Subsidy Advice Unit Report on the Coated Particle Fuel Demonstration Programme Subsidy to National Nuclear Laboratory

Referred by the Department for Energy Security and Net Zero

Subsidy Advice Unit

Part of the Competition and Markets Authority

Contents

1. Introduction

1.1 This report is an evaluation prepared by the Subsidy Advice Unit (SAU), part of the Competition and Markets Authority, under section 59 of the Subsidy Control Act 2022 (the Act).[1] The SAU has evaluated the Department for Energy Security and Net Zero's (DESNZ) assessment of the compliance of the Coated Particle Fuel (CPF) Demonstration Programme subsidy with the requirements of Chapters 1 and 2 of Part 2 of the Act (the Assessment).[2]

1.2 This evaluation is based on the information provided to the SAU by DESNZ in its Assessment and evidence submitted relevant to that Assessment. The CMA has also received and reviewed a third party submission from an industry participant.

1.3 This report is provided as non-binding advice to DESNZ. The purpose of the SAU's report is not to make a recommendation on whether the subsidy should be given, or directly assess whether it complies with the subsidy control requirements. DESNZ is ultimately responsible for granting the subsidy, based on its own assessment, having the benefit of the SAU's evaluation.

1.4 The SAU's approach to the evaluation report is commensurate with the circumstances of the subsidy referred. A summary of our evaluation is set out at section 2 of this report.

The referred subsidy

1.5 DESNZ is funding the acceleration of domestic CPF TRI-structural ISOtropic (TRISO) technology[3], through a direct award to the National Nuclear Laboratory Ltd (NNL).

1.6 NNL is the operating subsidiary of NNL Holdings Limited, which in turn is owned by UK Government[4]. NNL's sponsoring department is DESNZ. NNL is a private limited company which engages in public work on behalf of government and industry as well as undertaking commercial activities.

1.7 The referred subsidy will be a research and development (R&D) subsidy to support the development and demonstration of a sovereign manufacturing capability. The programme will award up to £21.5 million of UK Government funding to the

[1] The report is published pursuant to section 53 of the Act.

[2] Chapter 1 of Part 2 of the Act requires a public authority to consider the subsidy control principles and energy and environment principles before deciding to give a subsidy. The public authority must not award the subsidy unless it is of the view that it is consistent with those principles. Chapter 2 of Part 2 of the Act requires a public authority to ensure that a prohibited subsidy is not awarded, and that the requirements in relation to the giving of certain other subsidies are satisfied.

[3] TRISO is a type of Coated Particle Fuel, which are structurally more resistant to neutron irradiation, corrosion, oxidation and high temperatures. This makes it a suitable fuel for advanced nuclear reactors.

[4] via UK Government Investments

beneficiary (NNL) to deliver this programme by March 2025, complementary to the Advanced Modular Reactor Research, Development & Demonstration (AMR RD&D) Phase B Reactor work.[5] The programme will build upon previous HMG investments to improve energy security for the UK and invest within the UK nuclear sector.

SAU referral process

1.8 On 26 April 2023, DESNZ referred the CPF subsidy to the SAU under section 52(1)(a) of the Act. The SAU notified DESNZ on 3 May 2023 that the SAU would prepare and publish a report within 30 working days, on or before 15 June 2023.[6] The SAU published details of the referral on 4 May 2023.[7]

1.9 DESNZ explained[8] that the CPF subsidy is a 'subsidy of particular interest'.[9] In particular, the estimated funds going to the primary beneficiary in the CPF programme, NNL, are expected to exceed £10 million within the applicable period. DESNZ confirmed that the research, development and innovation streamlined route is not applicable to this subsidy.[10]

[5] Advanced Modular Reactor (AMR) Research, Development and Demonstration Programme: Phase B competition - GOV.UK (www.gov.uk)

[6] Sections 53(1) and 53(2) of the Act.

[7] Referral of National Nuclear Laboratory Ltd subsidy by the Department for Energy Security and Net Zero

[8] In the information provided under section 52(2) of the Act.

[9] Within the meaning of regulation 3 of the Subsidy Control (Subsidies and Schemes of Interest or Particular Interest) Regulations 2022

[10] Subsidy Control Act 2022: Streamlined Routes.

