European Network of Transmission System Operators for Electricity

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RDI Implementation Report 2021-2025 – Treatment of responders' submissions

| 25 November 2021

From: ENTSO-E Working Group RDI Planning

Contents

Summary

The purpose of this document is to compile all the comments and questions the European Network of Transmission System Operators for Electricity (ENTSO-E) received during the public consultation period (from 4 June to 13 September 2021) regarding the **ENTSO-E RESEARCH & DEVELOPMENT & INNOVATION IMPLEMENTATION REPORT 2021–2025.**

The thematic working groups under the Research, Development and Innovation Committee took a thorough look at all the received feedback and reacted on each of them which can also be found within this document attached to their respective comments or questions. All feedbacks were taken into account, and a part of them led to modifications in the text of the RDI Implementation Report 2021-2025.

□ = confidential

General Comments

No.	Responder	Respondents' feedback	ENTSO-E's views
1.	Storelectric Ltd	It determines most of the answers within the questions, and these answers are based on mistaken assumptions and faulty analyses. Distributed systems All distributed systems rely on grids for back-up in times of system stress, e.g. kalte Dunkelflaute. So there are 2 issues: (1) what is on the system providing back-up, and (2) how much distributed resource is beneficial without both duplicating and eating into the revenues / cost-effectiveness of transmission connected assets? Connecting Renewables / reinforcing grids Most of the challenges will be solved by connecting large-scale renewables to the grid THROUGH large-scale long-duration inertial storage. See https://www.storelectric.com/saving-billions-on-grid-upgrades/ Types of Storage Selecting the appropriate types of storage is very important indeed. See https://www.storelectric.com/comparing-energy-storage-like-with-like/ and https://www.storelectric.com/batteries-expensive-and-inadequate-solutions/ As for the amount of storage required to decarbonise the grid, see https://www.storelectric.com/calculating-the-	The TSOs are technology integrators and provide a level playing field for all technologies to access the network according to regulation. It is on the side of the technology providers to prove their technology useful for the energy transition and ready for grid integration, in which case collaborative projects are welcome. The examples provided can be framed within P1, P2, P4 and P9. Incentives to the development of some specific technology are outside the scope of TSO's RDI activities.

No.	Responder	Respondents' feedback	ENTSO-E's views
		need-for-storage/ Incentivising the right technologies Incentives are totally perverse, and getting worse. See https://www.storelectric.com/wp-content/uploads/2021/03/Revenue-Stacking-and-Salami-Slicing.pdf and https://www.storelectric.com/wp-content/uploads/2021/03/Issues-with-Ever-Shortening-Contract-Durations.pdf which are drawn together within a very simple, easily introduced but radically different regulatory system https://www.storelectric.com/a-21st-century-electricity-system/ And all this is best done within a much simpler overall framework for incentivising decarbonisation https://www.storelectric.com/incentivising-clean-energy/ Transportation There isn't enough elemental lithium in the earth's crust for all the world's vehicles. Or grids. Or behind-the-meter storage. And that's without considering portable and remote devices. And without considering how little of the elemental lithium is recoverable, how short the batteries' lives are, how hard it is to recycle etc. Or that 40% of people don't have aa dedicated parking spot for charging. So most transportation must be hydrogen / fuel cell powered. See https://www.storelectric.com/the-future-role-of-hydrogen/ and https://www.storelectric.com/vehicle-to-grid-and-shared-mobility/	
2.	International Renewable	A short session to introduce this work and explain the approach would have been useful for completing this survey	Thank you for the proposal. The ENTSO-E RDI implementation report was initially presented and announced during the

No.	Responder	Respondents' feedback	ENTSO-E's views
	Energy Agency (IRENA)		InnoGrid conference on 4 June 2021. We also acknowledge request for additional discussion session, thus the we did a stakeholders webinar on 1 October 2021.
3.	International Renewable Energy Agency (IRENA)	I find the roadmap clear. I am missing a few points, such as how descentralisation may support TSOs, for example using demand-side flexibility. Also the role of digitalisation (not only cybersecurity) in enabling a better operation of TS	"Deeper digitalisation" is part of the strategic "RDI vision" (page 5). This is a condition sine qua non for the energy transition. We highlight that almost all suggested project concepts address the digitalisation with focus on data-exchange, tools & models, interoperability, standards etc. developments. The demand side flexibility is particularly targeted by P1 (in means of electromobility), by P2 (in means of development of operation and planning tools to enable flexibility assessments) and specifically by P4 (with major focus on flexibility potential via various sectors).
4.	Confidentiality requested by stakeholder		
5.	SuperNode Ltd	It is well focused and it may seem better suited for collaborative research between TSOs in different jurisdictions, thus providing the foundation for collaborative European research. However, it is not clear from the Implementation Report which "key stakeholders" beyond TSO's will be involved and how ENTSO-E intends to include non-TSO's such as research institutions and private sector companies in the RDI projects. Moreover, there seems to be little recognition of the need for grid technology innovation beyond HVDC grids, such as grid enhancing technologies and technology based on High Temperature Superconductors (TRL 5-8 according to ENTSO-E's Technopedia) . The latter would certainly be relevant for	In each project sheet the funding scheme states the opportunity for collaborative efforts and interested stakeholders are welcome to approach one or more TSOs towards implementing this effort. We are also highlighting that ENTSO-E RDI Implementation Report 2021 – 2025 is focused more on system-challenges (like HVDC interoperability) rather than specific technology (like High Temperature Superconductors) research. The selection of particular technology will be done by the project consortia. Therefore, it is on the side of the technology providers to focusing on novel technologies, that should be researched and in collaboration with TSOs proved robust and useful before being integrated into the system to solve system challenges.

No.	Responder	Respondents' feedback	ENTSO-E's views
		the P8 project, scheduled to commence in 2025 and should also be referenced in P7.	
6.	currENT	Excellent work to integrate RD and ENTSO-E ´heavy ´committee work much better through real world focused and key RD topic prioritisation. Excellent stakeholder consultation and interaction approach. It is well focused and seem better suited for collaborative research between TSOs in different jurisdictions, thus providing the foundation for collaborative European research. However, it is not clear from the Implementation Report which "key stakeholders" beyond TSO's will be involved and how ENTSO-E intends to include non-TSO's such as research institutions and and private sector companies in the RDI projects. Moreover, there seems to be little recognition of the need for grid technology innovation beyond HVDC grids, such as grid enhancing technologies and technology based on High Temperature Superconductors (TRL 5-8 according to ENTSO-E's Technopedia) .	Thank you for remarks. For better clarity, we provided additional chapter on the stakeholder involvement in page 22. We also highlight that in each project sheet the funding scheme states the opportunity for collaborative efforts and interested stakeholders are welcome to approach one or more TSOs towards implementing this effort. Please note that ENTSO-E RDI Implementation Report 2021 – 2025 is focused more on system-challenges (like HVDC interoperability) rather than specific technology (like High Temperature Superconductors) research. The selection of particular technology will be done by the project consortia. Therefore, it is on the side of the technology providers to focusing on novel technologies, that should be researched and in collaboration with TSOs proved robust and useful before being integrated into the system to solve system challenges.
7.	EERA Joint Program Smart Grids	Narrowing the scope could be an optimal way to achieve the targets and is a god way to recognize the urgent need for new system level knowledge of power system but focus on implementing very applied projects can limit the innovation potential. Furthermore, the limitation towards selection of 12 presented projects narrows the scope, compared to the initial RDI-ambitions presented in the 2020-2030 Roadmap and may disregard several critically important topics issues.	The purpose of the Implementation Report is to prioritize the TSOs' research directions for the period 2021-2025 in order to effectively promote the execution of these research priorities and, thus, contribute to make the energy transition a reality. Hence, by definition, it does not cover the full ambition of the ENTSO-E Research, Development and Innovation Roadmap 2020-2030 that contains 80 milestones for the 10 year period. We feel confident with this approach since 85% of the public consultation participants support ENTSO-E's approach to base RDI Implementation Report on a limited number of project concepts.

