June 2021

currENT Response to "PDIRT-E 2021" Proposal

CURRENT
Enabling Network Technology throughout Europe

currENT welcomes the opportunity to provide input on the ***PDIRT-E 2021*** for the years 2022 to 2031 as part of this consultation. Making significant progress in this period will be critical for integrating the additional 14 GW+ renewable generation capacity that is planned in the next ten years, and ultimately achieving the 2030 target of 47% of final gross consumption of energy from renewable energy sources. This is even more challenging with high uncertainty on the location of new generation and changing power flows between transmission and distribution networks. We believe there is no alternative to ambitious RES targets and that Grid Enhancing Technologies (GETs) are a key element to make this happen in a secure, affordable and sustainable way in Portugal. We believe that its ambition could be even better met in insisting more on the value add of Grid-Enhancing Technologies (GETs) for the existing grid, but also for reinforcement and future grids, which would further enhance the overall impact of this PDIRT-E.

currENT is the industry association representing the voice of innovative grid technology companies that operate in Europe. Our members offer solutions that climate proof existing power networks and add innovative elements to the new ones that are yet to be built. Power networks can be optimised and reinforced through these solutions, and additional networks can start off with the latest state-of-the-art technology. Our solutions[1] enable power networks to deliver the energy transition at least cost; in a secure, sustainable and socially responsible manner.

currENT aims to generate greater awareness of Grid Enhancing Technologies and to accelerate their implementation on electric grids across Europe[2]. We do so by working with the wider stakeholder ecosystem to generate awareness of the benefits of these technologies, share learnings, and contribute to developing future-proof regulatory and policy frameworks.

In relation to this PDIRT-E, currENT believes there is a need for greater recognition and explicit mention of grid enhancing technologies and innovative solutions that increase the network efficiency, especially those that are recognised in ENTSO-E Technopedia. GETs and innovative solutions can enhance the PDIRT-E in many ways, including;

- *Modular flexible solutions enable REN to meet the grid needs of today with minimal investment risk or the option to defer investments; solutions can be scaled up or down, or moved as needs change.*
- *Rapidly deployable means near-term progress on integrating RES and interconnection capacity, and act as enablers for larger infrastructure Base and Complementary projects.*
- *A shorter payback period of solutions enables efficient, low-risk investments and minimum cost to consumers.*
- *Minimal impact on local communities/environment and faster release of capacity for RES (value of early delivery).*

[1] Overview of technology types provided by currENT members https://www.currenteurope.eu/xq28
[2]For more information, read our Policy Recommendations.

- *GETs enable more granular observability and control of the network and quicker response to unforeseen network or environmental events.*
- *Leveraging portfolio of GETs provides maximum benefits to the system and consumers.*
- *Innovative new grid technologies can provide more efficient bulk power transfer of large amounts of power over long distances from generation to demand.*

CurrENT proposes four key points for ERSEs and REN's consideration:

1. **GRID ENHANCING TECHNOLOGIES ARE READY FOR WIDE-SCALE IMPLEMENTATION IN PORTUGAL AND NEED TO BE EXPLICITLY RECOGNISED IN THE PDIRT-E**

   currENT notes that there are no explicit references to Grid Enhancing Technologies (GETs)[3] or innovative solutions in the proposed Base and Complementary projects. currENT strongly supports the PDIRT-E's approach of modernisation of assets and maximising the use of existing assets to defer investment decisions until there is more certainty on need/probability; however, the role of GETs needs to be recognised more explicitly. GETs can support maximising the use of the existing network and provide additional operational benefits and improve the flexibility and resilience of the network. Given the high level of uncertainty on the future location of generation in Portugal, there is scope to increase the use of GETs in this PDIRT-E and future plans, particularly those GETs which have higher TRLs and thus proven benefits. GETs can enable REN to meet the grid needs of today with minimal investment risk or the option to defer large investments due to their modular nature (i.e. solutions can be scaled up or down, or moved as the system needs change; thus, GETs will not become stranded assets). The typically short payback period of GETs further reduces the risk of investments and supports the PDIRT-E's commitment to ensuring minimal additional costs to consumers or changes in the level of the grid component in tariffs. Greater use of GETs is in line with recent European legislation which seeks to accelerate the transition to smarter low carbon grids, such as the Smart Grid Indicator, which NRAs were tasked to develop by the end of 2020 and the relevant provision in the Energy Efficiency Directive relating to the efficiency of networks.[4]. This is valuable not only for the Portuguese transmission network and national targets, but also on cross borderlines where GETs can support Portugal's linear progress towards the EU 70% available capacity target by 2025 and achieving the 15% interconnection target by 2030 through enabling larger interconnection projects.