2. Summary of the SAU's evaluation

2.1 The Assessment is drafted in line with the four-step process described in the *Statutory Guidance for the United Kingdom Subsidy Control Regime* (Statutory Guidance)[11] and as reflected in the SAU's *Guidance on the operation of the subsidy control functions of the Subsidy Advice Unit* (the SAU Guidance).[12]

2.2 We found that DESNZ has engaged with each of the subsidy control principles outlined in the Act (the Principles) and has undertaken an assessment broadly commensurate with the potential negative effect of the subsidy, considering the market involved and the policy objective.

2.3 Taken overall, the Assessment clearly defined the policy objective and provided clear evidence of the existence of a market failure. Nevertheless, we found that generally the Assessment would be strengthened by providing further reasoning and evidence to support its conclusion, as well as by more closely following Statutory Guidance. In particular we have found that in relation to Principle F:

a) the Assessment would be strengthened by further setting out the reasoning and supporting evidence as to why NNL was determined to be the only credible beneficiary;

b) the assessment of the subsidy's impacts on competition and investment would have been strengthened with a more forward-looking assessment of potential positive and negative effects as well as from a fuller consideration of Statutory Guidance.

2.4 Our report is advisory only and does not directly assess whether the CPF subsidy complies with the subsidy control requirements, nor is its purpose to make a recommendation on whether the subsidy should continue to be implemented.

2.5 This report does not contain advice about how the proposed subsidy may be modified to ensure compliance with the subsidy control requirements.[13]

[11] Statutory Guidance for the United Kingdom Subsidy Control Regime.

[12] Guidance on the operation of the subsidy control functions of the Subsidy Advice Unit

[13] Section 59(3)(b) of the Act.

3. The SAU's Evaluation

3.1 This section sets out our evaluation of the Assessment following the four-step framework used by DESNZ.

Step 1: Identifying the policy objective, ensuring it addresses a market failure or equity concern, and determining whether a subsidy is the right tool to use

3.2 The first step involves an evaluation of the Assessment against Principles A and E.[14]

(a) Principle A: Subsidies should pursue a specific policy objective in order to (a) remedy an identified market failure or (b) address an equity rationale (such as local or regional disadvantage, social difficulties or distributional concerns); and

(b) Principle E: Subsidies should be an appropriate policy instrument for achieving their specific policy objective and that objective cannot be achieved through other, less distortive, means.

Policy objectives

3.3 Statutory Guidance sets out that public authorities may only give subsidies to pursue a specific policy objective. The objective must be one which remedies a market failure or addresses an equity concern.[15]

3.4 The Assessment identifies that the specific policy objective is to undertake the necessary R&D required to develop a UK CPF called TRISO, using uranium in the form of uranium dioxide, UO_2 to a prototype level. It later describes the 'desired outcomes' from the subsidy as:

a) Development of CPF technology to a prototype level that is available for irradiation testing by April 2025.

b) Development of UK skills and regulatory capability through this programme, to allow advanced fuel technologies to be deployed in the UK and to allow CPF fuel qualification (such as thermal and physical properties testing) to begin by 2025.

c) Creation of UK owned know-how and capability that will position the UK to take advantage of any emerging fuel export opportunities.

[14]Further information about the Principles A and E can be found in the Statutory Guidance (paragraphs 3.18 to 3.42) and the SAU Guidance (paragraphs 4.7 to 4.11).

[15] Statutory Guidance, paragraph 3.18.

d) Build on the evidence base for further work on the CPF Demonstration Programme through generation of cost and schedule estimates as well as anticipated Technology Readiness Level (TRL) advancements.

3.5 The SAU held a clarification call with DESNZ on 23 May 2023. DESNZ clarified that whilst the UK has previously had CPF pilot scale production capabilities in the late 1950's, the capability is long lost and no nation currently makes CPF at industrial scale (except potentially China) but a number of private US entities, backed by US DOE are developing industrial scale plants.

3.6 The policy objective of the CPF programme is to accelerate the development of domestic skillset(s), commercialisation capacity and relevant UK regulatory capability alongside the development of a more resilient fuel supply for the UK. This has the potential to aid fuel developments/advancements in parallel to new reactor design and development to overcome a co-ordination market failure (see paragraph 3.9).

3.7 We consider that the Assessment has described the specific policy objective and its relationship to the broader UK strategic priorities clearly.

Market failure

3.8 The Statutory Guidance sets out that market failure occurs where market forces alone do not produce an efficient outcome. The most common cases of market failure which are relevant to subsidy control occur when at least one of the following features is present: the existence of externalities; the involvement of public goods; or imperfect or asymmetric information[16].