No.	Responder	Respondents' feedback	ENTSO-E's views
8.	T&D Europe	Selecting 12 clearly defined projects gives clear focus points for innovation work in the next years. The projects cover essential needs of the evolving electrical grid, particularly regarding the achievement of the Green Deal goals for offshore energy.	Thank you, we acknowledge your positive feedback.
9.	Individual expert opinion via email	it is clear that you have put lot of effort in producing this report and the suggested projects are interesting. However, I find the choice of most of the projects rather conservative. While I understand that there are research questions that are in urgent need of investigation, i am missing a foreword looking perspective.	The purpose of the Implementation Report is to prioritize the TSOs' research directions for the period 2021-2025 in order to effectively promote the execution of these research priorities and, thus, contribute to make the energy transition a reality. Hence, by definition, it does not have the forward looking perspective of the ENTSO-E Research, Development and Innovation Roadmap 2020-2030.

Flagship 1

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
10.	Aims	International Renewable Energy Agency (IRENA)	Besides electromobility, electrification of heating and cooling (buildings) and industries (via green hydrogen) can be considered to have a full picture of cross-sectorial integration needed.	Thank you, we share common views with your suggestion. We highlight that while P1 focus on electromobility, the P2, P3 and P4 are more wide (cross-sector) integration focused. In addition, a new project concept was proposed "P5 / Market for the cross-sector integration", which addresses needed market developments for small-scale energy storage, heat pumps (and cooling), smart charging of electric vehicles, power-to-gas, smart buildings solutions etc. integration.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
11.		International Renewable Energy Agency (IRENA)	This priority is aligned with IRENA's view, for example: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Sep/IRENA_Power-to-Hydrogen_Innovation_2019.pdf and https://www.irena.org/publications/2019/Sep/Hydrogen-A-renewable-energy-perspective	Thank you, we do see as Power to Hydrogen as well as X to Power to X as integral part of optimised cross-sector integration.
12.		Confidentiality requested by stakeholder		
13.		currENT	While these three Projects are very comprehensive, currENT miss content on how the TSO-DSO interaction will be addressed in Flagship 1. We also miss the regional dimension of RCCs. We see TSO-DSO addressed in Flagship 2, but believe it also needs to form part of the first flagship.	We would like to highlight, that P1 address TSO-DSO interaction through, demonstration how a wide area charging infrastructure can be planned and operated to meet user needs and deliver the lowest system costs, while P2, P3 and P4 does not specifically address it, but assume it as part of wider cross-sector integration. The research effort concerning the TSO-DSO interaction will build upon the diverse research effort ongoing in this direction (e.g. EU-SysFlex, CoordiNet, Interrface and OneNet).
14.		EERA Joint Program Smart Grids	Interconnection and interoperability over the different sectors (including the markets) is of primarily importance. In general topic of cross-sector markets is not present. This topic is critically important for cross-sector integration and does not seem to have sufficient attention. Considering the novelty of cross-sector markets, development and implementation of these will take long time.	Thank you, we agree with comment given. Additional project concept was drafted and is now included to address markets for the cross-sector integration (see P5).

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			It is continuous process related to grid/grid problem and solution(s), new element and actors' involvement into PS operation and interaction. Important aspect is understanding the development planning needs to integrate flexibility and operational planning to maintain the grid.	
15.		T&D Europe	The Flagship topics F1 „Optimize cross-sector integration" and F2 "Develop an ecosystem for deep electrification" seems to my quite overlapping. The Project concepts P1, P2 and P4 should be merged into a single Flagship Sector integration and flexibility and mainly focus on the energetical research. The Project concept P3 "Design of a pan-European cross-sector data model" should be assigned to Flagship topic about Digital market. (See also comments to Flagship 2)	There are strong and complementing links between Flagship 1 and Flagship 2 as both falls under the same ENTSO-E RDI priority Area/Cluster - One System of Integrated Systems. However, we prefer to keep the focus on different project concepts in order to expose the differences and manage the different challenges.
16.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
17.	Scope and expected impact	International Renewable Energy Agency (IRENA)	all types of smart charging of EVs should be considered in P1	Thank you, we share the same opinion.
18.		International Renewable Energy Agency (IRENA)	I'm missing also the smart electrification of heat: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Sep/IRENA_Power-to-heat_2019.pdf?la=en&hash=524C1BFD59EC03FD44508F8D7CFB84CEC317A299 Also, the use of thermal storage by TSOs as exemplified in: https://www.irena.org/publications/2020/Nov/Innovation-outlook-Thermal-energy-storage	Thank you, we support the suggestion. Please see answer for comment nr. 10.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
19.		Confidentiality requested by stakeholder		
20.		currENT	See above <Reference to comment: While these three Projects are very comprehensive, currENT miss content on how the TSO-DSO interaction will be addressed in Flagship 1. We also miss the regional dimension of RCCs. We see TSO-DSO addressed in Flagship 2, but believe it also needs to form part of the first flagship.>	See comment above (nr. 13.)
21.		EERA Joint Program Smart Grids	The scope of P1 should be extended from electric mobility only to electrification of transport in general, including at least public transport. Regulatory framework incentivising system operators to optimise the roll-out of charging infrastructure (not always the case for the time being). Description of P2 does not seem to be clear regarding the energy carriers i.e., whether it limits to hydrogen only or considers other energy carriers. P2 does not seem to have clear compliance to the referred CL5-2021-D3-02-05 Call. P3: from the description it appears that the cross-sector model will have a strictly centralised approach with potentially high complexity.	Please find our reflection below: - P1: is focused on electricity transport in general, but it is emphases on EV charging infrastructure. Thus, we improved the text part of Scope and Expected impact, to better highlight that the project concept targets to all electrification of transport (including heavy-duty, marine and aviation). - P2: the project concept contributes to the ENTSO-E Roadmap for a multi-sectorial Planning Support [13], thus it takes a long-term, holistic view of system planning, not limited only to hydrogen. Some parts of project concept description were improved to remove the impression of being limited to hydrogen. - P3: does not provide preference for centralized or decentralised approach, but rather focus on possible harmonisation and standardisation to bridge existing models between different sectors.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
22.		T&D Europe	As flexibility provision by e-car charging will mostly apply to private or semi-private charging facilities, the ambition to cover "the full scope ranging from planning to operations including all actors covering both e-mobility infrastructure and power system perspective" seems to be challenging, as it will be difficult to get the required stakeholder involved. The design of a pan-European cross-sector data model should be moved to a separated Flagship about digitalization topics.	We share the view that the full system wise uptake of P1 will be a challenging task for all EU, thus proper initiatives as well as regulatory support will be needed. The latter can already be seen in the new proposals of Renewable Energy Directive and The Alternative Fuel Infrastructure Directive. Regarding the suggestion to move P3, we must first note that digitalization is an integral part of the RDI Vision (page 5). Hence, while digitalization is a necessary condition for the energy transition, the pan-European cross sector data model is a specific challenge towards optimising cross-sector integration, i.e a project concept within Flagship 1.
23.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
24.	Barriers and policy context	International Renewable Energy Agency (IRENA)	There are more issues around e-mobility to be included, particularly on business models and market design. This might be useful: https://www.irena.org/publications/2019/May/Innovation-Outlook-Smart-Charging	Thank you for shared reference. We included it into our reference list as a reference to the new project P5.
25.		Confidentiality requested by stakeholder		
26.		currENT	See above <Reference to comment: While these three Projects are very comprehensive, currENT miss content on how the TSO-DSO interaction will be addressed in Flagship 1. We also miss the regional dimension of RCCs. We see TSO-DSO addressed in	Please see comment nr. 13.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			Flagship 2, but believe it also needs to form part of the first flagship.>	
27.		EERA Joint Program Smart Grids	P2: there are still several regulatory gaps, especially related to hydrogen infrastructure, which may create a distorted cost and benefit picture and influence the investments in negative way.	Thank you, so the following sentence was added: "The regulatory gaps may prevent the uptake of the multi-sector system of systems, so regulatory sandboxes can enable the execution of specific pilot projects and their results may support regulatory recommendations".
28.		T&D Europe	The information about barriers and policy given in the RDI document are not understandable enough to given an answer.	Thank you for the feedback, we hope that information is clear enough for the majority of the stakeholders. We encourage to carefully read the methodological description on page 8, which explains wider the project concept scoping.
29.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
30.	State of the art, current and future TRL	Storelectric Ltd	These aren't even stated within the document. And you don't give an option to say that all options are wrong.	We thank you for indicating your choices in the comment and apologise for technical issue in the questionnaire.
31.		EUROPACABLE	We do believe that the proposed answers to question 9 are not clear/correct. Our response to question 9 re. P1, P2 and P3 is "YES"	
32.		Confidentiality requested by stakeholder		
33.		EERA Joint Program Smart Grids	(there are missing options in the form, so the answer is "Yes" to all three projects)	
34.		T&D Europe	Not clear how to answer this question	

