5. Net Zero Risk Register

The risks detailed here reflect our main findings from the Engineering Net Zero assessment and can be used as a basis for further discussions on successfully delivering Net Zero (H – High, M – Medium).

Risk	Level	Description	Consequence	Mitigation
1.	H	**CCS commercial structure/policy** Challenges exist around the structuring of project finance, security of revenue streams, transport infrastructure and final storage liability. Project structure is critical to raise finance. To date there is no precedent, each cluster may have different participants so a single structure will not suit all. Projects depending on use of existing offshore oil and gas assets must evaluate the condition and serviceability of the assets. Contractors will be reluctant to accept long-term liability for the performance of such assets. Failure to structure projects will result in greatly reduced CCS capacity.	The Net Zero scenario is dependent on rapid development of CCS. Failure to develop CCS makes the Net Zero scenario non-viable. 28% of power generation and 84% of hydrogen production will have to be substituted with alternatives. CCS-dependent industries with no alternative will not be able to operate; balancing CO_2 removal from the atmosphere will be needed.	Government should assume both the commercial transport risk and long-term storage liability. Reconfigure CCS strategy to focus only on CO_2 generators who have no other option.
2.	H	**CCS deployment** Total installed CCS capacity in UK today is zero. Up to 176MtCO_2 per annum may be required for Net Zero – the deployment rate required to meet this target is hugely challenging.	The Net Zero scenario is dependent on rapid development of CCS. Failure to develop CCS makes the Net Zero scenario non-viable. 28% of power generation, 84% of hydrogen production is impacted. CCS-dependent industries will not be able to operate or will have to compensate.	Expedite CCS demonstrator project(s). Reconfigure CCS strategy to focus only on CO_2 generators who have no other option.
3.	H	**Hydrogen production and distribution technical risks** The rate of deployment of hydrogen production plants is challenging. This is compounded by the cost, logistics and phasing of the extensive work needed on the distribution network (both national and local), as well as the dependency on CCS with its associated risks.	Hydrogen is an important element to various aspects of decarbonisation in Net Zero: domestic heat, industry, shipping, surface transportation. If hydrogen is not successfully deployed, the demand on electricity will increase which will require additional capacity to be installed.	Expedite current hydrogen research and proposed full-scale community demonstration projects. Assess alternative (non-CCS dependent) hydrogen production methods and support development of most promising candidates.

4.	H	**Decarbonisation of domestic heating – adoption risk through scale and pricing** Net Zero requires around 19 million heat pumps to be installed in homes (1/4 installed as hybrid heat pump systems). The rate of deployment is substantial, and there are likely barriers to adoption due to the high cost of purchase and installation.	A slower uptake and rate of installation of heat pumps will challenge the ability to decarbonise domestic heating.	Greatly increase electrification of heating (and system generating capacity). Review of Government subsidy scheme (Domestic Renewable Heat Incentive) to support home owners' transition costs.
5.	H	**Renewable Energy Sources: System Costs Associated with High Intermittent Penetration** The costs associated with system balancing at high renewables penetration are uncertain. Net Zero estimates £20/MWh at 50% penetration, rising steeply as penetration increases.	Modelling to optimise the Net Zero system without a full understanding of these costs may result in a sub-optimal system with long-term cost impacts to the consumer.	Develop further exhaustive modelling, with extensive independent peer review to evaluate the robustness of modelling and the sensitivity of results to variable input assumptions.
6.	H	**System Integration: lack of overall Engineering System Architect and/or Programme Delivery Office** Net Zero by 2050 is now enshrined in law and will be one of the most complex political, scientific and engineering challenges of our generation. Accountability for Net Zero system coordination and delivery is therefore needed.	Without an Energy System Architect (ESA) and a strategic framework, there is a significant risk that short-to-medium term decisions will compromise delivery. Net Zero will either not be delivered or will result in a sub-optimal system with long-term economic impacts.	Create an ESA organisation that is both empowered to direct Government support and independent of any one Government department.
7.	H	**Nuclear: major capital programme construction risk** Nuclear projects are complex capital programmes where return on investments can be impacted through construction overruns, with potential for construction cost increases.	If the risk around construction cost overruns cannot be managed, there is a potential that large-scale nuclear will continue to be un-investable and will not form a necessary part of the Net Zero system.	Continue to develop alternative financial models (e.g. RAB) which could support this element for investors. Leverage the benefits of a construction learning curve from technology repetition.

8.	M	**Offshore wind: pricing risk** The latest CfD auction strike prices for offshore wind are not yet proven viable, as projects are not due to come online until the mid-2020s. Separately, offshore wind programmes are likely to need to exploit conditions where only floating turbines are an option in the future. The learning curve for floating offshore wind may require the strike price to increase.	Strategy of very high offshore wind generation based on continuing low generating costs and not fully recognising the system integration costs could lead to sub-optimal generation mix if OSW prices rise. Could also impair development of alternatives. Thus increasing system vulnerability.	Ensure OSW is assessed on a whole system cost basis. Closely monitor OSW load factors and global OSW supply chain pricing as floating technology is deployed. Ensure that firm power alternatives (nuclear and CCGT with CCS) are developed in sufficient quantity to be viable.
9.	M	**Nuclear: pricing and affordability risk**	Nuclear deployment is reduced to minimum and UK nuclear capability declines to non-viable levels such that the option of nuclear is effectively abandoned	Develop a fit for purpose financial model (possibly RAB) that will facilitate the continued deployment of large scale nuclear. Pursue advanced nuclear SMR with clear objectives.