PANTERA
Pan European Technology Energy Research Approach

Work Package 6

Collaboration working groups

Deliverable D6.3

Consolidated Summary Report of Desk Activities in the Target Regions

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Table of contents

Abbreviations

AMR	Automatic meter System
BFIEC	Bulgarian Federation of the Industrial Energy Consumers
CO2	Carbon Dioxide
COVID-19	Coronavirus disease
DSO	Distribution System Operator
EC	European Commission
EERA	European Energy Research Alliance
EFSI	European Fund for Strategic Investments
EIRIE	European Interconnection for Research Innovation & Entrepreneurship
ELMA	Electrical Machines, Drives and Power Systems
ENTSO-E	European Network of Transmission System Operators for Electricity
ESFRI	European Strategy Forum on Research Infrastructures
ESIF	European Structural and Investment Funds
ETIP-SNET	European Technology & Innovation Platforms - Integrated Roadmap Strategic Energy Technology Plan
ETS	Emissions Trading System
EU	European Union
EV	Electric Vehicles
FEC	Final Energy Consumption
GDP	Gross Domestic Product
GHG	Greenhouse Gas
H2020	Horizon 2020
HV	High Voltage
HVAC	High Voltage Alternating Current
ICT	Information and Communications Technology
JRC	Joint Research Centre
LULUCF	Land Use, Land-Use Change and Forestry
LV	Low Voltage
MV	Medium Voltage
OEB	Cyprus Employers and Industrialists Federation
PEC	Primary Energy Consumption
PV	Photovoltaics
R&D	Research&Development
R&D&I	Research&Development&Innovation
R&I	Research&Innovation
RED	Renewable Energy Directive
RES	Renewable Energy Source
RES-T	Renewable Energy Sources in Transport
RTDI	Research, Technological Development and Innovation
S3P	Smart Specialisation Platform
SET	Strategic Energy Technology
SME	Small and Medium-sized Enterprise
TSO	Transmission System operator

Executive Summary

This document provides a summary of activities performed within the Regional Desks framework from building up the approach and setting the objectives to analysing results and outlining next steps so far.

It includes not only descriptions of activities within all Regions, but also supportive actions performed centrally, including developing and analysing dedicated survey, investigating pathways of implementation of Smart Specialisation, continuous update and monitoring of PANTERA country profiles launched in D6.2 ‘Review of EU strategic priorities and relevant policy developments’ and identification of best-practice examples. The selected approach can be considered as effective and capable of delivering the envisaged results if supported actively by all involved parties. Discussed recommendations form a useful guideline and are the source of inspiration for enriching different dimensions of PANTERA process not limited to Regional Desks only.

1 Introduction

1.1 Purpose, Scope and Limitations of the Document

The work in this report is carried out under Work Package six (WP6) 'Collaboration Working Groups' of the Pan European Technology Energy Research Approach (PANTERA) project. This deliverable aims at describing regional activities and is the first version of consolidated summary report on Desk activities.

The report is committed to be a useful source of structured information on the current situation of PANTERA target countries in perspective of climate and energy targets and create a foundation for cross-country comparison. It contains descriptions of all Regional Desks specifics, activities held and future plans. Examples of good practices and actions within specific Desks are highlighted and shall be replicated and enhanced within the future work. Moreover, the report intends to present results of dedicated survey aiming to guide PANTERA in approaching stakeholders from the target countries.

The core objective of this first version is to understand and shape stakeholder faced challenges that might be minimised and needs that might be met by PANTERA and define next steps accordingly. The whole process will continue until month 43th to identify opportunities for accelerating R&I activities in the targeted countries.

1.2 Structure of the Document

This deliverable D6.2 is structured to cover all aspects of the regional work performed under the PANTERA regional desks. It starts with a brief introduction of regional dimension of PANTERA process in Section 2 followed by definition of Regional Desk concept in Section 3. Section 4 looks at each Desk individually, concentrating on specifics and progress made in building stakeholder network and populating PANTERA desks. Section 5 includes updated country profiles. Section 6 describes the value of Smart Specialisation and presents some analysis from the target country perspective. In addition, but equally important Section 7 focuses on Desks survey and obtained results. Section 8 includes discussion on best practices in R&I. Finally, section 9 concludes the document and sets directions for further work.

2 Regional Dimension of PANTERA Process

PANTERA initiative as a coordination and support action (CSA) includes a variety of activities on European and national levels, that may be grouped into tree core dimensions:

- the set-up of European Interconnection for Research Innovation and Entrepreneurship (EIRIE), an interactive multidimensional Platform of pan-European status and influence;
- working with regions via **Regional Desks** aiming to find ways of supporting R&I in energy field, particularly in smart grid, storage and local energy networks;
- joining efforts in supporting R&I through ad hoc **Working Teams** under the ETIP-SNET umbrella.

Current deliverable is part of activities related to regional dimension of PANTERA focusing on development and operation of Regional Desks. It's worth mentioning, that WP6 "Collaboration working group" activities form a core of regional dimension and are fully aligned with Desks timeline, see Figure 1. The regional dimension was consistently developed from drafting the approach in consultation plan [1] , setting framework for analysing situation related to energy policy and energy R&I at national level by creating a first version of so-called country profiles in the frame of policy review [2] and taking corrective measures after the first project year considering results of workshops and analysis.

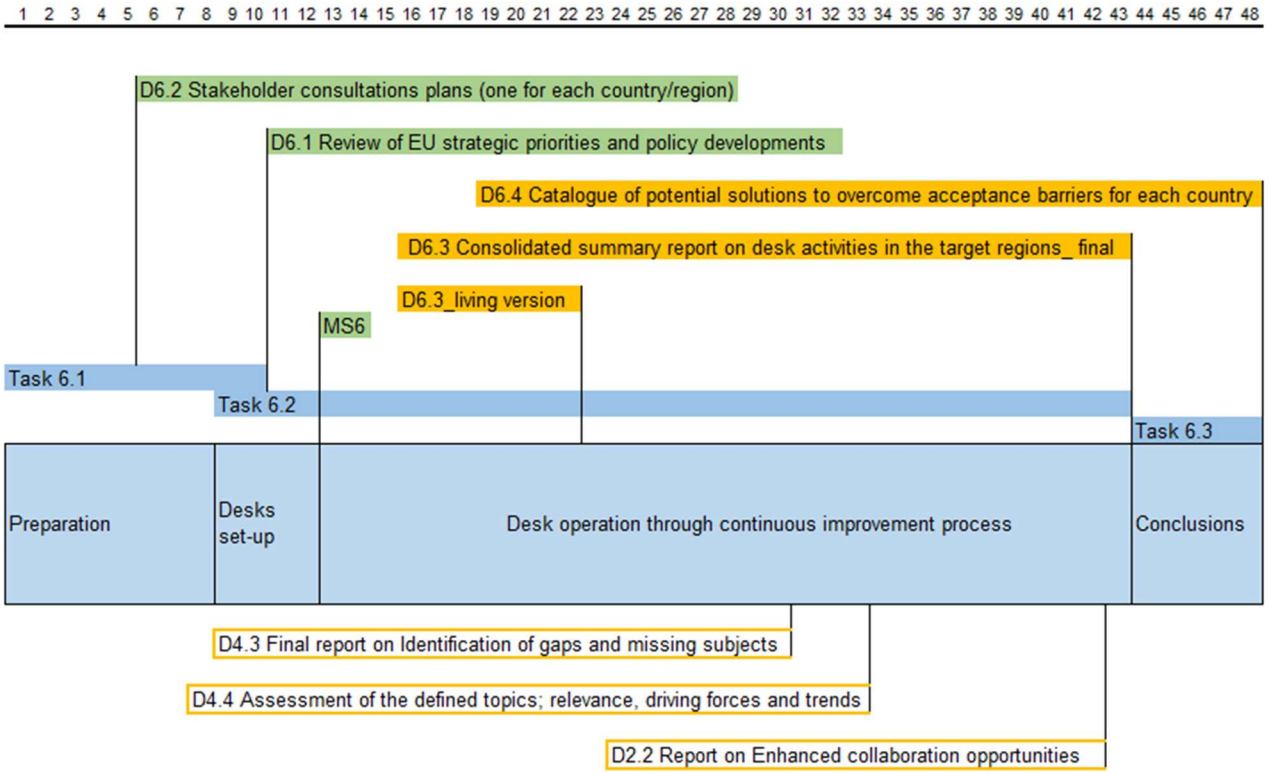


Figure 1: Regional Desk and WP6 timeline

Other activities linked to Regional Desks are being performed within WP4 'Key topics and content management' and WP2 'Pan-European R&I community' aiming accordingly at monitoring throughout the project the operational topics and stakeholder interaction that is of great value and significance.

In addition to the core activities of Regional Desks, the PANTERA consortium has established close cooperation with Joint Research Centre (JRC) under the regional prism. In specific we collaborate with theSmart Specialisation platform which assists Member States and regions to develop, implement and review their Smart Specialisation Strategies. These focus on identifying competitive advantage areas and enable the prioritisation of R&I investment under cohesion policy. This issue is addressed in Subsection 6 of this report.

3 Regional Desk Approach

PANTERA 6+1 approach, introduced in [1] aims to organize and synchronize efforts of different actors to strengthen national participation rate in smart grid R&I activities and investment. It is a place for raising discussions with national decision-makers, sharing experience and challenges in research and innovation, inviting local stakeholders to interact more actively with PANTERA and other EU-level initiatives. Thus, it is a key opportunity for attaining PANTERA ambition of creating a true pan-European R&I community.

During the first year of the project the concept was discussed within the partners and stakeholders during workshops, thus a structure, targets and activities were identified and corrected accordingly to the received feedback. This subsection presents the actual Desk structure. However, as Desk operation is a continuous improvement process, any necessary enhancements may be made during the whole project lifecycle.

PANTERA 6+1 approach includes six PANTERA Regional Desks committed to target countries which appear to have a lower rate of smart grid R&I activities and investment and one best-practice Desk elaborating on gathering and systemising good experience in projects and R&I governance from more successful countries (Figure 2). The term “Regional” describes the way the work is organised within the consortium rather than geographical division, it stresses the intention of PANTERA to be closer to the local stakeholders and adapt to the local processes and cultures. Relevant PANTERA partner is responsible for the host country and for the closer, so called associated, countries.

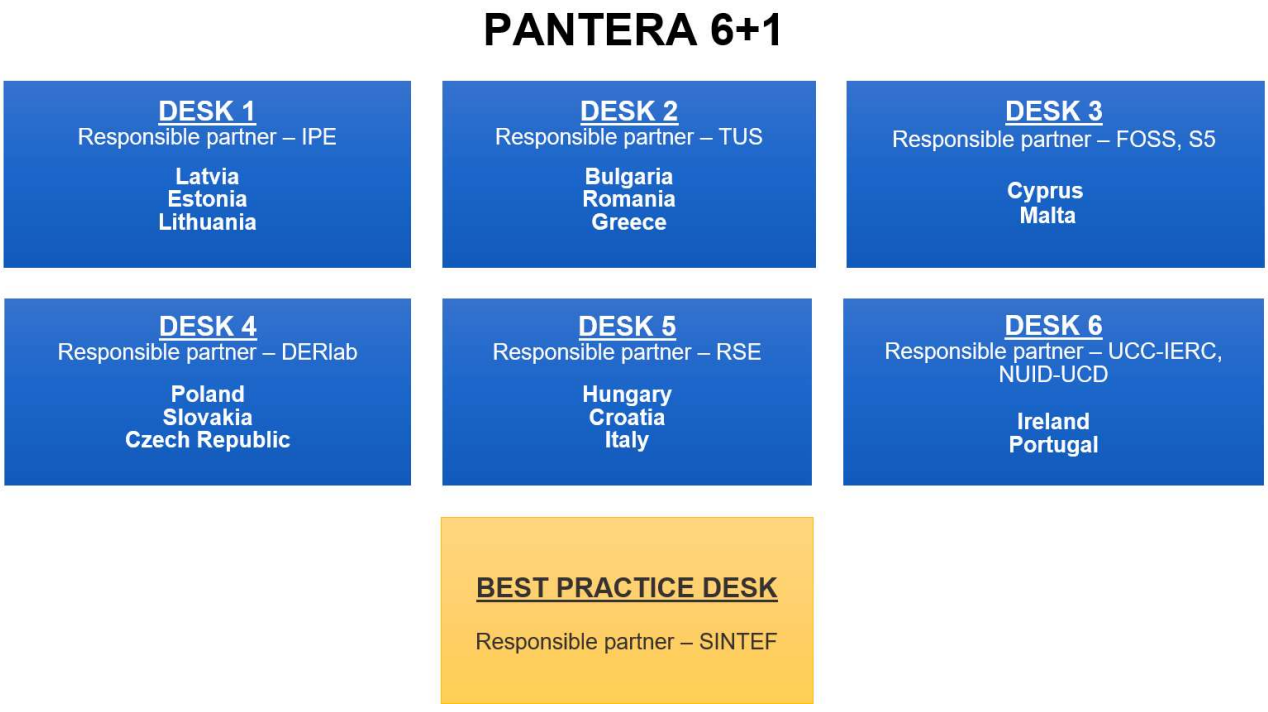


Figure 2: PANTERA 6+1 approach

The six main Desks serve as a PANTERA project’s contact point for all potential stakeholders from the defined region and for any other interested stakeholders from other countries. The Desk leader, e.g. the relevant project partner, is responsible for the Desk operation and establishing working relations with an active stakeholder acting as a contact person for the

relevant associated country's stakeholders. The Desk is a dynamic structure, where contact persons and stakeholders may join and express different level of activity and commitment during the project implementation. It supports organising stakeholder consultations and workshops, dissemination activities on regional level, generating country specific reports and publications, developing and updating PANTERA country profiles. Through this process the regional contexts will be provided for the PANTERA Working Teams and the Platform.

The additional best-practise Desk serves as an information hub for gathering successful practical experience and knowledge which may be utilised for benchmarking and accumulating lessons learned. The work performed within the best-practice Desk compliments the PANTERA national level activities in the target countries, supports Working Teams and fosters the Platform implementation by providing valuable information in the structured way. The Desks' structure and tasks are illustrated in Figure 3.

Figure 3: Structure and scope of work of PANTERA Desks

Current report includes monitoring of activities performed within each Desk: descriptions, lessons learned and proposed corrective action.

4 Regional Desks activities – Plan and Process Description for Each Desk

4.1 Desk 1 (Latvia, Lithuania, Estonia)

4.1.1 Regional highlights

Desk 1 consists of three Baltic States (Latvia, Estonia and Lithuania) and is led by PANTERA Consortium Member – IPE operating in Latvia. So, Latvia can be called as a host country, and Lithuania and Estonia as associated countries from Desk 1 operation point of view. In Desk's 1 particular case, PANTERA 'region' corresponds to geographical meaning of this term, where all three countries additionally to common boarders have close historical, political, cultural and business links. All three countries joined EU after 2004 and are classified as widening countries under Horizon 2020 framework.

From energy system perspective, Baltic States' electricity grid still operates synchronously with the Russian and Belarusian systems. The desynchronization of the Baltic States' electricity grid from these systems and the synchronisation with the continental European network, planned by 2025, is an essential political priority. Latvia, Estonia and Lithuania, along with EC, Denmark, Germany, Poland, Finland and Sweden (Norway as an observer) participate in high level Baltic energy market interconnection (BEMIP) plan initiative. As part of the BEMIP implementation, a number of cross-border and domestic infrastructure projects have been completed across the Baltics to improve their integration with the Nordic electricity market. According to EC Report on Connecting Europe Facility (CEF) supported actions [3] €547.2 million of EU funding has been allocated to the BEMIP in electricity through the CEF for works and studies within fifteen actions since 2014. However, this funding does not correspond to R&I in the field of Smart Grids directly, it could implicitly support Smart Grid development by investment in innovative grid infrastructure technologies.

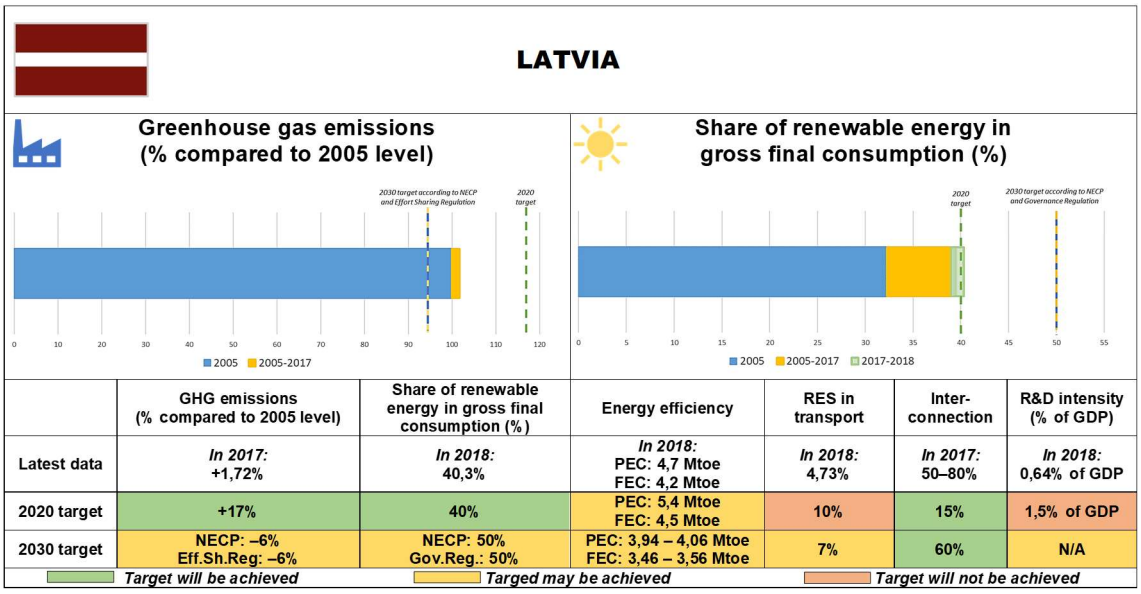
As smart metering is one of key enables of Smart Grids, it is worth mentioning that progress towards a wide roll-out of smart meters differs among all these three countries. While Estonia has completed a roll-out of smart meters and developed a data hub to ensure the efficient handling of data in retail energy markets [4] and Latvia is on the way to have almost full coverage of electricity smart metering nation-wide by 2022 (by the end of the 2018 these account for 49% of the total fleet of electricity meters and measure 83% of the total amount of electricity consumed by customers [5]), Lithuania has no significant progress in this field except including a plan to establish a mass roll-out of smart metering by 2023 in the recently endorsed 'National Energy Independence Strategy'.[6]

From scientific collaboration perspective, additionally to opportunities provided by European and national programmes, stakeholders from Baltic States may apply for funding under the Joint Baltic-Nordic Energy Research program initiated by Nordic Energy Research and supported by the Ministry of Energy of Lithuania, the Ministry of Economics of Latvia and the Ministry of Economic Affairs and Communications of Estonia. The overall objective of this program is to promote energy research and analysis in the Baltic States and inspire intra-Baltic and Baltic-Nordic collaboration. This aim translates into three central actions: promotion of intra-Baltic and Baltic-Nordic research projects with the participation of Baltic researchers, a Baltic-Nordic Doctor of Philosophy (PhD) collaboration and exchange of energy researchers between the Baltic and Nordic countries. [7]

As for innovation performance, Estonia might be considered a leader among Baltic States, being widely known for its success in digitalization and start-ups. It is one of three from sixteen

PANTERA target countries belonging to the strong innovators group according to European Innovation Scoreboard (other strong innovators are Ireland and Portugal). [8] Estonia has the most attractive research system and the highest international co-publication rate from Baltic countries. [8]

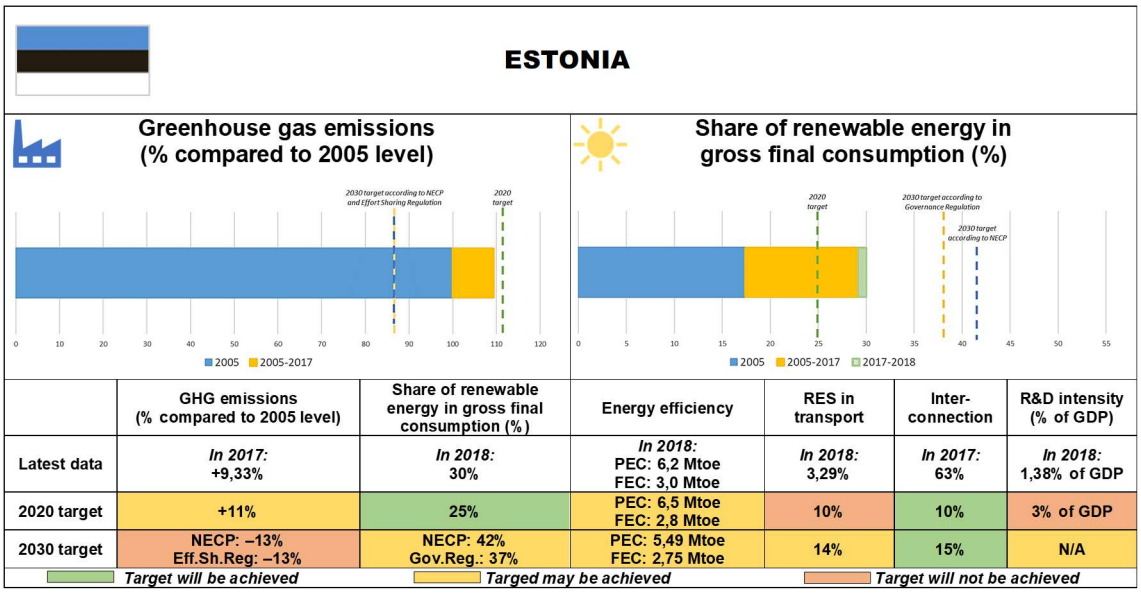
Details on the state of each country according to the five dimensions of Energy Union are given in the country profiles. Figures 4, 5 and 6 summarise countries progress towards 2020/2030 targets.



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* +1,72%	*In 2018:* 40,3%	*In 2018:* PEC: 4,7 Mtoe FEC: 4,2 Mtoe	*In 2018:* 4,73%	*In 2017:* 50–80%	*In 2018:* 0,64% of GDP
2020 target	+17%	40%	PEC: 5,4 Mtoe FEC: 4,5 Mtoe	10%	15%	1,5% of GDP
2030 target	NECP: –6% Eff.Sh.Reg: –6%	NECP: 50% Gov.Reg.: 50%	PEC: 3,94 – 4,06 Mtoe FEC: 3,46 – 3,56 Mtoe	7%	60%	N/A

Target will be achieved *Targed may be achieved* *Target will not be achieved*

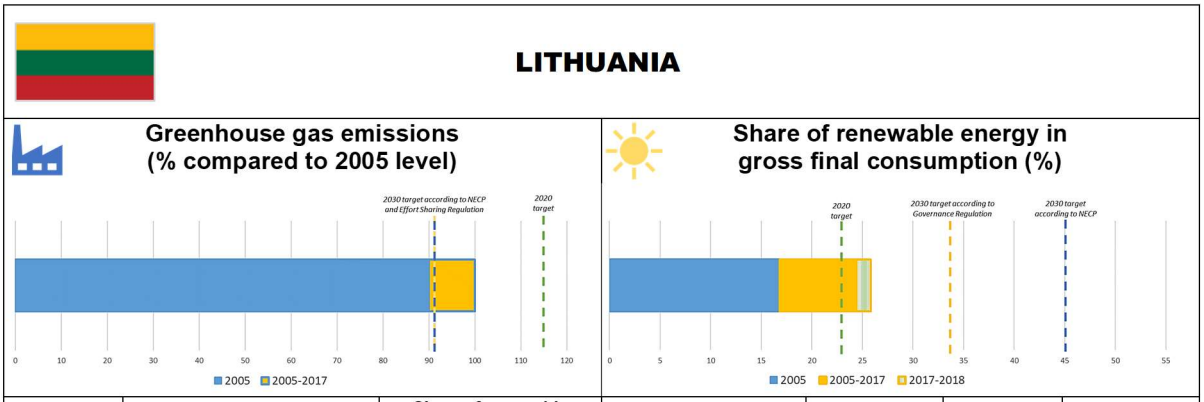
Figure 4 Progress of Latvia towards2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* +9,33%	*In 2018:* 30%	*In 2018:* PEC: 6,2 Mtoe FEC: 3,0 Mtoe	*In 2018:* 3,29%	*In 2017:* 63%	*In 2018:* 1,38% of GDP
2020 target	+11%	25%	PEC: 6,5 Mtoe FEC: 2,8 Mtoe	10%	10%	3% of GDP
2030 target	NECP: –13% Eff.Sh.Reg: –13%	NECP: 42% Gov.Reg.: 37%	PEC: 5,49 Mtoe FEC: 2,75 Mtoe	14%	15%	N/A

Target will be achieved *Targed may be achieved* *Target will not be achieved*

Figure 5 Progress of Estonia towards 2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –10%	*In 2018:* 24,4%	*In 2018:* PEC: 6,3 Mtoe FEC: 5,55 Mtoe	*In 2018:* 4,33%	*In 2017:* 23%	*In 2018:* 0,88% of GDP
2020 target	+15%	23%	PEC: 6,0 Mtoe FEC: 4,3 Mtoe	10%	10%	1,9% of GDP
2030 target	NECP: –9% Eff.Sh.Reg: –9%	NECP: 45% Gov.Reg.: 34%	PEC: 5,4 Mtoe FEC: 4,5 Mtoe	15%	15%	N/A

Target will be achieved | *Targed may be achieved* | *Target will not be achieved*

Figure 6 Progress of Lithuania towards2020/2030 targets

4.1.2 Activities performed and results achieved

Stakeholder engagement

Stakeholder engagement in Desk 1 followed two main dimensions, identifying and engaging contact persons from associated countries Estonia and Lithuania, and extensive networking activities, including multiple face-to-face meetings in the host country, Latvia. Links with contact persons were successfully established and first results of collaboration already achieved. These include publishing PANTERA related article in Lithuania, engaging speakers for the envisaged Riga workshop and identifying additional potential stakeholders.

As for Latvia, thanks to vast personal experience in both academic work and research activities it was possible to establish links and organise face-to-face meetings with stakeholders from different categories, including not only academia and/or research organisations, but also TSO, DSO, Ministry of Education and Science and Ministry of Economics. As a result, main lines and thematic for Riga workshop were identified and high-level speakers were invited. Moreover, analysis of views and opinions received led to an idea of a consultation within all Desks aiming at clarifying stakeholder needs and searching for additional ideas on how PANTERA might support certain stakeholder categories.

Dissemination activities

Regional Workshop within Desk 1 activities ‘Energy Transition in the Baltic States: Funding Opportunities for Smart Energy Research and Innovation’ was scheduled on 26th March 2020. All preparations took place as planned but due to risks and limitations resulted from COVID-19 pandemic it was postponed to the next year. The workshop was supported by Latvian Ministry of Education and Science and State Education Development Agency. Moreover, dissemination channels were established which can be used for other PANTERA and Desk’ 1 emerging purposes. Information about the workshop was disseminated in Horizon2020 national contact point’s network Twitter, LinkedIn and Facebook accounts, Latvian State Education Development Agency webpage and in professional energy journals

"Energija&Pasaule" (Latvia) and "ENERGETICA" (Lithuania). More highlights are summarised in the Table 1.

As for publications, as a result of close cooperation with Latvian professional journal 'Enerģija un Pasaule' two articles were published. First article devoted to R&I role in energy system transformation is available also online (available at: *http://www.energijaunpasaule.lv/wp-content/uploads/2019/10/EP.pdf*). Another one, about international initiatives is available only in paper version. Both articles published in Latvian language. Both articles include information on PANTERA project and benefits that provides for the stakeholders.

Another success is a publication in Lithuanian scientific journal in energy field, 'ENERGETIKA' with the additional focus on Lithuanian situation. The article 'Facilitating research and innovation for energy transition' is published in English and available online (available at: *https://www.lmaleidykla.lt/ojs/index.php/energetika/article/view/4250/3240*).

Table 1 Dissemination activities within Desk 1

Activity	***Country***	***Status***	***Comments***
PANTERA workshop in Riga			
'Energy Transition in the Baltic States: Funding Opportunities for Smart Energy Research and Innovation'	LV LT EE	Postponed	Initially planned for 20th March 2020, the workshop was postponed to October 2020 and then to March 2021 due to COVID-19 pandemic. Intensive preparations took place and resulted in: - more than 30 personal invitations sent; - 24 external (not members of consortium) participants registered one week before planned date; - 6 external speakers engaged, among them 3 speakers from Latvia, one speaker from Lithuania, one speaker from Estonia and one from EC.
Publications			
Articles in professional journal 'Enerģija un Pasaule': 1. 'Pētījumu un inovāciju loma Eiropas Savienības enerģētikas attīstībā' ('R&I role in EU energy system development') 2. 'Tīras enerģētikas pētniecības un inovācijas virzienu noteicošas iniciatīvas' ('Main Initiatives	LV	Close collaboration with journal is established. Done December 2019 Done March 2020	In this article a brief review of EU energy policies is performed and the role of Smart Grids R&I in energy system development and climate goals achievement is discussed. Then PANTERA project is introduced. Focus is given on Latvian situation and benefits PANTERA can provide to local stakeholders. This article briefly introduces such initiatives as SET plan, EERA, ETIP-SNET, Mission Innovation and PANTERA. Each description is supported with a representative opinion presented in interview like style.

Guiding Clean Energy R&I')			
Article in 'ENERGETIKA'	LT		Publication completed with the support of Lithuanian contact person for PANTERA
'Facilitating research and innovation for energy transition'		Done June 2020	At first a brief review of latest EU energy policies is given. Then PANTERA objectives, main elements and methodology with special attention on Regional Desks concept is described. Additionally, highlights on Lithuanian energy policy are given. Finally, collaboration opportunities with Lithuanian stakeholders are discussed.

Regarding external events, IPE is continuously monitoring the situation and events schedule in the Baltics in order to find an option for presenting PANTERA at once as such opportunity will arise.

4.1.3 Next steps

Desk 1 operation after one year from Desks set-up (January 2020) can be considered as successful. Working relations with stakeholders are established, three publications are completed, specific concept for regional workshop is prepared. So, it is planned to continue working in the selected directions:

- **PANTERA workshop.** Planned Riga 2021 workshop is the most important event to reinforce Desks' 1 success.
- **Publications.** Continue cooperation with journals and search for similar option in Estonia.
- **Stakeholder engagement**. Deeper understanding on stakeholders' needs and expectations through survey and structured interviews.
- **Platform popularisation.** Advertise the platform when it goes live.

For the next period it is important to strengthen contacts in associated countries and broaden the stakeholder network. Due to geographic proximity of all three countries it shall be cost-effective to organise face-to-face meetings and/or nano-workshops in Estonia and Lithuania. However, this is highly dependent on travel restrictions due to COVID-19 pandemic.

4.2 Desk 2 (Bulgaria, Romania, Greece)

4.2.1 Regional highlights

Desk 2 is dedicated to the regional activities in three South East EU Balkan States (Bulgaria, Romania, and Greece) and it is led by the PANTERA Consortium Member – TUS, operating in Bulgaria and supported by another consortium member – Suite5 operating in Greece. Having Bulgaria as 'host country' situated between Romania and Greece, associated countries in Regional Desk 2, from operation point of view provides easy geographical and cultural access not only to these countries but it also allows observation of the R&I processes happening in the other neighbouring countries from the region (such as North Macedonia and the other foreign Yugoslavia countries, which are showing their interest towards collaboration with the EU R&I community. Although all the countries in Desk' 2, share many similarities in

terms of close cultural and business links, there are however some historical, social and political specificities which can be marked. While Greece has joined European Union (EU) since it's very early beginning and gained significant experience and knowledge, Bulgaria and Romania as post eastern bloc socialistic countries entered the EU at later stage. These processes gradually affected the Energy sector in Bulgaria and Romania towards significant lag in the R&I activities [9]. Thus, from scientific R&I collaboration perspective, Greece is considered as the most advanced country in Desk 2 from which many good practices, knowledge sharing and education activities could be adopted.