3.9 The Assessment describes the focus of intervention as undertaking the necessary experimental R&D to enable the establishment of a domestic CPF capacity and introduces market failure arguments which are described in terms of imperfect information and co-ordination failures.

3.10 The Assessment states that imperfect information results from ambiguity regarding the size of the future market and demand with uncertainty on the timescale for return on investment, alongside high capital costs of entry, meaning private organisations are unwilling to invest independently and, in particular, are unwilling to invest in developing UK CPF capabilities. Co-ordination failures are described as resulting from a 'chicken and egg' coordination issue between reactor and fuel developers given their design and operational interdependency, whose TRL pathways to commercialisation occur over similar periods.

3.11 DESNZ's Assessment also states that the design and development of advanced reactors requires a degree of certainty on fuel source and typology, but investment

[16] Statutory Guidance, paragraph 3.21.

in potential advanced CPF requires a degree of certainty as to future demand. The subsidy therefore aims to facilitate the development of reactor and fuel capacity to occur in parallel to effectively address the coordination market failure.

3.12 Overall, in relation to Principle A, the Assessment provides clear evidence of a specific policy objective to overcome a market failure.

Appropriateness

3.13 The Statutory Guidance sets out that, once the policy objective has been identified, public authorities must determine whether a subsidy is the best means for achieving the policy objectives. As part of this, there should be consideration of other ways of addressing the market failure or equity issue.[17]

3.14 DESNZ states in its Assessment that alternative options to address the market failures were considered during the development of the programme and associated business case. A standalone subsidy was assessed as being the only effective intervention in this case because there is currently no CPF capability in the UK beyond laboratory scale in the national laboratory funded by the Advanced Fuel Cycle Programme (AFCP),[18] and there are currently no CPF customers in the UK. The Assessment describes that 'less invasive interventions' (eg tax rebates) were considered but were found to be impractical as there was no commercial market for them to target. The Assessment considers whether alternative options could be appropriate instruments for addressing the identified policy objective, including loans and/or regulatory measures. It concludes that a standalone cash grant supported by match funding would be the most effective instrument to meet the policy objective. It explains that loans or regulatory measures would be unlikely to enable additional commercial finance to be secured.

3.15 Overall, the Assessment against Principle E was quite high level with limited evidence provided as to why alternatives would be ineffective. The Assessment would be strengthened by providing additional evidence to support its reasoning here.

Step 2: Ensuring that the subsidy is designed to create the right incentives for the beneficiary and bring about a change

3.16 The second step involves an evaluation of the assessment against subsidy control principles C and D.[19]

[17] Statutory Guidance, paragraphs 3.40-3.41.

[18] AFCP – Advanced Fuel Cycle Programme – Advancing fuel cycle innovation to secure a Net Zero future (nnl.co.uk).

[19] Further information about Principles C and D can be found in the Statutory Guidance (paragraphs 3.43 to 3.57) and the SAU Guidance (paragraphs 4.12 to 4.14). without the subsidy.

(a) Principle C: First, subsidies should be designed to bring about a change of economic behaviour of the beneficiary. Second, that change, in relation to a subsidy, should be conducive to achieving its specific policy objective, and something that would not happen without the subsidy; and

(b) Principle D: Costs that would be funded anyway: Subsidies should not normally compensate for the costs the beneficiary would have funded in the absence of any subsidy.

Counterfactual assessment

3.17 The Statutory Guidance explains that, in assessing the counterfactual, public authorities should consider what would happen in the absence of the subsidy, the 'do nothing' scenario. This is the baseline against which public authorities should assess the change in behaviour.[20]

3.18 The Assessment describes a counterfactual whereby development of the AFCP would not continue to the design maturity stage and there would be a reduction in CPF capabilities, know-how and skills in the United Kingdom.

3.19 The counterfactual is set out at a high-level in the Assessment. Supplementary evidence was submitted which provided more detailed information about the current state of AFCP development.

3.20 In our view, in relation to Principle C, the Assessment would be strengthened by providing additional evidence and analysis behind the key assumptions which have been made in selecting the counterfactual, particularly in relation to other potential uses for the capabilities and capacity which have been used in developing AFCP.

Changes in economic behaviour of the beneficiary

3.21 The Statutory Guidance sets out that subsidies must bring about something that would not have occurred without the subsidy.[21] In demonstrating this, public authorities should consider the likely change or additional net benefit.