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
35.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
36.	Estimated budget and funding schemes	Confidentiality requested by stakeholder		
37.		T&D Europe	Within the Flagship, the budget share seems to be reasonable, however comparing the total budget for this Flagship with Flagship 4, there seems to be a mismatch. Sector integration is at least as well es as important as Offshore integration for a sustainable energy system.	We do acknowledge your comment, indeed, the budget assumptions where different for this project concept and now is amended to reflect only TSOs expected efforts (meaning excluding efforts of offshore RES developers, HVDC vendors and other stakeholders of HVDC systems).
38.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
39.	Suggestions	Confidentiality requested by stakeholder	P1 can be improved by good setting of standards, support for research into new types of batteries P2 - opportunities for cooperation and involvement of each country and the SME companies in this process P3 - same as P2	Thank you for suggestion, we aim, that ENTSO-E RDI Implementation Report 2021 – 2025 is focused more on system-challenges rather than specific technology (like batteries) research. We expect that the research of new type of batteries will be driven by EV and batteries manufactures. Regarding, the stakeholder involvement: It is an important aspect, thus we have developed a dedicated chapter in the report.
40.		International Renewable Energy Agency (IRENA)	why limit cross-sectorial integration to power and transport integration? buildings and industry should be considered also	Thank you, we support the suggestion. Please see answer on comment nr. 10.
41.		Confidentiality requested by stakeholder		

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
42.		Confidentiality requested by stakeholder		
43.		EERA Joint Program Smart Grids	P2: Adding strong focus on regulatory conditions enabling the cross-sector integration, including implementation roadmap. Adding aspects related to the security of supply for multi-sector operation and planning.	We acknowledge your suggestions and improved the scope of the P2 by adding: "Develop and test new methodologies in ENTSO-E's ERAA and TYNDP/multi-sectorial planning support (MSPS) innovation tracks and enhance security of supply of electricity with applicable cross-sectors operation and planning. <...>" "Review and assess the impact of different regulatory conditions and provide suggestions on removing potential regulatory barriers for large sector coupling investments and large-scale roll-outs in a cost-effective manner."
44.		T&D Europe	Shift project concept P4 into this Flagship as it has a close relationship to project concept P1. P1 could be improved by considering not only EU but long-distance trucks as well.	There are strong and complementing links between Flagship 1 and Flagship 2 as both falls under the same ENTSO-E RDI priority Area/Cluster - One System of Integrated Systems. However, we prefer to keep the focus on different project concepts in order to expose the differences and manage the different challenges. (similar to the answer given to comment nr. 15.) We also acknowledge the suggestion on P1 and we amended the project concepts scope description with better inclusion of "electrification of heavy-duty transports"
45.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
46.		Individual expert opinion via email	While I understand that there are research questions that are in urgent need of investigation, i am missing a foreword looking perspective. In particular in your flagship 1, i have the impression (also from your timeline for updates) that you are not considering the speed of change, the interactions across the energy sector, the different users and actors. P2 about planning tools for sectors integration does not include (at least in the text provided) an effort to understand how to optimise resources in the broad sense and not just in the (neoclassical) economic sense. As a matter of fact the ongoing discussion around the governance of the TYNDP and the TEN-E is very much linked to the ability of planning differently, more transparently and in a more holistic way. Some of these points related to P2 are partially addressed in the ambition of P3. I am missing something specific about integrating heating in the TYNDP (a recurring complain of ACER)	Thank you, we acknowledge your position. ENTSO-E RDI Implementation Report 2021 – 2025 is not intended to limit innovation and various technologies development, but to be more system-challenge focused. TSOs research focus is on answering system challenges with development of processes, system integration and standardization. Such approach does not limit innovation and various (even extremely novel and disruptive) technologies development. It is on the side of the technology providers to focusing on novel technologies, that should be researched and in collaboration with TSOs proved robust and useful before being integrated into the system to solve system challenges.
47.	Missing concept	Confidentiality requested by stakeholder	I think it is a process, gradually their specific concepts will be created according to specific needs.	Thank you we agree and value your positive feedback.
48.		International Renewable Energy Agency (IRENA)	more examples in: https://www.irena.org/innovation/toolbox	Thank you for the shared reference
49.		Confidentiality requested by stakeholder		
50.		currENT	TSO-DSO interaction should be included.	See comment above (nr. 13.)

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
51.		EERA Joint Program Smart Grids	Projects targeting development of cross-sector markets and integration of these into the existing market structure e.g., DAM, IDM, ancillary services. Projects targeting also the new and sustainable business models and the emergence of new markets linked to the cross-sector integration.	Thank you, we support the suggestion. Please see answer on comment nr. 10.
52.		T&D Europe	On the one hand side buildings are responsible for a large share of today's energy consumptions, on the other side can provide large amount of flexibility, there should be an additional project concept to leverage building flexibility for grid stabilization. Furthermore, many e-car charging points will be located in the perimeter of buildings, so the integration of smart building and smart grid becomes an even more important research topic.	Thank you, we support the suggestion. Please see answer on comment nr. 10.
53.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
54.		Storelectric Ltd	Totally wrong direction. See response to the first questions, repeated here. The proposal determines most of the answers within the questions, and these answers are based on mistaken assumptions and faulty analyses. Distributed systems All distributed systems rely on grids for back-up in times of system stress, e.g. kalte Dunkelflaute. So there are 2 issues: (1) what is on the system providing back-up, and (2) how much distributed resource is beneficial without both duplicating and eating into the revenues / cost-effectiveness of transmission connected assets?	Thank you, we acknowledge your position. ENTSO-E RDI Implementation Report 2021 – 2025 is not intended to limit innovation and various technologies development, but to be more system-challenge focused. TSOs research focus is on answering system challenges with development of processes, system integration and standardization. Such approach does not limit innovation and various (even extremely novel and disruptive) technologies development. It is on the side of the technology providers to focusing on novel technologies, that should be researched and in collaboration with TSOs proved robust and useful before being integrated into the system to solve system challenges.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			Connecting Renewables / reinforcing grids Most of the challenges will be solved by connecting large-scale renewables to the grid THROUGH large-scale long-duration inertial storage. See https://www.storelectric.com/saving-billions-on-grid-upgrades/ Types of Storage Selecting the appropriate types of storage is very important indeed. See https://www.storelectric.com/comparing-energy-storage-like-with-like/ and https://www.storelectric.com/batteries-expensive-and-inadequate-solutions/ As for the amount of storage required to decarbonise the grid, see https://www.storelectric.com/calculating-the-need-for-storage/ Incentivising the right technologies Incentives are totally perverse, and getting worse. See https://www.storelectric.com/wp-content/uploads/2021/03/Revenue-Stacking-and-Salami-Slicing.pdf and https://www.storelectric.com/wp-content/uploads/2021/03/Issues-with-Ever-Shortening-Contract-Durations.pdf which are drawn together within a very simple, easily introduced but radically different regulatory system https://www.storelectric.com/a-21st-century-electricity-system/ And all this is best done within a much simpler overall framework for incentivising decarbonisation https://www.storelectric.com/incentivising-clean-energy/	

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			Transportation There isn't enough elemental lithium in the earth's crust for all the world's vehicles. Or grids. Or behind-the-meter storage. And that's without considering portable and remote devices. And without considering how little of the elemental lithium is recoverable, how short the batteries' lives are, how hard it is to recycle etc. Or that 40% of people don't have aa dedicated parking spot for charging. So most transportation must be hydrogen / fuel cell powered. See https://www.storelectric.com/the-future-role-of-hydrogen/ and https://www.storelectric.com/vehicle-to-grid-and-shared-mobility/	

Flagship 2

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
55.	Aims	Confidentiality requested by stakeholder		
56.		EERA Joint Program Smart Grids	Deep electrification as such is probably the most important and cost-effective approach to reach the climate neutrality. Compared to the roadmap, the ambitions have been significantly reduced, several topics are not included.	See comment above (nr. 7.)
57.		T&D Europe	As already commented above, the project concept P4 should be moved to Flagship 1 This Flagship should be redefined to tackle the digitalization aspects, especially the interoperability of the existing systems	See comment above (nr. 15.)