From energy system perspective the Desk 2 States power systems operate synchronously in ENTSO-E Continental Europe Synchronous Area which together with the passed and ongoing cross border connectivity improvements initiatives is considered as very positive.

However, due to the EC policy towards forcing Bulgaria to close nuclear power plant (NPP) Kozloduy Unit 1 and 2 as well as NPP Kozloduy Unit 3 and 4 (after their substantial safety improvement and the International Atomic Energy Agency (IAEA), and the World Association of Nuclear Operators (WANO) safety approval) as a prerequisite to access the EU, a significant lack of trust among the Bulgarian energy society in the EC energy policy is present.

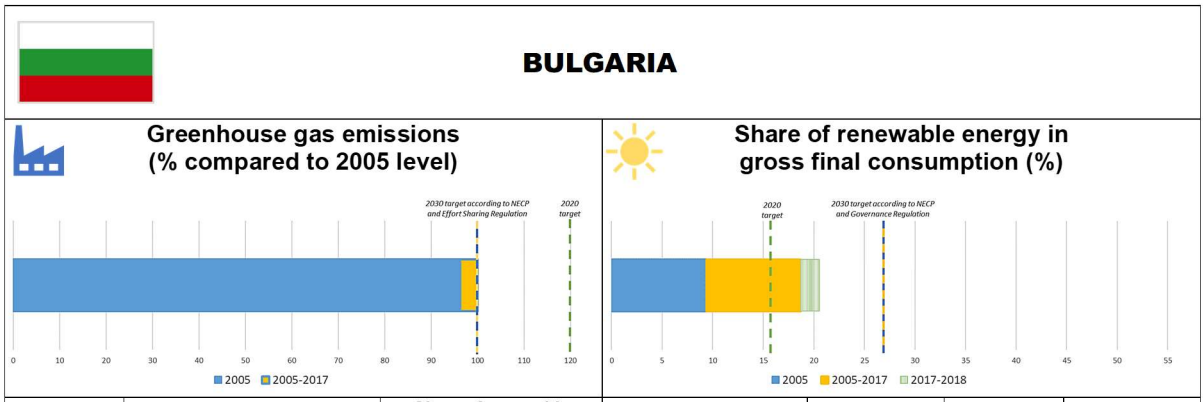
Additionally, due to the unsuccessful local performance of some EU RES, Energy Efficiency and GHG emission reduction initiatives (especially in Bulgaria and Romania), an opposition to the EU mechanisms for energy transition could be marked on local stakeholder level.

Due to the high share of coal fired power generation which will be limited in the near future due to the greenhouse gas emissions pricing scheme, gradual R&I intensive transformations of the Energy Sector are needed. Some of the urging problematic issues which need to be faced in closest near future are:

- Significant lag in the EU Green Deal actions (especially in Bulgaria and Romania);
- Reduced ancillary services sources;
- Reduced power system stability levels;
- Reduced system inertia;
- Upcoming Energy poverty;

Although the region is among the ones with lowest activity, some successful practices within the European programmes can be marked such as the Interreg cooperation and the cross-border, transnational and domestic infrastructure projects.

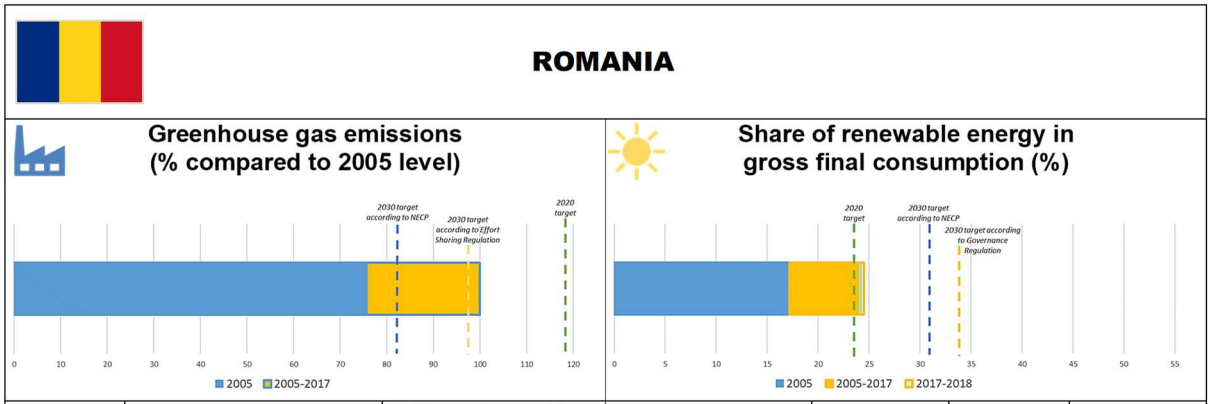
Figures 7, 8 and 9 illustrate countries progress towards 2020/2030 targets.



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –3.72%	*In 2018:* 20,53%	*In 2018:* PEC: 18,4 Mtoe FEC: 9,89 Mtoe	*In 2018:* 8,06%	*In 2017:* 7%	*In 2018:* 0,75% of GDP
2020 target	+20%	16%	PEC: 16,9 Mtoe FEC: 8,6 Mtoe	10%	10%	1,5% of GDP
2030 target	NECP: 0% Eff.Sh.Reg: 0%	NECP: 27,09% Gov.Reg.: 27%	PEC: 17,5 Mtoe FEC: 10,1 Mtoe	14,2%	>15%	N/A

Target will be achieved | *Targed may be achieved* | *Target will not be achieved*

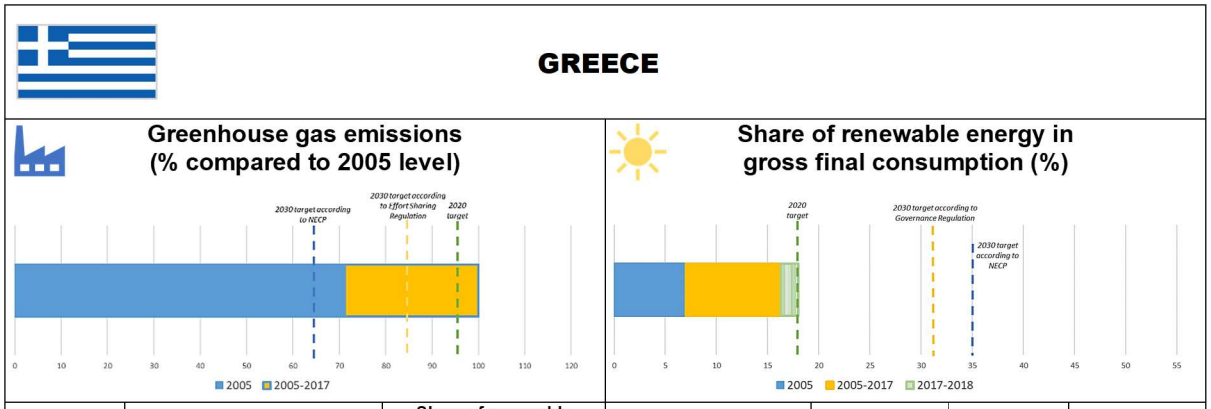
Figure 7 Progress of Bulgaria towards2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –24,32%	*In 2018:* 23,88%	*In 2018:* PEC: 32,5 Mtoe FEC: 23,5 Mtoe	*In 2018:* 6,34%	*In 2017:* 7%	*In 2018:* 0,51% of GDP
2020 target	+19%	24%	PEC: 43,0 Mtoe FEC: 30,3 Mtoe	10%	10%	2,0% of GDP
2030 target	NECP: –18% Eff.Sh.Reg: –2%	NECP: 30,7% Gov.Reg.: 34%	PEC: 32,3 Mtoe FEC: 25,7 Mtoe	14,2%	15,4%	N/A

Target will be achieved | *Targed may be achieved* | *Target will not be achieved*

Figure 8 Progress of Romania towards2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –28,8%	*In 2018:* 18%	*In 2018:* PEC: 22,4 Mtoe FEC: 16,0 Mtoe	*In 2018:* 3,83%	*In 2017:* 9,3%	*In 2018:* 1,18% of GDP
2020 target	–4%	18%	PEC: 24,7 Mtoe FEC: 18,4 Mtoe	10%	10%	1,21% of GDP
2030 target	NECP: –36% Eff.Sh.Reg: –16%	NECP: 35% Gov.Reg.: 31%	PEC: N/A FEC: <16,5 Mtoe	>14%	21%	N/A

Target will be achieved *Targed may be achieved* *Target will not be achieved*

Figure 9 Progress of Greece towards2020/2030 targets

4.2.2 Activities performed and results achieved

Stakeholder engagement

Stakeholder engagement in Desk 2 is based on identifying and engaging selected contact persons from the associated countries Greece and Romania who are interested and able to support the PANTERA activities, and also extensive networking activities, including multiple face-to-face meetings, conference presentations, regional workshops and nano workshop in the host country, Bulgaria. A successful collaboration was established with stakeholders from Varna (Bulgaria), who actively supported the PANTERA Regional Desk processes in Northeast Bulgaria. Links with contact persons were successfully established and the first results from this collaboration are already present. These include publishing PANTERA related articles in Bulgaria, involvement of the relevant stakeholders in the Regional workshops in Sofia, Bulgaria and Athens, Greece as well as nano workshop in Varna, Bulgaria.

As for Bulgaria, thanks to the experience in the academic work, research activities and the industry relations built, it was possible to establish links and organise face-to-face meetings with selected stakeholders from different categories, including not only academia and/or research organisations, but also TSO, DSO, Industry, Energy Traders, Electric Vehicle Cluster, Equipment Manufacturers, Ministry of Energy, Ministry of Education and Science. These Stakeholders took part as high-level keynote speakers and participants in the first PANTERA Workshop in Sofia, Bulgaria. The collaborative stakeholder engagement activities in the host country resulted in high participation of the Bulgarian stakeholders on the PANTERA Regional Workshop in Athens Greece, despite of the financial struggles which these Stakeholders are facing.

Dissemination activities

The desks' Regional Workshop in Sofia entitled 'Pan European Research and Innovation

activities for Smart Grids, Energy Storage and Local Energy Systems', was held on 02 July 2019. Being the first PANTERA regional event the workshop included panel presentation session, teamwork brainstorming session in small groups, discussion session and interviews with selected stakeholders [more information available at *https://pantera-platform.eu/pantera-workshop-an-innovative-approach-towards-unified-pan-european-research-innovation-efforts-in-the-energy-sector-balkan-series-sofia-bg-2-july-2019/*]. The analysis showed that the most valuable results from this event originated from the roundtable discussions, teamwork in small groups and the interviews. Thus, the following dissemination activities were focused on more personally oriented stakeholder interaction.

A nano- workshop was organised on the 13th of September 2019 in Varna, Bulgaria within the BULEF scientific conference. The event results showed that the nano workshop concept is very promising and highly productive.

The PANTERA Athens Regional Workshop entitled 'Green Islands as a driver for the Energy Transition – Going Renewable and Smart', Athens, took place on 13 February 2020 and considered important country and region-specific R&I needs and opportunities [more information available at *https://pantera-platform.eu/pantera-workshop-green-islands-as-a-driver-for-the-energy-transition-going-renewable-and-smart-athens-gr-13-february-2020/].* Few of accompanying faces to face meetings and interviews were organised to maximise the benefits of the event.

An article in Power Industry Bulgaria Journal and announcement for the PANTERA Regional Workshop in Sofia, Bulgaria was published in Bulgarian language prior to the event.

A paper entitled 'PAN European Approach for Strengthening Research and Innovation in Smart Grids, Energy Storage and Local Energy Systems' was published on the 11th Scientific IEEE Conference BULEF 2019, Varna, Bulgaria.

Table 2 Dissemination activities within Desk 2

Activity	***Country***	***Date***	***Comments***
Events			
BFIEC Conference: Climate, Energy and Environment	BG	14 March 2019	General presentation on the PANTERA project, Sofia Workshop Announcement, Flyers
ELMA International conference Varna, Bulgaria	BG, GR, RO	06-08 June 2019	General presentation (on screen), Sofia Workshop Announcement, Flyers, Poster
Climate-Friendly Energy & Industry, Converting Challenges to Opportunities Sofia, Bulgaria	BG	06 June 2019	Sofia Workshop Announcement, Flyers, Poster
ERIGrid Summer School on Advanced Operation and Control of Active Distribution	GR, BG, RO, other	10-14 June	Poster, Sofia Workshop Announcement, Flyers

Networks Athens, Greece			
PANTERA regional workshop Sofia, Bulgaria	BG, RO, GR	01-02 July 2019	Presentations, Flyers, Poster
PANTERA nano workshop, Varna, Bulgaria	BG	13 September 2019	Presentation, Discussion, Brainstorming, Flyers, Poster
PANTERA regional workshop, Athens	GR, BG	13-14 February 2020	Presentations, Flyers, Poster
Final Conference of the EUKI-project ALLIES	BG, RO, GR, other	26 May 2020	PANTERA presentation, Stakeholder interaction
Publications			
Article in Power Industry Bulgaria Journal	BG	27 June 2019	Article and Announcement for PANTERA regional workshop in Sofia, Bulgaria
Conference paper: PAN European Approach for Strengthening Research and Innovation in Smart Grids, Energy Storage and Local Energy Systems, 11th Scientific IEEE Conference BULEF 2019, Varna, Bulgaria	BG, EU	13 September 2019	PANTERA presentation

4.2.3 Next steps

A valuable and sustainable collaboration based on fair win-win relations with the Desk 2 stakeholders was established. Two regional workshops and one nano workshop were performed. Two publications were presented. The results achieved from the work so far are considered to be very positive.

The future work will be dedicated more actively in the following directions:

- Strengthening of the activities in the associated countries and especially in Romania. Evaluation of the possibilities for performing a nano workshop.
- Extension of the publication activities.
- Identifying of effective new collaboration opportunities in the light of the COVID 19 pandemic.
- Support of the stakeholders towards better presentation of their R&I work, capabilities and research infrastructure.

4.3 Desk 3 (Cyprus, Malta)

4.3.1 Regional highlights

Regional Desk 3 includes Cyprus and Malta islands to be supported by activities and a solid plan to leverage interest on smart grids R&I investment and progress. Both are Mediterranean countries-islands and Member States of EU that share to a certain extent the same challenges for availability of energy resources and sufficiency with a high potential of solar capacity.

The activities that were supported in Regional Desk 3 took under consideration the islands' NECPs priorities and objectives and tried to contact the related regional initiatives to build a momentum on collaboration and continuous communication under the PANTERA process prism. These topics can be found in the related NECPs of the countries and their short review analysis is reported in D3.1 [10] of the project PANTERA.[11]

Both islands share membership in "The Smart Islands Initiative" [12] . This initiative is based on bottom up approach and it builds on years of collaboration between European islands and seeks to communicate the significant potential of islands to function as laboratories for technological, social, environmental, economic and political innovation related to the smart grids. From Malta side, the Local Councils Association is a coordinator member whereas from Cyprus side, the Cyprus Energy Agency (CEA) is the coordinator of the regional initiative. This form a local network that PANTERA will definitely pursue to build working relations with.

The main topics of high interest for the region and the local communities are:

- Reducing greenhouse gas emission to meet environmental objectives
- Increasing the share of RES in energy use
- Improving Energy Efficiency
- Improving Security of supply

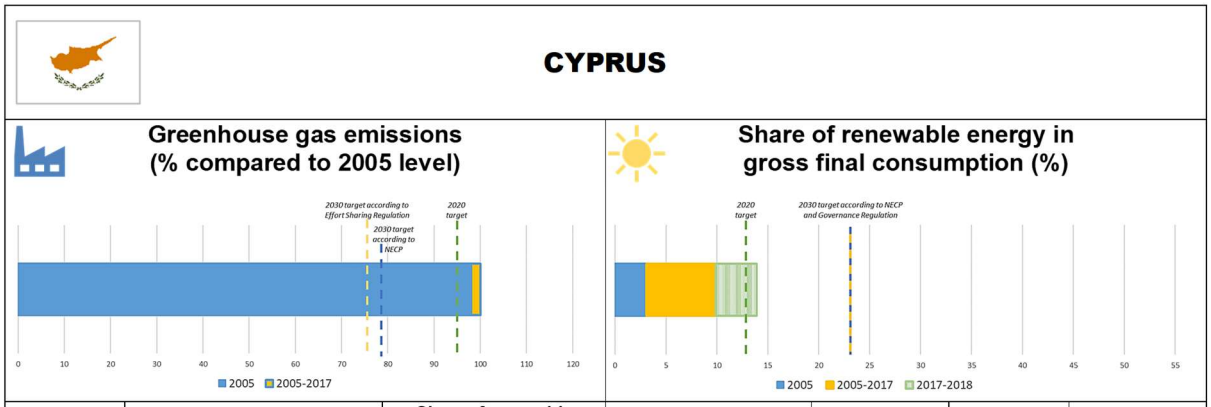
In more specific, the countries of the Desk share the following R&I priorities to achieve 2030 target as defined in their NECP and summarized in Table 3.

Table 3 The Regional Desk 3 R&I common priorities

Decarbonization
• Wind energy resources utilization • Solar Energy exploitation (PV panels)
Energy Efficiency
• Thermal insulation building systems • Deployment of PVs
Internal Energy Market
• Load profile management through demand response

Thus, every attempt of the PANTERA partners towards the regional stakeholders has as an objective to highlight how the PANTERA process through their different activity arms can be helpful and supportive for the above.

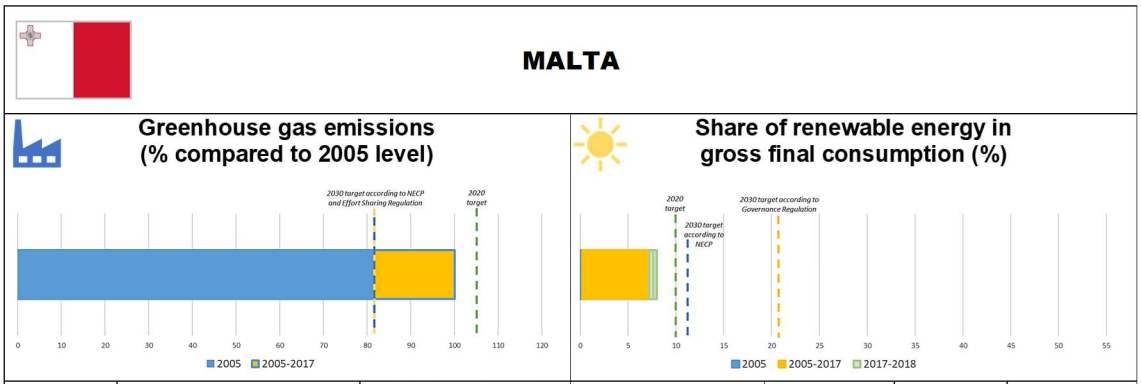
Figures 10 and 11 illustrate countries progress towards 2020/2030 targets.



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –1,96%	*In 2018:* 13,9%	*In 2018:* PEC: 2,6 Mtoe FEC: 1,9 Mtoe	*In 2018:* 2,67%	*In 2017:* 0%	*In 2018:* 0,55% of GDP
2020 target	–5%	13%	PEC: 2,2 Mtoe FEC: 1,8 Mtoe	10%	10%	0,5% of GDP
2030 target	NECP: –20,9% Eff.Sh.Reg: –24%	NECP: 23% Gov.Reg.: 23%	PEC: 2,4 Mtoe FEC: 2,0 Mtoe	14%	15%	*2023 target:* 1,5%

Target will be achieved *Targed may be achieved* *Target will not be achieved*

Figure 10 Progress of Cyprus towards 2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –18,75%	*In 2018:* 8%	*In 2018:* PEC: 0,8 Mtoe FEC: 0,7 Mtoe	*In 2018:* 7,97%	*In 2017:* 24%	*In 2018:* 0,55% of GDP
2020 target	+5%	10%	PEC: 0,823 Mtoe FEC: 0,623 Mtoe	10%	10%	2% of GDP
2030 target	NECP: –19% Eff.Sh.Reg: –19%	NECP: 11,5% Gov.Reg.: 21%	PEC: 1,051 Mtoe FEC: 0,786 Mtoe	15%	15%	N/A

Target will be achieved *Target may be achieved* *Target will not be achieved*

Figure 11 Progress of Malta towards 2020/2030 targets

4.3.2 Activities performed and results achieved

Stakeholder engagement activities

Regarding the collaboration practices, the PANTERA partners tried to reach the regional stakeholders that serve the triangle of knowledge and fall under the targeted stakeholders PANTERA categories: academia, industry and research & innovation. They have also tried to reach the institutional national contact points for energy related issues i.e. ministries and Smart Specialisation representatives

As an overall evaluation of the Regional Desk 3 activities, Cyprus has shown signs of engagement in the PANTERA process although it is considered that more targeted activities and innovative tools shall be employed for better results. Malta seems to show low engagement at this point and thus PANTERA partners need to find alternative ways of interacting with Maltese stakeholders.

In Cyprus, the contact persons have responded to the outreach and a face-to face meeting has been organized with the related Ministry and Smart Specialisation representative. Through these contacts, the following have been identified:

- The needs and challenges for engaging in regional activities. It seems that both human and economic resources are low and these two hinder the consistent working relations with many initiatives. Also, the administrative structure can delay the stakeholders' reaction.
- The main expectations from PANTERA Regional Desk for the benefit of the regional stakeholders (DSO, TSO of Cyprus, Energy Office, OEB representing the local industry, ETEK representing the local professionals etc) for participating in the PANTERA process through workshops, consultations etc. Moreover, strengthen the networking possibilities, facilitate access to valuable data in support of their R&I activities and build close working regional relations for mutual benefit.

Stakeholders and PANTERA partners have agreed to be in contact and try to build a constant and a rolling plan of different activities that serve both parties.

On the other hand, in Malta, PANTERA partners haven't manage to establish close working relations yet although the stakeholders were identified and contacted. This fact, suggests that more tangible benefits should be available for interest to grow and generate results. This is expected to be generated through the facilities that will be made available through the EIRIE platform.

Dissemination activities

As seen in the table below different dissemination activities were performed within 2020.

Table 4 Dissemination activities within Desk 3

Dissemination activities	***Country***	***Status***	***Comments***
Publications			
Article through the University press	CY	Done	good working relations
Article for Low Spending Countries evaluation	ALL	In process	Will be presented in the MEDPOWER conference 2020 in Paphos , Cyprus
PANTERA workshop			
Paphos regional workshop will be a plenary session under the MEDPOWER conference and is under preparation	ALL	In progress	The conference is organized to take place on November 9-12 2020 in Paphos, Cyprus
Workshop related dissemination activities			

MEDPOWER website, University dissemination channels	ALL	In process	may be used for further dissemination activities
Presentation of PANTERA in other events			
Participation in the Final Conference of our ALLIES project (virtual event)	South-East Europe, especially from Croatia, Bulgaria, Rumania and Italy	Complete	participated in the Mediterranean countries' session talking about the regional desks setup and make a follow up to the interested stakeholders post event

4.3.3 Next steps

The main activity plan for the next year will include:

- Participation in related regional activities through mini and nano-workshops. A nano-workshop in collaboration with NEEMO project with Maltese colleagues has already been organized for the second week of November 2020 focusing on "The public policies of Cyprus and Malta on electric mobility". This nano-workshop will give the opportunity to the PANTERA partners to strengthen collaboration with the Maltese colleagues and build a common vision on energy transition and engage them to the activities of the EIRIE platform for enriching R&I activities in the region. The further participation in such events in 2021 are under investigation in order to make sure that the added value and the impact will be as expected.
- Organize online meetings with the identified stakeholders for both islands. PANTERA partners will try to make this a rolling procedure.
- Participation in activities of regional initiatives and try to build a momentum of PANTERA platform users

4.4 Desk 4 (Poland, Slovakia, Czech Republic)

4.4.1 Regional highlights

Regional Desk 4 consists of three countries which are: the Czech Republic, Poland and Slovakia. PANTERA partner, DERlab located in Germany, is leading the activities in the Desk 4. DERlab is an association of over thirty institutes from Europe and U.S. performing testing and research related to Smart Grid and grid integration of Distributed Energy Resources (DER). DERlab has a wide contact network and its members within the region support DERlab to reach the stakeholders and engage them in the PANTERA regional activities. All Desk 4 countries along with Hungary are members of Visegrád Group, a cultural and political alliance aiming to advance co-operation in military, cultural, economic and energy matters with one another and to further their integration to the EU. All three countries joined the EU in 2004 and belong to widening countries from Horizon 2020 perspective.

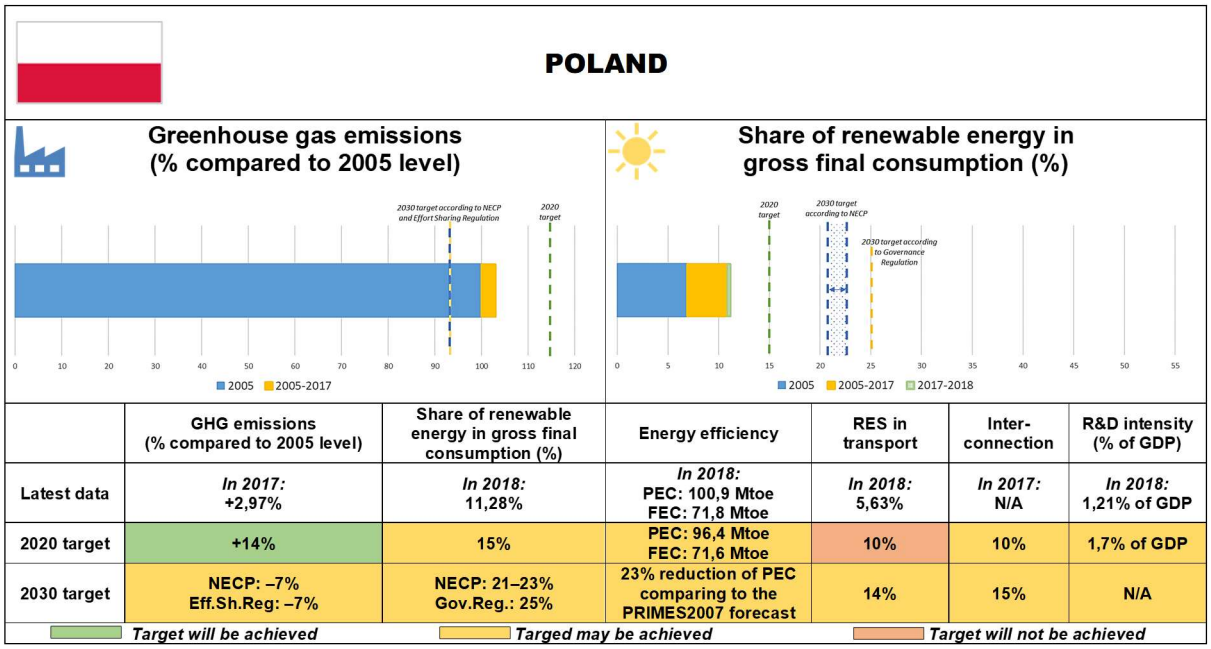
All three countries are dependent on coal and are participating in the Coal regions in Transition initiative developed by European Commission.

From Trans-European Networks for Energy (TEN-E) perspective Czech Republic and Slovakia belong to North-South electricity interconnections in Western Europe (NSI West

Electricity) corridor, while Poland belongs to Baltic Energy Market Interconnection Plan (BEMIP). Poland has committed to achieving the synchronisation of its electricity grid with the Baltic States by 2025.

As for scientific and innovation performance, according to the European Innovation Scoreboard all three countries are moderate innovators [13].

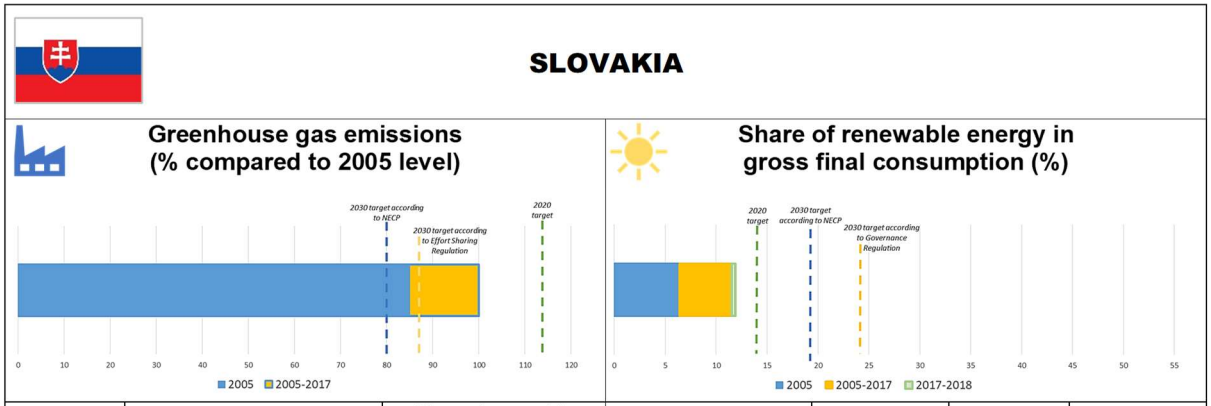
Figures 12, 13 and 14 illustrate countries progress towards 2020/2030 targets.