3.22 Whilst the Assessment does not expressly set out the expected change in behaviour, we note that there are several references throughout the Assessment to the subsidy being expected to 'accelerate' the pace of development of a potential UK production route for CPF. Further, the Assessment states that the subsidy will be used to procure hardware, equipment and facilities which will contribute to building capacity and capability within the UK. We are therefore able to infer that the principal change in behaviour or additional net benefit which the subsidy will

[20] Statutory Guidance, paragraphs 3.46-3.47.

[21] Statutory Guidance, paragraph 3.50.

bring about is the development of CPF which would not otherwise occur at all, or only occur more slowly.

3.23 We consider that it is credible and rational to assume that giving financial assistance to a project will result in increased capabilities and/or capacity compared with a 'do nothing' baseline scenario. Therefore, the development timeframe will be shortened.

3.24 In our view, the Assessment would benefit from providing more details of when specific development milestones are expected to occur with and without the subsidy, including evidence and analysis of the key factors affecting these judgements.

3.25 The Assessment also states that, without the subsidy, organisations would not be brought together in the form of delivery consortia capable of delivering the programme objectives, with NNL functioning as a central integrator. The Assessment infers that the subsidy would result in this change in economic behaviour. We consider that the Assessment would be strengthened by providing more evidence and analysis of how this conclusion has been reached.

Additionality assessment

3.26 According to the Statutory Guidance, 'additionality' means that subsidies should not be used to finance a project or activity that the beneficiary would have undertaken in a similar form, manner, and timeframe without the subsidy.[22]

3.27 The Assessment states that the subsidy will only be given once the beneficiary has demonstrated that the 'innovation activity' would not take place in the absence of the subsidy. The Assessment, in relation to Principle D, could be improved by providing more detail on the design of this safeguard and explaining, with commensurate evidence and analysis, how a judgement was made regarding its adequacy.

Step 3: Considering the distortive impacts that the subsidy may have and keeping them as low as possible

3.28 The third step involves an evaluation of the Assessment against the subsidy control principles B and F.[23]

(a) Principle B – Subsidies should be proportionate to their specific policy objective and limited to what is necessary to achieve it; and

[22] Statutory Guidance, paragraphs 3.49-3.53.

[23] Further information about the Principles B and F can be found in the Statutory Guidance (paragraphs 3.58 to 3.93) and the SAU Guidance (paragraphs 4.15 to 4.19).

(b) Principle F – Subsidies should be designed to achieve their specific policy objective while minimising any negative effects on competition or investment within the United Kingdom.

Proportionality

3.29 The Assessment sets out a number of factors which demonstrate the proportionality of the subsidy with respect to the stated policy objectives, including that:

a) the size of the subsidy was calculated based on market intelligence, which estimated the overall cost of investment needed to support a CPF manufacturing capability in the UK, including a third-party report as well as estimates made by NNL and DESNZ;

b) the subsidy is limited in duration to two years with defined outputs which were assessed to be achievable;

c) NNL will seek match funding to complement any funds made available by DESNZ.

3.30 The Assessment also states that funds will be paid out by DESNZ *ex post*, with only expenses relating to the specified scope of work required to deliver the objectives being covered. Additionally, monitoring provisions will be put in place, with no option to increase the overall subsidy amount available.

3.31 Overall, we consider that the Assessment describes at a high level the steps DESNZ took to ensure the proportionality of the subsidy with respect to the policy objectives.

Assessment of effects on competition or investment

3.32 The Assessment sets out at a very high level how the subsidy's design is intended to minimise negative effects on competition and investment. Its primary reasoning is that there is no existing market domestically for CPF and the specific type of fuel kernel pursued by the programme, Uranium di-oxide (UO_2), differs from other kinds being developed internationally. It is suggested that the development of CPF UO_2 in the UK will therefore have potentially positive effects through the provision of an alternative CPF fuel source for High Temperature Gas Reactors (HTGR) in the long run.

3.33 As described earlier, the SAU held a clarification call with DESNZ, following which it provided reasoning as to the selection of NNL as the main beneficiary of this subsidy. It stated that, in its view, there is no other UK organisation with the necessary underpinning capabilities (people, facilities and knowledge), capable of acting as the integrator to deliver the required programme of work (ie building UK

capacity and capability whilst ensuring energy security and independence). The award to NNL would lead to continued value for HMG's investment within the AFCP and that the selection of an alternative beneficiary, such as an overseas partner, would not necessarily lead to the required outcomes for the programme, namely aligning with the British Energy Security Strategy, amongst other policy objectives.