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			at the grid edge. Deep electrification also implies more than flexibility.	
58.	Scope and expected impact	International Renewable Energy Agency (IRENA)	I find a bit overlap of confusing between the scope of Flagship 1 and 2. 1 is about cross sectorial integration, 2 is on deep electrification (I find the concept very much interrelated). I notice flexibility is discussed here, also from green hydrogen, industry, buildings and transport. I think the topic is highly relevant, I just find a bit confusing the scoping between Flagship 1 and 2.	See comment above (nr. 15.)
59.		Confidentiality requested by stakeholder		
60.		Confidentiality requested by stakeholder		
61.		T&D Europe	As already commented above, the project concept P4 should be moved to Flagship 1. Flagship 2 should be reammed into "Digital market enablement" and the Project concept P3 "Design of a pan-European cross-sector data model" should be assigned to this Flagship. This Flagship should be further extended with other Project topic about standardized "Grid Edge API" to develop pan-European standards for information exchanges between the grid and flexibility providers like buildings, e-mobility, etc.	See comments above (nr. 15. and 22.)
62.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
63.	Barriers and policy context	International Renewable	here the scope seems to have been limited to electrolysis and green hydrogen. other sectors are not mentioned, including the power sector,	We highlight, that the project concept aims to bring operational understanding, new ancillary services and business models for P2X plants that support system efficiency. The project concept is

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
		Energy Agency (IRENA)	and limitations on power sector side in taking advantage of all flexibilities potentially available.	about P2X, which is wider than P2G. We improved the text to avoid the impression that project concept is limited to P2G.
64.		Confidentiality requested by stakeholder		
65.		EERA Joint Program Smart Grids	Apart from unclear ownership of electrolysers there are several other gaps in hydrogen-related regulation including definition of roles and responsibilities, traceability of electricity used etc.	We agree with your remark and included additional barriers mentioned to the concept description.
66.		T&D Europe	The information about barriers and policy given in the RDI document are not understandable enough to given an answer.	We hope that the new draft is more understandable.
67.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
68.	State of the art, current and future TRL	International Renewable Energy Agency (IRENA)	again, the focus seems to be only on hydrogen here.	See comment above (nr. 63.)
69.		EERA Joint Program Smart Grids	According to the description in P4, especially the impacts, the research on potential flexibility in integrated power system will be essentially related to hydrogen. Compliance with the referred CL5-2021-D3-02-06 Call is not clear.	See comment above (nr. 63.)
70.		T&D Europe	The information given for TRL in the RDI document was not sufficient to give an answer to this question.	We acknowledge your feedback.
71.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
72.	Estimated budget and	Confidentiality requested by stakeholder		

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
73.	funding schemes	EERA Joint Program Smart Grids	Compliance with the referred CL5-2021-D3-02-06 Call is not clear.	Indeed, the concept could also be supported by the call CL5-2021-D3-02-05 'Energy Sector Integration: Integrating and combining energy systems to a cost-optimised and flexible energy system of systems'.
74.		T&D Europe	See comment to Question 10. <reference to Question 10: Within the Flagship, the budegt share seems to be reasonable, however comparing the total budget for this Flagship with Flagship 4, there seems to be a mismatch. Sector integration is at least as well es as important as Offshore integration for a sustainable energy system.>	We support your remark. Please see comment above (nr. 63.)
75.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
76.	Suggestions	International Renewable Energy Agency (IRENA)	Clearer definition of scope of flagship 1 and 2. - avoid overlaps between them and set the limitations a bit clearer	See comment above (nr. 15.)
77.		Confidentiality requested by stakeholder		
78.		EERA Joint Program Smart Grids	Inclusion of several sources of flexibility into the scope and interplay between these, in particular pumped-storage hydropower.	Pumped-storage hydropower plays a key role in current energy system and will continue to do so in future. Project concept focuses on expending potential resources.
79.		T&D Europe	See comment to questions 13 & 14. <reference to Question 13: As already commented above, the project concept P4 should be moved to Flagship 1 This Flagship should be redfined to tackle the digitalization aspects, especially the interoperability of the existing systems at the grid edge. Deep electrification	See comments above (nr. 15. and 22.)

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			also implies more than flexibility> <reference to Question 14: As already commented above, the project concept P4 should be moved to Flagship 1. Flagship 2 should be reammed into "Digital market enablement" and the Project concept P3 "Design of a pan-European cross-sector data model" should be assigned to this Flagship. This Flagship should be further extended with other Project topic about standardized "Grid Edge API" to develop pan-European standards for information exchanges between the grid and flexibility providers like buildings, e-mobility, etc.>	
80.		Individual expert opinion via email	in P4 the concept of flexibility you use appear to be too narrow. We know that flexibility is king but flexibility is made of many diverse and complementary pieces. Bringing clarity on the diversity of these pieces while we decarbonise and scale variable RES is essential unless we consider that gas(ses) will provide all the flexibility needed. of course this would be a big waste	See comments above (nr. 63.)
81.	Missing concept	EUROPACABLE	Europacable calls on ENTSO-E to prioritise renewable based electricity and direct electrification over other energy carries as they are the most cost-effective and energy efficient tool to meet Europe's decarbonisation ambition. To connect renewable energy sources to the centers of consumption, Europacable firmly believes that hydrogen does not have a role to play as a means of an "energy carrier". Accordingly, energy transmission needed for the direct, green electrification for building heating or light electric mobility shall be carried over conventional power lines, underground and submarine cables to ensure the best possible energy efficiency of the systems.	We value your remark and suggest to see comments above (nr. 54. and 63.)

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
82.		Confidentiality requested by stakeholder		
83.		T&D Europe	See comment to questions 13 & 14. <reference to Question 13: As already commented above, the project concept P4 should be moved to Flagship 1 This Flagship should be redfined to tackle the digitalization aspects, especially the interoperability of the existing systems at the grid edge. Deep electrification also implies more than flexibility> <reference to Question 14: As already commented above, the project concept P4 should be moved to Flagship 1. Flagship 2 should be reammed into "Digital market enablement" and the Project concept P3 "Design of a pan-European cross-sector data model" should be assigned to this Flagship. This Flagship should be further extended with other Project topic about standardized "Grid Edge API" to develop pan-European standards for information exchanges between the grid and flexibility providers like buildings, e-mobility, etc.>	See comments above (nr. 15. and 22.)
84.		Storelectric Ltd	<Responder provided same comments as in Nr. 54>	See comment above (nr. 54.)