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* +2,97%	*In 2018:* 11,28%	*In 2018:* PEC: 100,9 Mtoe FEC: 71,8 Mtoe	*In 2018:* 5,63%	*In 2017:* N/A	*In 2018:* 1,21% of GDP
2020 target	+14%	15%	PEC: 96,4 Mtoe FEC: 71,6 Mtoe	10%	10%	1,7% of GDP
2030 target	NECP: –7% Eff.Sh.Reg: –7%	NECP: 21–23% Gov.Reg.: 25%	23% reduction of PEC comparing to the PRIMES2007 forecast	14%	15%	N/A

Target will be achieved | *Targed may be achieved* | *Target will not be achieved*

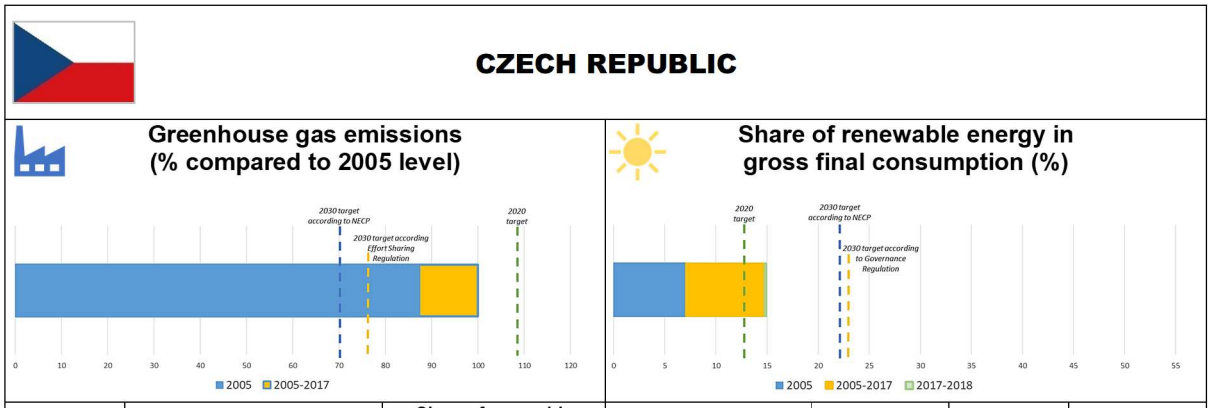
Figure 12 Progress of Poland towards2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –15,2%	*In 2018:* 11,9%	*In 2018:* PEC: 15,8 Mtoe FEC: 11,1 Mtoe	*In 2018:* 6,96%	*In 2017:* 43%	*In 2018:* 0,84% of GDP
2020 target	+13%	14%	PEC: 16,2 Mtoe FEC: 10,38 Mtoe	10%	10%	1,2% of GDP
2030 target	NECP: –20% Eff.Sh.Reg: –12%	NECP: 19,2% Gov.Reg.: 24%	PEC: 15,7–16,15 Mtoe FEC: 10,3–10,44 Mtoe	14%	15%	N/A

Target will be achieved | *Targed may be achieved* | *Target will not be achieved*

Figure 13 Progress of Slovakia towards2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –12,71%	*In 2018:* 15,15%	*In 2018:* PEC: 40,4 Mtoe FEC: 25,3 Mtoe	*In 2018:* 6,52%	*In 2017:* 19,3%	*In 2018:* 0,73% of GDP (public exp.)
2020 target	+9%	13%	PEC: 44,3 Mtoe FEC: 25,3 Mtoe	10%	10%	1% of GDP (public exp.)
2030 target	NECP: –30% Eff.Sh.Reg: –23%	NECP: 22% Gov.Reg.: 23%	PEC: 41,44 Mtoe FEC: 23,65 Mtoe	14%	15%	N/A

Target will be achieved *Targed may be achieved* *Target will not be achieved*

Figure 14 Progress of Czech Republic towards2020/2030 targets

4.4.2 Activities performed and results achieved

Until now there was not much progress appeared in engaging stakeholders as contact persons for Desk 4 countries. However, stakeholders were identified and contacted via emails. Unfortunately, the stakeholders were not so responsive what might be partially justified by the following:

- It was not possible to organise face-to face meetings due to Covid-19 pandemic;
- Stakeholders are expecting to have on-spot tangible results e.g. access to the EIRIE platform, which is not the case as the platform is still under development.

In order to facilitate stakeholder engagement in Desk 4 and broaden Desk 4 activities a mitigation plan shall be set along with the lines described below:

- Identifying and developing working relations with contact person from every Desk 4 country is the top priority.
- Additional opportunities for engaging stakeholders shall be developed, including networking through all consortium partners and/or Advisory Board and existing European initiatives.
- Continuous monitoring of planned regional events shall be performed with in order to utilise every opportunity to participate in these offline or online.

4.4.3 Next steps

Future activities' plan within Desk 4 include:

- Organise virtual Nano-/mini-workshops targeting stakeholders active in the energy field and try to engage them within the PANTERA activities.
- Organise bilateral telephone conferences with the stakeholders and try to involve them more within the PANTERA activities.
- Participate in conferences within the region.

- Gather information from the stakeholders about the challenges that face this region and try to find solutions with experts to overcome those challenges and present best practice. The PANTERA platform will be used to connect the stakeholders with the right experts.

Table 5 Planned dissemination activities within Desk 4

Dissemination activities	***Country***	***Status***	***Comments***
PANTERA participate in the conference			
21st International Scientific Conference on Electric Power Engineering (EPE) [October 19-21, 2020]	CZ	Planned	The PANTERA consortium is planning to participate in the conference and attract stakeholders to be involved in PANTERA activities.
Organise Workshops			
Virtual Nano-/Mini-Workshops	CZ, PL, SK	In process	The PANTERA consortium is planning to organize Nano-/Mini-Workshops in combination with other events to other events. Those workshops target stakeholders active in the energy field.

4.5 Desk 5 (Hungary, Croatia, Italy)

4.5.1 Regional highlights

Desk 5, coordinated by the PANTERA partner RSE from Italy consists of three countries: Croatia, Hungary and Italy.

Despite other PANTERA Regional Desks, such as for example Desk 1 that gathers Latvia, Estonia and Lithuania and represents a well-defined geographical area (the Baltic states in this case), it doesn't have a geographical strong connotation. In fact, the Regional Desk 5 has been set up considering Croatia, Hungary and Italy more for organizational purposes rather than for historical or geographical considerations.

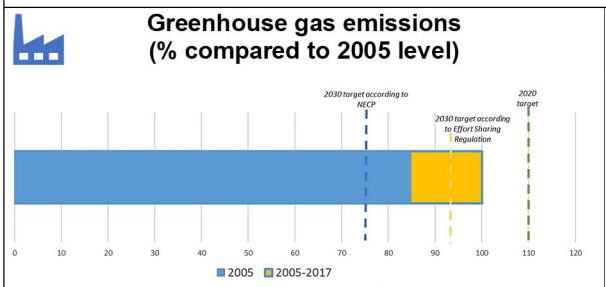
Regarding the degree of innovation of the electrical system toward smart grid approaches in these three countries it can be briefly reported about the status of smart meters deployment. In Italy the smart metering system is in place and covers almost all costumers. Moreover, the Italian authority has recently established the functional requirements for the second-generation low voltage smart electricity metering systems ('2G meters').

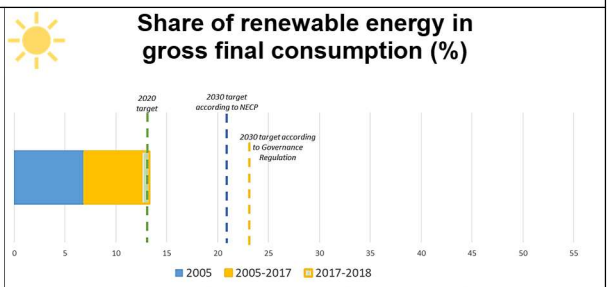
Instead even if also in Croatia and Hungary the smart meters deployment is recognised as an important step toward the evolution of the electric system, their actual deployment is at the moment planned but not yet completed.

As for R&I performance, considering a general 'innovation index', Croatia, Hungary and Italy are considered as moderate innovators. [8]

Figures 15, 16 and 17 illustrate countries progress towards 2020/2030 targets.

HUNGARY



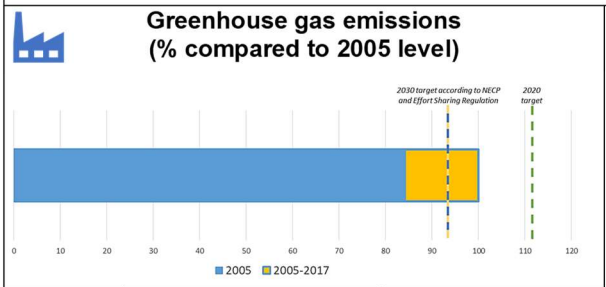


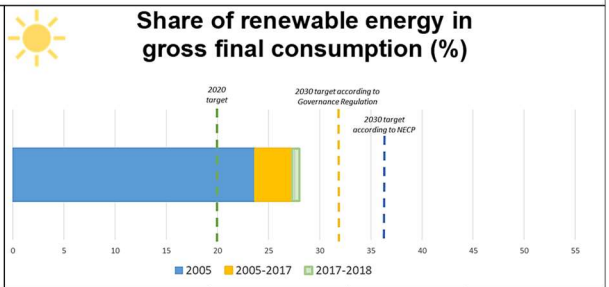
	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –15,35%	*In 2018:* 12,5%	*In 2018:* PEC: 24,5 Mtoe FEC: 18,5 Mtoe	*In 2018:* 7,68%	*In 2017:* 47%	*In 2018:* 1,53% of GDP
2020 target	+10%	13%	PEC: 24,1 Mtoe FEC: N/A	10%	10%	1,8% of GDP
2030 target	NECP: –25,8% Eff.Sh.Reg: –16%	NECP: 21% Gov.Reg.: 23%	PEC: N/A FEC: 18,75 Mtoe	16,9%	60%	N/A

Target will be achieved *Targed may be achieved* *Target will not be achieved*

Figure 15 Progress of Hungary towards2020/2030 targets

CROATIA

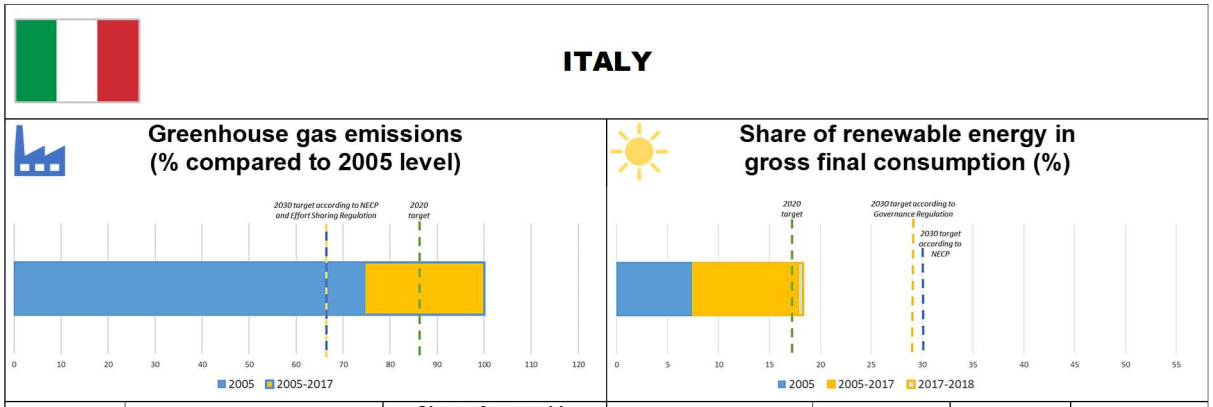




	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –15,84%	*In 2018:* 28%	*In 2018:* PEC: 8,2 Mtoe FEC: 6,9 Mtoe	*In 2018:* 8,06%	*In 2017:* 290%	*In 2018:* 0,97% of GDP
2020 target	+11%	20%	PEC: 11,2 Mtoe FEC: 7,0 Mtoe	10%	10%	1,4% of GDP
2030 target	NECP: –7% Eff.Sh.Reg: –7%	NECP: 36,4% Gov.Reg.: 32%	PEC: 8,23 Mtoe FEC: 6,85 Mtoe	13,2%	15%	N/A

Target will be achieved *Targed may be achieved* *Target will not be achieved*

Figure 16 Progress of Croatia towards2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –25,5%	*In 2018:* 17,78%	*In 2018:* PEC: 147,5 Mtoe FEC: 116,5 Mtoe	*In 2018:* 7,66%	*In 2017:* N/A	*In 2018:* 1,39% of GDP
2020 target	–13%	17%	PEC: 158 Mtoe FEC: 124 Mtoe	10%	10%	1,53% of GDP
2030 target	NECP: –33% Eff.Sh.Reg: –33%	NECP: 30% Gov.Reg.: 29%	PEC: 125,1 Mtoe FEC: 103,8 Mtoe	14%	15%	N/A

Target will be achieved | *Targed may be achieved* | *Target will not be achieved*

Figure 17 Progress of Italy towards2020/2030 targets

4.5.2 Activities performed and results achieved

It is worth to consider Italy separately from the other two countries in assessing the stakeholder engagement achieved so far.

RSE has all the needed contacts from local (Italian) stakeholders but this potential has not yet been fully exploited because it has been decided to focus efforts on the other two countries and leave Italy as a subsequent target. Therefore, up to now a real involvement of local Italian stakeholders, even if not so difficult to achieve, has been delayed. Nevertheless, it would be the objective of the next phase of regional desk activities.

Instead more effort has been spent in order to involve stakeholders from Croatia and Hungary. The first approach was to send out the questionnaire prepared in the framework of Work Package 2 (WP 2). The replies received through this have indicated some barriers that, according to the view of local stakeholders, hinder the development of R&I activities in these countries.

- Lack of responsive networking facilities;
- Lack of access to reliable information/data to facilitate R&I activity;
- Limited human resources;

are among the most important limits to be removed. In this view it is important to note that PANTERA could actually help with its activities at least in lowering the effect of ‘lack of access to reliable information/data to facilitate R&I activity’.

Apart from information exchange, local stakeholders consider that the PANTERA project would be very helpful in fostering R&I activities giving the possibility to enlarge their networking potential.

These points are in line with the Regional Desk approach that tries to involve local stakeholders through meetings, direct contacts and information exchange.

Regarding the overall status of Desk activities, good progress has been made especially in

contacting and establishing relations with stakeholders from Croatia. In fact, two very valuable contacts (one with the University of Zagreb and one with the regional agency active in the energy field REGEA) have been established. Moreover, through a recent interaction it has been discussed and agreed a strategy for jointly organise a workshop. The event is foreseen to be held in 2021 and, considering the coronavirus COVID-19 situation at that moment, it will be decided if it will be a physical meting or a virtual one.

4.5.3 Next steps

It is foreseen to reach a high number of stakeholders for the organization of the Croatian workshop through the well-established two Croatian contacts and the support of the SUPPERA project with which PANTERA has built multi-level cooperation to achieve mutual objectives (*https://www.supeera.eu*). Moreover, considering the feedbacks that will be received, the organization of further events will be evaluated after the first one.

More difficulties have been encountered in establishing deep relation with Hungarian stakeholders, but the effort will continue also exploiting the Hungarian Smart Specialisation contact. In fact, as happened for Croatia it is important to find a local contact point willing to collaborate and that clearly sees the benefits in teaming up with PANTERA in order to be able to reach other local stakeholders and organise dedicated events. This underlines that common selected approach in reaching all associated countries is set in the right direction.

Finally, it is worth to mention that also within the Regional Desk 5 the functionalities of the EIRIE platform would be exploited. Information sharing and the other platform functionalities are in fact an important added value able to attract stakeholder giving a first tangible hint of the possible benefits that could be achieved by the collaboration with the PANTERA project.

4.6 Desk 6 (Ireland, Portugal)

4.6.1 Regional Highlights

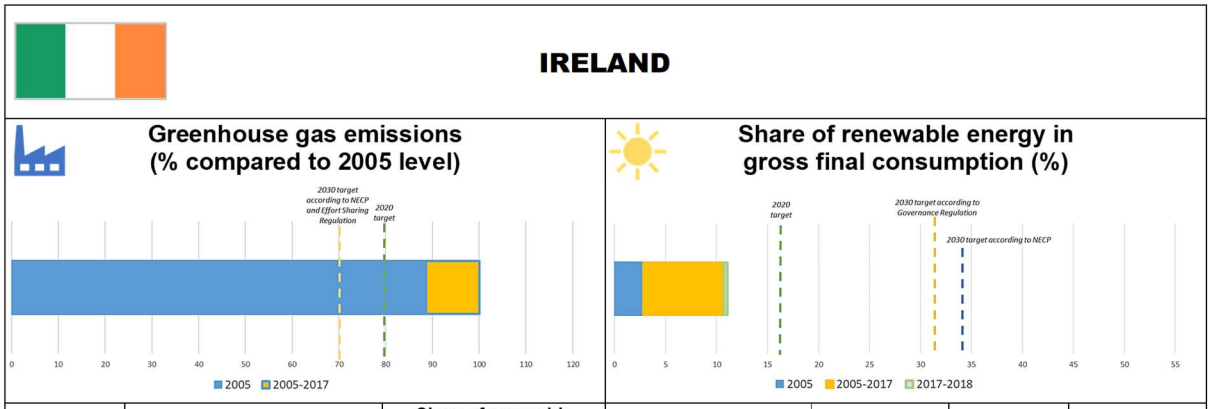
Desk 6, coordinated by the PANTERA partner UCD from Ireland consists of Ireland and Portugal. Thus, Desk 5 has been set up considering Portugal more for organizational purposes rather than for historical or geographical considerations. Ireland and Portugal are both historical Member States of the EU with considerable international collaboration experience. Both are members of Clean Energy for European Union Islands imitative launched by European Commission in 2017.

As for R&I performance both countries belong to strong innovator category [13] and most probably some of adopted approaches and practices might serve as best practice cases for other target countries. Still, according to the JRC Smart grid projects outlook both perform below EU average in total investment in Smart Grid projects per capita. [14]

In the case of Ireland, funding is available for Smart Grid R&I through Science Foundation Ireland on a competitive basis and other national funding agencies. Further details of the Smart Grid R&I funding landscape in Irelands are detailed in Deliverable 4.2 ‘The 2nd report on Identification of Gaps and Missing Subjects’, Section Case Study: Ireland covers funding landscape. The Sustainable Energy Authority of Ireland did not run a funding call in 2020, but had run calls in previous years.
As for smart metering as one of main Smart grid enabling factors, plans are also in place for a Smart Meter rollout in 2020 in Ireland. The single Distribution Systems Operator, ESB

Networks, are responsible for implementing the Smart Meter Rollout plan. In Portugal, the distribution systems operator Energias de Portugal is aiming to deploy 6 million smart meters by 2020.

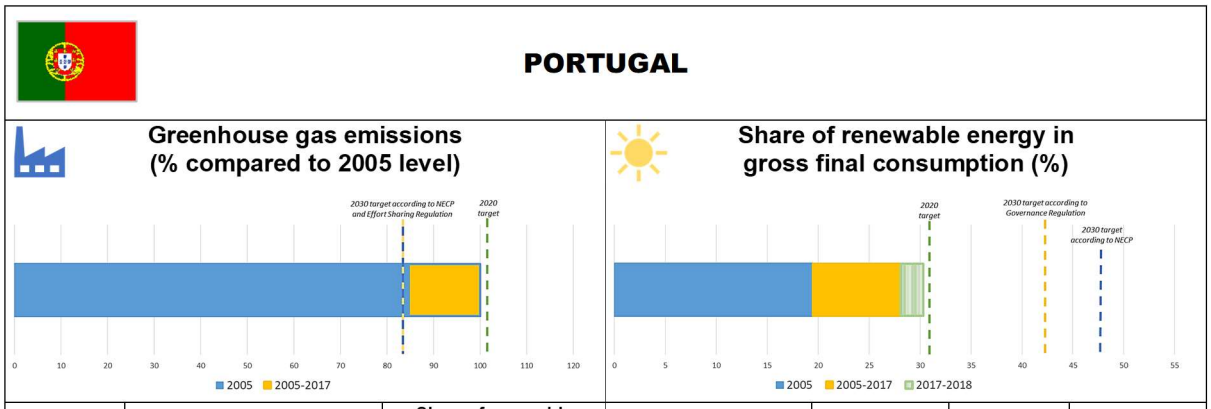
Figures 18 and 19 illustrate countries progress towards 2020/2030 targets.



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –11,39%	*In 2018:* 11,1%	*In 2018:* PEC: 14,5 Mtoe FEC: 12,3 Mtoe	*In 2018:* 7,17%	*In 2017:* 7,4%	*In 2018:* 2,5% of GNP
2020 target	–20%	16%	PEC: 13,9 Mtoe FEC: 11,7 Mtoe	10%	10%	1,15% of GDP
2030 target	NECP: –30% Eff.Sh.Reg: –30%	NECP:–34% Gov.Reg.: 31%	PEC: N/A FEC: N/A	14%	15%	N/A

Target will be achieved *Targed may be achieved* *Target will not be achieved*

Figure 18 Progress of Ireland towards2020/2030 targets



	GHG emissions (% compared to 2005 level)	Share of renewable energy in gross final consumption (%)	Energy efficiency	RES in transport	Inter-connection	R&D intensity (% of GDP)
Latest data	*In 2017:* –15,32%	*In 2018:* 30,3%	*In 2018:* PEC: 22,6 Mtoe FEC: 16,9 Mtoe	*In 2018:* 9,04%	*In 2017:* 10%	*In 2018:* 1,35% of GDP
2020 target	+1%	31%	PEC: 22,5 Mtoe FEC: 17,4 Mtoe	10%	10%	2,7% of GDP
2030 target	NECP: –17% Eff.Sh.Reg: –17%	NECP: 47% Gov.Reg.: 42%	PEC: 15,6–21,5 Mtoe FEC: 14,4–14,9 Mtoe	20%	15%	N/A

Target will be achieved *Targed may be achieved* *Target will not be achieved*

Figure 19 Progress of Portugal towards2020/2030 targets

4.6.2 Activities performed and results achieved

IERC and UCD engage with stakeholders in the energy sector in the Republic of Ireland across multiple funded projects including PANTERA. This gives opportunities to advertise PANTERA,

and to identify potential content from other Smart Grid projects that could be made available on the EIRIE platform.

Actors in the Irish energy sector were invited to complete the PANTERA questionnaire in early 2019 and sign up as a stakeholder. Likewise, invitations were sent to actors in Portugal.

UCD and IERC jointly organised a PANTERA regional workshop in December 2019 to facilitate the exchange of best practices and information among R&I experts and policy makers in Ireland, and foster links with EU level initiatives. The workshop aimed to highlight how the PANTERA project could address the energy transition challenges at regional and EU level through the prism of smart grid R&I. Sessions explored the opportunities and challenges for research and innovation in Smart Grids, Energy Storage and Local Energy Systems in Ireland. Speakers from the DSO, TSO, New Entrant and academia presented their perspectives. Representatives from all major Smart Grid stakeholders attended the Dublin Workshop and indicated positive support for PANTERA and positive interest for the type of content proposed on the EIRIE Platform.

4.6.3 Next Steps

Connections are being maintained with relevant stakeholders from the Dublin workshop to keep them up to date on PANTERA developments. A Nano workshop is proposed for January 2021 focusing on the needs identified at the Dublin workshop to be able to share data for research purposes to support enabling energy communities and the energy transition. This workshop will explore The General Data Protection Regulation (GDPR) issues and how smart grid researchers can share GDPR compliant energy research data.

Efforts to attract active participation from stakeholders in Portugal shall be intensified in various dimensions, including developing contact with Smart Specialisation representative.

5 Country Profiles

Creating and continuously updating PANTERA country profiles for target countries aims at:

- identifying countries' specific gaps for further detailed analysis of causes of insufficient performance to determine PANTERA desks' activities;
- Identify the progress of the countries within the life time of the project and possibly evaluate the regional desks activities effectiveness
- providing input for preparing PANTERA workshops;
- supporting the envisaged regional area of EIRIE platform;
- providing input to Task 6.3.

In the frame of this report, existing country profiles were updated with actual information from final National Energy and Climate Plans (NECP's), EC Country reports 2020, information about Smart Specialisation priority areas, Eurostat data and other sources.

Full country profiles are summarised in Annexes 11.4-11.9, whereas main highlights from 2020/2030 target perspective are included as a short visualisation in all Desks' description.

6 Regional Approach – Smart Specialisation

6.1 The Core of Smart Specialisation

The Smart Specialisation defines the EU approach to innovation on regional and country level. It enables the prioritisation of R&I investment under cohesion policy in a number of EU policy areas, including energy. For example, the existence of a smart specialisation strategy (S3) is a prerequisite for receiving funding from the European Regional Development Fund (ERDF). According to Regulation (EU) N° 1303/2013 of the European Parliament and of the Council [15], "Smart specialisation strategy means the national or regional innovation strategies which set priorities in order to build competitive advantage by developing and matching research and innovation own strengths to business needs in order to address emerging opportunities and market developments in a coherent manner, while avoiding duplication and fragmentation of efforts". Thus, the overarching objective of S3 is to boost growth and jobs in the whole Europe, by enabling each region to identify and develop its own competitive advantages.

In order to strengthen capacities to develop innovative solutions to climate change challenges for the new programming period, EU is shaping its investment programs such as Horizon Europe and ERDF to support the objectives of the Green Deal. In this context, new EU innovation policy approaches such as smart specialisation and mission-oriented policy should play a role. Join Research Centre (JRC) report 'Place-based innovation for sustainability' published in 2020 [16] marks a shift from S3 to S4+, e.g., smart specialisation strategies for sustainable and inclusive growth, where the evaluation of innovation-driven and enterprise-driven activities would be assessed with respect to their potential contributions to promoting sustainable growth and/or inclusive growth, e.g., their ability to contribute to the Green Deal objectives.

S3 development and implementation is supported by Smart Specialisation Platform (S3 Platform) operated by JRC. S3 Platform aims to provide information, methodologies, expertise and advice to national and regional policy makers, as well as promote mutual learning, transnational co-operation and contribute to academic debates around the concept of Smart Specialisation. [17] However, it seems that the platform is underused and S3 works best in countries that are already experienced with synergy-seeking strategies. [18]

A good practice example taking advantage of the S3 for synergies at strategy level are the European S3 Thematic Platforms: for Industrial Modernisation, Agri-Food and Energy. In recent years, efforts have been made in building a large number of interregional partnerships, with the ultimate goal to establish European ecosystems for interregional collaboration in regions and countries that share similar energy priorities in their S3. So far, the following six interregional partnerships have been launched under the S3 Thematic Platform Energy: Bioenergy, Geothermal Energy, Marine Renewable Energy, Smart Grids, Sustainable Buildings and Solar Energy. Regarding the partnership on Smart Grids involved countries are: Cyprus, Finland, France, Italy, Poland, Portugal, Sweden and Slovenia.

Ensuring and strengthening synergies between framework program (FP) related activities and those supported by the cohesion policy can improve the overall efficiency and effectiveness of public funding for R&I, enhance the performance of R&I activities and improve FP participation prospects [19] and is one of the main important orientations of Horizon Europe

framework program described in the first version of 'Implementation Strategy for Horizon Europe' [20] . This should facilitate synergies on operational level: projects receiving sequential funding from one programme to another (upstream and downstream of Horizon Europe), accumulation of funds from different programmes in a single project, or alternative funding when Horizon Europe budget cannot cover all high-quality proposals.

As for alternative funding, it is represented by Seal of Excellence Program (SoE). The SoE Certificate is a high-quality label awarded to projects submitted to Horizon which were deemed to deserve funding but did not receive it due to budget limits. The SoE Certificate holder can approach alternative regional, national, private or public funding sources. For their part, interested funding agencies willing to invest in promising proposals (including national & regional authorities through European Structural & Investment Funds) can identify promising projects more easily. SoE Certificates are currently awarded to proposals which were applied under European Innovation Council (EIC) Accelerator Pilot (former SME Instrument), Marie Skłodowska-Curie actions (MSCA) individual fellowships and Teaming. Implementation of the SoE is on a voluntary basis. It is up to each country or region to establish supporting funding schemes which are specifically dedicated to SoE proposals and provide alternative funding, in compliance with national and European rules. For example, the following countries have adopted provisions for SoE implementation in the area of SME instrument: Cyprus, Czech Republic, France, Germany, Greece, Italy, Poland, Slovenia, Spain and Sweden. [21] Alignment of proposals with S3 priorities enables project holders to participate in the above-mentioned schemes.

6.2 Energy in Target Countries Smart Specialisation Strategies

As discussed above, S3 allows capitalising on increasing cooperation in innovation investment across regions and harnessing synergies and complementarities between EU policies and instruments. To achieve that, S3 should be properly designed and effectively utilised and monitored. Literature sources on S3 analysis are limited and as indicated in [22] very few studies analyse the priorities identified by regions and countries in their S3. Furthermore, no works were identified providing analysis of S3 specifically in energy field.

A deep scientific analysis of S3 energy priorities is beyond the scope of the present report. Still, in order to evaluate the value given to energy sector and acknowledge priority setting trends in target countries relevant information was obtained from eye@RIS3 tool (available at https://s3platform.jrc.ec.europa.eu/map). It is summarised in Table 6 under the prism of the Regional Desks . For countries with regional priority setting; central, e.g., country level priorities are considered, with the exception of Italy, where no central priority is indicated.