[3] The term GETs refers to hardware, software and associated protocols applied to existing and new transmission facilities that increase the network's operational transfer capacity. Examples include Dynamic Line, advanced sensors, and modular power flow control solutions.

[4] The JRC report of December 2020 Improving Energy Efficiency in Electricity Networks https://publications.jrc.ec.europa.eu/repository/handle/JRC121757

2. RAPIDLY DEPLOYABLE SOLUTIONS MUST BE FAIRLY VALUED IN THE MULTI-CRITERIA CBA

Given the common delays associated with implementing new infrastructure projects due to permitting and public acceptance complexities, the value of rapidly deployable solutions must be recognised, e.g. Dynamic Line Rating, intelligent asset sensors and modular power flow control solutions such as SSSC devices[5]. Rapidly deployable solutions can often be delivered in less than a year, leading to the quicker release of capacity, increased efficiency of the existing network and ultimately faster progress towards renewable and cross border capacity targets. currENT recommends that ERSE and REN consider whether any of the existing projects identified in the NDP could be improved through using rapidly deployable solutions as an interim or enabling measure for large projects, or in some cases as a more optimal solution to part or all of the proposed project. ERSE and REN should also review existing selection and evaluation processes for projects to ensure that the processes fairly value the benefits of rapidly deployable solutions. While we support that the criteria for project selection/multi-criteria CBA have to include socio-economic factors and mentions 'weighted flexibility to adaptation to future developments and uncertainties' of infrastructure options, we miss here the value of early delivery of projects: when lines come late grid optimisation technologies can bridge gaps and reduce costs to society. See example in the detailed comments section)

3. COMPLEMENTARY SOLUTIONS OPTIMISE THE USE OF THE EXISTING GRID

currENT would like to highlight the complementarity of GETs, particularly in terms of maintaining network resilience, managing congestion and optimising the power flows across the network. By leveraging multiple GETs with different functionalities to meet a network need, in most cases, the overall impact will be far greater than if only one technology was used in isolation. This holistic approach to solving network needs provides operational benefits by enabling more granular observability and control of the network, and quicker response to unforeseen network or environmental events. Furthermore, it provides socio-economic and ecological benefits as using multiple GETs in combination allows more flexibility in how and where the solutions are located, thus enabling minimal impact on local communities and the environment. currENT recommends that ERSE and REN consider GETs not only as standalone solutions, but also as solutions that can be combined in order to maximise the benefits of an existing or new project, and ultimately provide maximum value to both the network and consumers.

[5] The static synchronous series compensator (SSSC) is a power quality FACTS device that employs a VSC connected in series to a transmission line through a transformer or multilevel inverters [ENTSO-E Technopedia]

4. **HIGH POTENTIAL NEW GRID SOLUTIONS MUST BE PRIORITISED AND ADDED TO THE NETWORK PLANNING TOOLBOX**

   Given the 40 years plus lifetime of new grid assets, the latest innovative and technological advancements must be taken into account when planning new grids. Examples of these new grid technologies include superconductor cable systems. As the level of renewables connecting to the network continues to increase, highly efficient bulk power transfer of large amounts of power over long distances from generation to demand and across borders will be required across Europe. currENT recommends that ERSE and REN review the processes for qualification of new technologies that have been proven in other geographies to ensure that technologies that can deliver significant value to Portugal in the long-term are sufficiently included and fairly considered as possible solutions as part of the network development plan process. This would need to be supported by a strong sharing of learnings and 'best practices' between ERSE, REN and other network companies and stakeholders to minimise the risk of wasting research money and duplicating work on proving a technology that has already been proven on another network. The ENTSO-E Technopedia[6] and the Competitiveness Progress Report[7] are among the useful sources of information on the TRLs of new technology solutions and references of existing projects, and the results of innovation projects under programmes such as Horizon 2020 (now Horizon Europe) should also be considered.

