs to the economy. The nuclear industry currently directly supports 60,000 jobs across the UK, disproportionately outside London and the South East.

Hydrogen production using nuclear power would add tens of thousands of high-skilled, well-paid jobs to this total. The South West of England is already home to many leading companies that are developing hydrogen solutions, while the North West Nuclear Arc, a cluster which spans the North West of England and North Wales, has great potential for integrating hydrogen and nuclear.

Work is already being done to develop nuclear-hydrogen which the Government should support:

Nuclear-hydrogen case studies	
Hydrogen to Heysham	**Sizewell C**
EDF Energy's Hydrogen to Heysham (H2H) project examined the feasibility of producing hydrogen by electrolysis using electricity directly	Sizewell C has the potential to make huge quantities of green hydrogen, using both electricity and heat, and to help the East of

from Heysham nuclear power station, for a range of potential local applications. The feasibility study involved the development of a concept design for a 2MW electrolyser system—1MW each from a PEM and an Alkaline electrolyser—and was done in collaboration with EDF Hynamics, Lancaster University, EIFER and Atkins. The H2H project, if realised, is calculated to have a carbon footprint of 24 gCO_2/kWh H_2, compared to 509 gCO_2/kWh H_2 for an equivalent grid-connected project—a significant difference in the level of carbon emissions. The project also assessed the use of the by-product oxygen, for onsite use at the Heysham power stations or further applications. The study confirmed the technical feasibility of the production of hydrogen, coupled with nuclear generation for future nuclear new builds and that it met the relevant nuclear safety and industrial regulatory requirements, including health and safety and air quality. The project did not progress to demonstrator phase due to challenges in developing a successful business model without any support or incentives for end users to consume the green hydrogen produced.	England take a lead in the new hydrogen economy. Heat assisted green hydrogen is projected to be more efficient (by around 10%) than hydrogen produced from electricity only. To decarbonise construction at Sizewell C, the new nuclear project in Suffolk is looking to develop a demonstration electrolyser of around 2MW and around the size of a shipping container, capable of producing up to 800kg of hydrogen per day. This low-carbon hydrogen could be used in buses transporting construction workers to and from site, and to provide cleaner shipping at nearby ports, as well as providing clean heat and power to manufacturing around the facility. In the longer term a permanent larger facility supplied with low-carbon heat and power by Sizewell C could produce hydrogen at scale. In November 2020, Sizewell C issued an Expression of Interest (EoI) seeking partners to develop its hydrogen demonstrator project, which may be powered by Sizewell B. Current steps also include an Innovate UK funded study on transitioning from a diesel to a hydrogen fleet of vehicles at Sizewell. East Suffolk Council is also involved in the study.
Advanced Modular Reactors Advanced Modular Reactors (AMRs) are an increasingly popular choice for decarbonisation globally, with development programmes in some of the world's largest economies, such as Canada, the US, China, France and the UK. Their small size and associated lower costs, modularity and flexibility are seen as advantageous to not only producing electricity, but also for process heat and hydrogen. One of the key benefits to AMRs is that location is not a significantly limiting factor, which is a constraint for large scale nuclear and renewables. A report from Lucid Catalyst found that using AMRs to transition to a hydrogen economy could be achieved through an investment of $17 trillion globally over 30 years, compared to the $25 trillion needed to maintain fossil fuels over the same period. The UK Government has already taken steps to enable the development of AMRs in electricity generation by committing up to £385 million for the Advanced Nuclear Fund in the Government's 2020 Energy White Paper, which may include the development of a demonstrator AMR for hydrogen production. Such demonstrators are targeted to be deployed in the early 2030s	

Nuclear's inclusion in RTFO scheme

The anomaly in which nuclear-produced hydrogen, unlike renewable-powered hydrogen, does not qualify for RTFO support should be removed as soon as possible, and the Department for Transport should work with the nuclear industry in establishing eligibility parameters for how nuclear-hydrogen can be included in the scheme.

We will need to deploy every low-carbon technology at our disposal to produce clean hydrogen, especially "green hydrogen" from zero-carbon sources. Nuclear, as a proven zero-carbon generator, should be a key part of the clean hydrogen mix:

- Current nuclear reactors and those under construction today could power cold-water electrolysis, producing emissions-free hydrogen at normal temperatures. Modular reactor technologies will also be able to power this process to produce green hydrogen.
- Low carbon heat from new nuclear reactors could power steam electrolysis, which is more efficient in producing hydrogen.

- Advanced modular reactors under development operating between 600-900°C could split water into hydrogen and oxygen without electricity, as envisaged in the Prime Minister’s Ten Point Plan.

All of these processes would produce emissions-free hydrogen. Combined with the extremely low lifecycle carbon footprint of nuclear power, these options would form an invaluable part of a robust, clean hydrogen mix.

Nuclear’s potential for cogeneration, producing electricity and useful heat together, opens further possibilities for a resilient, decarbonised system. For example, when there is surplus renewable generation, using cogeneration could divert nuclear output to hydrogen production.

One of the advantages of nuclear energy is that it provides firm power, which means a consistent supply of low-carbon hydrogen that can be used for fuelling transport. Renewables are intermittent and given the expected scale of decarbonisation required in the transport sector, they cannot do it all, Nuclear-hydrogen can complement renewables in the production of low-carbon hydrogen.

Modular reactors capable of cogeneration or dedicated to hydrogen could be built on brownfield sites, such as old fossil fuel plants and decommissioned nuclear plants, such as Trawsfynydd in Wales, that are already connected to existing energy infrastructure, and are therefore suitable of serving less well-connected rural towns and communities.

Nuclear-hydrogen should also become eligible for RTFO support to ensure consistency with other Government policy. Hydrogen produced by nuclear technologies is set to feature prominently in the Government’s upcoming Hydrogen Strategy, and with provisions already being made for CCS, biomass and renewable products to be included in the RTFO scheme, excluding nuclear is an obvious irregularity and one that would undermine the Government’s Net Zero ambitions.

Recommendations

The NIA therefore recommends the following:

1. Remove anomaly in which nuclear-hydrogen is not eligible for RTFO support
2. Collaboratively work with industry to establish parameters of nuclear-hydrogen inclusion in RTFO
3. Meet with the nuclear industry and establish regular dialogue