Table 6 Information on S3 priorities for PANTERA target countries

Country	Energy priority (Country Level)	Description of intervention areas	Scientific Domain
Desk 1			
Latvia	Smart Energy	Development of smart grids - development of demand-supply systems, smart buildings, home, appliances and home automation systems. Development of next-generation technologies for energy from renewable energy sources. Increasing energy efficiency - energy efficiency of building structures, energy efficiency of residential infrastructure elements. Sustainable energy for transport - new technologies, accelerating their implementation, electric mobility.	05.30 - CO2 capture and storage 05.31 - Energy conservation 05.32 - Energy efficiency - consumption 05.33 - Energy production and distribution efficiency 05.34 - Hydrogen and fuel gas 05.35 - Nuclear fission and fusion 05.36 - Other power and storage technologies 05.37 - Renewable energy sources
Lithuania	Energy and sustainable environment	Smart systems for energy efficiency, diagnostics, monitoring, metering and management of generators, grids and customers. Energy and fuel production using biomass/waste and waste treatment, storage and disposal. Technology for the development and use of smart low-energy buildings - digital construction. Solar energy equipment and technologies for its use for the production of electricity, heat and cooling.	05.31 - Energy conservation 05.32 - Energy efficiency - consumption 05.33 - Energy production and distribution efficiency 05.34 - Hydrogen and fuel gas 05.36 - Other power and storage technologies 05.37 - Renewable energy sources
Estonia	Enhancement of Resources	Biomass (primarily timber and food) and oil shale, including energy efficiency related to knowledge-based construction.	05.32 - Energy efficiency - consumption 05.36 - Other power and storage technologies 05.37 - Renewable energy sources
	ICT	Industry 4.0, Robotics and Embedded Systems	5.33 - Energy production and distribution efficiency
Desk 2			
Bulgaria	Energy is not indicated as priority in eye@RIS3 tool		
Greece	Energy and its cross-cutting implications (transport, industrial production, etc.)	Emphasis on renewables, efficiency enhancement technologies, cost-reduction of energy as a key input, outward-looking competitiveness, environmental impacts, smart grids, fuel cells, renewables-sourced energy storage, etc.)	05.31 - Energy conservation 05.33 - Energy production and distribution efficiency 05.36 - Other power and storage technologies 05.37 - Renewable energy sources

Romania	Increasing end-use energy efficiency	Optimizing the use of conventional and non-conventional water resources. Substitution of critical materials and functional covering. Intelligent cities.	05.30 - CO2 capture and storage 05.31 - Energy conservation 05.32 - Energy efficiency - consumption 05.33 - Energy production and distribution efficiency 05.37 - Renewable energy sources
	New-generation vehicles and ecological and energy-efficient technologies	New-generation vehicles and ecological and energy-efficient technologies. Innovative technologies, equipment and technical systems for the generation of bioresources. Depolluting and waste reuse technologies.	No energy domain indicated
Desk 3			
Cyprus	Energy production and use, renewables and hydrocarbons;	Emphasis will be placed on solar energy applications and photovoltaics, advanced materials and energy storage, high concentration technologies, co-generation of solar energy and water desalination, heat pump technologies, insulation, heat transfer. Wind power (aeolic energy) will also be highlighted; materials, fluid dynamic models, simulation techniques will be emphasized. Applications of renewables in construction, tourism, agriculture, fisheries, etc. will be pursued. In terms of hydrocarbons, natural gas storage and use and related RTDI are underscored. In terms of energy use, attention is given to efficient energy systems in buildings, ICT use for energy use optimisation, and technologies for energy transmission networks, integrating energy produced by renewables in them.	05.31 - Energy conservation 05.33 - Energy production and distribution efficiency 05.36 - Other power and storage technologies 05.37 - Renewable energy sources
	Structured environment and construction;	Emphasis will be placed on urban networks and interconnectivity (smart cities, integrated waste management, transport, energy use, etc.), environment-friendly energy-efficient buildings, cultural/architectural heritage, technological updating of buildings, construction materials, resource use efficiency, and construction methods.	02.13 - Protection of atmosphere and climate 05.32 - Energy efficiency - consumption
	Transport, logistics and shipping;	Emphasis will be placed on public transport systems, smart cities, alternative fuels and energy efficiency, maritime infrastructure development, maritime tourism and intelligent transport systems.	05.32 - Energy efficiency - consumption

	Environment	Climate change, pollution, ecosystems, eco-innovation and water resources.	02.13 - Protection of atmosphere and climate 02.18 - The elimination and prevention of pollution
Malta	Energy is not indicated as priority in eye@RIS3 tool		
Desk 4			
Czech Republic	Energy is not indicated as priority in eye@RIS3 tool		
Poland	Sustainable energy	Natural resources and waste management. Technologies of acquisition, processing and use of natural resources, reducing their consumption and re-use of secondary raw materials as materials or energy sources.	05.30 - CO2 capture and storage 05.31 - Energy conservation 05.32 - Energy efficiency - consumption 05.33 - Energy production and distribution efficiency 05.34 - Hydrogen and fuel gas 05.36 - Other power and storage technologies 05.37 - Renewable energy sources
	Natural resources and waste management	Natural resources and waste management. Technologies of acquisition, processing and use of natural resources, reducing their consumption and re-use of secondary raw materials as materials or energy sources.	02.18 - The elimination and prevention of pollution 05.32 - Energy efficiency - consumption
Slovakia	Energy is not indicated as priority in eye@RIS3 tool		
Desk 5			
Croatia	Transport and Mobility	Added value manufacturing of road and rail vehicles parts and systems; environmentally friendly transport solutions; and Intelligent transport systems and logistics.	No energy domain indicated
	Energy and Sustainable Environment	Energy technologies, systems and equipment; environment friendly technologies, equipment and advanced materials.	05.32 - Energy efficiency - consumption 05.33 - Energy production and distribution efficiency 05.36 - Other power and storage technologies 05.37 - Renewable energy sources

Hungary	Sustainable environment	The priority is aimed at promoting the sustainability of the environment and natural resource management (e.g., environmental biotechnology) through the research and development of modern technologies and the implementation of the environmental industry and sectoral innovation. In addition to the advanced innovative water treatment technologies and waste water treatment and waste management, priority will be given to the non-pipe technologies.	No energy domain indicated
	ICT and information services	This is a horizontal priority intending to support sectoral priorities, such as bioinformatics or diagnostic imaging in the health industry, or the intelligent transport systems in the vehicle industry, or “smart city” in the energy domain.	No energy domain indicated
	Clean and renewable energies	This priority involving the energy sector is designed to reduce the energy dependency of Hungary by means of clean and environmentally friendly energy and promoting the related RDI activities, so that the energy produced locally is sustainable, decreases the environmental load and is cost-effective, in particular, for the households. In addition to using the renewable energies and thermal water for energy purposes, another objective is the use of bio- energy (such as biomass, biogas, bio refinery methods or the use of various wastes and by-products for energy purposes) as well.	05.32 - Energy efficiency - consumption 05.37 - Renewable energy sources
Italy	Energy (In Piedmont, Valle d’Aosta, Liguria, Lombardy, Campania, Apulia, Basilicata, Calabria, Sicily, Sardinia, Bolzano, Trento, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Lazio) Clean energy, environment, renewable energy, etc.		05.30 - CO2 capture and storage 05.31 - Energy conservation 05.32 - Energy efficiency - consumption 05.33 - Energy production and distribution efficiency 05.34 - Hydrogen and fuel gas 05.35 - Nuclear fission and fusion 05.36 - Other power and storage technologies 05.37 - Renewable energy sources
Desk 6			
Ireland	Smart Grids & Smart Cities	Smart Grids & Smart Cities	05.33 - Energy production and distribution efficiency
	Marine Renewable Energy	Marine renewable energy	05.33 - Energy production and distribution efficiency 05.36 - Other power and storage technologies 05.37 - Renewable energy sources

Portugal	Blue growth	Fishing and aquaculture (in land and off shore, food processing and safety). Marine ecosystems and renewable energy resources. Deep sea resources (Marine biotechnology, mining of minerals, natural gas and hydro carbons). Coastal tourism, culture, sport and leisure.	05.37 - Renewable energy sources
	Energy	Energy sustainability based on R&I and a competitive advantage in new forms of renewables.	05.31 - Energy conservation 05.32 - Energy efficiency - consumption 05.33 - Energy production and distribution efficiency 05.34 - Hydrogen and fuel gas 05.37 - Renewable energy sources
	Blue growth	Ecosystems and renewable energy resources. Increase in knowledge and sustainable use of marine ecosystems	05.37 - Renewable energy sources

As can be seen from the Table 6, four of sixteen target countries have no reference to energy at all in their national S3 priority settings: Slovakia, Bulgaria, Malta and Czech Republic. Estonia also has no energy in general priority definition, but energy-related areas are linked to 'Enhancement of Resources' and 'ICT' as can be seen from description and domain selection. Other target countries have identified energy as one of their priorities. However, it is not possible to estimate the value given to energy sector as a priority. Additional studies are needed in order to understand the degree of significance and the arguments below the specific priority selection. For that purpose, a search for additional and national S3 related information sources was performed. As information sources are scattered, updates and monitoring reports in most cases are unavailable or available in national language only; so, it is not possible to perform deeper analysis at current stage.

It may be concluded that countries tend to select a broad scope of intervention areas; in such cases regional specifics might be lost. For example, according to scientific domain selection (all domains are selected, including nuclear as well) almost every single energy related activity can be related to Latvian 'Smart Energy' and to Polish 'Sustainable Energy' priorities. Large sets of priorities may, de facto, circumvent the principle of selective intervention, as the strategies ultimately cover most of the broad economic areas.[22]

6.3 PANTERA collaboration with S3 Platform

PANTERA partners have established close working relations with the JRC office and Smart S3Platform to utilize the active regional stakeholders in support of the objectives of the PANTERA project. PANTERA project and its Regional Desk concept was presented in the workshop 'Smart grids in the new programming period: the role of transnational R&I networks to strengthen smart energy' organized jointly by S3P Energy and 'Stairway to excellence' (S2E) project team on February 6, 2020, where both parties agreed to formalize a regular exchange of information, views and experience through the respective activities, achieved results and pursuing ways of reinforcing cooperation and support.

7 Regional Desk Stakeholder Survey

7.1 Objectives, methodology and progress of the work

In order to shape the future work of Regional Desks and other PANTERA activities targeting to increase involvement of less active actors and countries, better understanding of stakeholder needs and expectations is required. Having analysed outcomes of workshops, questionnaire results and country profiles along with activities held within the Desks, it was decided to perform a dedicated stakeholder consultation in the form of closed survey with carefully selected experienced stakeholders.

The process follows the methodology and is aligned with initial provisions for Desks activities provided in D6.2 thus supporting the consistency of all activities under WP6.

While designing a survey, the following issues were considered:

- the survey should not be too long, to avoid discouraging potential respondents;
- the respondents should be approached individually, where possible with prior personal contact, within the four targeted categories: DSO, TSO, Academia/Research Organisation and SME/Industry;
- the major aspects covered shall be devoted to stakeholder experience in participation in EU/internationally funded projects and availability and quality of national support;
- open questions shall be used to stimulate respondents think outside the box and base their inputs on their own experience and share ideas for improvement if any;
- additionally, a question on awareness of Smart Specialisation shall be added to support relevant analysis.

The survey was checked through the trail consultation within the consortium members and finalised in May 2020. Its template is provided in Annex 11.3. PANTERA partners were asked to circulate it within their contact network according to Desks' allocation but not limited to it. Best-practice Desk coordinator circulated the survey within the Nordic countries' stakeholders, which allowed to see the difference between advanced and less active countries.

7.2 Analysis

Before entering into the details, it shall be noted that the response rate has been around 80% meaning that the utilised approach is successful. It was possible to cover all targeted stakeholder categories; meanwhile, the majority of responses were received from Academia/Research organisation category (see Figure 20). Moreover, regional Desks being more active during all operational timeline have succeeded better in inviting stakeholders to fill in the survey. It might be useful to extend the survey time allowing reaching stakeholders from all categories and all target countries.

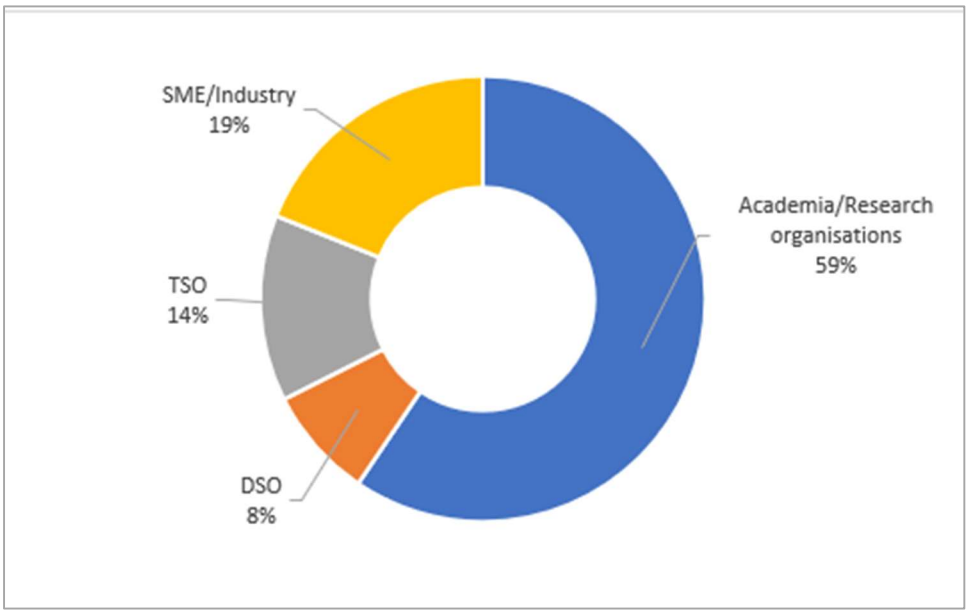


Figure 20 Distribution of respondents by category

Experience in participation in EU/internationally funded projects in target countries

As expected, the most widely utilised instrument is Horizon 2020/FP7 (see Figure 21). It is mentioned by around 80% of respondents within all stakeholder categories from target countries. As the number of participants from DSO, TSO and SME/Industry category is lower than from Academia/Research, it is not possible to discuss with confidence about their involvement level. However, it appears that operators and industries are not utilising the possible opportunities within Horizon 2020/FP7 to full extent.

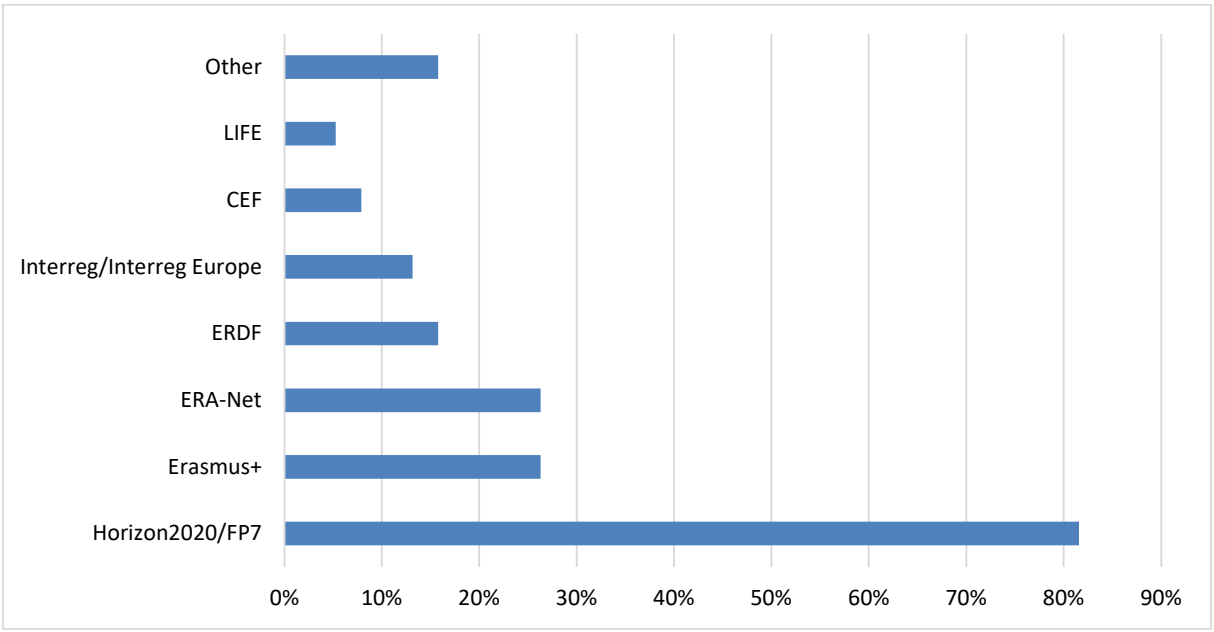


Figure 21 Distribution of funding instruments utilised by all respondents

Erasmus+, ERA-Net, ERDF, Interreg and LIFE programs are also popular within Academia/Research community. The Connecting Europe Facility (CEF) instrument is mentioned

only by TSO representatives. Although the involvement of TSO and DSO representatives is limited, the results are credible as beneficiaries of most infrastructure projects financed under CEF facility are TSOs, whereas DSOs are involved in Smart Grid projects which are far fewer. As Smart Grid development is heavily dependent on the innovation in distribution network segment, it seems that supporting DSOs involvement by fostering TSO-DSO cooperation and/or changing the rules of the game might be beneficial.

As answers to open question 'What were the challenges and barriers in project preparation, access to finance and success?' have many commonalities, it was decided to group them into the following areas:

- **project proposal** - requirements, calls' thematic, resources needed to prepare a proposal;
- **consortium building** - partner search, issues to involve businesses, communication between partners;
- **insufficient support** – lack of support on national and/or European level;
- **lack of information** – insufficient information on successful projects, research infrastructure, lack of experience in applying for funding;
- **formalities/bureaucracy** – complicated procedures and demanding paper work, uncoordinated activities of the institutions;
- **other** – challenges that can't be classified under the above-mentioned categories, including high competition, issues with review process, copyright, etc.

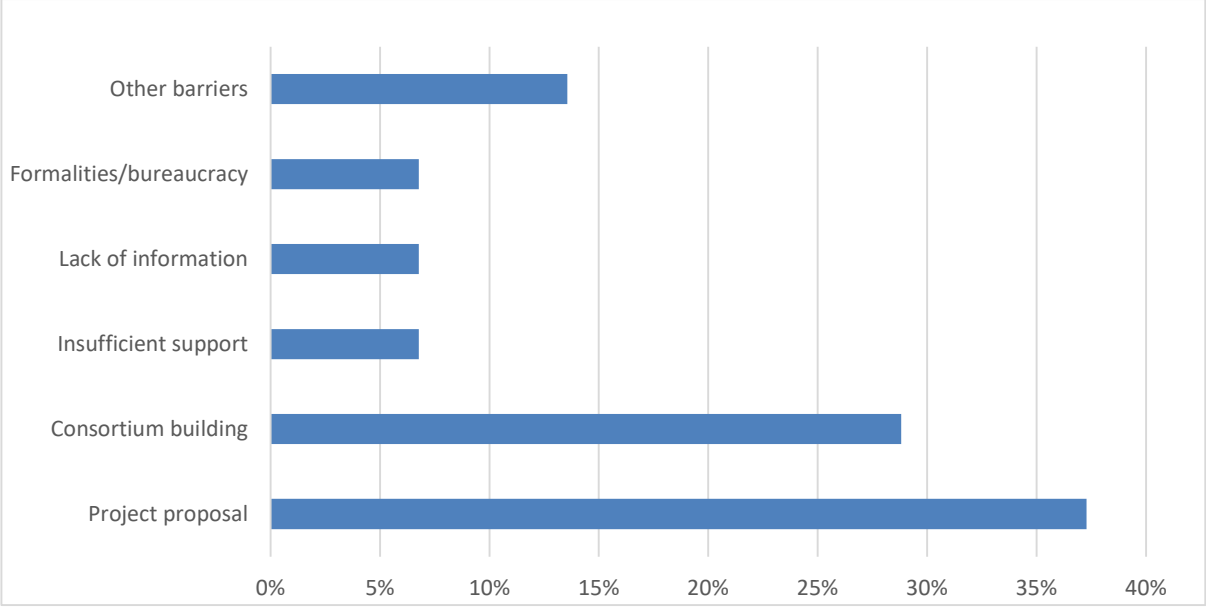


Figure 22 barriers in project preparation, success and access to finance

Figure 22 illustrates a share of responses referring to each area of barriers. Issues related to project proposal and consortium building are considered as major challenges for project success.

Figure 23 illustrates how often respondents from each category (share of respondents from specific category) refer to the issues relevant to project proposal and consortium building areas. For respondents from Academia/Research category both areas have approximately equal significance, consortium building is mentioned a bit more often. Respondents from SME/Industry category more often mention issues related to project proposal, e.g., resource- and time-consuming proposal preparation process. Stakeholders from DSO and TSO don't refer to any issues with consortium

building, rather to complicated project proposal preparation process.

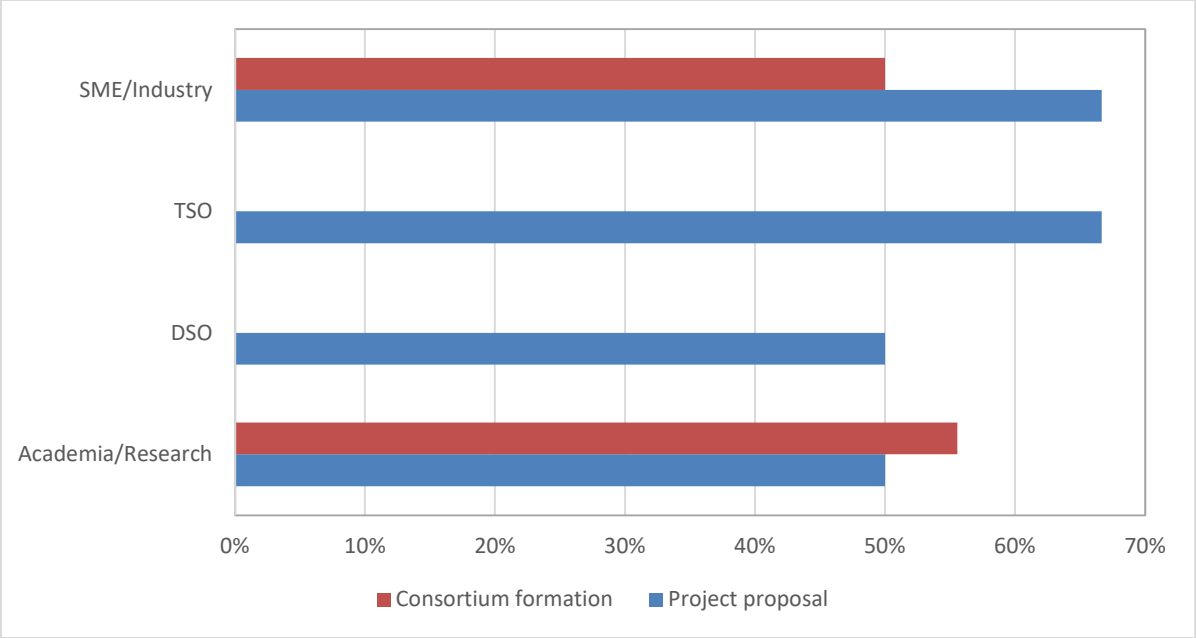


Figure 23 Distribution of responses including references to issues related to project proposal and consortium building

Stakeholders were invited to share their recommendations and ideas on what could be done to overcome mentioned challenges and what additional support might be useful. The results are twofold: some recommendations shall be explicitly considered for organising PANTERA activities, e.g., kind of information stakeholders would like to receive from the platform, workshops and other tools, and some thoughts and ideas which could form the basis for recommendations to authorities on EU or national level. The latter shall be developed and specified during further work including deeper investigation and interviews. Stakeholder recommendations are summarised in Table 7 structured through the selected categories of barriers.

Table 7 Stakeholder recommendations to overcome specific barriers

Topic	***Stakeholder recommendations and proposed solutions***
Project proposal	• A guidance through the proposal preparation. • A **tool** which helps in preparation and pre-evaluation of project proposal/s according to a call requirements/criterion. • The **evaluation results** of all projects in the same call should be available to all those who have participated in that call. This helps to understand for next time why the project application left under threshold evaluation. Evaluation criteria are available at a high level, but it may help, if the detailed criteria were explained by some forum. • A more flexible application form. • Increasing of preparation time. • An easier application process which involves lower cost is needed. • Less complex projects: with fewer partners with clearer objectives and goals - one clear objective per project instead of ten objectives per project. • Simplified application procedure focusing on the real value added instead of the number of the pages written in the proposal.

	• **Workshops and webinars** on project preparation (including emphasis on particular calls, explanation of criteria, real-life examples/best practices, etc.). • Some**?-Ihow to guides on** how to fulfil project requests, because often it is not possible to take part in informative training. • Information on the type of research and industry partners expected to participate in specific calls for proposals and what kinds of demos are expected on certain calls. • More strict control that specific interests are removed. • Better selection of reviewers. • EU project evaluation scheme which stimulates projects with participation of all member states.
Consortium building	• More advanced/credible **platform** for partners searching and evaluation (incl. comments/recommendation on the finished project implementation from the (supervisory/EU) project officers). • A networking **platform** with access to partners depending on the subject of each project proposal (which can occur in the best-case scenario of partnerships that have worked well together in the implementation of previous projects). • Increasing the mobility and networking funds. • Funded face-to-face meetings prior to the project to form a good multi-discipline project team. • Opportunity for a change in the consortium for more suitable partners. • A **mechanism** that gives the possibility of participation in a consortium via other ways and not just through networking.
Insufficient Support	• Better support from national contact points (NCP) and more informed feedback. • Better communication with competent authorities and other institutions. • More support for early stage researchers and postdocs. • Legal support from the Commission to project's coordinators for resolving potential conflicts and disagreements. • Technical support for preparation of innovative project.
Lack of information	• Creating a **database** with successful project information. • More **information** on different funding mechanisms. • **Information** on the policies and priorities of the EC for the upcoming competition period. • Access to infrastructure and reliable source of results to build innovation needs. • Better understanding of differences between national laws.
Formalities/ bureaucracy	• Smart national support schemes. • Coordination between ministries. • Simplified rules for public procurement. • Less "bureaucracy" involved (sometimes there are more PMs on the project that people actually doing R&I). • Simplified and streamline EC procedures, also in project control. • Simplifying the administrative rules.

Other	• Enabling pre-financing in all projects. • Attractive cost of person month. • Better estimation of travel budgeting in accordance to the country's location. • Manage innovation projects differently - separate conditions for special innovation. • The move towards large demonstration projects is not the most efficient use of money - smaller more focused projects and a consolidation process could be a solution.

A trend that most recommendations are linked to project proposal and consortium building areas additionally highlights the importance of these. It is very positive that the consultation results on the proposed solutions validate once again the planned functionalities and tools of the EIRIE platform.

Support on national level

As can be seen from the above analysis, insufficient support is in top five issues stakeholders are struggling with. Moreover, while addressing challenges on European level could be time-consuming, local support activities, especially those not involving finance, could be improved in a shorter period and with minor involvement of authorities. In order to understand stakeholder satisfaction level with support provided by local institutions and organisations, respondents were asked to rate it on a scale from one to five. Figure 24 illustrates a share of respondents considering local support sufficient by rating it on a score four and five, where lower scored support is qualified as insufficient.

Figure 24 clearly indicates the lack of support in target countries for all stakeholder categories and the difference in satisfaction levels between target and more advanced countries (specific case of Nordic countries considered). An alarming trend is that only 14% representatives from SME/Industry category are satisfied with support provided locally. As for DSO and TSO representatives, it seems that they receive better support than other actors, which might be justified that usually grid development is tightly interlinked with political objectives and might be lobbied by authorities.

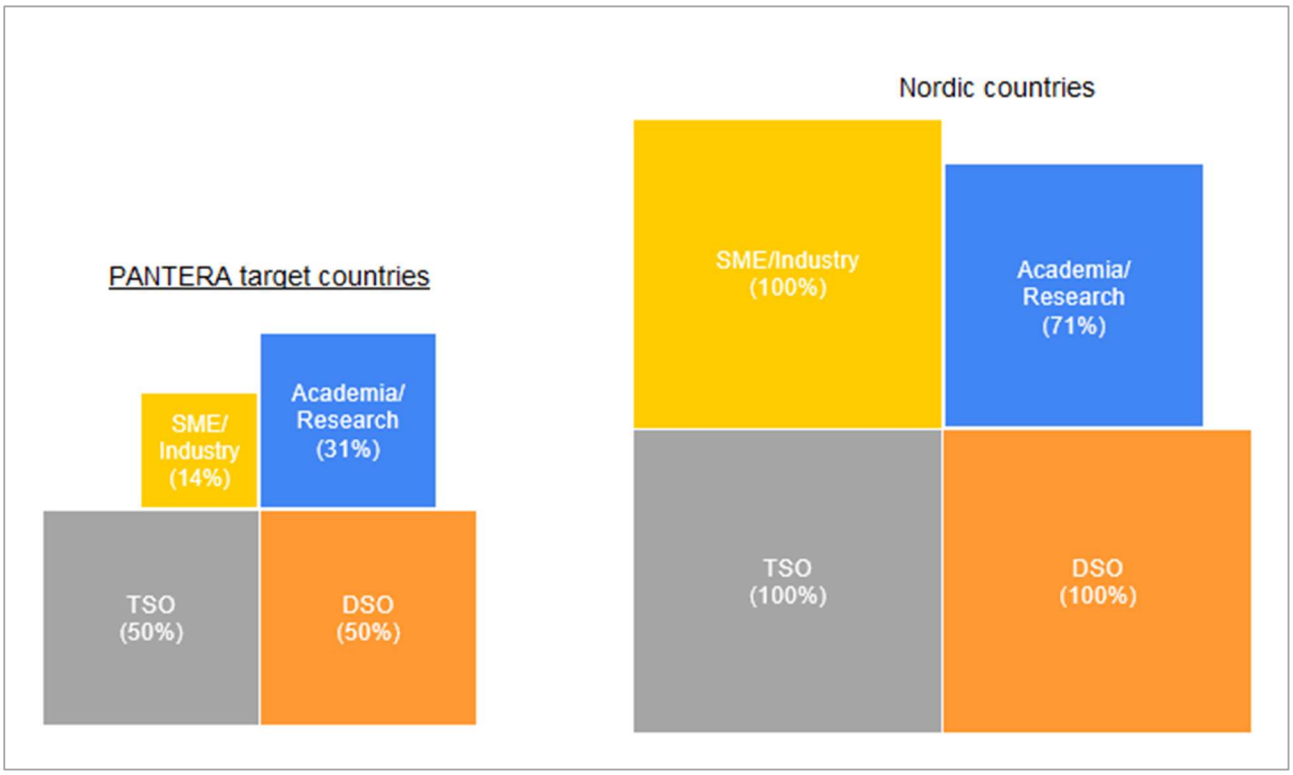


Figure 24 Share of respondents rating national support on a score four and five

Moreover, almost one third of respondents from target countries indicated that they haven't received any national support. So, it could be assumed that changes on the way to more active involvement in R&I activities shall start from the national level.

Awareness of Smart Specialisation Strategy

Smart Specialisation Strategy is a regional or national innovation strategy, which aims at guiding national/regional investment and is a prerequisite for receiving funding under cohesion policy. It should be developed with the active involvement of many different types of actors, including firms, science and business parks, universities and other research institutions, civil society organisations as well as national, regional and local authorities. [23]

Considering that, it was decided to include a question on awareness of S3 in the Desk survey. With respect to importance and efforts made on European level to promote Smart Specialisation, the received results are somewhat unexpected. These illustrate that less than 20% of respondents from target countries know well or were involved in S3 creation/monitoring process. As for more advanced countries, stakeholders from Nordic countries, participated in the current survey, have very little or no knowledge on S3 as well. However, this might be explained to some extent with the fact that more advanced countries are less dependent on cohesion funds.

Considering the nature of the above-mentioned results, more investigation is needed in the frame of Smart Specialisation.

7.3 Conclusions

The Regional Desk survey produced quite a few interesting points about the stakeholders' needs

and expectations.

Stakeholders face multiple difficulties in applying for funding, from appropriate partner search to understanding how project proposals are evaluated. This is aggravated by lack of support from local institutions and a lot of formalities and bureaucracy, especially in target countries.

As actions and solutions for improving the situation, respondents mention several options that are covered explicitly by both PANTERA activities and EIRIE platform, e.g. advanced networking and partner search platforms, training on project preparation for specific calls, a database with successful project information, availability of information on the priorities for the upcoming period and funding mechanisms.

Furthermore, PANTERA team could indirectly approach solutions which require actions from authorities by providing recommendations and/or best-practice examples issues related to R&I governance and organisation of support activities. Deeper investigation might be required to understand regional/country context of these issues and possibility provide some practical advice.

8 Identified Best Practice Examples

8.1 Introduction

One of the key objectives in PANTERA is to research and transfer best practices across countries to support and accelerate R&I activities in the Smart Grid domain. During the first PANTERA workshop in Sofia (BG) in July 2019 WP4 arranged a set of personal interviews with several stakeholders, representing different sectors e.g. TSO, DSO, vendors and academia. The intention of the interviews was to validate some initial hypothesis and establish an overview of thematic areas for interaction and knowledge transfer i.e. best practices to increase national R&I activities in Smart Grid domain. During the interviews it was received a strong feedback from the stakeholders that organisation of regulatory and decision-making processes can be equally important as the technical part. Several transformation processes in today's power sector are driven by the overarching political goals related to the global climate challenges. Therefore, the national regulatory and decision-making part is an important trigger for targeted R&I activities. It was specifically mentioned that long-term alignment and coordination of R&I efforts within the research community on national level will support meeting the overall targets for implementation of Smart Grids technologies.

This first communication was further supported and elaborated by the following interviews at workshops in Dublin (IE) and Athens (GR). Based on the feedback and national case studies, developed in T4.2 several best practices proposals have been developed.

8.2 Best practices for R&I

This section presents an overview of best practices, which support maintaining sufficient level of Research and Innovation (R&I) activities on national level with focus on the Smart Grid domain.

The list of the suggested proposals is based on the current results from several activities in PANTERA, including case studies and interaction with stakeholders (see [24] and [25] for details) and thus is not final and is continuously updated according to the new findings and feedback from the project's stakeholders.

One of the main tasks of "Best Practice Desk" is to explore and identify different well-functioning mechanisms, which contribute to increased R&I activities, so this experience can be considered and replicated in other countries. The general approach is that the project group does not advice other countries to specific actions but provides a selection of alternatives, which had been proved to work.

Selection of the best practice topics was done based on several assumptions:

- The proposal should avoid any controversy political, ethical or commercial.
- The suggested best experiences should be justified or substantiated by existing positive experience, feedback from the stakeholders or conclusions from the 3rd parties.
- The suggestions should be as much as possible universally relevant and applicable to different countries and different stakeholders (both academia, R&D and industry).

Development of Smart Grid solutions as any other technical field follows the general Technology Readiness Level (TRL) ladder going through Basic Technology Research to Operation. Development and implementation of novel technical solutions requires an unbroken chain of R&D activities corresponding the whole TRL scale or the final part of it, in case of replicability and technology transfer from another country. This means that support mechanisms should be applied

at different TRL levels in a balanced and coordinated manner in order to avoid segmentation of results.

