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Policy briefs for policymakers and end-users

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Summary

Deliver policy briefs for the development of hybrid systems by 2030’s, taking into account the evolution of European energy policies. Briefs shall be targeted at EU policymakers as well as other stakeholders

Approval

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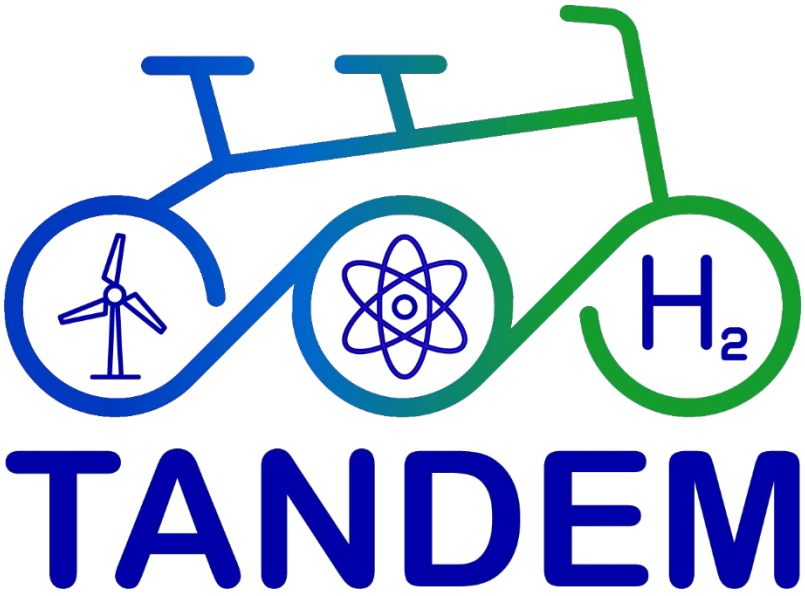

D5.1 – Policy Briefs

WP5 - Task 5.1

24 June 2025 [M34]

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Abbreviations and Acronyms

Acronym	Description
H2	Hydrogen
SMR	Small Modular Reactor
WP	Work Package

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Executive Summary

This document gathers together the different policy briefs developed under Task 5.1. The goal of these briefs is to highlight challenges identified in terms of financing and economics, public acceptance, regulatory requirements and skills and puts forward a series of policy recommendations. These policy briefs can be used as stand alone documents or as part of a pack. The target audience is policy makers at all levels (EU, national, regional and local).

Keywords

TANDEM, Policy, Finance, Economics, Skills, Regulatory Requirements, Public Acceptance, Education & Training

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1 Policy Briefs

1.1 Finance & Economics

About

With the goal of identifiying the economic and financial potential of integrating Small Modular Reactors (SMRs) within the hybrid energy system of the future, the project developed three case studies:

- The utilisation of the heat generated by an SMR for the district heating network of Helsinki (Finland) from the perspective of a district heating network operator. This case study took into account elements including operation and investment needs.
- The production of both heat for district heating systems and hydrogen for use in an industrialised area (e.g. for steel and heavy machinery industries) in the Moravian-Silesian region (Czech Republic). This case study looked at the issue from the perspective of a design office commissioned to undertake decarbonisation studies.
- The production of both heat and hydrogen via High Temperature Steam Electrolysis (HTSE) in order to supply an energy hub in a heavily industrialised French port, such as Fos-sur-Mer. Here again, this case study looked at the issue from the perspective of a design office commissioned to undertake decarbonisation studies.

Key Challenges

- SMR and electrolyser technologies face strong competition from other technologies as well as energy imports, hampering potential investment. For example, hydrogen (H2) imported via global corridors could be cheaper in 2050. In addition, for some processes it could be easier to replace grey hydrogen (produced from natural gas) with blue hydrogen (produced from natural gas combined with carbon capture technologies). Therefore, construction and maintenance costs will need to be low enough to encourage investment in both SMRs and electrolysers.
- Particularly when dealing with H2, there is also competition between electricity production and H2 production in terms of revenue maximisation. If an SMR is dedicated to "cogenerating" electricity for both the grid and hydrogen production, then a mechanism to avoid distortions should be considered to ensure constant H2 production.
- The unit size of SMR technologies can vary. Larger SMRs could lead to lower production costs, but can make the unit too large for certain applications. The characteristics of the SMR need to be in line with the needs of the market which it aims to address in terms of size and the temperature of the delivered heat.