3.34 During its evaluation the SAU received a third party representation from an industry participant who stated their belief that: "the DESNZ proposal to provide a £21.5m of single source R&D funding to NNL to support the development and demonstration of a UK sovereign TRISO fuel manufacturing capability does not represent value for money for UK taxpayers as the TRISO fuel manufacturing process has already been developed and proven in a number of other countries, including the USA". It also stated that "assuming appropriate UK Government support, [this participant] would like to build a TRISO fuel production facility in the UK using our already proven process from the USA".

3.35 The SAU is not in a position to comment on the merits of this proposal, however we would encourage DESNZ to consider this further as appropriate.

3.36 We have found that the Assessment, in relation to Principle F, would be strengthened by further setting out its reasoning and supporting evidence as to how DESNZ reached the conclusion that NNL was the only credible provider which could deliver the programme in line with the policy objectives, including how it explored the potential for other beneficiaries and the reasons they were not chosen.

3.37 Whilst DESNZ has outlined details on the characteristics of the subsidy as set out in the Guidance, we consider that its assessment could be strengthened by providing an explanation of how these characteristics and features were designed to minimise negative effects on competition and investment in the UK.

3.38 The Assessment states that NNL will engage in a public procurement exercise upon being awarded the grant to identify its partners in delivering the policy objectives. We note that this may contribute to minimising potential negative effects on competition and investment in adjacent markets.

3.39 Overall, it is our view that the evaluation of the subsidy's impacts on competition and investment is light and high-level and only briefly examines impacts on other vendors of CPF. The principal reason for this appears to be that the programme will not lead to any commercial product by its end and that there is currently no domestic or international market for CPF.

3.40 Whilst DESNZ's reasoning is clearly articulated, the Assessment, in relation to Principle F, could be improved by a fuller consideration of the Statutory Guidance[24] which would have allowed DESNZ to more systematically assess potential effects on competition or investment beyond the status quo in which, as it sets out, there is currently no commercialisation of the products and services in question. A more forward-looking and broader assessment would have strengthened this section and could also have identified distortive effects which may occur indirectly, or in the future, including third parties that could potentially be affected.[25]

Step 4: Carrying out the balancing exercise

3.41 This fourth step involves an evaluation of the Assessment against subsidy control principle G: Subsidies' beneficial effects (in terms of achieving their specific policy objective) should outweigh any negative effects, including in particular negative effects on: (a) competition or investment within the United Kingdom; (b) international trade or investment.[26]

3.42 The Assessment sets out an explanation of expected benefits as described earlier, which centres on the development for deployment of a CPF technology, whilst building resilient domestic supply which has the capacity to supply fuel to a future fleet of HTGRs in the UK. This is presented as crucial to the overall mission of energy security for the UK and to the development of related domestic skillsets, commercialisation capacity and relevant regulatory capability.

3.43 As discussed above, the Assessment states that few negative effects are anticipated through the subsidy lifetime until 2025 as the programme will not produce any commercial product and therefore the wider effect on the market is minimised, as well as stating that the UK capability to produce CPF would not be in direct competition with overseas vendors, due to differences in the kernel used.

3.44 The Assessment addresses the potential for international competitive effects, in particular in relation to the United States and China, where it states that the introduction of a new type of CPF through this programme may disrupt the long term export potential for overseas CPF but this would introduce more choice into the marketplace and increase competition.

3.45 The Assessment also provides justification for the intervention stating that the potential distortive effects – beyond those intended to stimulate the market – are limited given that the intervention is focused upon increasing the technology readiness level of a domestic CPF, reiterating that it will not produce any commercial product. As such, it is argued the wider effect on the market is

[24] Statutory Guidance, paragraphs 16.29-16.63.

[25] See for instance paragraph 1.2 above and Statutory Guidance, Annex 2 paragraph 16.30.

[26] See Statutory Guidance (paragraphs 3.96 to 3.98) and SAU Guidance (paragraphs 4.20 to 4.22) for further detail.

minimised and any negative effects are outweighed by the public benefits arising from the subsidy linked to achievement of policy objectives.

3.46 We consider that the Assessment explains the benefits arising from the subsidy against low potential risk of distortions. In relation to Principle G, the Assessment would be strengthened by more clearly setting out the potential negative competitive impacts of the subsidy including those identified by reference to paragraph 3.40, and making an assessment of them against the pro-competitive effects discussed within the Assessment. This could then inform why, in DESNZ's view, the benefits of the subsidy outweigh any negative competitive effects.

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