In addition, the process should involve various types of organisations on different stages of technology development, starting from basic research organisations (in case of novel technology development) to industrial partners deploying the actual technology. A coordinated involvement of all necessary types of organisations into this process requires different facilitation and support mechanisms.

8.3 Funding schemes

8.3.1 Common industrial funding of R&D projects

Pooling resources from several industrial organisations and for solving specific challenges is a well-established practice. There are several different ways to organise the process i.e. schemes, which can be applied depending upon the scope and TRL level of a specific challenge.

Common funding by several DSOs is one of the most well-functioning financing schemes. DSOs as natural regulated monopolies, do not directly compete and normally are willing to cooperate to solve their common problems, develop common methods, share knowledge and experience in the process. This scheme has also been applied for procurement of automatic meter reading (AMR) in several countries, where several DSOs developed common technical specifications and arranged common procurement and installation procedures. Svenska Mätsamarbetet (SAMS) initiative is a good example of such cooperation, when more than 30 Swedish DSOs successfully worked together on configuration, procurement and installation of AMR systems for almost 800 000 customers back in 2000s [26]. Later this cooperation form was successfully replicated in several Nordic countries as well.

In general, this type of industrial financing seems to work best and is well-suited for countries which are not necessarily big but have several DSOs. Nevertheless, applicability of the common project financing scheme is not limited to DSOs only and may also include TSO, soft- and hardware vendors and industrial associations as financing parts. In some cases, this work can be organised and coordinated on a permanent basis by industrial associations. REN AS in Norway [27] and Swedenergy [28] are good examples of this type of arrangement, where members-companies initiate organisation of specific research tenders by their association. The research is than financed by their membership fees and managed by the corresponding associations. Since these projects are independent from public financing, they may have less formal reporting and publications requirements.

Apart from a simple raising of funds for research, the common financing involves different actors into projects thus making the final results more interdisciplinary, replicable and scalable due to considering interests of different involved actors.

Among other limitations it can be mentioned that since the projects are financed by industry and have high TRL, there is no public access to the results.

Table 8: Summary for common industrial funding of R&D projects

TRL level	High

Limitations	Functions best in countries with countries having several DSOs
Common industrial financing of R&D projects	Raising funds for R&D activities with high TRL
	Solving specific and applied problems
	Involvement of different actors supports interdisciplinarity and considers interests of different actors

8.3.2 Mixed funding of R&D projects

The previously mentioned scheme focuses on specific challenges with high TRL and is not applicable for broader R&I topics, involving more fundamental research activities and thus having fairly low TRL indicators. These projects however can be still interesting for industrial partners as minor financing parties. The remaining budgeting needs can be covered by national funding agencies to ensure that these projects will be developed and maintain certain level of scientific research. The funding agency providing the major part of the funding is normally responsible for tendering and follow-up of the projects.

In case of Norway for example, for this type of projects the required distribution mix requires at least 20% of industrial funding and the remaining part is covered by the national funding agency. In case the project is not able to secure sufficient industrial funding share (20% or more) it will not be initiated and support from the funding agency will be cancelled. Another example of showing application of this scheme can be observed in Ireland (see summary of interview results in [25]), where industrial funds can be combined with Science Foundation Ireland or Enterprise Ireland.

The public funding presumes that the results are fully or partially available publicly. The minor industrial involvement is more than a mere financing, but it also functions as an important tool, which is intended to ensure that a given project maintains its relevance to the industry and develops useful and applicable results.

Table 9: Summary for mixed funding of R&D projects

TRL level	Low-Medium
Limitations	Certain level of industrial funding is needed
Benefits	Public financing secures that results are fully or partially available publicly
	Raising funds for R&D activities with low TRL
	Industrial partners ensure relevance of the results

8.4 Creation of financial incentives

8.4.1 Tax exemptions

R&I activities and corresponding investments often include substantial risks and uncertainties. There are several ways to create additional financial incentives encouraging different actors to get involved into R&I project. One of the most well-known is tax exemptions or tax credits, when companies substantially invest in R&D work both internally and externally, can reduce their tax burden. Normally this applies to full or partial exemption of Value Added Tax (VAT) but can vary according to national taxation rules. Tax exemptions normally are not automatic and a given organisation has to comply with certain requirements e.g. certain TRL level or thematic priorities in order to get tax exemption for its investments or activities.

Following the interviews with various stakeholders, which were done in the course of the project (see [25]) several respondents representing actors from R&I pointed out positive effects of such arrangements. The main limitation of this mechanism is that it has limited impact and in general does not substitute funding.

Table 10: Summary for tax exemptions

TRL level	Low-High
Limitations	Certain level of industrial funding is needed
Benefits	Encourages investments into R&D activities both internal and external

8.4.2 Regulation of DSOs

As it was previously mentioned in this section DSOs are regulated natural monopolies. There are several different methods of regulation of DSOs across Europe. Evaluation of national regulation schemes for DSOs and taking any specific positions is a complicated task, which is not within the scope of the present project. In addition, this is a somewhat sensitive issue and has to be decided by the National Regulating Authorities (NRA) upon the local conditions in each specific country.

It has been pointed out that national regulation schemes are critically important for deployment of new technologies and especially the SmartGrids [29]. The recent comparative study done by Eurelectric [30] further elaborates this issue and concludes that regulation is decisive for investment into Smart Grids technologies. The study stated that in most countries R&I activities, including pilots are treated like any other cost, i.e. there is no specific compensation for the risks involved in testing new technologies and processes. Investment into Smart Grids technologies does not necessarily lead to short-term cost reductions and depending upon the regulation scheme may have negative effect on companies' incomes. Based on their study, Eurelectric points out that there are several best practices around Europe (see [30], [31], [32] for more details).

Table 11: Summary for regulation of DSOs

TRL level	Low-High
Limitations	Adjustment of national regulation is very long process
	Variety of models are available
Benefits	Encourages DSOs to invest into new technologies

8.5 Regional cooperation

The general observation so far is that there are normally two layers of research programmes and operating funding agencies: national and Pan-European. In the Nordic region there is however a long-term tradition of having regional cooperation, functioning as an additional intermediate level. This cooperation functions in particular in the energy field, probably due to common synchronous energy system, previously known as NORDEL. The cooperation is facilitated by Nordic Energy Research (see [24] for details) acting as a funding agency, which finances projects dealing mostly with region-specific challenges, defined by a dedicated entity – The Nordic Council of Ministers.

This type of cooperation proved to be very efficient and fruitful throughout many years, especially when it comes to replicability and fast deployment of innovative results across several countries. As a good example, it can be mentioned the implementation of AMR, which was initially started in

Sweden and later the experience and important learnings from Sweden were successfully deployed in other Nordic countries. The process was facilitated by the Research Council of Norway by funding projects focusing on knowledge transfer.

The conclusion is that regional cooperation is one of available well-functioning mechanisms, which support deployment of Smart Grids technologies. As a limitation it has been observed so far that funding for this type of cooperation is usually low. It also seems like establishment of such cooperation requires presence of common regional challenges and strong political will and engagement.

None of the target countries seem to have any similar cooperation, functioning on regional level across several countries.

Table 12: Summary for regional cooperation

TRL level	Low-High
Limitations	Establishment of such cooperation requires presence of common regional challenges and strong political will and engagement.
	Limited funding volumes
Benefits	Improved deployment of new technologies by cross-national transfer of experiences and learnings
	Development of regional solutions
	Raising funds for solving region-specific challenges

9 Conclusions

Desk success is key to reaching PANTERA specific objectives in supporting involvement of less active countries. Until now some Desks have performed better that others. Although, this could be justified with regional specifics, actions shall be taken to activate all Desks to the higher degree as possible. As seen from the report, the spread of Covid-19 pandemic has hampered organisation of face-to-face meetings and workshops considered as most effective way of stakeholder interaction. To minimise the effects of these the closed stakeholder survey was performed within the current task and the results described in the Section 7 of this report are quite promising. Another barrier to wider stakeholder engagement is that EIRIE platform which could provide tangible outcomes is still under development.

Having said that, it becomes clear that PANTERA consortium shall enhance activities related to regions in two main dimensions: strengthening national and European contact network and building PANTERA activities, including EIRIE platform based on stakeholder needs.

The experience described in the current report proves that no major changes are required to the structure of Desks itself at the moment and the concept of involving contact persons for associated countries works well. Therefore, establishing good working relations with contact persons from associated countries is the top priority for the next few months specially in less successful Desks. Additionally, Desk leaders shall seek for communication and if possible support of national professional associations and bodies.

Another opportunity to approach local stakeholders and overcome their reactance is building common activities with European level initiatives, such as Smart Specialisation Platform, and projects, such as SUPEERA (*https://www.supeera.eu/*) or Erigrid2.0 (*https://erigrid2.eu/*). SUPEERA is targeting the same countries for raising activities towards enhanced R&I work of the EU-13 countries in meeting the targets of the SET Plan and ERIGrid2.0 targets to expand the research services and tools of research infrastructures for validating smart energy networks with the electric power grid as the main backbone.

To support the Regional Desks PANTERA consortium has initiated collaboration with Smart Specialisation central office. The responce was positive and support was provided by communicating with all active regional offices giving all the shared information and asking them to respond positively to the needs of the PANTERA project. So far, good feedback was received from Latvia, Bulgaria, Romania and Portugal and limited feedback from Ireland, Croatia, Italy, Cyprus, Greece, Estonia, Lithuania. It is important to capitalise these initial promising results to establish cooperation on go further with other less active countries.

In parallel a review of available information on target countries' S3 in energy field was performed within the frame of this report. The information on strategies, their monitoring and implementation seems to be scattered. Moreover, some countries do not have energy in their priority list at all. Additionally, in order to acknowledge stakeholder awareness of S3 the relevant question was added to the Desks survey. The obtained results confirm the need of deeper investigation which could be performed with support of S3 representatives and central office, for example in the form of consultation. If successful such cooperation shall obviously result in a mutual benefit. Of course, the national priorities are very difficult or almost impossible to influence. Still an attempt to mark the importance of raising priority of Smart Grid in light of energy transition could be undertaken by

circulating short reports with main findings through newsletters, EIRIE platform, webinars and meetings where possible and other channels.

The Regional Desk survey pointed out main challenges that the stakeholders from target countries are facing. These are concentrated in the following areas: project proposal, consortium building, insufficient support, lack of information and formalities/bureaucracy. As actions and solutions for improving the situation, stakeholders proposed several solutions which partially could be covered explicitly by PANTERA activities, e.g., advanced networking and partner search platforms, access to successful project information, availability of information on the priorities for the upcoming period and funding mechanisms. Other issues which require actions from local authorities could be addressed implicitly by developing and disseminating recommendations and/or best-practice examples. This process could benefit a lot from involvement of local stakeholders, including institutions, in the discussions on relevant topics by face-to-face meetings and structured interviews. The first step in this direction could be for example, disseminating the survey results through PANTERA newsletter.

To sum up, it can be noted that considering the variety of envisaged approaches and rather positive intermediate results, Regional Desks of PANTERA could be promoted as an instrument facilitating R&I activities in target countries.

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11 Annex

11.1 List of Figures

11.2 List of Tables

11.3 Content of the survey

PANTERA Regional Desks Survey
PANTERA is a coordination and support action (CSA) funded by H2020 aimed at setting up a European Interconnection for Research Innovation & Entrepreneurship (EIRIE) for engaging and supporting stakeholders active in the field of smart grid, storage and local energy networks. This survey is intended to investigate and help PANTERA to deeper understand stakeholder needs and identify opportunities to facilitatate R&I and bridge the gaps existing between different EU Member States.

PANTERA project Consortium will process the data provided through this survey in compliance with the GDPR, for purposes related only to contract execution as provided by Art. 6b of the GDPR. In order to proceed with the survey, you need to confirm that you have read and understood PANTERA Privacy Policy (https://pantera-platform.eu/wp-content/uploads/2019/03/PANTERA-Privacy-Policy.pdf).

- Yes, I have read and understood

General information
Country

- Austria … Other

Type of organisation

- Academia/Research organisation
- DSO
- SME/Industry
- TSO
- Other…

EU / international level projects
What are the EU instruments/programs you have received support from for energy related R&I projects during the past five years?

- Connecting Europe Facility (CEF)
- ERA-Net
- Erasmus+
- European Cooperation in Science and Technology (COST)
- European Regional Development Fund (ERDF)
- Horizon2020/FP7
- LIFE programme
- Other *…/a place to write an answer/…*

What were the challenges and barriers in project preparation, success and access to finance?
…/a place to write an answer/…

What can be done in order to overcome these barriers?
…/a place to write an answer/…

What kind of additional support could increase your participation rate in R&I projects financed by the EU?
…/a place to write an answer/…

National level projects
What are the national instruments you have received support from during the past five years?

Please specify your answer.
…/a place to write an answer/…

Please rate (on a scale of 1 to 5) national organisation and institution support in project preparation and submission

	1	2	3	4	5	
Poor support	○	○	○	○	○	Excellent support

What kind of support do national organisations and institutions provide to you?
…/a place to write an answer/…

How familiar are you with Smart Specialization (RIS3) strategy?

- *Never heard of it*
- *Heard of it but hardly know anything about*
- *Know a little*
- *Know it well*
- *I'm involved (was involved) in the RIS3 creation and/or monitoring process*

11.4 Country Profiles for Desk 1 (Latvia, Lithuania, Estonia)

 **LATVIA**	**Desk 1**
	Responsible partner: IPE

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [36]	IPE	30.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [56]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1. Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	Latvia's "Long-Term Energy Strategy of Latvia 2030" gives a vision how the 2030 could look like, but the proposed targets are not officially adopted by the government.[33] The Long-Term Energy Strategy is linked to a broader "Sustainable Development Strategy of Latvia until 2030"[34], which covers areas like culture, education, environment and innovation.
GHG target 2020	Greenhouse gas emissions: maximum increase by 17% between 2005 and 2020.[35] According to the latest national projections and taking into account existing measures, the target is expected to be achieved: 8% in 2020 compared to 2005.[35]
GHG target 2030	According to Effort sharing regulation 2030 target which requires Latvia to reduce its emissions by 6% by 2030 (relative to 2005 levels). They are projected to rise by 13%, instead.[35]
	To reach its 2030 target Latvia will have to break the current trend of increasing emissions. The increase in greenhouse gas emissions in non-ETS sectors is driven mainly by increasing use of passenger cars. [36]
	According to NECP, 2030 GHG target is in line with Effort sharing regulation 2030 target [37]
1.2 Uptake of renewable energy resources (RES)	
RES 2020 target	Latvia is on track to achieve its 2020 target for the share of energy produced from renewable sources (40%), although the support scheme has proved expensive.[35] In 2017, the indicator constituted 39%.[38]
	In 2018, Latvia's share of renewable energy was 40.3%, thus reaching its 2020 target. However, maintaining the renewables share at this level will remain a challenge. [36]
RES 2030 target	In the NECP, Latvia has set a contribution to the EU renewable energy target of at least 50% in gross final consumption of energy for 2030, in line with results from the formula of Annex II of the Governance Regulation.[37]
National support schemes	In Latvia, renewable electricity generation was stimulated through a complex support system based on a feed-in tariff, which also includes elements of a quota system and tenders.[39] In the spring of 2018 the Ministry of Economy initiated a reform of the existing support scheme for the electricity produced from renewables with a view to reduce the costs to final consumers (a threshold of 0.3% of GDP). The Ministry of Economy proposed a set of solutions for abolishing the mandatory procurement component as of January 2022.[35]

Connection of RES to the grid	Access of renewable energy plants to the grid is subject to the general legislation on energy. Electricity from renewable sources is not given priority. Also, installations for heat production from renewable energy sources are not given priority connection, and there is no special legislation promoting the connection of RES heating devices to the heat transmission network at the national level. [39]
RES in transport	The penetration of renewable energy in transport sector in Latvia according to Eurostat data in 2017 was 2.5%[40]. The target according to the first Renewable Directive RED I [41] is 10%.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 4.73% [42]
	According to NECP, Latvia has set a 2030 target for RES in transport: 7% [37]
Support of RES in transport	Renewable energy use in the transport sector is promoted through obligation to sell petrol and diesel blended with biofuels and a tax regulation mechanism. [39]
	Latvian government is drafting a new law – Transport Energy Law. It will include regulatory measures to ensure that Latvia achieves the 2020 target of 10% renewable energy share in the transport sector. Electric mobility is picking up slowly as the development of charging infrastructure picks up pace. [36]
Charging points	According to Eurostat data, there are 7.25 EV charging points per 100000 inhabitants in Latvia in 2017 (EU rank 23 of 28).[43]
Plug-in vehicles	The share of newly registered plug-in electric vehicles (including Battery Electric Vehicles) and Plug-in hybrid electric vehicles) in the 2017 was 0.61% (EU rank 15 of 28)[44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.9% [45]
2. Energy Efficiency	
Energy efficiency indicative target	Latvian indicative energy efficiency target for 2020 is 5.4 Mtoe expressed in primary energy consumption and 4.5 Mtoe expressed in final energy consumption. In 2017, Latvia's primary energy consumption increased to 4.5 Mtoe from 4.3 Mtoe in 2016. The final energy consumption also increased from 3.8 Mtoe to 4.0 Mtoe. Given the current trend, Latvia is on track to achieve its energy efficiency target.[35]
	In 2018, Latvia's primary energy consumption increased to 4.7 Mtoe. Final energy consumption also increased to 4.2 Mtoe. Given the current trend, Latvia is at some risk of missing its 2020 target. [36]
Energy savings	In 2016, it had made only 7% of the total savings it had committed to achieve over the 2014 to 2020 period.[46]
2030 target	In the NECP, Latvia has set its national energy efficiency contribution for 2030 at 3.94 – 4.06 Mtoe of primary energy consumption, which has been converted into final energy consumption of 3.46 – 3.56 Mtoe.[37]
3. Energy security and interconnection	
Interconnection	According to NECP data, Latvian electricity grid interconnection level with neighbouring countries in 2017 was 50-80%. 2030 target for interconnectivity is 60%.[37]
Energy security target 2030	The NECP puts forward an ambitious objective to reduce imports of energy and energy resources from third countries by 50% compared to 2011 by 2030[37], reaching the energy dependence level of 30-40%.
	The ongoing Baltic Synchronisation Project, scheduled for completion by the end of 2025, is key to ensuring security of supply of the whole Baltic region. Latvia continues to implement the key electricity infrastructure projects that form part of the implementation of the Baltic energy market interconnection plan. (In 2019, the third and last phase of the 'Kurzeme ring' was commissioned. Construction of an internal 330 kV power-line 'Riga TEC-2 — Riga HES' and the third interconnector between Latvia and Estonia, are expected to be finalised by 2020. [36]
Trade deficit	The Latvian energy dependence fell from 64% in 2005 to 44% in 2017.[47]
	In 2018, Latvia's energy import dependency was 44,3% [48]
Electricity generation capacities	In 2018, 61% of total produced electricity in Latvia was delivered from conventional power plants (utilizing mostly natural gas), 37,2% - from hydropower plants and 1,8% from wind.[49]
4. Integrated electricity market	

Wholesale electricity market	Latvia is part of the Nord Pool market since 2013.[33]
Retail electricity market	Latvia's electricity market was liberalised in 2015. In 2017, 100% of total electricity was traded in the electricity market at contract prices in accordance with bilateral agreements and 62% of that electricity was traded by the dominant trader in the market -"Latvenergo", and the remaining 38% - by other traders. During the year, 4% of all households and 20% of all non-household users changed electricity trader.[50]
Intelligent metering systems	Since 2014, more than 544 000 smart meters have been installed; these account for 49% (end of the 2018) of the total fleet of electricity meters and measure 83% of the total amount of electricity consumed by customers. Smart electricity meters are planned for all Sadales tīkls AS (Latvian DSO) customers until 2020.[5]
Tariffs	Dynamic tariff is available.
5. Research, innovation and competitiveness	
R&I strategy	The main strategic frameworks in which the country operates are the Guidelines for National Industrial Policy 2014-20, the Guidelines for Science, Technology Development and Innovation (2014-20) and in particular the Smart Specialisation Strategy (RIS3, 2014-20) [51]
Innovation performance	Latvia is a moderate innovator.[52]
National target	Latvia will likely not meet its national R&D intensity target of 1.5% of GDP.[35]
Total R&D expenditure	In 2007, R&D intensity reached 0.55% of GDP.[53] In 2017, R&D intensity reached 0.51% of GDP.[35]
	In 2018, R&D intensity reached 0.64% of GDP.[36]
	The coverage of sustainability-related research and innovation topics is limited. [36]
Public R&D expenditure	The public funding level in 2017 reached 0.37% of GDP.[35]
	Additional financial instruments would be needed to attract private investments in addition to public funding. [36]
Business expenditure in R&D	The level of business expenditure in R&D comprises 0.14% of GDP and is among the lowest in the EU.[35]
Academia-business links	Having still relatively few research-industry and intra-industry links remain key challenges. Latvian start-ups and SMEs also lag in innovation capacity compared to other EU Member States. To address this, in 2018 Latvia's technology transfer programme was amended to improve innovation voucher support for the innovation activities of SMEs. [36]
R&D policy coordination	This weakness is aggravated by inadequate administrative capacity and the scattering of policymaking and implementation among a multitude of ministries and agencies.[35]
	In 2019, the government approved a new strategy for the institutional consolidation of the Latvian science policy system. [36]
Funding from Horizon 2020	Latvia is among least successful countries received only 0.18% of the overall Horizon funding according to the Horizon dashboard.[54]
Research infrastructures roadmap	National roadmap with identified ESFRI projects is not available.[55]
Smart specialisation priority areas	1.Information & communication technologies 2.Human health & social work activities 3.Key Enabling Technologies 4.Energy production & distribution 5.Manufacturing & industry [56]
Just Transition Investment Guidelines	Development of new and innovative solutions for the reclamation of peatlands and wetlands, the reskilling of employees, etc., thus limiting the potential impact of energy transition on local communities, specifically in Vidzeme and Latgale. Key actions of the Just Transition Fund could target in particular: productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; investments in the creation of new firms, including through business incubators and consulting services; investments in research and innovation activities and fostering the transfer of

	advanced technologies; [36]

LITHUANIA	**Desk 1**
	Responsible partner: IPE

Document history:

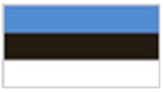
No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [57]	IPE	30.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [60]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1. Climate action, decarbonizing the economy	
1.1 Decarbonization and energy strategies	
National strategies	Revised ambitious National Energy Independence Strategy was approved by the Seimas of the Republic of Lithuania in 2018.[6]
	The national authorities prepare a three-year plan containing the measures and funding needed to implement the Strategy for National Climate Change Management Policy for 2013-2050. In 2018, Lithuania started issuing green bonds in order to raise funding for the renovation of multi-apartment buildings with low energy efficiency. In 2019, Lithuania started a project 'The Lithuanian Strategy and Action Plan for Sustainable/Green Finance (Green Capital Markets)'. [57]
GHG target 2020	Greenhouse gas emissions: maximum increase by 15% between 2005 and 2020. [58] Lithuania's emissions are expected to increase by 2% in 2020 compared to 2005. It will consequently meet its target. [58]
	The country will meet its target with a margin of 9 percentage points. [57]
GHG target 2030	According to Effort sharing regulation 2030 target which requires Lithuania to reduce its emissions by 9% by 2030 (relative to 2005 levels). Lithuania expects emissions to rise by 6% by 2030 relative to 2005 levels.[58]
	Lithuania is unlikely to achieve the emission reduction of 9% by 2030. Total greenhouse gas levels per capita are below the EU average but remain virtually unchanged since 2010. This is due to the share of fossil fuel consumption remaining constant in manufacturing and agriculture and increasing in the transport sector. [57]
	NECP's 2030 GHG target is in line with Effort sharing regulation target[59]
1.2 Uptake of renewable energy resources (RES)	
RES 2020 target	With a 25.6% share of renewables in 2016, Lithuania has already more than achieved its 2020 target (23%).[58]
	Lithuania has already surpassed its 2020 renewable energy target, but the share of renewables is not increasing. At 24.4% of gross final energy consumption, the share of renewables is at the same level as it was in 2014 and 2015, and has decreased by 1.6 pps between 2017 and 2018, mainly due to the statistical transfer of energy from renewable sources to another EU Member State under Article 8 of the Renewable Energy Directive. [57]

RES 2030 target	According to the NECP, the proposed share of 45% of energy from renewable sources in gross final energy consumption in 2030 is a contribution to the EU renewable energy target for 2030 that is significantly above the share of 34% in 2030 resulting from the formula in Annex II of the Governance Regulation.[59] This includes doubling domestic power generation capacities (with 70% of electricity produced domestically in 2030). This will be achieved through investment in wind and solar power generation and wide uptake of small-scale renewable installations owned by private energy consumers and communities (with 30% of consumers producing energy for their own needs in 2030.[58]
National support schemes	In Lithuania, electricity from renewable sources is mainly promoted through a sliding feed-in premium. Under the sliding feed-in premium scheme only the already existing RES plants are supported. Support is not available for new RES installations and no tenders are currently being organised. However, a new support scheme for renewable energy technologies is planned to be introduced from 2019 - technology neutral tenders in combination with a fixed feed-in premium.[39] Furthermore, the producers of renewable electricity may apply for subsidies and loans from the Environmental Project Management Agency under the Climate Change Special Programme and are exempt from excise duty. For solar, wind and biomass power installations, net-metering is in place.[39]
Connection of RES to the grid	The operators of RES-E plants are entitled to priority connection to the electricity grid. The transmission and distribution of electricity from renewable energy sources shall also be given the priority. Heating devices using renewable energy sources are connected according to non-discriminatory principles.[39]
RES in transport	The penetration of renewable energy in transport sector in Lithuania according to Eurostat data in 2017 was 3.6%.[40]
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 4.33% [42]
	According to NECP, 2030 target for RES in transport: 15%[59]
Support of RES in transport	Transport sector is promoted through reimbursement of raw materials for biofuel production, obligation to sell petrol and diesel blended with biofuels (quota obligation), an excise tax relief and an exemption from the environmental pollution tax.[39] CO2-based motor vehicle taxes are not in place in Lithuania. Incentives to favour cars with lower CO2 emissions are very limited and new vehicles purchased in Lithuania are among the least environmentally friendly in the EU.[58]
	In 2019 Lithuania changed the legal act regarding the biofuel blending obligations which should lead to increasing shares of blended biodiesel and bioethanol. [57]
Charging points	According to Eurostat data, there are 12.67 EV charging points per 100000 inhabitants in Lithuania in 2017 (EU rank 21 of 28).[43]
Plug-in vehicles	The share of newly registered plug-in electric vehicles (including Battery Electric Vehicles) and Plug-in hybrid electric vehicles) in the 2017 was 0.28% (EU rank 22 of 28).[44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.5% [45]
2. Energy Efficiency	
Energy efficiency indicative target	Lithuanian indicative energy efficiency target for 2020 is 6 Mtoe expressed in primary energy consumption and 4.3 Mtoe expressed in final energy consumption. In order to reach its 2020 final energy consumption target, Lithuania must further increase its efforts to promote energy efficiency.[59]
	Primary energy consumption was 6.3 Mtoe in 2018, in line with achievement of the 2020 target. However, primary energy consumption has been increasing for four years in a row, putting at risk the achievement of the target. Lithuania's final energy consumption is also on an increasing trend, with a 3,8% increase between 2017 and 2018 to reach 5.55 Mtoe. In order to reach its 2020 final energy consumption target, Lithuania must radically increase its efforts to implement additional policies and measures. [57]
Energy savings	In 2016, it had made only 19% of the total savings it had committed to achieve over the 2014 to 2020 period.[46]
2030 target	In the NECP, Lithuania's national contribution for energy efficiency is presented in terms of primary and final energy intensity, which is to be 1.5 times lower than in 2017

	- primary energy consumption : 5.4 Mtoe and final energy consumption: 4.5 Mtoe.[59]
3. Energy security and interconnection	
Interconnection	Lithuania's target for interconnectivity is in line with EU target (15%) in 2030 (23%).[59]
Energy security target 2030	According to NECP, electricity imports will be replaced by local electricity generation: it is planned thatelectricity generation in Lithuania will account for 35% of total final electricity consumption in 2020 (65% will be imported), 70% (30% imported) in 2030, and 100% in 2050.[59]
Trade deficit	With the final shutdown of Ignalina nuclear power plant in 2009, the Lithuanian energy dependence increased from 56.6% in 2005 to 75.6% in 2017.[47]
	In 2018, Lithuania's energy import dependency was 77,2% [48]
Electricity generation capacities	Lithuanian electricity imports have increased since Ignalina nuclear power plant shut down at the end of 2009. In 2018, 35.7% of total domestically produced electricity in Lithuania came from wind power plants, 29.6% from hydro (including pumped hydro) and 25.2% from conventional thermal power plants, additionally 2.5% contributed solar and 7% geothermal and other sources.[49]
	Lithuania, together with Estonia and Latvia, is making progress on the synchronisation of their electricity grids and the rest of Europe. Synchronisation will take place through Poland, notably via the existing link between Poland and Lithuania together with a new high-voltage direct current line between Lithuania and Poland, Grid optimisation measures will also be carried out. All of these actions will involve significant investments in the coming years. [57]
4. Integrated electricity market	
Wholesale electricity market	Lithuania is part of the Nord Pool market since 2012.[33]
Retail electricity market	Lithuanian domestic electricity market is not liberalized.
	Liberalisation of the electricity market is set to start in 2021 and will run until 2024. [57]
Intelligent metering systems	The mass roll-out of smart metering in Lithuania by 2023 is included in the National Energy Independence Strategy.[6]
	Liberalisation is supported by the roll out of smart metering, which was recently approved by the regulator. The objective is to install 1 million smart meters, from 2020 to 2023, covering 70% of those consumers, for whom smart meters are most cost-effective. [57]
5. Research, innovation and competitiveness	
R&I strategy	Several strategies and programmes in the field of R&I, although the National Progress Strategy 'Lithuania 2030' is an overarching reference as it sets the strategic direction for the development of the country. It includes some general terms around R&I. Six other documents influence the direction of R&I: the National Progress Strategy 'Lithuania 2030;' the National Progress Programme for Lithuania for the period 2014-2020 (NPP); the Programme for Development of Studies and R&D for 2013-2020; the updated Concept of the Establishment and Development of Integrated Science, Studies and Business Centres (Valleys); the Lithuanian Innovation Development Programme for 2014-2020 and the Programme on the Implementation of the R&D&I Priority Areas and Their Priorities.[51]
Innovation performance	Lithuania is a Moderate Innovator.[52]
National target	Lithuania is far away from reaching its R&D intensity 2020 target of 1.9%.[58]
Total R&D expenditure	In 2017, total R&D investments amounted to only 0.9% of GDP.[53]
	In 2018 Lithuania's R&D investment decreased to 0.88 % of GDP. R&D investment is unlikely to reach the target level by 2020. [57]
Public R&D expenditure	Public investment, which is funded mainly from EU funds, made up the bulk of R&D investment at 0.6 % of GDP.[58]
	Public R&D intensity went to 0.53% of GDP in 2018. [57]