More details on each of these four points are in the following section.

Detailed comments

1. Grid Enhancing Technologies are ready for wide-scale implementation in Portugal

The term Grid Enhancing Technologies (GETs) refers to hardware, software and associated protocols applied to existing and new transmission facilities that increase the network's operational transfer capacity. Examples of GETs with medium to high TRLs include Dynamic Line Rating, intelligent sensors, modular power flow control solutions such as SSSC devices and many more. GETs are typically modular, quick to deploy, cost-effective and can be relocated as system needs evolve over time. This ensures that GETs are a 'no risk' investment as the solution sizes can be scaled up or down over time, moved to a new location on the network if the system needs changes, or used as a temporary solution while a project is underway or in outage conditions. The ENTSO-E Technopedia comprises factsheets on 60+ technologies for use on

[6] ENTSO-E Technopedia https://www.entsoe.eu/Technopedia/
[7] Competitiveness Progress Report https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1602695747015&uri=COM:2020:953:FIN

transmission grids, providing a useful source for system operators, regulators and other stakeholders on new and emerging technologies. Many of the GETs included in this Technopedia are at high TRLs with proven benefits, and thus ready for wide-scale roll out globally.

currENT strongly supports the PDIRT-E's approach of modernisation of assets and maximising the use of existing assets to defer investment decisions until there is more certainty on need/probability. However, the role of GETs needs to be recognised more explicitly. GETs enable network operators to maximise the capacity on the existing grid, minimise renewables constraint costs, increase network resilience, create more flexibility on the network, and provide operational benefits by enabling more granular observability and control of the network and quicker response to unforeseen network or environmental events. GETS act horizontally on existing grids that they optimise, on reconductoring and new grids that they equally optimise and complete as they can also be used as a temporary solution while a large project is underway or in outage conditions. While the energy transition requires more grids to be built, public opposition often leads to delays, so that GETs can act as in-betweens. GETs can enable REN to meet the grid needs of today with minimal investment risk and/or the option to defer large investments, due to their modular nature (i.e. solutions can be scaled up or down, or moved as the system needs change; thus, GETs will not become stranded assets). The typically short payback period of GETs further reduces the risk of investments and supports the PDIRT-E's commitment to ensuring minimal additional costs to consumers or changes in the level of the grid component in tariffs. GETs result in further socio-economic and environmental benefits through minimal impact on local communities/environment compared to traditional infrastructure and faster release of capacity for RES (value of early delivery).

As already mentioned, currENT strongly supports Portugal's commitment to optimisation of the existing grid and ageing assets. However, currENT would like to see explicit mention of GETs or similar solutions in the Base or Complementary projects in this PDIRT-E. As such, currENT proposes that ERSE and REN consider how GETs could enable planned projects or even defer the need for large infrastructure projects where there is high uncertainty of the future network need. This is valuable not only for the Portuguese transmission network and national targets, but also on cross borderlines where GETs can support Portugal's linear progress towards the EU 70% available capacity target by 2025, achieving the 15% interconnection target by 2030 through enabling larger projects, and support the development of a network that can be adapted over time to cope with the impact of climate change. The greater implementation of GETs is also in line with recent European legislation, which seeks to accelerate the transition to smarter low carbon grids, such as the Smart Grid Indicator, which NRAs were tasked to develop by the end of 2020 and the relevant provision in the Energy Efficiency Directive relating to the efficiency of networks. It is also important that REN, ERSE and other stakeholders regularly review the ENTSO-E Technopedia, Competitiveness Progress Report and other sources to ensure that all available technologies are fairly considered for future revisions of this NDP.