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- In many European countries, district heating networks are often small and not interconnected.
- Some EU countries, such as France, do not have a legal framework for the sale and use of heat produced by nuclear reactors. The legal framework only exists for electricity and waste heat produced by nuclear reactors. The legal framework therefore needs to be adapted to the different products that can be produced by nuclear reactors.
- In some EU countries, such as France, operators of nuclear reactors have to pay taxes, which do not depend on the nominal power of the reactors. To support the deployment of SMRs and AMRs which will be smaller than current large reactors, taxes will need to be adapted to take into account the nominal power output of such reactors.
- Electricity can be sold directly to the market regardless of the location, but for now heat and hydrogen cannot be transported over long distances. Furthermore, there are uncertainties regarding the framework which will apply to hydrogen transportation. As a result, SMRs destined for non-electric applications will most likely need to be situated close to the end consumers.
- Demand for low-carbon hydrogen still needs to be ramped up to stimulate investment in production.
- Public acceptance will also play a key role in the deployment of such technologies, as this can help or hinder a project.

Policy Recommendations

- Clarify the status of nuclear heat inline by integrating it within the projected low-carbon energy share together with renewables and heat recovery for district heating, as this currently differs across Europe.
- Adopt a clear and technology neutral low-carbon hydrogen delegated act in which the status of hydrogen produced from nuclear is clearly recognised alongside renewables.
- When comparing the economics of nuclear H2 with H2 provided from other sources, system and other external costs (e.g. CO2 intensity, reliability, resilience and sovereignty) should included alongside ‘Levelised Cost of’ .

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1.2 Stakeholder Engagement & Public Acceptance

About

Public acceptance will be key to the deployment of Small Modular Reactors, particularly in regions and communities which do not currently have any nuclear facilities. It is therefore essential that the nuclear industry work together with stakeholders, in particular policymakers and municipalities, to enable a conversation about SMRs and the benefits which they will bring. This engagement should also enable local communities, in particular, to raise any questions which they may have.

Key Challenges

- SMRs are a new concept which can be difficult to define, particularly for non-technical audiences.
- Given that no SMR has been deployed as yet in Europe, stakeholders may have many questions about the benefits, risks and impacts of these technologies. In addition, because there has been no proactive engagement on this issue to date, there is no common language or narrative to discuss these aspects.
- As a result, existing attitudes (and potentially fears) towards nuclear and radiation – combined with previous decision-making experiences – have the potential to hinder open and fact-based communication.
- This is all the more important when we consider that the green transition and distributed energy solutions are likely to bring energy technologies closer to residents.
- Furthermore, from a stakeholder engagement perspective, there is a need to cover a variety of interests and stakeholder groups. Each stakeholder will have potentially very different needs. This, combined with the complexity of different languages and cultures, could hinder the possibility to reach and engage with different stakeholders and residents.
- Fragmented and political decision-making in cities could also negatively affect the conversation around SMRs.

Policy Recommendations

- Continuous and transparent dialogue between decision-makers and residents needs to be established.