	Investment in R&D is well below the EU average, and has not yet recovered from the sharp drop in 2016. This is mostly because of the fall in public R&D intensity due to diminishing rates of investment from European structural and investment funds. Inefficient public funding limits public research and innovation capacities and lowers the quality of output. This is amplified by a cumbersome institutional network and a shortage of talent. [57]
Business expenditure in R&D	Business expenditure on R&D in 2017 was 0.3% of GDP.[53]
	In 2018, Business expenditure on R&D was 0.33 % of GDP. [57]
Academia-business links	2019 R&I inputs into the innovation system (innovation friendly environment, non-R&D innovation expenditures) were adequate but output remained weak (unattractive research systems, modest employment impact). Innovating companies are of moderate size, are weakly integrated in international value chains, and struggle to attract investments of sufficient critical mass. Science-business cooperation is limited to high-tech "pockets of excellence". [57]
R&D policy coordination	R&I policy coordination was slightly improved by reassigning responsibility for it to the Ministry of Economy and the Ministry of Education and Science, and transferring the experimental development in companies file to the Ministry of Economics. However, a coherent new R&I policy still needs to be developed.[58]
	The government is making efforts to improve the design and funding of the innovation ecosystem. Innovation reform aims to (i) reduce the fragmentation of programmes, funding mechanisms and support services for research and innovation, (ii) improve innovation skills across businesses and public institutions, and (iii) increase innovative and pre-commercial procurement to 20% of total procurement expenditure by 2027. However, the consolidation of research and innovation agencies has stalled. The planned Innovation Support Fund will be funded domestically to limit the dependency on funding from ESIF funds. [57]
Funding from Horizon 2020	Lithuania is among least successful countries received only 0.15 % of the overall Horizon funding according to the Horizon dashboard.[54]
Research infrastructures roadmap	National roadmap with identified ESFRI projects is available, with latest update in 2015.[55]
Smart specialisation priority areas	1.Agriculture, forestry & fishing 2 Energy production & distribution 3.Human health & social work activities 4.Social innovation 5.Key Enabling Technologies [60]
Just Transition Investment Guidelines	Transition Fund could contribute to mitigating the socio-economic impact of decarbonisation and transformation of GHG–intensive industrial installations, particularly in Kaunas, Telsiai and Siuliai counties. Key actions of the Just Transition Fund could target in particular: investments in research and innovation activities and fostering transfer of advanced technologies; investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; investments in enhancing the circular economy, notably through promoting new circular business models and smarter design for reparability, reuse and remanufacturing; upskilling and reskilling of workers. [57]

 **ESTONIA**	**Desk 1**
	Responsible partner: IPE

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [63]	IPE	30.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [68]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonizing the economy	
1.1 Decarbonization and energy strategies	
National strategies	In 2017, the "National Development Plan of the Energy Sector until 2030" was adopted and published.[61] The "General Principles of Estonian Climate Policy until 2050" were approved in the Estonian Parliament in April 2017. [62]
	Estonia is planning to update its 2017 General Principles of Climate Policy guidance to incorporate findings from the recently commissioned study 'Analysis to increase the Estonian climate ambition by 2050'. In this way, Estonia is seeking to align its long-term policy vision with concrete ways to reach the 2030 effort sharing target. [63]
GHG target 2020	Greenhouse gas emissions: maximum 11% increase in 2020 compared with 2005.[4] Emissions are projected to be 11% higher in 2020 than in 2005, according to national projections and taking into account existing measures. This means that the target is expected to be met.[4]
	Provisional GHG emissions data for 2018 show that Estonia currently emits 17% more GHG emissions in the sectors not included in the EU emissions trading system than it did in 2005. Projections with existing measures, however, indicate that Estonia will likely meet its 2020 target. [63]
GHG target 2030	According to Effort sharing regulation 2030 target which requires Estonia to reduce its emissions by 13% by 2030 (relative to 2005 levels). Under the existing policies, Estonia is projected to fall short of its 2030 target.[4]
	Current projections based both on existing and additional measures illustrate that Estonia will miss its effort sharing target for 2030 by a significant margin. [63]
	NECP 2030 target is in line with effort sharing regulation 2030 target [64]
1.2 Uptake of renewable energy resources (RES)	
RES 2020 target	With a renewable energy share of 29.2% in 2017, Estonia is already above its 25% target for 2020.[4]
	With a renewable energy share of 30% in 2018, Estonia is already above its 25% target for 2020. [63]
RES 2030 target	Estonia estimates a share of 42% of energy from renewable sources in gross final consumption of energy for 2030. This level of ambition, is significantly above the share of 37% in 2030 that results from the formula in Annex II of the Governance Regulation.[64]
National support schemes	In Estonia, electricity from renewable sources has so far been promoted mainly through a premium tariff. However, major revisions in the legislation regarding RES support schemes have taken place in recent years. An auction-based system to promote RES development has been introduced in June 2018 which replaced the previous premium tariffs.[39]

Connection of RES to the grid	Access of electricity from renewable energy sources to the electricity grid is granted based on the principle of non-discrimination. The grid operator is obliged to develop the grid to guarantee grid services for all electricity producers and to be able to connect further electricity plants to the grid. The connection of a heat generation plant to the grid is auction based and follows the principle of non-discrimination.[39]
RES in transport	With a 0.4% share of RES in transport in 2017, Estonia is lagging behind the binding 10% target in transport to be achieved by 2020.[40]
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 3.29% [42]
Support of RES	In transport, the use of renewable energies is currently mainly encouraged through a measure to support biomethane use and build biomethane fuelling stations.[39]
	Estonia expects to reach its 10% target for the share of renewable energy in transport by 2020 through obligation on retailers to achieve a statistical target share of renewables sold. The government is looking into the electrification of Estonia's rail network that today mostly runs on diesel, with the aim of mitigating greenhouse gas emissions from rail by 2028. The government also provided a limited number of subsidies for the purchase of some 200 electric vehicles (0.8% of annual new registrations) in 2019. It has also privatised the nationwide electric charging network that comprises 165 charging stations. The Liquid Fuel Act sets the proportion of renewable fuel sold to 6.4% of all transport fuels; this is expected to increase to 10% by 2020. There are no plans to use more efficient measures such as emissions-based taxation or to increase support for the charging network or the use of low or zeroemission zones, or to limit the use of vehicles classed as older under EU emission standards. [63]
Charging points	According to Eurostat data, there are 65.78 EV charging points per 100000 inhabitants in Estonia in 2017 (EU rank 9 of 28).[43]
Plug-in vehicles	The share of newly registered plug-in electric vehicles (including Battery Electric Vehicles) and Plug-in hybrid electric vehicles) in the 2017 was 0.2% (EU 27 of 28).[20] Sales of alternative fuel vehicles have decreased from 2.7% to 0.2% between 2012 and 2017 notwithstanding the measures taken in recent years.[4]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.5% [45]
2. Energy Efficiency	
Energy efficiency indicative target	Estonia's 2020 indicative energy efficiency target is 6.5 Mtoe expressed in primary energy consumption (2.8Mtoe expressed in final energy consumption).[4] In 2017, Estonia's primary energy consumption decreased to 5.6Mtoe, compared to 2016. On the other hand, final energy consumption increased to 2.9Mtoe.[4]
	In 2018, Estonia's primary energy consumption increased by 11% to 6.2 Mtoe, compared to 2017. Final energy consumption increased by 3% to 3.0 Mtoe. [63]
Energy savings	In 2016, Estonia had made 47% of the total savings it had committed to achieve over the 2014 to 2020 period.[46]
	The period 2021-2030 requires annual energy savings equivalent to 0.8% of the average final energy consumption in the period 2016-2018.[64]
2030 target	According to NECP, the expected primary energy consumption in 2030 is 10% less than in 2012, while final energy consumption is 32 TWh (115 PJ). Overall energy efficiency target primary energy consumption up to 2030 is 230 PJ. [64] The contribution represents low ambition, and more details on policies and measures would be necessary to assess their sufficiency.
3. Energy security and interconnection	
Interconnection	In 2017, Estonia had an electricity interconnectivity level of 63%.[64]
Energy security	Estonia's main objective in the energy security dimension appears under the headline of ensuring continuous energy supply. This can be ensured by more extensive use of domestic energy resources – oil shale and renewable energy, while at the same time ensuring that the share of any one energy source does not exceed 30% by 2020.[65]
	The gradual phase-out of oil shale-based electricity generation means that electricity imports and the development of domestic renewable energy will play a key role in ensuring security of supply. [63]
Trade deficit	The Estonian energy dependence fell from 28% in 2005 to 4% in 2017.[47]
	In 2018, Estonia's energy import dependency was 0,7% [48]

Electricity generation capacities	In 2018, 94% of total produced electricity in Estonia was delivered from conventional power plants (utilizing oil shale and shale gas) and 6% - from wind power plants.[49]
	Estonia is progressing towards synchronisation with the continental European grids, and this remains a key priority for the coming years. Estonia continues to implement key electricity infrastructure projects that form part of the Baltic Energy Market Interconnection Plan. The third interconnection between Estonia and Latvia, planned to be commissioned in 2020, will be key to alleviating congestion at the border between the two Member States. [63]
4. Integrated electricity market	
Wholesale electricity market	Estonia is part of the Nord Pool market since 2011.[33]
Retail electricity market	Estonian market was liberalised in 2013. In 2017 there were 16 independent electricity suppliers in Estonia, 10 of them are active players in the market.[66]
Intelligent metering systems	Estonia completed a roll-out of smart meters and developed a data hub to ensure the efficient handling of data in retail energy markets, relatively low proportion of households is switching suppliers, which in turn allows incumbents to maintain a high market share.[4]
Tariffs	Estonia is among the EU leaders in terms of availability of dynamic price contracts. These contracts cover about 1/3 of the population and directly reflect the price in the wholesale spot market.[4]
5. Research, innovation and competitiveness	
R&I strategy	Single overarching strategy: Knowledge Based Estonia 2014-2020 (2014).[51]
Innovation performance	Estonia is a strong innovator or in 2019 Innovation Scoreboard (previously Moderate Innovator.[52]
National target	R&D target set in the 2013 National Reform Programme: 3% of GDP, of which 2% for the private sector.[4]
Total R&D expenditure	In 2017, total R&D investment in Estonia slightly increased to 1.29% of GDP, up from 1.25% in 2016, but remains below the EU average of 2.07% of GDP.[4]
	In 2018, expenditure on R&D reached 1.38% of GDP. [63]
	The only substantial change is the 50% increase in basic funding for universities in 2017. The actual funding increases in other areas have been quite modest. R&D [63]
Public R&D expenditure	Public expenditure in R&D reached 0.66% of GDP in 2017, slightly below the EU average of 0.69% of GDP.[4] While currently around 48% of funding for R&D is provided by the EU, Estonia plans to increase the state budget allocation for R&D to 1% of GDP.[4]
	In 2018, public R&D expenditure increased to 0,79% of GDP. [63]
Business expenditure in R&D	Business enterprise expenditure in R&D decreased slightly from 0.64 in 2016 to 0.61% in 2017.[4]
	In 2018, business R&D expenditure decreased to 0,59% of GDP. [63]
Academia-business links	Cooperation between research institutions and enterprises is still limited. As an indicator of the lagging cooperation, the share of public-private co-authored publications was 53.1 per million population in 2018 (EU average 86.4). Estonian industry lags behind the EU average in the number of researchers employed in private companies. The number of employed researchers with a PhD has been constantly decreasing in the business sector as a whole, as well as in key sectors such as manufacturing, information and communication industries. [63]
R&D policy coordination	Estonia has pursued a widespread liberalisation and deregulation process at the fastest pace among the Widening countries. By implementing structural reforms and an enabling legal framework, Estonia has aligned its R&I strategies with the European policies and directed Structural Funds to the development of R&D infrastructure, human capital and entrepreneurship.[67]
	A promising step towards better coordination between innovation and research policies is the initiative to merge the national entrepreneurship strategy and the research and development strategy: the process of writing a single strategy — TAIES — provides clear opportunities to improve coordination. [63]

Funding from Horizon 2020	Estonia is among the best performing countries in terms of the Horizon 2020 funding contribution normalised per inhabitant, researcher and R&D&I investment.[67] It received 0.42% of total net funding according to Horizon dashboard.[54]
Research infrastructures roadmap	National roadmap with identified ESFRI projects is available and updated in 2019.[55]
Smart specialisation priority areas	1.Manufacturing & industry 2.Key Enabling Technologies 3.Information & communication technologies 4.Construction 5.Human health & social work activities [68]
Just Transition Investment Guidelines	The Just Transition Fund, as proposed by the EC, could contribute to the limiting the potential impact of the energy transition in Ida-Viru region, which relies heavily on the oil shale sector, that provides 75% of the Estonia's energy production. Key actions of the Just Transition Fund could target in particular: productive investments in SMEs, investments in the creation of new firms, investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; upskilling and reskilling of workers. [63]

11.5 Country Profiles for Desk 2 (Bulgaria, Romania, Greece)

 **BULGARIA**	**Desk 2**
	Responsible partner: TUS

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
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4.	3rd content update from [77]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	The present Energy Strategy of Bulgaria covers the period till 2020.[69]
	Bulgaria has not yet finalised its energy strategy beyond 2020 and a coal phase-out is currently not being discussed. In fact, the continued use of lignite coal resources is anticipated in the medium and long term. [70]
GHG target 2020	Greenhouse gas (GHG) emissions target: maximum increase of 20% in 2020 compared to 2005 (in non-ETS sectors)[71] In 2020 Bulgaria's non-ETS emissions are expected to be 1.7% less than in 2005, which is an overachievement of the 2020 target by a margin of 21.7 percentage points. [71]
	While the 2020 target has been met, provisional inventories indicate that the gap to the 2018 target is estimated to be close to 3pp. [70]
GHG target 2030	Effort sharing regulation and NECP requires Bulgaria to keep its greenhouse gas emissions at no higher than the 2005 level.[72] Based on its own projections, Bulgaria may miss by 1 pp. its 2030 target of keeping its greenhouse gas emissions at no higher than the 2005 level.[69]
	Looking ahead to 2030, projections suggest that the target of keeping emissions no higher than their 2005 level will be missed by about 8pps [70]
1.2 Uptake of renewable RES	
RES 2020 target	Bulgaria is on track. The 2017 share of renewable energy in gross final energy consumption was 18.7%, on par with the level registered in 2016 and well above the 2020 target of 16% of gross final energy consumption.[69] In 2017, the indicator constituted 18,7%.[38]
	Provisional inventories show that in 2018 Bulgaria has already surpassed its 2020 target for renewable energy shares by 2.7pp. [70]
RES 2030 target	The Bulgarian NECP sets a share of 27,09% renewable energy in gross final consumption of energy for 2030 as contribution to the EU renewable energy target for 2030, which is in line with the share of 27% in 2030 that results from the formula in Annex II of the Governance Regulation.[72]

National support schemes	In Bulgaria, electricity from renewable sources is promoted through a feed-in tariff (FiT) and a premium tariff. As of 1 July 2018, the FiTs are terminated and the RES producers, which enjoyed PPAs and FiT are offered to execute Premium contracts with the ESSF (Electricity System Security Fund) by 1 July 2018. The Energy and Water Regulatory Commission regulates the electricity selling price at the wholesale market and the FiT at which the RES producers sell electricity to suppliers. RES-E producers with a total installed capacity of at least 4 MW are obliged to sell their electricity on the exchange.[73]
Connection of RES to the grid	In Bulgaria, the connection of renewable energy systems to the grid is subject to the provisions of the general legislation on energy. Renewable energy is not given priority access. Plant operators are contractually entitled to have their electricity dispatched by the grid operator. Grid operators are obliged to upgrade and expand their grids if the upgrade or expansion is required to connect a plant.[69] The use of renewable energy for heating and cooling is promoted through a subsidy from the European Regional Development Fund, several loan schemes and through an exemption for building owners from property tax.[69]
RES in transport	The penetration of renewable energy in transport sector in Bulgaria according to Eurostat data in 2017 was 7.2%.[40] The respective 2020 target is 10 %.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 8.06% [42]
Support of RES in transport	In Bulgaria, the main support scheme for renewable energy sources used in transport is a quota system. This scheme obliges companies importing or producing petrol or diesel to ensure that biofuels make up a defined percentage of their annual fuel sales. Furthermore, biofuels are supported through a fiscal regulation mechanism. [73]
Charging points	According to Eurostat data, there are 7.1 EV charging points per 100000 inhabitants in Bulgaria in 2017 (EU rank 24 of 28).[43]
	The number of electric charging points has been increasing since 2016, in line with the increase in the market share of electric vehicles in 2018. [70]
Plug-in vehicles	Share of newly registered plug-in electric vehicles (PEV) in the 2017 was 0.37% (EU rank 20 of 28) [44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.7% [45]
2 Energy Efficiency	
Energy efficiency indicative target	The 2020 energy efficiency target of Bulgaria is 16.9 Mtoe expressed in primary energy consumption and 8.6 Mtoe expressed in final energy consumption. [71]
	Indicative national target not yet achieved. In 2017 primary energy consumption stood at 18.3Mtoe, up from 17.7Mtoe in 2016. In 2017 final energy consumption stood at 9.89Mtoe, up from 9.65Mtoe in 2016. [71]
	In 2018, Bulgaria's primary energy consumption was 18,4 Mtoe [74] and final energy consumption was 9,9 Mtoe [75]
	Continuing the trend from previous years, Bulgaria's final energy consumption in 2018 increased slightly, remaining above the linear trajectory by 11pp. Bulgaria's primary energy consumption in 2018 has also stayed above the linear trajectory, putting at risk the fulfilment of its obligation by 2020 [70]
Energy savings	In 2016, it had made only 9% of the total savings it had committed to achieve over the 2014 to 2020 period.[46]
2030 target	The Bulgarian NECP includes a national energy efficiency contribution for 2030 of 27,89% (primary energy consumption) and 31,67% (final energy consumption), which translates into a national contribution of 17.466 Mtoe of primary and 10.138 Mtoe of final energy consumption.[72]
3 Energy security and interconnection	
Interconnection	According to Bulgaria's NECP, it has set an electricity system interconnection target of at least 15 % by 2030. In 2017, interconnection level was 7%.[72]
Energy security target 2030	National energy security objectives regarded in the Bulgarian NECP are: diversification of the supply of energy resources; increasing the flexibility of the national energy system; addressing constrained or disrupted supply of energy sources for the purpose of enhancing the resilience of regional and national energy systems; and improving interconnectivity and information security (cybersecurity). [72]
	The Energy Act was amended to remove fees levied on electricity exports. This lifted

	obstacles to trade with market participants from neighbouring systems. Bulgaria is also working on market coupling projects with North Macedonia, Croatia and Serbia. Progress on market coupling with Romania and Greece has stalled [70]
	To support the security of supply objectives of the Energy Union, Bulgaria is planning to rely on the use of indigenous energy resources. The operational licence of the Unit 6 reactor of the Kozloduy Nuclear Power Plant was extended until 2029, following a recent similar extension of the licence for Unit 5 in 2017. [70]
Trade deficit	The Bulgaria energy dependence fell from 47,33% in 2005 to 39,5% in 2017.[47]
	In 2018, Bulgaria's energy import dependency was 36,5% [48]
Electricity generation capacities	In 2018 46,4% of total produced electricity in Bulgaria was delivered from conventional power plants mainly in coal power plants, 36,7% produced from nuclear energy. The share of hydro power plants is about 11,2% and the rest is produced from wind and solar energy. [49]
	About 48% of electricity is produced by coal-fired power plants using predominantly lignite coal [70]
4 Integrated electricity market	
Wholesale electricity market	The wholesale electricity market is liberalized. Nord Pool is presented as NEMO (Nominated Electricity Market Operator)
	The Independent Bulgarian Energy Exchange (IBEX) joined the European Single Intraday Coupling in November 2019 and is now a part of a platform for continuous trading of intraday electricity covering 21 European countries. [70]
Retail electricity market	Bulgarian electricity market is liberalized but still has regulated market for householder consumers. In December 2017 50% of the electricity is sold on the regulated market.[76]
	Bulgaria is planning to introduce market-based elements in the formation of retail prices for electricity by July 2020. In the meantime, retail markets remain regulated and linked on a cost-plus basis to a non-market segment of wholesale supply. [70]
Intelligent metering systems	The Energy and Water Regulatory Commission (KEVR) has powers to assess the cost-effectiveness of the implementation of intelligent metering systems proposed by the operators of the networks. Where cost-effective, the KEVR draws up schedules for the implementation of intelligent metering systems and guarantees the interoperability of the said systems. None data of the number of the smart meters installed is present in the NECP.[72]
Tariffs	Dynamic tariffs are not presented.
5 Research, innovation and competitiveness	
R&I strategy	Single overarching strategy: National strategy for development of scientific research in the Republic of Bulgaria 2017-2030
Innovation performance	Bulgaria along with Romania are modest Innovators with performance below the EU average.[52]
National target	Bulgaria national R&D intensity target of 1.5% of GDP [49]
Total R&D expenditure	In 2007, R&D intensity reached 0.43 % of GDP. [53] In 2017, R&D intensity reached 0.75 % of GDP. [53]
	Bulgaria has the fifth lowest R&D intensity level in the EU: 0.75% of GDP in 2018. [70]
Public R&D expenditure	The public funding level in 2017 reached 0.21 % of GDP.[71]
	The public funding level in 2018 reached 0.21 % of GDP [70]
Business expenditure in R&D	The level of business expenditure in R&D comprises 0.53 % of GDP and is among the lowest in the EU.[71]
	In 2018, business expenditure in R&D was 0.54 % of GDP [70]
Academia-business links	Links between academia and businesses are still insufficiently developed to support knowledge and technology transfer.This is also reflected in the low share of public-private scientific co-publications. Several relevant initiatives to promote innovation, knowledge transfer and science-business links are slowly progressing, supported by

	the ESIF. The future regional innovation centres, as well as the Centres for Competence and Centres of Excellence, will serve as a link between science and business and local/national authorities [70]
R&D policy coordination	The lack of an adequate funding portfolio in R&D remains a barrier for fostering public-private cooperation and internationalisation as well as reintegration of researchers and innovators.
	Investments in research and development (R&D) in low-carbon technologies are rather low but increasing. Investments are driven primarily by the private sector. Several relevant initiatives to promote innovation, knowledge transfer and science-business links are slowly progressing, supported by the ESIF. [70]
	The authorities announced a doubling of the budget for research programmes to support the strategy for development of scientific research 2017-2030. In addition, the government has approved 11 national scientific programmes for 2018-2022, with a budget of more than €30 million. On the other hand, the Smart Growth Council that was set up in 2015 to provide independent, robust and coordinated management of national and EU funding is under-utilised. [70]
	Research infrastructure is outdated and low wages act as deterrents to attracting and retaining young talent. [70]
	Investment in research remains fragmented and concentrated in the capital region and multinational companies. [70]
	Bulgaria has introduced an update of the Research Performance Assessment procedure, but the structural reform of the research landscape that was essential to tackle its fragmentation and increase performance has not been carried out. The proposed creation of a state Agency for Innovations and Applied Research to ensure stronger governance and ownership of the R&I policies could lead to positive developments. [70]
Funding from Horizon 2020	According to the H2020 country profile of Bulgaria as of Sept. 2019, the net EU contribution (funding received by the project's participants after deduction of their linked third parties' funding) is only 0.25 % of the EU total.[54]
	Participation of Bulgarian scientists and innovation entrepreneurs in European programmes, as well as synergies between national and operational programmes and other Commission programmes such as Horizon 2020, are limited. [70]
Research infrastructures roadmap	Roadmap published in 2010, updated in 2017[55]
Smart specialisation priority areas	1.Manufacturing & industry 2.Information & communication technologies 3.Creative, cultural arts & entertainment 4.Human health & social work activities [77]
Just Transition Investment Guidelines	The “Maritsa” area in the Stara Zagora province hosts the largest coal mining and coal-fired power plant area in Bulgaria. Moving away from fossil fuel production is likely not only to lead to the closure of extraction sites, but will also affect the energy generating plants. Based on this preliminary assessment, it appears warranted that the Just Transition Fund concentrates its intervention on that province. In order to tackle these transition challenges, high priority investment needs have been identified for diversifying and making the regional economy more modern and competitive, as well as alleviating the socio-economic costs of transition. Key actions of the Just Transition Fund could target in particular: productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; investment in research and innovation activities and fostering transfer of advanced technologies; investment in digitalisation; upskilling- and reskilling of workers; job-search assistance to jobseekers; active inclusion of jobseekers. the deployment of technology for affordable clean energy; regeneration and decontamination of sites, land restoration and repurposing projects; enhancing the circular economy. [70]

 **ROMANIA**	**Desk 2**
	Responsible partner: TUS

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [80]	IPE	30.03.2020
3.	2nd content update from [48], [74], [75], [45], [42]	IPE	06.04.2020
4.	3rd content update from [87]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1. Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	Romania's Energy Strategy 2019-2030 was developed with perspectives for 2050, and in March 2019, the Environmental Report and the Appropriate Assessment Study for this Strategy were published.[78]
GHG target 2020	National GHG emissions target: maximum increase of 19% in 2020 compared with 2005 (non-ETS)[79] According to the latest national projections based on existing measures, non-ETS emissions will increase by 1.4% between 2005 and 2020. The target is consequently expected to be met with a margin of 17.6 percentage points.[79]
GHG target 2030	Effort sharing regulation requires Romania to reduce its emissions by 2% by 2030 (relative to 2005 levels). The 2030 target would be missed by a margin of 12.5% based on existing measures, as emissions are projected to increase above the base year in the long run.[79]
	Although Romania has among the lowest greenhouse gas emissions (GHG) per person in the EU, the country has some of the highest rates of carbon intensity. Moreover, several industrial sectors contribute significantly to emissions. Transport, agriculture and manufacturing show a somewhat rising trend. The agricultural sector accounts for 17% of total emissions. Transport in Romania produced 16.6% of GHG emissions in 2017, well below the EU average. [80]
	According to NECP, Romania's 2030 GHG target is 18% reduction (relative to 2005 level)[81]
1.2 Uptake of RES	
RES 2020 target	Romania is on track and slightly above in attaining its renewable energy target (24%) for 2020. In light of the stable or slightly decreasing share, continued efforts are needed to install more capacity in a context of economic growth. [79] In 2017, the indicator constituted 24.5%.[38]
	With 24.8% renewable energy share in gross final consumption, Romania is on track in attaining its renewable energy target for 2020. [80]
RES 2030 target	The Romania's NECP sets a 30.7% renewable energy contribution in gross final consumption of energy for 2030, which is significantly below the renewable share of at least 34% in 2030 that results from the formula in Annex II of the Governance Regulation.[81]

National support schemes	In Romania, electricity from renewable sources has been organised according to a quota system. The quota support scheme has been available for new installations until 31 December 2016. Since 2017 there is no longer a comprehensive RES in electricity support scheme in place. The quota system is still valid for the installations commissioned before 2017 and will be in place until 2031.[83] While the quota system is not available anymore for new installations, these can still obtain a subsidy through the National Rural Development Programme and financial scheme supported by the Ministry of Regional Development, Public Administration and European Funds, for energy production from less exploited energy sources (biomass, biogas and geothermal energy). Starting from 1 January 2019, the Administration of the Environmental Fund will finance small PV systems up to 90% of the total costs.[83]
Connection of RES to the grid	Grid operators are obliged to connect renewable energy plants to their grids without discriminating against certain plant operators. They are also obliged to transmit electricity from renewable sources as a priority. In general, the grid operators are obliged to develop their grids on the request of a plant operator, if the connection of a plant to the grid requires the grid to be developed.[83] For RES heating and cooling Support is provided by subsidy programmes of the Romanian Environmental Fund, National Rural Development Programme and Ministry of Regional Development, Public Administration and European Funds.[83]
RES in transport	The penetration of renewable energy in transport sector in Romania according to Eurostat data in 2017 was 6.6%.[40] The respective 2020 target is 10%.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 6.34% [42]
Support of RES in transport	In Romania, renewable energy sources in the transport sector are promoted by a quota system. Fuel retailers are obliged to ensure that biofuels make up a prescribed percentage of their annual sales.[83]
Charging points	According to Eurostat data, there are 4.41 EV charging points per 100000 inhabitants in Romania in 2017 (EU rank 26 of 28).[43]
Plug-in vehicles	Share of newly registered plug-in electric vehicles (PEV) in the 2017 was 0.36% (EU rank 21 of 28) [44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.5% [45]
2 Energy Efficiency	
Energy efficiency indicative target	Romania's 2020 energy efficiency target is 43 Mtoe expressed in primary energy consumption and 30.3 Mtoe expressed in final energy consumption. [79] Romania appears to be on track for reaching its 2020 target. However, both primary and final energy consumption increased in 2017, and therefore continued efforts are needed to limit energy consumption in a context of economic growth.[79]
	In 2018, Romania's primary energy consumption was 32,5 Mtoe [3RO] and final energy consumption was 23,5 Mtoe [75]
Energy savings	In 2016, it had made only 24% of the total savings it had committed to achieve over the 2014 to 2020 period.[46]
	In 2017, Romania has achieved only 53% of its required end-use energy savings obligation for the period 2014-2020 under the Energy Efficiency Directive, which puts at risk its ability to fulfil the obligation by 2020. [80]
2030 target	National energy efficiency contribution of 36.7Mtoe by 2030, expressed in primary energy consumption only, which corresponds to 27.5Mtoe of final energy consumption, reflect a very low ambition considering the need to increase efforts at EU level to collectively reach the Union's 2030 energy efficient targets. [82]
3 Energy security and interconnection	
Interconnection	The current interconnection capacity of Romania is 7%, and for year 2020 an increase is expected beyond 9%, thus facilitating the achievement of the 10% objective for year 2020. [81]
	With improved infrastructure Romania could tap into its potential for renewable power generation. The implementation of the Planned Projects of Common Interest (PCI) in electricity will contribute to interconnection goal (10%). The Back Sea Corridor PCI cluster aims to relieve grid congestion in Southeast Romania and enable the integration of renewable power generation in both Romania and Bulgaria, creating a bridge to the energy markets of the Western Balkan countries. [80]

Energy security target 2030	In the Romanian NECP it is stated that most of the objectives for this dimension are of qualitative nature, therefore no numerical targets have been set. Among other objectives with regard to this dimension, Romania considers the electricity supply from internal sources as a primary objective for ensuring the national energy security.[81]
Trade deficit	The Romania energy dependence fall from 27.2% in 2005 to 23.1% in 2017.[47]
	In 2018, Romania's energy import dependency was 24,1% [48]
Electricity generation capacities	In 2018 38.5% of total produced electricity in Romania was delivered from conventional power plants mainly in coil power plants, 17.8% produced from nuclear energy. The share of hydro power plants is about 30.1% and the rest is produced from wind and solar energy.[49]
4 Integrated electricity market	
Wholesale electricity market	Wholesale electricity market is fully liberalized. OPCOM is the Romanian Electricity and Gas Market Operator. OPCOM is also a Nominated Electricity Market Operator designated according to the Regulation (EU) 2015/1222 for performing the day-ahead and intraday markets coupling for Romania.[84] Romanian day-ahead market is functioning in coupling mode with day-ahead markets from Czech Republic, Slovakia and Hungary.[85]
Retail electricity market	Rumanian electricity market is fully liberalized. During 2017, 105 holders of licenses for electricity supply were active on this market. [86] In 2017, the supplier changeover rate for non-household consumers (according to the energy supplied) was 4.08%. For households, the supplier changeover per measure points was 0.84%, and the renegotiation rate for the same supplier was 1.31%.[86]
Intelligent metering systems	The Romania will introduce smart metering "at the latest in 2028".[82] So far none other official information on the topic has been found.
Tariffs	Dynamic tariffs are not presented
5 Research, innovation and competitiveness	
R&I strategy	Single overarching strategy: National Strategy for Research, Development and Innovation 2014-2020
Innovation performance	Romania is modest innovator with performance below the EU average.[52]
National target	The Romanian national 2020 R&D intensity target is 2% of GDP.[79]
Total R&D expenditure	In 2007, R&D intensity reached 0,51% of GDP.[53] In 2017, R&D intensity reached 0,5 % of GDP.[53]
	Romania will not achieve the R&D intensity target by 2020. The country's R&D intensity in 2018 was only 0.51% of GDP, thus ranking last in the EU. [80]
Public R&D expenditure	The public funding level in 2017 reached 0,21 % of GDP.[79]
Business expenditure in R&D	The level of business expenditure in R&D comprises 0.29 % of GDP and is among the lowest in the EU.[79]
Academia-business links	Academia-business links continue to be poor. Regulatory barriers (e.g. red tape, conflicting or unclear rules) hamper academia-business links, which tend to occur on an ad-hoc basis. [80]
R&D policy coordination	The national objectives addressing the Research and Innovation pillar are outlined in the 2014-2020 National Strategy for Research, Development and Innovation.[81] In respect to the progress in achieving the national targets of Europe 2020 strategy, the objectives regarding investment in the field of research and development are at a distance from the assumed target. [78]