2. Rapidly deployable solutions must be fairly valued in the multi-criteria CBA

currENT commends the NDP's ambitious plans to integrate 14 GW+ of additional renewable generation in the next 10 yrs. We are strong advocates that power networks must be enablers, rather than barriers, to Europe's green recovery and achievement of national and European energy targets. Hence, the implementation of key network projects and next-generation solutions must be accelerated.

Given the common delays associated with implementing new infrastructure projects due to permitting and public acceptance complexities, we would like to highlight the value of rapidly deployable solutions to enable on-time delivery of other critical infrastructure projects and/or act as an interim solution while these projects are under permitting/construction. Rapidly deployable solutions are often non-wires solutions that can be delivered in less than a year, leading to the quicker release of capacity and increased efficiency of the existing network. For example, in Belgium, Dynamic Line Rating is used to manage high power flows on the transmission network during major planned outages. The outages are required to carry out the work to uprate the 400kV network with HTLS lines. During such outages which can extend over months, costly congestion management can be avoided without any risk of overloads by using DLR. This allows the uprating work to be carried out on time, safely, and with minimal financial impact.[8]. In this way, rapidly deployable solutions are particularly valuable to system operators where there is network congestion, high renewable constraints, or issues utilising the existing lines due to weather conditions or other factors.

Another example of a rapidly deployable solution is modular power flow control solutions such as the modular SSSC (Static Synchronous Series Compensator), which can optimise power flows across circuits, be quickly deployed in existing substations or corridors, and due to the modular design, can be easily scaled up or down or redeployed to another location. This limits costs that result from delayed networks and is very complementary with DLR or other GETs (see point 4). The value of such near- and short-term solutions needs to be recognised by the NDP more generally, and regulatory framework and processes should make sure that such solutions become part of the TSOs operational toolboxes. Modular SSSC are now deployed across the World: the specific ENTSO-E overview in the Technopedia provides for a comprehensive overview.[9]

CurrENT recommends that ERSE and REN consider whether any of the existing projects identified in the NDP could be improved through using rapidly deployable solutions as an interim or enabling measure, or in some cases as a more optimal solution to part or all of the proposed project.

ERSE and REN should also review existing selection and evaluation processes for projects to ensure that the processes fairly value the benefits of rapidly deployable solutions, particularly the benefits that would be accrued before the alternative solution could feasibly be implemented or while other infrastructure

[8] Presentation by Elia in the https://www.currenteurope.eu/conclusions-dynamic-line-ratings-for-optimised-grids/

[9] Static Synchronous Series Compensator - ENTSO-E

projects are under permitting/construction. While we support that the criteria for project selection/multi-criteria CBA have to include socio-economic factors and mentions 'weighted flexibility to adaptation to future developments and uncertainties' of infrastructure options, we miss here the value of early delivery of projects: when lines come late grid optimisation technologies can bridge gaps and reduce costs to society. Projects should be evaluated in terms of which solution or combination of solutions can best meet the identified system need in the required timeframe, as the value of reducing carbon emissions in the near term is far greater than reducing the same carbon emissions in 10 years' time.

Example of the value of rapidly deployable solutions

Compare two projects that meet the same need of reducing congestion but project A can be delivered in 1 year (using rapidly deployable solutions) and project B in 10 years' time. All other factors being equal, project A will be delivering operational, societal and financial benefits for at least 9yrs before project B is even built. The same principle applies to projects which combine rapidly deployable solutions with larger infrastructure projects, as the project benefits can be realised over a number of years as the project is delivered incrementally. In this way, the 'cost of delay' associated with some projects can be taken into account.

In this way, ERSE and REN can ensure that the projects, most critical to Portugal and its consumers, are prioritised and – even more importantly - delivered on time.