Flagship 3

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
85.	Aims	EERA Joint Program Smart Grids	Although P5 is very timely and relevant as project, it does not seem to be fully aligned with Flagship 3 ambitions and previously defined topics. Rather than focusing on specific	We would like to highlight that Flagship 3 has a milestone "SF6 free solutions" and the project concept address this milestone and focus on further development of SF6 free components, in

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			components, more system-related approach should be pursued.	line with the Flagship 3. This project concept is a system challenge because it addresses the replacement of materials widely use in the electricity system.
86.	Scope and expected impact	International Renewable Energy Agency (IRENA)	no expertise in SF6	Thank you for the note.
87.		Confidentiality requested by stakeholder		
88.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
89.	Barriers and policy context	E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
90.	State of the art, current and future TRL	Confidentiality requested by stakeholder		
91.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
92.	Estimated budget and funding schemes	Confidentiality requested by stakeholder		
93.		T&D Europe	For the P5, budget is very low and timeline too short.	Thank you, we consider timeline appropriated, however we acknowledge the notice on the costs. We note, that it is stated in the document: "An actual demonstrator for an SF6-free high-voltage substation would have a budget orders of magnitude higher. Such substation is typically

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
				part of normal TSO investments, but has an additional innovation/risk component that requires acknowledgement in regulatory review or leveraging via innovation funding."
94.	Suggestions	E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
95.		Individual expert opinion via email	P5 and 6: these two projects have a strong societal dimension. Defining standards alone will not be sufficient and probably not helpful either. You will need to do it together with those organisations that have been in this field for decades.	We agree with your comment. The project concepts are also meant for stakeholders to cooperate with European TSOs. Key stakeholder involvement is an important aspect, we made dedicated changes to address it (see answer No. 6). Regarding the remark of flexibility and related market, we invite to review the updates in Flagship 1, which deals with these topics.
96.	Missing concept	Storelectric Ltd	<Responder provided same comments as in Nr. 54>	See comment above (nr. 54.)

Flagship 4

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
97.	Aims	International Renewable Energy Agency (IRENA)	About planning: The 3 key dimensions to consider when performing energy planning exercises to assess and select infrastructure projects: • Time dimension: projects that will be selected should be compatible with net zero plans, benefiting also in long term • Regional cooperation: flexibility options are pulled across regions • System thinking: interlinkages of various spots of energy systems will increase in the future, due to hydrogen electrolysers, EVs, heat pumps. Flexibility from all sectors	Thank you, we acknowledge your shared view on the infrastructure projects planning. We share common view, that the actual project(s) initiated under specific concept has to aim on bringing the system-wide benefits.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			needs to be considered, otherwise it will result in overinvestments and stranded assets.	
98.		SuperNode Ltd	As P8 is planned to commence in 2025, it will not have an impact within the 2021-2025 timeframe. Its impact will, to a large degree, be determined by the success of P7, which certainly contributes to the aims set for the period. The point-to-point approach to offshore infrastructure based on current (HVDC) grid technology will not deliver the Green Deal. Without innovation in network technology (including a fundamental review of physical materials within the design scope), Europe will fail to deliver on its Paris Agreement commitment and its climate neutrality objectives. Flagship 4 presupposes that offshore infrastructure will be based on HVDC grids and makes little mention of other innovative technologies, such as new grid enabling technologies and cable technology based on high-temperature superconductors (TRL 5 to 8 according to ENTSO-E's Technopedia), which have the potential to unlock large efficiency gains at a system level, e.g. in the form of fewer losses and reduced material use.	Thank you, indeed, we share your views, which are well align with ENTSO-E position paper on Offshore Development focuses on interoperability and recent jointed ENTSO-E, T&D Europe and WindEurope paper on the development of multi-vendor HVDC systems and other power electronics interfaced devices. We would like to highlight, that the develop and pilot of new network components with reduced environmental impact such as HV cables without lead or application of superconductors etc. are foreseen under the scope of Flagship 3, P6.
99.		currENT	As P8 is planned to commence in 2025, it will not have an impact within the 2021-2025 timeframe. Its impact will, to a large degree, be determined by the success of P7, which certainly contributes to the aims set for the period. The point-to-point approach to offshore infrastructure based on current (HVDC) grid technology will not deliver the Green Deal. Without innovation in network technology (including a fundamental review of physical materials within the design scope), Europe will fail to deliver on its Paris Agreement commitment and its climate neutrality objectives.	See comment above (nr. 98.).

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			Flagship 4 appears to presuppose that offshore infrastructure will be based on HVDC. It should make explicit references to innovative grid enhancing technologies and cable technology based on high-temperature superconductors (TRL 5 to 8 according to ENTSO-E's Technopedia), which have the potential to unlock large efficiency gains at a system level, e.g. in the form of fewer losses and reduced material use.	
100.	Scope and expected impact	SuperNode Ltd	The presumption of the proposal is that only HVDC technology has a role to play in the future development of offshore grid infrastructure, to tap into Europe's vast offshore renewables resources. The Flagship should ensure that other, innovative technologies such as sub-sea superconducting cables systems (SSCS) and other MVDC technologies are allowed access. Access to multi-terminal DC pilot projects (or electrolyser projects) are needed by SSCS to access risk-free testing as part of their TRL progression. Without access, alternative technologies, and their qualification programmes, may be heavily impacted at the expense of innovation linked to global climate ambitions. The European technology lead will be lost to other nations without inclusion of all grid technologies.	The purpose of the Implementation Report is to prioritize the TSOs' research directions for the period 2021-2025 in order to effectively promote the execution of these research priorities and, thus, contribute to make the energy transition a reality. Therefore, all project concepts focus on one or maximum two milestones of the ENTSO-E RDI Flagship projects. We would like to highlight, that the develop and pilot of new network components with reduced environmental impact such as HV cables without lead or application of superconductors etc. are foreseen under the scope of Flagship 3, P6.
101.		currENT	The presumption of the proposal is that only HVDC technology has a role to play in the future development of offshore grid infrastructure, to tap into Europe's vast offshore renewables resources. The Flagship should ensure that grid enhancing technologies, sub-sea superconducting cables systems (SSCS) and other innovative MVDC technologies are addressed in the programmes. Access to multi-terminal DC pilot projects (or electrolyser projects) are needed by SSCS to access risk-free testing as part of their TRL progression. Without access, alternative technologies, and their	See comment above (nr. 100).

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			qualification programmes, may be heavily impacted at the expense of innovation linked to global climate ambitions. The European technology lead will be lost to other nations without inclusion of all grid technologies.	
102.	Barriers and policy context	Confidentiality requested by stakeholder		
103.		T&D Europe	As long as HVDC vendors are closely integrated in project P7, the confidentiality of the controls should not be the main barrier. Rather this is a completely normal property of coupling (any type of) systems from different vendors (in this case a multi-vendor HVDC grid). The main barrier is expected to be the development of a universally accepted definition of "multi-vendor" HVDC grids, which all vendor controls can and must adhere to. Additionally, the challenge of performing only necessary but adequate system studies when expanding the HVDC grid is significant. Finally, it has to verify that a vendor, not initially involved in the construction of an HVDC grid, is not a commercial disadvantage when adding an additional station to the grid.	Thank you, we share your views. There are several different challenges related with practical implementation of HVDC multi-terminal, multi-vendor projects, which are more widely discussed in ENTSO-E position paper on Offshore Development focuses on interoperability. The text is updated as follow: "The main barrier as experienced in earlier projects are around two areas: (1) Technical issues, like functional and operational requirements, demonstration in target environment, power system engineering and planning, and standardisation of systems and equipment; (2) Legal issues, like the confidential nature of HVDC controls, current contractual relations and warranties as well as national and EU regulation and legal frameworks. This project puts these challenges at the core and aims for clear procedures to address contractual/legal issues and ensure technical interoperability validations.."
104.	State of the art, current	*Error in the survey question on this part - no open comment given		No changes