	Scientific performance and academia-business links continue to be poor. Policies supporting the transition towards a more knowledge-based economy remain limited. The economic competitiveness, research and innovation and smart specialisation strategies cannot achieve their stated objectives without a sufficient level of public R&D funding. Besides the tax exemption for ICT professionals, there are no targeted measures for innovative start-ups. The 'Start-up Nation' programme was not deemed well-tailored to the needs of innovative start-ups. [80]
	In early 2017, government emergency ordinance 3/2017 introduced a 10-year tax exemption for R&D firms, but procedural norms are still in preparation [80]
	The combination of EU funds grants and financial instruments for supporting innovative enterprises is largely unexplored. [80]
Funding from Horizon 2020	According to the H2020 country profile of Romania as of Sept. 2019, the net EU contribution (funding received by the project's participants after deduction of their linked third parties' funding) is only 0.45 % of the EU total.[54]
Research infrastructures roadmap	Roadmap published in 2017. Updated version under preparation. [55]
Smart specialisation priority areas	1.Manufacturing & industry 2.Information & communication technologies (ICT) 3.Services 4.Sustainable innovation 5.Key Enabling Technologies [87]
Just Transition Investment Guidelines	The Just Transition Fund could support the diversification of the economy towards lowcarbon intensive activities. Romania still relies heavily on coal for energy production. Coal mining and the respective power plants are mainly concentrated in the Hunedoara and Gorj counties. Moreover, energy intensive manufacturing and heavy industries are present in the Dolj, Galați, Prahova and Mureş counties. Phasing out these sectors would have a significant negative socioeconomic impact on the regions and local communities. Key actions of the Just Transition Fund could target in particular: investment in regeneration and decontamination of sites, land restoration and repurposing projects; investment in the deployment of technology and infrastructures for affordable clean energy, greenhouse gas emission reduction, energy efficiency and renewable energy; productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; investment in the creation of new firms, including through business incubators and consulting services; investment in research and innovation activities and fostering transfer of advanced technologies; upskilling and reskilling of workers; job-search assistance to jobseekers; active inclusion of jobseekers; technical assistance. [80]

 **GREECE**	**Desk 2**
	Responsible partner: TUS

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [91]	IPE	30.03.2020
3.	2nd content update from [48], [74], [75], [45], [42]	IPE	06.04.2020
4.	3rd content update from [98]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	The Greek 2050 Energy Roadmap[88]
GHG target 2020	Greenhouse gas (GHG) emissions target: 4% reduction by 2020 compared to 2005 (in non-ETS sectors)[89] Greece is expected to over-achieve its 2020 effort sharing decision greenhouse gas emissions target by a significant margin, with a reduction of 22% by 2020 relative to the 2005 level.[89]
GHG target 2030	Effort sharing regulation requires Greece to reduce its emissions by 16% by 2030 (relative to 2005 levels). They are projected to decrease by 25%, with existing measures and 29% with additional measures[89]
	According to NECP, GHG emissions target: 36% reduction by 2030 (compared to 2005 level)[90]
1.2 Uptake of renewable energy resources (RES)	
RES 2020 target	The renewable energy share in Greece was 15.2% in 2016. While being above the 2015/2016 indicative trajectory (11.9%), further efforts are necessary to reach the 2020 target (18%).[89] In 2017, the indicator constituted 16.3%.[38]
	The renewable energy share in Greece was 18% in 2018. [91]
RES 2030 target	The Greek NECP sets out a contribution of at least 35 % (in gross final consumption of energy) for renewable energy share in 2030, which is more than the result of the formula in Annex II of the Governance Regulation (31%).[90]
National support schemes	From 2017, electricity from renewable sources in Greece are promoted through a feed-in premium granted by participation in “technology specific” tenders. In December 2016, a pilot tender for PV only took place. In 2018, two tenders for PV and wind energy took place. Apart from that, RES is eligible for a net metering scheme, mainly for PV and small wind power plants. In addition, a tax regulation mechanism and a subsidy scheme are available under the new Development Law.[92]
	Greece put in place a new tendering scheme for renewable energy in 2018. The framework conditions offer encouragement as they favour new investments in the Greek renewables sector. The domestic renewables sector has responded positively to this new regulatory environment, particularly in wind energy. The development of other renewable sources was comparatively moderate until 2018. Finally, a large part of the newly-awarded capacity under the renewables tendering scheme will be realised after 2020 [91]
	On renewables, law 4643/2019 introduced amendments to facilitate large investment projects, including the construction of hybrid plants in non interconnected islands, while the government has announced further measures to streamline the investment-licensing framework in the area of renewable energy sources. [91]
Connection of RES to the grid	The grid operator is obliged to connect renewable energy plants to the grid. Furthermore, the grid operator is obliged to purchase electricity from renewable sources. The connection contract, signed between the grid operator, the plant operator and Public Power Corporation (PPC), as the owner of the grid, must state that the grid operator is obliged to carry out the necessary grid development works.[92] In Greece, renewable energy sources in heating and cooling sector are supported by two tax relief mechanisms and subsidies.[92]
RES in transport	The penetration of renewable energy in transport sector in Greece according to Eurostat data in 2017 was 1.8%.[40] The respective 2020 target is 10%.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 3.83% [42]
Support of RES in transport	Greece supports biofuels with a quota system, while there is also a tax regulation and a subsidy scheme available.[92]

	Law 4643/2019 introduced amendments regarding the development of installations for electric vehicles, and an inter-ministerial committee has been set up to design by June 2020 a strategic plan for the development of electro-mobility in Greece. [91]
Charging points	According to Eurostat data, there are 0.78 EV charging points per 100000 inhabitants in Greece in 2017 (EU rank 28 of 28).[43]
Plug-in vehicles	Share of newly registered plug-in electric vehicles (PEV) in the 2017 was 0.22% (EU rank 25 of 28)[44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.2% [45]
2 Energy Efficiency	
Energy efficiency indicative target	Greece's 2020 energy efficiency target is 24.7 Mtoe expressed in primary energy consumption and 18.4 Mtoe expressed in final energy consumption.[93] At 23.55Mtoe in 2016, Greece is on track to meet its primary energy consumption targets for 2020, but it should make more efforts to keep the primary energy consumption at this level or to minimise its increase when the GDP grows again during the next five-year period. [89]
	At 23.01 Mtoe in 2017, Greece is on track to meet its primary energy consumption targets for 2020, but it should make more efforts to keep the primary energy consumption at this level or to minimise its increase when the GDP grows again during the next five year period. [91]
	In 2018, Greece's primary energy consumption was 22,4 Mtoe [74] and final energy consumption was 16,0 Mtoe [75]
	The transport sector is responsible for the largest share of total final energy consumption in Greece. [91]
	On energy efficiency, by 2019, investments co-financed by the EU had improved energy efficiency for 19,100 households. Programmes such as the 'Energy saving at home' and 'Electra' will further improve energy efficiency for household and public buildings (law 4643/2019 introduced amendments on the program ELEKTRA allowing energy service companies to participate in the development and financing of energy upgrading projects). [91]
Energy savings	In 2016, it had made only 12% of the total savings it had committed to achieve over the 2014 to 2020 period. [46]
	The building sector will be a key area for energy savings. Greece is transposing the new revised provisions of the Energy Performance of Buildings Directive and strengthening the implementation of the existing provisions. [91]
2030 target	According to NECP, the objective is to improve energy efficiency in final energy consumption by at least 38% in relation to the foreseen evolution of final energy consumption by 2030, as estimated in 2007 in the context of the EU energy policies, thus resulting in final energy consumption levels of not more than 16.5Mtoe in 2030. This rate of reduction is even higher if adjusted to primary energy consumption, in which case it stands at more than 43% [90]
3 Energy security and interconnection	
Interconnection	The interconnectivity level in 2017 was 9.3%, and Greece expects to reach the 10 % interconnectivity target for 2020. [90]
	While mainland Greece has a good level of interconnection for electricity, additional investment is needed in particular to complete the interconnections with the Cyclades islands, and to create interconnections with Crete and neighbouring countries. [91]
	On interconnection projects, the National Energy and Climate Plan provides a timeline for non interconnected islands; the first phase of a major project connecting Crete to the mainland electricity transmission grid is underway, the construction of the Crete-Peloponnese interconnection is expected to be completed in 2020, and the interconnection of West Cyclades islands is scheduled for 2023. [91]
	Crete's connection to the mainland will improve the island's security of supply and integrate more renewables. Key schemes to be developed as Projects of Common Interest will address issues such as low interconnectivity levels and Cyprus' energy isolation. [91]
Energy security target 2030	As regards energy security, Greece targets the increased use of domestic sources, both renewable energy and fossil-fuels, and the reduction of import dependency, which

	is at very high levels. It has also set a target to connect 29 autonomous islands with the synchronised system of mainland Greece by 2030.[94]
Trade deficit	The Greece energy dependence raised from 68.2% in 2005 to 71.2% in 2017. [47]
	In 2018, Greece's energy import dependency was 70.5% [48]
Electricity generation capacities	In 2018 68.6 % of total produced electricity in Greece was delivered from conventional power plants 31.4 % produced from RES (11.4% - hydro, 12.4% - wind and 7,9% - solar). [49]
	Greece recently announced plan to decommission Greece's lignite-based generation plants by 2028. [91]
4 Integrated electricity market	
Wholesale electricity market	Wholesale electricity market is fully liberalized. HEnEx (Hellenic Energy Exchange) has been designated by the Greek Regulatory Authority for Energy as the Nominated Electricity Market Operator (NEMO) and is operating the Greek day-ahead market, while working on the creation of an intraday electricity market and an energy derivatives market.[92] In the non-interconnected islands, autonomous power systems currently operate without any wholesale electricity market. [96]
	At regional level, Greece is taking steps to implementing the internal market rules for electricity as soon as possible. This should allow the country to couple its wholesale markets with Italy and Bulgaria and, and with its neighbouring Energy Community Countries in the future. [91]
Retail electricity market	The retail electricity market is also fully liberalized
	Prices were liberalised in July 2013 and only social tariffs for those in need are still in place, though market distortions (such as the Public Service Obligation and certain discounts) has kept the link between wholesale and retail electricity weak, though recent reforms of energy bills taken by the authorities will strengthen this connection. [91]
Intelligent metering systems	By 2018 in Greece there are installed remote metering systems in the HV, MV and large LV customers, which consume almost half of the energy. The big challenge, however, is to replace all conventional meters across the country, with smart electronic meters. A first step was a pilot project for 200000 meters, which project by the date had not proceeded yet, due to legal disputes by the bidders. [91] No date has been set for the large-scale deployment of smart meters, and current plans involve only pilot installations.[89]
	Supplier switching in the market is still rather limited in Greece, in particular in the high voltage and low voltage levels, indicating that consumers may not be fully reaping the benefits of liberalisation. Smart meters will eventually lead to consumers' increased engagement in the market and enable them to participate in and benefit from energy efficiency, and demand response/flexibility schemes. However, current plans involve only pilot installations. One major concern to be addressed is the issue of arrears. Many customers are behind on their payment obligations, and collection while improving is still slow. The authorities have recently announced various measures to improve collection and payment culture [91]
Tariffs	Dynamic tariffs are not presented
5 Research, innovation and competitiveness	
R&I strategy	Single overarching strategy: National Strategy for Research, Technological Development and Innovation (ESETAK) 2015-2021. Action plan to implement this strategy remains pending.[51]
Innovation performance	Greece is moderate innovator with performance below the EU average.[52]
National target	Greece national R&D intensity target of 1.21% of GDP
Total R&D expenditure	In 2007, R&D intensity reached 0.58% of GDP. [53] In 2017, R&D intensity reached 1.13% of GDP. [53]
	In 2018, Greece reached a research and development intensity of 1.18% of GDP, according to provisional data by Eurostat [91]

Public R&D expenditure	The public funding level in 2017 reached 0.57% of GDP.[89]
	In 2018, research and development intensity was composed of 51% public investment (0.60% of GDP) [91]
Business expenditure in R&D	The level of business expenditure in R&D comprises 0.55% of GDP and is among the lowest in the EU.[89]
	In 2018, research and development intensity was composed of 48% business investment (0.57% of GDP) [91]
Academia-business links	Links between academia and the productive sector remain weak. Level of public-private scientific co-publications remains comparatively low . As a policy response, the country launched the 'Research-Create-Innovate' funding scheme in 2017 to encourage business research, development and innovation and knowledge transfer. [91]
R&D policy coordination	The low level of public R&D intensity coupled with the absence of a performance-based funding system, has a further negative impact on already relatively low levels of scientific excellence.[89]
	There are persisting weaknesses, with the loss of skilled human capital remaining a major challenge. Despite a relative high engagement of businesses in innovative activities, the production of academic research is not appropriately oriented to support the productive sector, as reflected by the low number of patents. Further, large disparities in innovation capacities remain, due to lack of robust governance, including low administrative capacity and weak coordination mechanisms. [91]
	Policy initiatives such as the establishment of the Hellenic Foundation for Research and Innovation, to promote research activity and support new researchers, and the Knowledge Bridges, which maps the profiles of highly skilled Greek professionals abroad and supports networking, are steps in the right direction. [91]
	Country launched the 'Research-Create-Innovate' funding scheme in 2017 to encourage business research, development and innovation and knowledge transfer. [91]
Funding from Horizon 2020	According to the H2020 country profile of Greece as of Sept. 2019, the net EU contribution (funding received by the project's participants after deduction of their linked third parties' funding) is 2.52 % of the EU total.[54]
Research infrastructures roadmap	Roadmap updated in 2014[55]
Smart specialisation priority areas	1.Manufacturing & industry 2.Tourism, restaurants & recreation 3.Sustainable innovation 4.Agriculture, forestry & fishing 5.Key Enabling Technologies [98]
Just Transition Investment Guidelines	In the region of Western Macedonia, notably in the Kozani prefecture where the largest mines and most power plants are located, lignite-based electricity production is the most important economic sector, accounting for over one third of regional GDP. Also, Megalopolis lignite mines and related power plants are by far the most important activity in the area. In its revised National Energy and Climate Plan, the Greek government has committed itself to the full closure of the lignite sector by 2028 and phasing out the inefficient and very polluting heavy oil and diesel fired power plants on the islands. To tackle these transition-related challenges in the mentioned areas, priority investment needs to be targeted at diversifying the regional economy and making it more modern and competitive. Notable actions to alleviate the socio-economic costs of the transition include: 1. Western Macedonia: productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; regeneration and decontamination of sites, land restoration and repurposing projects; upskilling and reskilling of workers; job-search assistance to jobseekers; active inclusion of jobseekers. 2. Megalopolis: productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; and regeneration and decontamination of sites, land

	restoration and repurposing projects; upskilling and reskilling of workers. 3. Crete and the Aegean islands: the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; upskilling and reskilling of workers [91]

11.6 Country Profiles for Desk 3 (Cyprus, Malta)

 **CYPRUS**	**Desk 3**
	Responsible partner: FOSS, S5

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [101]	IPE	30.03.2020
3.	2nd content update from [48], [74], [75], [45], [42]	IPE	06.04.2020
4.	3rd content update from [105]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	Climate change mitigation is one of the main targets identified in the Cypriot strategy for sustainable development launched by MARDE (Ministry of Agriculture, Rural Development and Environment) in 2007.[99] The priorities are: Development of New or Optimized Technologies for Renewable Energy Sources, Innovative Applications of Renewable Energy Sources, Exploitation of Hydrocarbons, Efficient Use-Energy Saving.
GHG target 2020	National greenhouse gas emissions target: 5% decrease in 2020 compared with 2005 (non-ETS). [100] GHG emissions in Cyprus continue to increase, and according to preliminary 2017 data and the latest national projections, Cyprus is expected to miss its target with a significant margin of around 12 percentage points.[100]
	Greenhouse gas emissions in Cyprus continue to increase, and according to preliminary 2018 data and the latest national projections, Cyprus is expected to miss its target with a significant margin of around 9 percentage points. [101]
GHG target 2030	Cyprus' binding national target for GHG according to Effort sharing regulation is to limit GHG at least by 24% in relation to its greenhouse gas emissions in 2005 in non-ETS sectors, compared to 2005 levels. Cyprus is expected to fall short of its 2030 target. On the positive side, Cyprus has estimated that with additional measures, in areas, such as: (i) transport (e.g. promoting low-emission vehicles and reduction of vehicle use), (ii) waste management (e.g. promoting biogas and exploiting organic waste), (iii) buildings (e.g. replacing old systems and promoting co-generation) and (iv) industry by promoting energy efficiency can help reduce the gap to 17 percentage points and it is of crucial importance to ensure sufficient investments for these measures.[100]
	2030 GHG target will be missed by 25 percentage points compromising significantly the transition to climate neutrality and sustainable growth. [101]
	According to Cyprus NECP, 2030 target of GHG reduction is 20.9% compared to 2005 level.[102]
1.2 Uptake of RES	

RES 2020 target	Target of share of renewables in gross final consumption of energy is 13% by 2020.[105] Cyprus renewable energy share increase from 9.3% in 2016 to around 9.9% in 2017; achieving the target for 2020 appears problematic. Considering Cyprus' high potential in this area the objective is still possible, but it would require a significant shift of the national energy policies.[100]
	13.9% in 2018 driven by the increased contribution of renewables for heating and cooling [101]
RES 2030 target	According to Cyprus NECP, it sets out a 23% share of energy from renewable sources in gross final consumption of energy in 2030, which is in line with results from the formula contained in Annex II of the Governance Regulation.[102]
National support schemes	Cyprus promotes renewable electricity generation through a subsidy and a net metering scheme/ net billing scheme for PV and Biomass/biogas. There is a provision to asymmetric net billing in the future.[39] Conditional financing for challenged individuals to invest in RES self-consumption and Accelerated depreciation for energy saving investments or RES self-consumption in enterprises are also discussed.[102]
Connection of RES to the grid	In general, the entitlement of plant operators to grid connection and development is subject to the general legislation on energy. According to the general legislation, plant operators are contractually entitled to the connection of a renewable energy plant to the grid without any plant operator being discriminated against. Furthermore, they are entitled to the expansion of the grid, if such an expansion is necessary to connect a plant to the grid. Plant operators are also entitled to priority access and dispatch of electricity from renewable sources.[39]
RES in transport	The penetration of renewable energy in transport sector in Cyprus according to Eurostat data in 2017 was 2.6%.[40] The target according to the first Renewable Directive (RED I) [41] is 10%
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 2.67% [42]
Support of RES in transport	At the moment, there is no support scheme for RES-T in Cyprus.[39] Actions such as improvement of infrastructure for further encouragement of use of public transport, cycling and walking and financial incentives to encourage new vehicles with low or zero emissions and discourage the use of vehicles with high emissions, can reduce the emissions of one of the most important sectors in Cyprus.[102]
	Obligation of fuel suppliers for blending biofuels to conventional transport fuels was increased to at least 5% in energy content for 2019. Additional measures, such as increasing the obligation up to 10% and the introduction of a grant scheme for photo-voltaic installation on residential houses for the charging of electric vehicles or plug-in hybrid electric vehicles, are still under discussion. [101]
Charging points	According to Eurostat data, there are 4.21 EV charging points per 100000 inhabitants in Cyprus in 2017 (EU rank 27 of 28).[43]
Plug-in vehicles	Share of newly registered plug-in electric vehicles (PEV) in the 2017 was 0.78% (EU rank 12 of 28)[44]
	Share of newly registered plug-in electric vehicles in the 2018 was 1% [45]
2 Energy Efficiency	
Energy efficiency indicative target	Cyprus' 2020 energy efficiency target is 2.2Mtoe expressed in primary energy consumption and 1.8MToe expressed in final energy consumption. [93] Primary energy consumption was reduced during the economic recession from 2.5Mtoe in 2012 to 2.2Mtoe in 2015, but in line with the sustained economic growth rose again to 2.5Mtoe in 2017. This poses a serious challenge in reaching the target without strong additional measures.[100]
	In 2018, Cyprus's primary energy consumption was 2,6 Mtoe[74] and final energy consumption was 1,9 Mtoe [75]
	Schemes are being implemented to support energy efficiency in SMEs and in private and public buildings. A new financial instrument for SMEs, energy efficiency and RES is expected to start implementation in 2020. [101]
Energy savings	In 2016, it had made only 6% of the total savings it had committed to achieve over the 2014 to 2020 period. Total cumulative savings required by 2020 target are 242ktoe.[46]

	The first estimation shows that the cumulative target of the period 2021-2030 will be between 235-238ktoe. Given that no official data are available at the moment for the national final energy consumption of the years 2017 and 2018, the national cumulative target of the period 2021-2030 will be recalculated in 2019 and will be included in the final national NECP of 2019.[46]
2030 target	The proposed contribution to the EU energy efficiency target would actually allow Cyprus to increase its primary and final energy consumption in 2030 by 3.1% and 18.8% compared to 2017 levels, respectively. This would go in the opposite direction of the collective EU effort on energy efficiency.[103]
	According to NECP, Cyprus will reduce its primary and final energy consumption in 2030 by 17% and 13% compared to 2007 levels[102]
3 Energy security and interconnection	
Interconnection	The planned EuroAsia interconnector would end Cyprus' energy isolation. When constructed, the EuroAsia interconnector will connect Cyprus with Israel, Crete and Attica. A feasibility study is currently under way.[100]
	According to NECP, Cyprus is aiming to set the national target based on the actual flow and also the findings in the cost benefit analysis studies of the EuroAsia Interconnector on 15% interconnection.[102]
Energy security target 2030	Cyprus is a small isolated energy system, with high dependency on oil products for its energy needs. More than 90% of Cyprus energy inland consumption is from oil products and the rest is from renewables. The introduction of natural gas via LNG imports and the development of the necessary infrastructure by the end of 2020, will end the current energy isolation and diversify Cyprus' energy sources.[102]
Trade deficit	The Cypriot energy dependence fell from 100% in 2005 to 96% in 2017.[47]
	In 2018, Cyprus energy import dependency was 92,5% [48]
Electricity generation capacities	In 2018 92% of total produced electricity in Cyprus was delivered from conventional power plants, 4% - from wind and 4% from PV.[49]
4 Integrated electricity market	
Wholesale electricity market	Cyprus is not integrated and not interconnected with any neighbouring power systems. No wholesale market is currently operating in Cyprus;
Retail electricity market	The sole supplier the Electricity Authority of Cyprus is a State-owned enterprise that operates as a de facto monopoly. There are only few renewable generators, which signed power purchase agreements with the Electricity Authority of Cyprus for the whole production. Therefore, although the consumers are legally entitled to choose their supplier, in practice the lack of alternative suppliers means that they are unable to do so. Steps are being taken to open up the electricity market in Cyprus, but progress has been slow.[100]
Intelligent metering systems	Cyprus intends to install Advanced Metering Infrastructure (AMI) and Smart Meters to enable optimization and control of the distribution system, increase the penetration of distributed renewable sources, enable aggregation of RES, demand response and storage, increase direct final customer participation in all market stages (active customers). The AMI includes the roll-out of 400 000 smart meters.[102]
Tariffs	For domestic consumers the flat tariff is used that offers no incentives for DSM, efficiency and / or flexibilities to the grid. For PV owners the tariff is still flat but on the principles of Net Metering. For commercial and industrial consumers, the Net Billing tariff has been introduced with time of use cost elements that vary between seasons, working days and weekends / public holidays. [104]
R&D performance	
R&I strategies	In 2014 the National Council for Research, Technology Development and Innovation (RTDI) delivered a report proposing the reform of the RTDI system, including a new strategy for Research, Innovation and Entrepreneurship. The main findings and recommendations of the study have also been identified in the Smart Specialisation Strategy and its corresponding Action Plan 2015-2022. In 2015 the Research Promotion Foundation published a draft new RTDI programme that will implement the S3CY. The Action Plan for Growth of the Presidency's Unit for Administrative Reform supports the RTDI system, particularly in areas linked to entrepreneurship.[51]
	A new R&I Strategy Framework for the period 2019-23 has been announced by the

	National Board for Research and Innovation in May 2019, with ambitious yet uncertain outcomes. Key enablers of this strategy framework include a new integrated governance system, in particular the establishment of a Deputy Ministry for Research, Innovation and Digital Policy, and a focus on knowledge transfer and commercial exploitation to stimulate R&I activity in the private sector. One of the planned measures is the creation of clusters of excellence, gathering universities and businesses in line with the national Smart Specialisation Strategy, which should be updated to reflect the recent changes at national level and new priorities at EU level. [101]
Innovation performance	Cyprus is a moderate innovator.[52]
National target	The R&D intensity in Cyprus stood at 0.56% of GDP in 2017, higher than its EU 2020 target (0.5%) — a target that was not deemed to be ambitious enough.[100]
Total R&D expenditure	In 2007, R&D intensity reached 0.4% of GDP.[53] In 2017, R&D intensity reached 0.56% of GDP.[53]
	In 2018, R&D intensity stayed 0.55% of GDP [101]
Public R&D expenditure	In 2017, public R&D expenditure was around 0.3% of the GDP, one of the lowest in the EU.[100]
	In 2018, public R&D intensity was 0.28% of GDP [101]
Business expenditure in R&D	The level of business expenditure in R&D comprises 37% of total expenditure and constituted 0.21% of GDP.[53]
	The R&D expenditure in the business sector was 0.20% of GDP in 2018 [101]
Academia-business links	The quality of the public research system is a point of strength, but its interaction with the business sector is very limited. University-business cooperation is very weak, due to both low demand from the business side and a lack of entrepreneurial culture in the academic sector. As a result, the commercialisation of research results remains at a low level. The law allowing universities to create spin-offs was adopted as measures to stimulate academia-business cooperation.[101]
R&D policy coordination	Incentives have been put in place to improve knowledge transfer, Progress in implementing the smart specialisation strategy is key in diversifying the economy. In addition, a policy support facility measure to stimulate the utilisation of research laboratories of government–funded organisations by the business community is planned to start in 2019[100]
Funding from Horizon 2020	With a population of 865 878 Cyprus is one of the least-populous member states of the European Union (0.2% of the total) but among the most successful Widening countries in Horizon 2020[67] According to the H2020 country profile of Romania as of Sept. 2019, the net EU contribution (funding received by the project's participants after deduction of their linked third parties' funding) is 0.51% of the EU total. [54]
Research infrastructure roadmap	Roadmap under preparation[55]
Smart specialisation priority areas	1.Energy production & distribution 2.Construction 3.Tourism, restaurants & recreation 4.Transporting & storage 5.Human health & social work activities [105]
Just Transition Investment Guidelines	First, the potential need for a considerable shift in energy production and consumption, increasing significantly electricity production and consumption from Renewable Energy Sources (RES). These represent currently around 13% of energy production in Cyprus, the remaining 87% coming from heavy oil or diesel power plants. This would allow a phasing out/smooth transformation of the highly pollutant oil power plants in Vassilikos and Dhekelia. Second, the potential need to invest in cleaner technologies to make manufacturing productions more efficient and less pollutant, particularly for the Vassilikos cement factory. Based on this preliminary assessment, it appears warranted that the Just Transition Fund concentrates its intervention on these two areas. Key actions of the Just Transition Fund could target in particular investment in: the deployment of technology and infrastructures for affordable clean energy, in

	greenhouse gas emission reduction, energy efficiency and renewable energy production; research and innovation activities fostering the transfer of advanced technologies; upskilling and reskilling of workers; job-search assistance to jobseekers. [101]

 **MALTA**	**Desk 3**
	Responsible partner: FOSS, S5

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [108]	IPE	30.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [111]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	Malta lacks an integrated approach to climate policy with a cross-sectoral focus.[107] As its Low-Carbon Development Strategy has not been completed (to be finalised in the beginning of 2020), Malta does not yet have an action plan to reach its 2020 targets.[107] Malta's National Strategy for Sustainable Development was endorsed by Cabinet in December 2007.[106] The newly adopted National Agricultural Policy for the Maltese Islands 2018 – 2028 addresses the areas of sustainable agriculture products, circular economy, mitigation through adaptation and soil management, whereas there is no measure directly seeking greenhouse gas emission reductions.[107]
	Malta is currently preparing a strategy for climate neutrality by 2050, and on 14 June 2019 it endorsed the Valletta Declaration supporting this goal. [108]
GHG target 2020	GHG emissions target: maximum 5% in 2020 compared to 2005 (non-ETS sector)[107] According to the latest national projections submitted to the Commission, the 2020 target under the Effort Sharing Decision is expected to be missed by a margin of 11 pps[107]
	In 2020, emissions are projected to be 32% above the 2005 level. Malta would thereby miss the 2020 target. [108]
GHG target 2030	Maltas' binding national target for GHG according to Effort sharing regulation and NECP is to limit GHG at least by 19% in relation to its greenhouse gas emissions in 2005 in non-ETS sectors, compared to 2005 levels.[109] In 2030, this gap with the effort sharing target is expected to rise to 46 pps.[107]
	In 2030, this gap with the effort-sharing target is expected to rise to 62 pps. [108]
1.2 Uptake of RES	
RES 2020 target	Target of share of renewables in gross final consumption of energy is 10% by 2020.[107] It only got 7.2% from these sources in 2017.[107] The share of renewables in Malta was 7.2 % in 2017.[107] In view of rising energy consumption and the steeper trajectory towards 2020, further investments in the renewable energy sector are required to meet the 2020 target.[107]