3. Complementary solutions optimise the use of the existing grid

CurrENT would like to highlight the complementarity of GETs, particularly in terms of maintaining network resilience, managing congestion and optimising the power flows across the network. By leveraging multiple GETs with different functionalities to meet a network need, in most cases, the overall impact will be far greater than if only one technology was used in isolation. This holistic approach to solving network needs provides operational benefits by enabling more granular observability and control of the network, and quicker response to unforeseen network or environmental events. Furthermore, it provides socio-economic and ecological benefits as using multiple GETs in combination allows more flexibility in how and where the solutions are located, thus enabling minimal impact on local communities and the environment.

For example, DLR provides visibility in real-time of the dynamic rating of the circuits and informs the system operator of the real available thermal headroom in the circuits, among other factors. To fully leverage this benefit, the system operator then operates the network in such a way as to utilise the capacity iden-

tified or take other action as required to maintain network resilience. Modular power flow control solutions is an effective solution to manage power flows and other network conditions in order to direct power towards underutilised lines or away from congested lines. In this way, the overall impact is maximised by combining solutions that enable the system operator to first identify network conditions in real-time and then take fast action using power flow control to optimise how the network is operated given these conditions.

CurrENT recommends that ERSE and REN consider GETs not only as standalone solutions, but also as solutions that can be combined in order to maximise the benefits of an existing or new project, and ultimately provide maximum value to both the network and consumers. On this note, currENT would like to highlight the recent 'Unlocking the Queue' report published by the WATT Coalition, which found that GETs can enable 2x greater capacity for renewables than without the technologies, avoiding over 3 Million Tonnes of carbon emissions and delivering $175 M production cost savings annually in just one region in the U.S. (Oklahoma and Kansas)[10]. CurrENT is also engaged in a similar study for Europe which will look at the value of smart transmission technologies/GETs in the 2030 time horizon, and we would welcome the opportunity to present the findings to ERSE and REN in autumn 2021.

4. High potential new grid solutions must be prioritised and added to the network planning toolbox

The priorities for innovation must be aligned with the overall strategic priorities for the Portuguese and wider transmission network to ensure the highest potential innovations are funded, developed, trialed and ultimately rolled out. It is important at once that high potential solutions with low Technology Readiness Levels (TRL) are prioritised for pilot projects, and implemented at scale once the benefits are proven on that network or in other geographies. High Technology Readiness Level technologies can be rolled out on a wider scale, and learning from other geographies - where they are deployed - is key. We recommend the use of ENTSO-E Technopedia[11] for seeing the TRLs as well as the deployments of technologies in networks.

The energy transition requires more grids to be built to facilitate the massive amounts of new renewables planned over the coming years. Given the 40 years plus lifetime of new grid assets, it is critical that the latest innovative and technological advancements are taken into account when planning new grids. As the level of renewables connecting to the network continues to increase, highly efficient bulk power transfer of large amounts of power over long distances from generation to demand and across borders will be required across Europe. Where the existing network is insufficient or non-existent (e.g. offshore or high capacity cross border lines), innovative New Grid Solutions must be considered to ensure that the grid

[10] Report: Unlocking the Queue – WATT (watt-transmission.org).
[11] ENTSO-E Technopedia - ENTSO-E

can be as efficient as possible from the outset, with minimal impact on local communities and the environment.

CurrENT recommends that ERSE and REN review the processes for qualification of new lower TRL technologies to ensure that technologies that can deliver significant value to Portugal in the long-term are sufficiently included as part of the network development plan process, i.e. newer technologies are not excluded as options to resolve near, medium or longer-term needs. This could be supported by an obligation on system operators to consider all possible solutions for an identified need as part of the network planning process.

This would result in more efficient long-term investments, and ultimately enable end-consumers to benefit from the new technology as early as possible. This would need to be supported by a strong sharing of learnings and 'best practices' between ERSE, REN and other network companies and stakeholders to minimise the risk of wasting research money and duplicating work on proving a technology that has already been proven on another network.

Concluding Remarks

currENT appreciates the opportunity to engage in this transparent consultation process on the PDIRT-E 2021, and to share our industry perspective on the planned network projects in Portugal. We would welcome the opportunity to engage further with ERSE, REN, and other stakeholders on this network development plan in the coming months. We suggest holding a workshop together that should lead to a common project assessing the benefit of GETs in Portugal.