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
	and future TRL			
105.	Estimated budget and funding schemes	SuperNode Ltd	This information is clear. Of particular note is that FS4 and FS5 account for more than 50% of total project budget, approx. €100million. With a proposed budget of this size, all technology options should be explored for greatest value to European citizens as well as achieving global climate targets.	The budget now is ammended to reflect only TSOs expected efforts (meaning excluding efforts of offshore RES developers, HVDC vendors and other stakeholders of HVDC systems).
106.		currENT	This information is clear. Of particular note is that FS4 and FS5 account for more than 50% of total project budget, approx. €100million. With a proposed budget of this size, all technology options should be explored for greatest value to European citizens as well as achieving global climate targets.	See comment above (nr. 105.).
107.	Suggestions	International Renewable Energy Agency (IRENA)	This event had very good insights on this topic: https://www.irena.org/events/2021/Jun/Trans-European-Networks-for-Energy	We acknowledge and thank you for shared reference.
108.		Confidentiality requested by stakeholder		
109.		SuperNode Ltd	It is vital that P7 and P8 make it possible for SMEs and new innovative entrants to contribute to network innovation.	We acknowledge the importance of collaboration of all stakeholders as well as the needed support of policy makers and regulatory authorities in the coming years. A proper cooperation framework must be set for such complex multi-stakeholder HVDC project, which is more widely presented in recent jointed ENTSO-E, T&D Europe and WindEurope paper on the development of multi-vendor HVDC systems and other power electronics interfaced devices.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
				We also invite to read answers on comments nr. 5. and 6.
110.		currENT	It is vital that P7 and P8 make it possible for SMEs and new innovative entrants to contribute to network innovation.	See comment above (nr. 109).
111.	**Missing concept**	International Renewable Energy Agency (IRENA)	F4 focuses on HVDC systems, but the question of Enable large-scale offshore wind energy into the grid goes beyond that. Maybe building adequate scenarios should be considered. Why are scenarios critical? 1. Getting scenarios right is important to make most of the RE solutions. Demand, including energy efficiency, is a critical endogenous parameter in the scenarios, and is key in future infrastructure planning in order to avoid overinvestment. 2. Scenarios are important to build hydrogen and ccs infrastructure and know where they're needed and by when 3. Scenarios are important to avoid building and maintaining unnecessary infrastructure	We acknowledge and share the views on the importance of well defined future network development scenarios. ENTSO-E is closely following the structural trends affecting the European power system, which are later reflected in ENTSO-E Ten-Year Network Development Plans and the further research areas identified in ENTSO-E Research, Development & Innovation Roadmap 2020–2030.
112.		SuperNode Ltd	Transmission systems based on sub-sea superconductors are missing. Prototypes are expected to be available by mid-decade and would fit well into P8, hence they must also be taken into account in P7.	The purpose of the Implementation Report is to prioritize the TSOs' research directions for the period 2021-2025 in order to effectively promote the execution of these research priorities and, thus, contribute to make the energy transition a reality. TSOs foresee that the multi-terminal, multi-vendor, offshore HVDC systems interoperability is one of the most urgent challenge to be solved to enable large-scale offshore renewable energy integration and AC/DC grids development. This does not

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
				preclude the importance to develop and research other novel technologies.
113.		currENT	Grid enhancing technologies should be included. Likewise, transmission systems based on sub-sea superconductors are missing. Prototypes are expected to be available by mid-decade and would fit well into P8, hence they must also be taken into account in P7.	See comment above (nr. 112.)
114.		Storelectric Ltd	<Responder provided same comments as in Nr. 54>	See comment above (nr. 54.)

Flagship 5

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
115.	Aims	International Renewable Energy Agency (IRENA)	very relevant topics	Thank you we value your acknowledgement.
116.		SuperNode Ltd	The techno-economic benefits of a widespread hybrid AC/DC system under its current scoping structure will only account for HVDC technologies in the DC space. Medium voltage DC (superconducting) technologies should be included within the scope of the wider projects and, as a result, ensure that an all encompassing techno-economic and societal analysis is produced.	The P9 and P10 are triggered by surge of power electronic coupled devices in the system and focusing on the stability management and assessment approaches of the widespread hybrid AC/DC system. We would like to highlight that the develop and pilot of new network components with reduced environmental impact such as HV cables without lead or application of superconductors etc. are foreseen under the scope of Flagship 3, P6. The selection of particular technology will be done by the project consortia.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
117.		currENT	currENT finds it unfortunate that the Flagship completely lacks consideration of the huge benefit of grid enhancing technologies beyond the stability aspect of power electronics. Moreover, the techno-economic benefits of a widespread hybrid AC/DC system under its current scoping structure will only account for HVDC technologies in the DC space. Medium voltage DC (superconducting) technologies should also be included within the scope of the wider projects and, as a result, ensure that an all encompassing techno-economic and societal analysis is produced.	See comment above (nr. 116.).
118.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
119.	Scope and expected impact	currENT	Power electronics are not only a stability issue, but a general power system optimisation tool. The role of grid enhancing technologies needs to be considered here.	See comment above (nr. 116.)
120.	Barriers and policy context	SuperNode Ltd	A barrier that needs addressing is how to ensure an open door for the private sector to participate in the Projects, thereby providing innovation and policy support for TSOs to facilitate development of new technologies from TRL6 to TRL9, e.g. by establishing sand boxes and / or other incentives. For that to happen, incentives must be established for TSOs to engage in external R&D partnerships to facilitate the demonstration and deployment of new, innovative grid technologies.	We agree that an appropriate partnership set up is crucial for the successful development of each project concepts (not only limiting of P10 or P9). Collaborative effort with key stakeholders is relevant to further scope and develop the final project proposals based on the concepts proposed in this report.
121.		currENT	Optimisation of grids needs to be addressed, see NOVA principle (existing and future). A barrier that needs addressing is how to ensure an open door for the private sector to participate in the Projects, thereby providing innovation and policy support for TSOs to facilitate development of new technologies from TRL6 to TRL9, e.g. by establishing sand boxes and / or other incentives. For that to happen, incentives must be established for TSOs to engage in	See comment above (nr. 120.)

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			external R&D partnerships to facilitate the demonstration and deployment of new, innovative grid technologies.	
122.		T&D Europe	It is not clear for P9 why the considering the commercial impact on manufacturers and competitive differences is a barrier to the development of a system for stability management.	We aimed to anticipate the holistic impact of the subject, but we agree with your comment and amended the barriers description accordingly.
123.	State of the art, current and future TRL	Confidentiality requested by stakeholder		
124.		EERA Joint Program Smart Grids	Ref. State of the art in P9: Considerable work in the field of measuring inertia, development and testing of inertia controls (laboratory environment) was done in EU FP7 project ELECTRA IRP http://www.electrairp.eu/	We integrated the following sentence to P9 State of the art: "ELECTRA IRP has contributed to the field of measuring inertia and testing horizontally-distributed control schemes"
125.		T&D Europe	For P10, is the target TRL only a set of models or rather a complete framework and set of procedures for assessment? Only developing benchmarked models for today's grid may limit the usefulness of the results when considering future developments in the grid.	The project concept focuses on the development of both, methodologies and simulation models, including modelling requirements and define information exchanges for various (new) designs. This is critical for a full assessment and de-risking of meshed DC systems and their interaction with the AC system prior to full-scale deployment.
126.		E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
127.	Estimated budget and funding schemes	SuperNode Ltd	FS5 is suggested to start in 2022. SuperNode proposes that alternative technologies should be considered alongside HVDC. Therefore, sufficient time must be allowed to scope in innovative technologies providing alternative technical solutions under this Flagship and related Flagships, the results of which may have a material impact on Flagship 5.	See comment above (nr. 116).

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
128.		currENT	FS5 is suggested to start in 2022. SuperNode proposes that alternative technologies should be considered alongside HVDC. Therefore, sufficient time must be allowed to scope in innovative technologies providing alternative technical solutions under this Flagship and related Flagships, the results of which may have a material impact on Flagship 5.	See comment above (nr. 116.).
129.		T&D Europe	The proposed timeline of P9 looks short. Furthermore, for P9 the European call "CL5-2021-D3-01-02" (CSA call) is not seen as appropriate for the scope of this project. A funded project focused on grid planning would be better matched. For P10 funding refers to a project following the HORIZON Europe call. This is not consistent with the proposed timeline of 2022-2024.	We agree that P9 timeline should allow more time for development and amend accordingly. It is beneficial if the TSO research priorities match with calls from the Horizon Europe. Unavailability of matching funding might be a challenge, but we aim to pave the way.
130.	Suggestions	Confidentiality requested by stakeholder		
131.		SuperNode Ltd	Where alternative technologies (e.g. MVDC, Superconductors, etc) could have material impacts on the outcomes of P9 and P10, these must be considered within this Flagship and related Flagships.	The P9 and P10 are triggered by surge of power electronic coupled devices in the system and focusing on the stability management and assessment approaches of the widespread hybrid AC/DC system. We would like to highlight that the develop and pilot of new network components with reduced environmental impact such as HV cables without lead or application of superconductors etc. are foreseen under the scope of Flagship 3, P6.
132.		currENT	Where alternative technologies (e.g. MVDC, Superconductors, etc) could have material impacts on the	See comment above (nr. 131.)