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- A broad variety of tools and channels which provide understandable and accessible information about nuclear and SMRs in particular need to be deployed.
- The information shared should include the benefits which these technologies can bring to people's daily lives, whilst at the same time answering any potential concerns which they may have.
- Practices to enhance citizen's trust towards science and easy to understand communication about technologies should be implemented, combined with honest and transparent communication practices.
- Efforts should be made to enhance the knowledge of decision-makers in relation to nuclear, whilst also ensuring transparent and efficient risk communication.
- Local policymakers could play a role in engaging diverse groups (eg immigrants) in the conversation
- Local policymakers should share relevant information about the project, adapted to the audience
- Local policymakers should be involved in emergency planning communication.
- Local/National policymakers interested in the deployment of SMRs should engage in stakeholder engagement early on to indicate why they are supporting the project. Furthermore, they should provide recommendations
- Local/National policymakers should also provide clarity on how projects will be undertaken (explaining the process to communities)
- Local/National policymakers need to highlight the expertise of the regulators (to build trust in projects)
- Local/National policymakers should facilitate (e.g. provide accommodation, support travel) the involvement of independent experts (not seen as industry bringing their own)
- Local/National policymakers should provide resources to enable stakeholder engagement (e.g. neutral space for dialogue/meetings/workshops)

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1.3 Regulatory Framework

About

When SMRs are integrated within hybrid energy systems, the interfaces between nuclear reactors and non-nuclear installations are multiple and dynamic: the development of additional specific guidelines are required to study the safety of integrating SMRs into hybrid energy systems, compared with a large reactor connected to a national power grid to supply electricity only. The regulatory framework for hybrid energy systems needs to be defined both by the nuclear safety authority and by non-nuclear regulators dealing with the industrial risks of electrical and non-electrical applications in hybrid energy systems.

Key Challenges

- In many instances, SMRs will be located next to industrial clusters meaning therefore licencing will need to take into account requirements stemming from the other industries in order to ensure compatibility between the nuclear and industrial regulatory frameworks and avoid duplication/overlaps.
- Safety requirements may need to be updated to consider potential impacts from surrounding sites.
- SMRs are likely to be sited close to populated areas raising potential issues in terms of public acceptance.

Policy Recommendations

- Ensure that the nuclear safety regulators have the resources they need (e.g skills and workforce) to support their involvement in project development early on (pre-licensing).
- Establish a collaborative framework between nuclear safety regulators and regulators covering other industries.
- Ensure involvment of downstream users in the licensing process at an early stage (pre-licencing)
- Ensure that nuclear safety regulators provide clear and understandable information to the public early on in order to anwser any concerns
- Update the licensing framework to take into account the co-generation possibilities linked to the integration of SMRs within hybrid energy systems.

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1.4 Skills

About

One of the goals of the project was to identify what the education and training needs are in relation to Small Modular Reactors – both today and in the future – as well as their integration within the hybrid energy system of the future. It also looked at designing and delivering specific courses, as well as developing a strategy to implement future educational and training needs.

Key Challenges

- Identifying the gaps in education can be challenging. Firstly, because some of the SMRs under development can be considered as new technologies (new approaches for existing technologies). Secondly, and even in the case of those based on existing technologies, the role of SMRs will in most instances be different to those of existing, large reactors in that they will be integrated within a hybrid energy system, closer to citizens and industry, thus requiring a new way of thinking.
- More research is still needed to identify the skills which the workforce will need to ensure a functional and trustworthy system.
- This new approach will need to be integrated within existing curricula, which may in turn need to be adapted to take into account the new way of integrating power production methods within existing grids.
- National education programmes will need to be adapted in order to accommodate curricula, in a coordinated way, connecting topics not necessarily strictly related to nuclear but to hybrid energy systems in general.
- The educational process takes time. Together with the need to adapt the educational curricula which usually is done at national level, the development of human resources needs to start well in advance.

Policy Recommendations

- Facilitate the rapid deployment of relevant education and training courses within the curricula of higher education institutions.
- Facilitate the connection between soft skill and hard skill providers and interaction between the different institutions.
- Facilitate cooperation between academia, research and industry to create viable programmes which will ensure the development of a skilled workforce. Avoid promoting ‘silo’ initiatives (academia OR research OR industry).

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2 Conclusion

In their current form, each policy brief can be used as a standalone document to be distributed to policymakers on a case by bases. It provides a starting point for a more indepth conversation about how the policy framework can help to overcome the different challenges identified as part of the TANDEM project.

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