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			outcomes of P9 and P10, these must be considered within this Flagship and related Flagships.	
133.	**Missing concept**	SuperNode Ltd	Where alternative technologies (e.g. MVDC, Superconductors, etc) could have material impacts on the outcomes of P9 and P10, these must be considered within this Flagship and related Flagships.	See comment above (nr. 131.)
134.		currENT	Where alternative technologies (e.g. MVDC, Superconductors, etc) could have material impacts on the outcomes of P9 and P10, these must be considered within this Flagship and related Flagships.	See comment above (nr. 131.)
135.		Storelectric Ltd	<Responder provided same comments as in Nr. 54>	See comment above (nr. 54.)

Flagship 6

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
136.	Aims	International Renewable Energy Agency (IRENA)	Blockchain can also be considered as one of the digital technologies that can support some materials here: https://www.irena.org/publications/2019/Sep/Internet-of-Things https://www.irena.org/publications/2019/Sep/Artificial-Intelligence-and-Big-Data https://www.irena.org/publications/2019/Sep/Blockchain	We thank for the given references. Blockchain is an interesting topic for TSO also, this can be seen on different national TSO projects. The project concepts proposed does not specify the technology to be used, but rather focus on system challenges. Stakeholders are welcome to propose the best technological solutions in in further projects development and scoping phase.
137.		T&D Europe	P12: Control center are today still highly customized and customer tailored solutions. To support better cyber resiliency and enable increased usage of open source components, TSO shall start an initiative to define a common control center	The definition of common rules is extremely important especially in the context of control centers. Thus, P11 and P12 focus on common topics like cyber resilience and a modular approach allowing for multi-vendor and open

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			requirement specification. This would help to reduce the vendor efforts to maintain the installed base.	source applications. Nevertheless one often has to consider national TSO specific needs in control centers. Therefore, the project concept focus on some important topics to push them further.
138.	Scope and expected impact	Confidentiality requested by stakeholder		
139.		T&D Europe	P12: To make the defined goals of project concept feasible, it is important to identify business models, that assures on the one hand side the vendor buy in, and on the other side, assure fast und competent reaction in case of detection of software errors or cyber vulnerabilities.	Very important point, thank you. In order to increase the motivation of manufacturers, the topic of "business models" is important and for the TSO the fast and competent reaction. Nevertheless these points are addressed in the scope: "Develop a cooperation framework and governance for TSOs and vendors that enables interoperability by accounting for future control centre functionality expansions, generic/detailed model sharing, model adaptations to plug in new modules, and future liabilities and warranties" and "Define services to reach an open community and continuous maintenance/support."
140.	Barriers and policy context	Confidentiality requested by stakeholder		
141.		T&D Europe	P12: A missing business case for the vendors to participate in open source communities is missing as barrier	We agree with your suggestion and highlighted it in the text.
142.	State of the art, current	Confidentiality requested by stakeholder		

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
143.	and future TRL	T&D Europe	P12: Within the Linux foundation there is already a open source community LF Energy (https://www.lfenergy.org/) which have already >10 projects in place. However the utilization of these software at TSOs is still low.	Thank you for the reference to the existing community. We will consider potential collaboration in further development phase.
144.	Estimated budget and funding schemes	Confidentiality requested by stakeholder		
145.		T&D Europe	Within the Flagship, the budget share seems to be reasonable, however comparing the total budget for this Flagship with Flagship 4, there seems to be a mismatch.	Thank you, we note that the Flagship 4 budget line was revised, to reflect only TSOs collaborative efforts.
146.	Suggestions	Confidentiality requested by stakeholder		
147.		T&D Europe	P12: See comment to question 41 <reference to Question 41: P12: Control center are today still highly customized and customer tailord solutions. To support better cyber resiliency and enable increased usage of open source components, TSO shall start an initiative to define a common control center requirement spezification. This would help to reduce the vendor efforts to maintain the installed base>	Please see answer on comment nr. 137.
148.		E.DSO	Confidentiality requested by stakeholder	
149.	Missing concept	Confidentiality requested by stakeholder		
150.		T&D Europe	P12: See comment to question 41 <reference to Question 41: P12: Control center are today still highly customized and customer tailord solutions. To support	Please see answer on comment 137.

No.	Section	Responder	Respondents' feedback	ENTSO-E's views
			better cyber resiliency and enable increased usage of open source components, TSO shall start an initiative to define a common control center requirement spezification. This would help to reduce the vendor efforts to maintain the installed base>	
151.		Storelectric Ltd	<Responder provided same comments as in Nr. 54>	See comment above (nr. 54.)

Ranking of project concepts

No.	Responder	Respondents' feedback	ENTSO-E's views
152.	Storelectric Ltd	"All the rest are totally irrelevant, except for building flexibility into the system. The concept of flexibility is totally inadequate as it only considers power and speed of response, not duration, inertia etc. which are needed in a manner integrated with power and speed of response. And having real inertia makes ultra-fast response times unnecessary. The focus on DC systems totally ignores the much superior and cheaper solutions from AC systems such as adiabatic CAES. And it assumes that interconnectors will hold the solution to weather pattern variability, which they don't: see https://www.storelectric.com/wp-content/uploads/2021/03/Interconnectors-and-Imports.pdf"	Please see answer nr. 1 and 54.
153.	International Renewable Energy Agency (IRENA)	Deep electrification and cross sectorial integration is key for decarbonising end-use sectors using renewable electricity.	Thank you, indeed we see from collective results the matching priority of other stakeholders as well.
154.	Confidentiality requested by stakeholder		

No.	Responder	Respondents' feedback	ENTSO-E's views
155.	currENT	In addition, P7, P8 and P10 are very important projects that require focus..	Thank you, we acknowledge your indication.
156.	EERA Joint Program Smart Grids	The R&D experience of EERA JP Smart Grids members indicates that the selected P1, P2 and P4 will cover the most urgent and relevant issues in Smart Grids domain.	Thank you, we acknowledge your indication.
157.	T&D Europe	"Flexibility is key to assure the stabe and reliable operation of an energy system driven by 100% renewable generation. A large share of this flexibility will be provided at the grid edge. So sector integration and demand side management will become very important enabler for as successful energy transition. In order to integrate mass offshore wind into the grid and achieve Green Deal goals in an economical fashion, HVDC grids are critical (P7, P8). With the entry of this inverter-interfaced power into the grid, a system for stability management (P9) also becomes of critical importance."	Thank you, we acknowledge your indication.

Level of interest to work with ENTSO-E and TSOs

No.	Responder	Respondents' feedback	ENTSO-E's views
158.	Storelectric Ltd	Storelectric (and others if their technologies are up to it) can deliver zero-carbon energy security and grid stability for the entirety of Europe without having to greatly increase interconnector or grid sizes. Such large-scale, long-duration, naturally-inertial electricity storage is the only way to enable renewables to power the world affordably, reliably and resiliently. All the current proposals sacrifice all three aspects: they're unaffordable, unreliable and fragile.	Please see answer nr. 1 and 54.

No.	Responder	Respondents' feedback	ENTSO-E's views
		They also depend on resources (especially lithium, cobalt and rare-earth metals) that the planet just doesn't have in sufficient quantity."	
159.	International Renewable Energy Agency (IRENA)	according to current IRENA workstreams	Thank you for answering.
160.	Confidentiality requested by stakeholder		
161.	currENT	currENT would like to be considered a key stakeholder in the process going forward on the projects in which it has expressed an interest, e.g. through membership of steering groups, committees.	Thank you, we welcome further cooperation.
162.	T&D Europe	"See detailed comments to the projects concepts and ranking in question 48 <reference to Question 48: Flexibility is key to assure the stabe and reliable operation of an energy system driven by 100% renewable generation. A large share of this flexibilty will be provided at the grid edge. So sector integration and demand side management will become very important enabler for as successfull energy transition. In order to integrate mass offshore wind into the grid and achieve Green Deal goals in an economical fashion, HVDC grids are critical (P7, P8). With the entry of this inverter-interfaced power into the grid, a system for stability management (P9) also becomes of critical importance.>"	Thank you, we acknowledge your indication.

Open Comments

No.	Responder	Respondents' feedback	ENTSO-E's views
163.	Storelectric Ltd	"Totally forgotten is Black Start: see https://www.storelectric.com/wp-content/uploads/2020/02/Lessons-for-Europe-from-the-UK-blackouts-v2.pdf There should also be common standards on how to compare different types of storage, which most people find almost impossible owing to the very different and incompatible ways in which each provider presents their capabilities. See https://www.storelectric.com/comparing-energy-storage-like-with-like/"	We would like to note that P9 addresses the system integration challenges of power electronics, including GFCs that can provide black start.
164.	Confidentiality requested by stakeholder		
165.	currENT	currENT has previously submitted a response to this consultation. It is this updated submission from 10 September that should be considered.	Thank you, we used indicated latest answers in consultation process.
166.	EERA Joint Program Smart Grids	In several suggested projects the titles do not fully correspond the scope and objectives in their detailed description in Annex I. In addition, several suggested projects do not clearly correspond the scope of the referred HEU Calls.	The TSO research priorities are aligned with several calls from the Horizon Europe. They partly originate from the ENTSO-E RDI strategic vision and Roadmap rather than from a particular funding programme. Unavailability of matching funding might be a challenge, but we aim to pave the way.
167.	E.DSO	Confidentiality requested by stakeholder	Confidentiality requested by stakeholder
168.	Individual expert opinion via email	Generally speaking your document does not spend a single word in describing how you collaborate and interact with other players. For modelling and planning, if you intend to develop an open source/access model, there is a fervent community ready to engage with knowledge and ideas. I assume that for multivendors solutions	In each project sheet the funding scheme states the opportunity for collaborative efforts and interested stakeholders are welcome to approach one or more

No.	Responder	Respondents' feedback	ENTSO-E's views
		and cyber security you will collaborate with actors from respective communities, but you do not write about it and give the impression to do all of it on your own. Finally, while all your projects have a very strong technical scope, solutions and approaches you intend to develop in those projects have to be deployed and have political, societal and environmental implications. As you aim at raising funds from public bodies and the Horizon programme the "soft" issues are usually essential for a successful application.	TSOs towards implementing this effort. Please also see answers nr. 5 and 6.

Comments provided during the Stakeholders' Webinar on 1st October 2021

No.	Responder	Respondents' feedback	ENTSO-E's views
169.	Storelectric Ltd	Powering grids with renewables requires at least tripling grid size unless renewables are connected THROUGH large-scale long-duration inertial storage. Such storage and project configurations need supporting.	The TSOs are technology integrators and provide a level playing field for all technologies to access the network according to regulation. It is on the side of the technology providers to prove their technology useful for the energy transition and ready for grid integration, in which case collaborative projects are welcome.
170.	Storelectric Ltd	Flexibility without duration will help very little: how do we power the entire evening peak and overnight on a windless winter day, and weather patterns that extend this to days or up to 2 weeks (kalte Dunkelflaute)? Must include duration.	Please note that the proposed additional project concept also considers long term (weekly, seasonal) energy storage.
171.	Storelectric Ltd	Pan-Euro power system fails if insufficient storage. Nearly all countries' plans rely on imports during times of system stress, which are largely concurrent (e.g. windless winter night): if all are importing simultaneously, who's exporting?	Please refer to ENTSO-E Ten-Year Network Development Plan and ENTSO-E Mid-term Adequacy Forecast.
172.	Storelectric Ltd	Smart charging will help a little but there's insufficient metal in the earth's crust to electrify all mobility, even without considering grid-connected batteries. Hydrogen vehicles must be a majority.	Please see answer Nr. 169.

No.	Responder	Respondents' feedback	ENTSO-E's views
173.	Storelectric Ltd	Smart systems are great at optimising the use of energy - but useless without enough long-duration storage. If there isn't enough energy in the grid, there just isn't enough, however smartly we use it.	Please see answer Nr. 169.
174.	Storelectric Ltd	Projects must be encouraged that address multiple project concepts, or the best and most flexible technologies will not be supported.	Thank you, further scoping of actual project based on the concepts, will be done in collaborative manner and will consider previous as well as parallel developments.
175.	Storelectric Ltd	Valuing/remunerating flexibility must also value stability, balancing & other benefits, and a single plant should win integrated contracts. Otherwise the most flexible plants are impossible, e.g. inertial storage delivers flex AND stability	We are aware that an MTU of an hour does not reflect the real-time imbalance and this is why there is currently work being done in decreasing the MTU to 15 minutes to better reflect the true imbalance and the value of flexibility in the settlement. Furthermore, if the installation is competitive in different services, the market allows for revenue stacking. However, despite the current opportunities, P4 as well as new project concept proposed will address research to improve market design and promote the integration of flexible solutions into the system, while remaining technology agnostic.
176.	EPRI Europe DAC	These project concepts align with research and demonstration efforts around the world (e.g. EPRI, Global - PST, etc.). We look forward to coordinating with ENTSO-e members to share technology advancements and lessons learned.	Thank you. Indeed, the TSOs research priorities call for collaborative efforts to achieve the goals for 2030 (and beyond).
177.	Storelectric Ltd	Energy transition requires >3x electricity capacity (even before considering intermittency) as electricity supports electrolysis, heat pumps, transportation, synthetic fuels etc.	We agree that the energy transition will rely heavily on the transmission electricity system and, hence, the ETNSO-E RDI Roadmap's and the Implementation Report project concepts to make the energy transition a reality.
178.	Confidentiality requested by stakeholder		

No.	Responder	Respondents' feedback	ENTSO-E's views
179.	Storelectric Ltd	There must be room for "other" projects that accord with 2050 objectives but don't fit the project concepts conveniently. This category should be as big as necessary: the more capable the solution, the less it will fit individual concepts.	The Implementation Report is a priority statement and it does not exclude the opportunity for stakeholders to approach one or several TSO with particular projects outside the scope of the selected project concepts.
180.	Confidentiality requested by stakeholder		
181.	Confidentiality requested by stakeholder		
182.	Storelectric Ltd	Need to reform regulatory systems so that they incentivise and remunerate major investments, broadly capable and long-lived plants, energy system greenness and sustainability, total energy sufficiency. No EU system does these adequately.	Thank you for remark, we support that the regulatory environment and renumeration of investments in innovative solutions could be enhanced to support innovation uptake. ENTSO-E is working on this topic, but it is not part of Implementation Report.
183.	Storelectric Ltd	Too much focus on developing models, concepts, smart, and data, not enough on building installations - especially first-of-a-kind commercial plants which are otherwise almost impossible to finance privately.	TSOs are technology integrators and cannot deploy commercial plants.
184.	Storelectric Ltd	Under Flagship 4 and Flagship 5, there are very important efforts coordinating Grid Forming Inverter technology and applications, e.g. new DOE effort- https://www.nrel.gov/news/program/2021/nrel-to-lead-grid-forming-inverter-consortium.html	Thank you for point out this reference.
185.	Confidentiality requested by stakeholder		
186.	Confidentiality requested by stakeholder		

No.	Responder	Respondents' feedback	ENTSO-E's views
187.	Storelectric Ltd	There need to be potential for contracts that include transmission operator, system operator, developer and others	The TSOs research priorities call for collaborative efforts to achieve the goals for 2030 (and beyond).
188.	NordPool Group	Probably all clear, but can you say what is included in "cross-sector integration" in terms of energy carriers, energy flexibilities, and transmission/transport systems?	The details on the project sheet in the annex to the Implementation Report can be complemented with the following publications: ENTSO-E Multi Sector Planning Support roadmap, ENTSO-E position paper on Sector Coupling through Power to Gas and Sector Integration, and ENTSO-E position paper on Electric Vehicle Integration into Power Grids.