	Malta has made progress towards the 2020 renewable energy target, reaching 8% in 2018 (projected to reach a RES share of 9.3% by the end of 2020). However, it estimates to be slightly short of the 10% RES share required and will therefore consider making use of biofuel imports and statistical transfers (as indicated in the NECP submitted in December 2019). [108]
RES 2030 target	On renewable energy, the NECP include 2030 RES target: 11.5%, which is significantly below the share of 21% that results from the formula in Annex II of the Governance Regulation.[109]
National support schemes	Electricity generated by PV installations in Malta is originally supported through a feed-in tariff. In addition, installations with a capacity exceeding 1,000kWp are promoted through tenders.[39]
	Malta intends to launch additional schemes to incentivise the installation of solar water heaters and photovoltaic panels. However, current renewable-energy policies and planned initiatives appear insufficient to generate the required renewable-energy volumes purely domestically. [108]
	Malta's 2020 budget introduces a number of environmental measures including: grants of up to €200,000 for the scrappage of polluting machinery in exchange for the purchase of cleaner models; reduced electricity tariffs for the charging of electric vehicles at one's home; additional schemes to encourage the purchase of bicycles, scooters and pedelecs. [108]
Connection of RES to the grid	Plant operators are contractually entitled against the grid operator, Enemalta plc, to the conclusion of a connection agreement. Plant operators are entitled to connection to the grid after they have obtained a licence from the Regulator for Energy & Water Services (REWS) [39]
RES in transport	The penetration of renewable energy in transport sector in Malta according to Eurostat data in 2017 was 6.9%.[40] The target according to the first Renewable Directive (RED I)[41] is 10 %.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 7.97% [42]
	According to NECP, 2030 target for RES in transport: 15% [109]
Support of RES in transport	Support for renewable energy sources (RES) used in the transport sector is provided through a substitution obligation on importers and wholesalers of fossil fuels.[39]
	In line with the National Transport Plan 2025, investment is being focused on a number of measures to encourage a modal shift from the private car to collective sustainable and alternative low carbon transport mode through the use of harbour ferry connections for travel within Malta.[108]
	Malta is planning to construct a system to provide the necessary electrical demand for ships docked in the Grand Harbour. [108]
	An inter-ministerial committee has been set up to decide by the end of 2020 on a cut-off date for banning the importation and registration of new and second hand (newly registered) sale of internal combustion engines on Maltese territory. [108]
Charging points	According to Eurostat data, there are 21.07 EV charging points per 100000 inhabitants in Malta in 2017 (EU rank 18 of 28).[43]
Plug-in vehicles	Share of newly registered plug-in electric vehicles (PEV) in the 2017 was 0.41% (EU rank 18 of 28)[44]
	Share of newly registered plug-in electric vehicles in the 2018 was 1.5% [45]
2 Energy Efficiency	
Energy efficiency indicative target	The 2020 indicative energy efficiency target (absolute level of energy consumption in 2020) is[107]: 0.823Mtoe expressed in primary energy consumption, and 0.623Mtoe expressed in final energy consumption. Original target of energy efficiency for 2020 expressed in final energy is 0.5 Mtoe. [93] Final energy consumption slightly increased since 2016 (Malta's National Energy Efficiency Action Plan, 2017), putting the energy efficiency targets at risk[107]

	Although Malta managed to reduce its primary energy consumption until 2016, indicators for 2017 and 2018 show once again an increasing trend (0.8 Mtoe according to Eurostat). Malta's final energy consumption has been continuously increasing over the last years (reaching 0.7 Mtoe in 2018, according to Eurostat), with transport remaining the most consuming sector. According to the National Energy and Climate Plan Malta is not on track to meet the 2020 energy efficiency targets. [108]
Energy savings	In 2016, it had made 24% of the total savings it had committed to achieve over the 2014 to 2020 period. Total cumulative savings required by 2020 target are 67ktoe.[46]
2030 target	The primary energy and final energy consumption levels in absolute terms are projected to be 1051 ktoe and 786 ktoe respectively.[109]
3 Energy security and interconnection	
Interconnection	The new interconnector between the electricity grid of Malta and Italy represents major improvement, increasing Malta's electricity interconnection level from 0% to over 24%.[107] The electricity networks in Malta and Sicily (Italy) are linked by a 200MW HVAC interconnector, connecting Malta to the European electricity grid, which came into full operation in 2015. Electricity imported over the interconnector is projected to meet between 24-35% of Malta's electricity demand during the period 2021-2030. [110]
	The electricity interconnection level is expected to remain well above the Union 15% target throughout the whole projection period, reaching 24% in 2030.[109]
Energy security target 2030	As indicated in the section above, Malta's electricity interconnection level is well above the 15% EU interconnection target for 2030 required by the Governance regulation. Currently, there are no plans for a second interconnector.[110]
	Malta's high-level objectives in the area of energy security as set out in the NECP can be summarized into the following: Continued diversification of energy sources and suppliers; Reduction of import dependency through the deployment of indigenous sources of renewable energy whilst taking into account the specificities of Malta's energy system; Increasing the flexibility of the national energy system, including through the roll-out of cost-effective, innovative solutions such as storage; Periodic contingency planning in the case of supply disruption for the electricity, gas and oil sectors; Energy security in the context of the long-term objective of decarbonisation of the energy system and increased deployment of RES.[109]
Trade deficit	The high dependency on oil and petroleum products decreased from 79% in 2016 to 56% in 2017, whereby the share of natural gas now amounts to 30% of the energy mix. The share of renewable energy is also increasing on an annual basis. The share of electricity imported over the interconnector in the energy mix in 2017 was 9%. In 2017, net import dependency in Malta reached 95.8%.[110]
	In 2018, Malta's energy import dependency was 96,7% [48]
Electricity generation capacities	In 2018, 91 % of total produced electricity in Malta was delivered from conventional power plants and 9% from geothermal and others.[49]
4 Integrated electricity market	
Wholesale electricity market **Retail electricity market**	Due to its size and insularity, Malta has no wholesale and retail markets for electricity and gas. The state-owned energy company Enemalta remains the only enterprise with a licence to supply electricity to final customers, and therefore it is not possible to implement customer switching. [107]
Intelligent metering systems	In line with its programme to ensure an efficient distribution system, Enemalta 9the leading energy services provider in the Maltese Islands) has equipped 99% of its consumers with smart meters.[110]
Tariffs	Malta has adopted a tariff system that favours the prudent use of energy.[110]
5 Research, innovation and competitiveness	
R&I strategies	Single overarching strategy: Multi-annual National R&I Strategy 2020 (2014)[51]
	The National R&I Strategy post-2020 is under preparation, smart specialisation strategy is being updated and the National AI Strategy launched in autumn 2019. The

	results of these policies are to be evaluated in the coming years. [108]
Innovation performance	Malta is a moderate innovator.[52]
National target	R&D intensity remained flat in recent years (0.55% of GDP in 2017 against 2.07% for the EU) and the country is likely to miss its target of 2% R&D intensity by 2020.[107]
Total R&D expenditure	In 2007, R&D intensity reached 0.55% of GDP.[53] In 2017, R&D intensity stood at 0.55 % of GDP.[53]
	Total R&D expenditure stood only at 0.55 % of GDP in 2018. [108]
Public R&D expenditure	In 2017, Malta's public investment in R&D was 38% of total investment and constituted 0.21% of GDP.[107]
	The recent slight increase in public R&D intensity is partly explained by the significant inflow of structural funds. The low level of public R&D investment in the public science base limits the full usage of the country's scientific and technological potential [107]
	Public R&D investment has also been on a declining trend since 2015, thus placing Malta at the bottom of the EU ranking on this measure. [108]
Business expenditure in R&D	Business enterprise R&D expenditure intensity has declined since 2012 (0.34% of GDP in 2017 against 1.36% for the EU).[107]
	Business R&D intensity stood at 0.33% of GDP in 2018. [108]
Academia-business links	Research activity suffers from limited national funding for R&D, technological development, and industrial cooperation. Academia-business links are underdeveloped due to the low R&D absorption capacity of Maltese firms. [108]
R&D policy coordination	The Research and Innovation Strategy 2014-2020 has little visibility and its implementation is scattered between various governmental bodies with limited coordination.[107]
	Six different ministries/governmental bodies are responsible for R&I policy, while public research is mainly performed by the University of Malta. Coordination mechanisms remain weak between the different authorities involved in the implementation of the smart specialisation strategy and the R&I strategy. The Horizon 2020 Policy Support Facility's peer review of the Maltese R&I system pointed to the need for a major overhaul of R&I policy governance, with possibly one institution/minister providing political leadership. [108]
	Most innovative companies are foreign-owned, which partly explains the low uptake of most R&I schemes. [108]
	The R&I system lacks public and private support both in terms of investment and dedication to the field. [108]
Funding from Horizon 2020	Malta gets a significant part of their national R&D expenditure from the Horizon 2020 funding i.e. 10% [67]
Research infrastructures roadmap	No roadmap available[55]
Smart specialisation priority areas	1.Information & communication technologies (ICT) 2.Services 3.Human health & social work activities 4.Construction 5.Key Enabling Technologies [111]
Just Transition Investment Guidelines	Just Transition Fund could in particular target the two main Maltese ports. It is necessary to provide an alternative to the burning of heavy fuel/gasoil in these ports by providing the ships with power supply, in light of the experience gained in other EU ports.. Key actions of the Just Transition Fund could target in particular: investment in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; investment in research and innovation activities and fostering the transfer of advanced technologies; investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair and recycling; upskilling and reskilling of workers. [108]

11.7 Country Profiles for Desk 4 (Poland, Slovakia, Czech Republic)

 **POLAND**	**Desk 4**
	Responsible partner: DERlab

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments*"	IPE	31.05.2019
2.	1st content update from [114]	IPE	30.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [122]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	The last adopted in 2009 energy strategy is the Poland Energy Strategy 2030, at the moment the work is going on the long-term strategy "Energy Policy of Poland until 2040".[112] The Ministry of Energy submitted for public consultation a draft version of „Energy Policy of Poland until 2040". The deadline for submitting opinions was January 2019.[113]
	The National Strategy of Regional Development 2030 adopted in September 2019 includes investment activities in the field of innovation, including energy related innovations [114]
GHG target 2020	National greenhouse gas (GHG) emission target: maximum 14% in 2020 compared to 2005 (non-ETS sectors). According to the latest national projections, Poland is expected to achieve its 2020 emission target for sectors outside the EU Emissions Trading Scheme. [115]
	In 2020, the emissions' increase is projected to level at +14% from 2005 levels; however, this implies an intensified effort to reduce emissions in the next two years to meet this target. [114]
GHG target 2030	The 2030 target (a reduction of emissions by 7% compared to 2005) could be missed by a wide margin if no additional measures are taken. [117]
	GHG emissions have increased slightly in recent years, especially in the transport sector. This puts Poland in the group of EU Member States with the highest emissions per capita. Energy supply and use are jointly responsible for the highest share of national greenhouse gas emissions. Around 90% of electricity is still generated in conventional power plants, mainly using domestic hard coal and lignite. [114]
1.2 Uptake of renewable energy resources (RES)	
RES 2020 target	Poland faces a risk of missing its 2020 target of 15% of energy from renewables.[115] In 2017, the share of renewables in gross final energy consumption declined to 10.9%. Investment in new renewable energy capacity has slowed down, presenting a challenge for achieving the 2020 renewables target 15%.[115]
	Poland is at risk of missing its 2020 target. With 11.16% (provisional Eurostat 2018 data), it is below the indicative trajectory (12.3%) leading to the 15% target. [114]
	Most of the new electricity power plants built in 2019-2020 is based on coal. [114]

RES 2030 target	The draft Polish Energy Policy strategy foresees a large role for fossil fuels at least until 2040. Coal is to remain the main fuel until 2030 and its role is to decline fast thereafter. The construction of a first nuclear power plant (1-1.5GW) is planned by 2033 and its extension until 2043. Onshore wind generation is to decline, despite its effectiveness recently confirmed in November 2018 auction for 1GW renewable energy generation. [115] The renewable energy contribution to the EU's 2030 target set out in the NECP (21-23%) is below the share of 25% in 2030 that results from the formula of Annex II of the Governance Regulation. [117]
National support schemes	In Poland, electricity from renewable sources is promoted through tenders for the definition of support level of a feed-in tariff or premium, tax relief and subsidy and loan schemes as well as a quota system for some older power plants.[39] In Poland, electricity from renewable sources is promoted mainly through a tender system for the definition of support level of a feed-in tariff or premium. The installations launched before 1 July 2016 are allowed to choose between the tenders and remaining in the quota system. [39]
Connection of RES to the grid	Access to the electricity grid for renewable energy generators is granted with priority. Furthermore, grid operators must give electricity from renewable sources priority dispatch. Plant operators are not entitled to the development of the grid.
RES in transport	According to Eurostat share of RES in transport in 2017 was 4.2%[40], whereas 2020 target is 10%.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 5.63%
	The implementation of the low-carbon mobility measures has been progressing slowly. [114]
	According to NECP, 2030 target for RES in transport: 14%[117]
Support of RES in transport	In Poland, renewable energy in transport is promoted through a biofuels quota obligation.[39]
Charging points	The Energy for the future project aims at 6000 charging points & additionally 400 rapid charging points by 2020. [117] In 2017 there were 5.71 EV charging points per 100000 inhabitants (rank 24 of 28).[43]
Plug-in vehicles	From 2019, Poland applies a new emission charge on fuels. The revenue collected is to finance electro-mobility projects and fighting smog[115]. The Energy for the future project aims to 50 000 electric vehicles in 2020 and in 2025 a million electric-drive vehicles.[117] Share of newly registered plug-in electric vehicles (PEV) in the 2017 was 0.21% (EU rank 26 of 28) [44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.2% [45]
2 Energy Efficiency	
Energy efficiency indicative target	Poland has set an indicative national energy efficiency target of 13.6Mtoe primary energy savings in 2020 reaching a 2020 level of 96.4Mtoe primary energy consumption and 71.6Mtoe final energy consumption.[115] Contrary to the EU trend, since 2005, Poland has increased both its primary energy and final energy consumption due to strong economic growth and historically high energy intensity of the Polish economy. In 2017, Poland's primary energy consumption reached 99.8Mtoe, exceeded its 2020 indicative target. Final energy consumption, at 71.0Mtoe was just below the 2020 indicative target.[115]
	In 2018 primary energy consumption reached 100.9 Mtoe and final energy consumption 71.8 Mtoe, i.e. both exceeded the 2020 target levels. This is a consequence of an upward trend in energy consumption since 2014. If the trend continues, Poland risks not meeting its energy efficiency target. [114]
Energy savings	Progress towards total cumulative savings requirement by 2020 is 22%.[46]
2030 target	Poland intends to reduce its energy consumption by 2030, but the level of the energy efficiency contribution set out in the NECP appears modest considering the level of effort needed to reach the EU's energy efficiency target for 2030. At the same time, the complementary energy efficiency objectives are quantified (for example on smart meters), which constitutes an approach that could be replicated by other Member

	States. [117]
	According to NECP, the national target for improving energy efficiency by 2030 was set at the level of 23% reduction of primary energy consumption comparing to the PRIMES 2007 forecast.[117]
3 Energy security and interconnection	
Interconnection	Poland is interconnected to the Baltic region through LitePol link.[33] The limited capacity for interconnectors enabling electricity imports played its role in a particularly strong increase in wholesale electricity prices in 2018. In the second quarter of 2018, prices in Poland were significantly higher than in its EU neighbouring countries, despite improvements in commercial imports from Germany, the Czech Republic and Slovakia. There are still inefficiencies inherent to the unscheduled electricity flows in Central Europe, notably between Germany and Poland, limiting the amount of electricity Poland can import through Western interconnectors.[115] Poland has committed towards achieving the synchronisation of its electricity grid with the Baltic states by 2025.[115]
Energy security target 2030	Compared to EU average, the Polish energy mix has a significantly higher share of solid fuels (notably coal and lignite), which are mainly used in power generation and heating. At the same time, Poland's energy dependency, i.e. the proportion of energy that the economy is importing, is currently lower than EU average. Coal, considered as stable and reliable energy supply, will keep a significant share in electricity generation.[118]
	Developing nuclear energy is one of the objectives recalled in the NECP. Activation of a first block of the first nuclear power plant is foreseen to take place in 2033. Share of coal in electricity generation will be systematically reduced - in 2030 it will reach the level of 56-60%. [117]
Trade deficit	The Poland's energy dependence raised from 17.7% in 2005 to 38.3% in 2017. [47]
	In 2018, Poland's energy import dependency was 44,8% [48]
Electricity generation capacities	The installed capacity in RES-based generation has increased to a level of ca. 8.5 GW (with the total installed capacity in the National Power System reaching ca. 43 GW in 2017). The share of RES in the gross final consumption was ca. 11.3% in 2016 [117] Poland is among the EU countries with the fastest growth in domestic electricity production and consumption in recent years. In 2017, increased by around 2%. With a share close to 80%, coal and lignite dominate in the electricity generation mix. New generation capacity installed since 2017 and planned for 2019 is predominantly based on coal, with a smaller role of gas. [115]
	Past regulatory changes have negatively affected the development of wind projects, but the situation has recently improved. The new support schemes for consumers who produce renewable energy also improves the outlook for renewables, including solar energy, hardly existing until recently. Still, the time needed to construct wind farms makes achieving the 2020 renewable target difficult. Also, strict rules on minimal distance between wind farms and buildings will continue to limit the development of new onshore wind capacities. [114]
	Developing nuclear power generation has been chosen as one of the strategies to cater for growing electricity demand. [114]
4 Integrated electricity market	
Wholesale electricity market	Three largest producers (which were part of the groups: PGE Polska Grupa Energetyczna S.A., TAURON Polska Energia S.A., ENEA S.A.) had in total almost 2/3 of the installed capacity and were responsible for almost 70% of domestic electricity production.[119] TGE (Polish Power Exchange) it is the Nominated Electricity Market Operator (NEMO) for the Polish pricing area and the only licensed commodity exchange in Poland.[120] Electricity is also traded at PXE.
Retail electricity market	In 2017 there were five default suppliers and over 119 alternative trading companies actively selling electricity to final consumers, including households. On the electricity market there were also 178 suppliers operating under companies vertically integrated with the DSOs. The greatest share in electricity sales to final customers is still held by incumbent suppliers which are default suppliers to households that have not selected a new supplier. [119]

	The role of state-owned enterprises in the energy sector has increased in recent years. This underlines the importance of a strong and independent regulator. [114]
Intelligent metering systems	The Polish government has decided to roll out smart electricity meters to 80% of electricity consumers, but has not yet implemented the decision into national law. Several hundred thousand consumers already have smart meters in Poland.[121]
Tariffs	Dynamic tariffs not present.
5 Research, innovation and competitiveness	
R&I strategies	The strategic framework includes the Strategy for Innovativeness and Efficiency of the Economy as the overarching document (2013). This is supplemented by the Enterprise Development Programme (PRP) as implementing programme of SIEG (2014); National Smart Specialisations (KIS) (2014); National Research Programme (KPB) (2014); Polish Roadmap of Research Infrastructures (PMDIB) (2014); Operational Programme Smart Growth 2014-2020(POIR) (2014); Regional Operational Programmes (RPOs). Strategy for Innovation and Efficiency of the Economy – Dynamic Poland 2020 (2013-20) [51]
Innovation performance	Poland lags on innovation, with recent legal changes only partially addressing challenges. Despite past efforts to improve the R&D framework and significant support from EU funds, Poland's innovation performance remains modest.[115]
National target	National R&D intensity target is 1.7% for 2020[115]
Total R&D expenditure	In 2007, R&D intensity in Poland was 0.56% of GDP. [115] In 2017, R&D intensity in Poland was 1.03% of GDP. [115]
	In 2018, R&D was 1.21 % of GDP. [114]
Public R&D expenditure	Public investment constituted 35% of the total investments in 2017 (0.36% of GDP). [115]
	In 2018, public R&D expenditure was 0.4 % of GDP. [114]
Business expenditure in R&D	Business investment constituted 64% of the total investments in 2017 (0.67% of GDP) [115]
	The intensity of business expenditure on R&D (0.8% of GDP) grew by 19.6% annually in the period 2010-2018. [114]
	Although business expenditure on R&D has more than quadrupled in the past ten years, it remains below the EU average. [114]
Academia-business links	The potential of cooperation between science and business remains underexploited. Cooperation between enterprises and scientific institutes is hardly improving, as confirmed by recent data on joint publications by business, science and public research financed by the private sector. In 2019, the Łukasiewicz Research Network, comprising 38 research institutes and the Łukasiewicz Centre, was established with the main goal of ensuring excellence of research and development and transfer of knowledge to the economy. It aims to support scientific excellence and the commercialisation of research activities. The Centre acts as an umbrella unit for the Network, ensuring coherence between the institutes' research agendas and State-level strategies. The role of technology transfer centres in the process of innovation diffusion remains limited. [114]
R&D policy coordination	Poland does not fully use environmental taxes as effective policy tools. The implicit tax rate on energy remained comparatively low in Poland and there are a number of tax exemptions. However, from 2019 Poland applies a new emission charge on fuels. The revenue collected is to finace electro-mobility projects and fighting smog. [115] Despite measures taken, including number of amendments to the act on higher education, only limited progress was observed in better links between research, innovation and industry. Some progress was achieved in improving the effectiveness of R&D tax incentives and better targeting financial instruments at the innovation cycle. In 2016-2018, Poland has reformed its R&D tax incentives with new regulations and changes encouraging wider use of R&D tax breaks. [115]
	Poland is introducing measures to improve its scientific performance. The 2018 Act on Higher Education and Science is under implementation, with implementing legal acts being prepared and adopted. The new evaluation criteria for scientific organisations emphasise the importance of international cooperation and the internationalisation of science. The first edition of the 'Excellence Initiative – Research University' programme

	was completed in October 2019, with the selection of 10 universities to be reinforced in their research activities. A new configuration of the university councils, including external stakeholders, may positively affect universities' social and economic impact. [114]
Funding from Horizon 2020	Poland, one of the most populous countries in Europe (38.5 million or 7.6% of EU-28, 6th in rank) has a relatively weak track record in the EU Framework Programme for research and innovation. The Horizon 2020 interim evaluation (2016) shows that Poland is one of the lowest performing EU-13 countries in terms of Horizon 2020 funding contributions normalised per inhabitant, full time researchers and RDI investments. [67] According to the H2020 country profile of Poland as of Sept. 2019, the net EU contribution (funding received by the project's participants after deduction of their linked third parties' funding) is 0.81% of the EU total [67]
Research infrastructures roadmap	Roadmap published in 2014[55]
Smart specialisation priority areas	1.Manufacturing & industry 2.Sustainable innovation 3.Key Enabling Technologies 4.Information & communication technologies 5.Human health & social work activities [122]
Just Transition Investment Guidelines	With help of Just Transition Fund, transition to a climate neutral economy is an opportunity to modernise Poland's economy, while addressing developmental challenges and citizens' needs. The transition process will likely impact all coal mining regions in Poland, namely Silesia, Wielkopolska, Lower Silesia, Łódzkie, Lubelskie and Malopolska. Key actions of the Just Transition Fund could target in particular: productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; investments in the creation of new firms, including through business incubators and consulting services; investments in research and innovation activities and fostering the transfer of advanced technologies; investments in regeneration and decontamination of sites, land restoration and repurposing projects; investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair and recycling; upskilling and reskilling of workers; technical assistance. [114]

SLOVAKIA

Desk 4

Responsible partner: DERlab

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1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
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Category	Description

1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	In June 2018, the Government adopted the Economic Policy Strategy 2030, focusing on raising productivity by supporting human resource development, R&D, a less energy intensive economy, the business environment, and agriculture.[123] The main problem however is that Slovakia lacks a long-term vision and strategy. There is some progress in terms of specific policies and projects, but the Slovak government should be more ambitious in its goals. To fulfil those, Slovakia needs a combination of well-targeted policies that are reasonably using EU funds together with private investments. Last but not least, the government needs to raise public support for energy transition policies.[124]
	The announced 2030 Vision and Development strategy to implement the Agenda 2030 – on the basis of Slovakia's set of six national priorities – in a whole-government approach and the establishment of a new coordinating body in the Office of the Deputy Prime Minister could provide the right governance to address these sometimes-conflicting objectives in a coherent way. Changing the incentive structure for energy production and consumption, including by adjusting carbon pricing, can support a cost-effective climate and energy transition. The draft 2030 Vision and Development Strategy of Slovakia suggests making access to public financial instruments conditional by using environmental criteria. [125]
GHG target 2020	National greenhouse gas (GHG) emissions target: maximum 13% increase in 2020 compared with 2005 (in sectors not included in the EU emissions trading scheme).[123] Slovakia is set to overachieve its 2020 greenhouse gas target in sectors outside the emission trading system.[123]
	In 2020, emissions are projected to be 20% below the 2005 level. [125]
GHG target 2030	According to Effort sharing regulation 2030 target requires Slovakia to reduce its emissions by 12% by 2030 (relative to 2005 levels). [123] According no NECP, 2030 GHG target is -20%. The target may be achieved with existing policies, provided that accounted CO2 removals in the land use, land use change and forestry (LULUCF) sector will compensate for accounted emissions in this sector. [126]
1.2 Uptake of RES	
RES 2020 target	2020 renewable energy target: 14%. Slovakia had a 12% share of renewable energy in gross final consumption in 2016.[123] This was above the indicative goal for 2017/2018 of 11.4 % needed to stay on track towards its 2020 target, however 2016 shares for Slovakia are lower than those of 2015, pointing to the risk of a decreasing trend. [123]
	Slovakia had an 11.9% share of renewable energy in gross final consumption in 2018. After two years of falling shares this indicates a slight stabilisation, but the upward trend would need to be significantly accelerated during the remaining period, in particular given the projected increased demand. [125]
RES 2030 target	The proposed contribution to the EU level target of renewable energy is a share of 19,2% of energy from renewable sources in gross final consumption of energy in 2030. This contribution is significantly below the share of 24% in 2030 that results from the formula contained in Annex II of the Governance Regulation.[126]
	According to its National Energy and Climate Plan, Slovakia has decided to bring the share of renewable energy to 19.2% by 2030. [125]
National support schemes	In the Slovak Republic, electricity from renewable sources is promoted through a fixed feed-in tariff. Energy companies are obliged to purchase and pay for electricity exported to the grid. Operators of renewable energy installations (especially PV and wind) may also receive subsidies under the Operational Programme Quality of Environment. The use of renewable energy sources is further incentivised through an exemption from excise tax.[39]
	Reforms in late 2018 and 2019 introduced auctions and regulated how consumers can participate in producing renewable energy (Renewable Energy Act). [125]
Connection of RES to the grid	Renewable energy plants must be given priority connection, and electricity from renewable sources must be given priority dispatch. The grid operator is obliged to extend the grid without discriminating against certain users.[39]

RES in transport	The low-carbon transformation of the transport sector is making tentative progress. While overall car fleet emissions are increasing and fuel taxes do not reflect CO2 intensities, subsidy schemes helped to put vehicles using alternative fuel sources into circulation, with the total increasing to 4,300 by mid-2018 (Ministry of Economy, 2018). [123]
	According to NECP, 2030 target of RES in transport: 14%[126]
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 6.96% [42]
Support of RES in transport	In Slovakia, the main support scheme for renewable energy sources used in transport is a quota system. This scheme obliges companies importing or producing petrol or diesel to ensure that biofuels make up a defined percentage of their annual fuel introduced to the market. Furthermore, biofuels are supported through a tax regulation mechanism.
	Slovakia hardly utilises EFSI and EU innovation funds for clean transport and sector coupling initiatives. [125]
	In March 2019, an action plan promoting e-mobility was adopted, including measures such as accelerated depreciation rates of electric vehicles and of charging stations. Green European vehicle licence plates and schemes to promote accessible charging stations and the purchase of electric vehicles are also being implemented, but take-up remains limited. [125]
Charging points	In November 2018 the Ministry of Economy proposed an Electromobility Action Plan for 2019-2020 including, among other things, the provision of financial support for purchasing an electric car or plug-in hybrids and constructing an additional 1,500 charging stations by 2025.[123] In 2017 there were 69.01 EV charging points per 100000 inhabitants (rank 8 of 28). [43]
Plug-in vehicles	Share of newly registered plug-in electric vehicles (PEV) in the 2017 was 0.41% (EU rank 18 of 28) [44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.6% [45]
2 Energy Efficiency	
Energy efficiency indicative target	According to NECP, Slovakia's 2020 energy efficiency target is to have a maximum consumption of 16.2 Mtoe (primary energy) and of 10.38 Mtoe (final energy). [126] The primary energy consumption was of 16.1Mtoe in 2017. Final energy consumption stood at 11.1Mtoe, exhibiting a trend that makes reaching the 2020 target very unlikely. [123]
	Primary energy consumption was of 15.8 Mtoe in 2018, still below the EU 2020 target. Final energy consumption stood at 11.1 Mtoe, exhibiting a trend that makes reaching the 2020 target very unlikely. Enhanced efforts need to be put into and additional measures considered for keeping primary energy consumption in check and considerably reducing final energy consumption. [125]
Energy savings	In 2016, Slovakia had made 22% of the total savings it had committed to achieve over the 2014 to 2020 period. [46]
2030 target	According to NECP, Slovakia's energy efficiency target for 2030 is 30.3%. primary energy consumption target is 15.7 - 16.15 Mtoe; final energy consumption: 10.27 – 10.44 Mtoe.[126] Such contributions are of low ambition compared to the collective EU effort needed to achieve the EU 2030 targets
3 Energy security and interconnection	
Interconnection	Slovakia has significant electricity interconnection capacity compared to its electricity generation capacity. The planned increase of new nuclear capacity is accompanied by new connections, e.g. with Hungary, aimed at reducing congestion. The interconnection level is projected to be at 52% in 2030. [126]
Energy security target 2030	With high dependency on energy imports, energy security is one of the priority topics of the Slovak national energy strategies. [126] In the plan nuclear energy is mentioned as the main carbon-free source of electricity. [127]
Trade deficit	Energy import dependency was 64.8% in year 2017 (66% in 2005).[123]
	In 2018, Slovakia's energy import dependency was 63,7% [48]
Electricity	In year 2018 more than 70% of electricity was produced by conventional and nuclear

generation capacities	power plants. [49] In November 2018, the Slovak Government decided to advance the phasing-out of domestic coal for electricity generation from 2030 to 2023.[123]
4 Integrated electricity market	
Wholesale electricity market	Following some success in electricity market coupling, Slovakia still has an active role to play in creating a pan-European electricity market by actively participating in the market coupling project 4MMC (Czech Republic, Slovakia, Hungary, Romania). This can help to strengthen security of supply and competition in the wholesale electricity market. [123] The Slovak electricity market is part of the CENTREL area which also includes Poland, Hungary and the Czech Republic. Slovenské elektrárne represents around 8% of CENTREL's installed capacity and 7% of its annual generation.[128]
Retail electricity market	Retail energy markets are heavily regulated, with all households and small and medium-sized enterprises being supplied with electricity and gas at regulated prices. The current regulatory system, expected to apply until 2021, hampers market development and innovation. Although energy prices are in general lower than the EU average, electricity prices for companies are the highest in the region, putting Slovak companies at a competitive disadvantage.[123] The number of licenced power retailers in the whole retail market has been constantly growing and it reached 407 at the end of 2012. 19 retailers provide electricity to household consumers at the end of 2012463. Despite the growing number of competitors in the power supply market, prices for household consumers and small and medium companies remain regulated. The numbers of consumers switching power providers are increasing every year, which is a good sign for energy market liberalisation.[123]
Intelligent metering systems	Slovakia has set a detailed smart metering plan to fulfil the EU requirements in the area of energy efficiency by 2020. The country`s goal is to install around one million smart meters that will enable utilities to perform demand response and allow consumers to better manage their energy consumption.[129] The Slovak authorities have mandated that customers with a consumption of more than 4000kWh per year should have smart meters, estimated at 600000 end points.[130]
Tariffs	Despite the growing number of competitors in the power supply market, prices for household consumers and small and medium companies remain regulated.[123]
5 Research, innovation and competitiveness	
R&I strategy	The national Smart Specialisation Strategy (RIS3 document) is the national R&I strategy for 2014-2020[51]
Innovation performance	Slovakia is a Moderate Innovator.[52]
National target	National R&D target: 1.2% of GDP.[123]
Total R&D expenditure	Although overall R&D investment has risen from 0.45% of GDP since 2007 to peak at 1.2% in 2015, it dropped again to 0.88% in 2017. [123]
	Total R&D expenditure stood at 0.84 % of GDP in 2018. [125]
	The use of funds under the operational programme Research and Innovation (OP R&I) is slow, hampering R&D spending. [125] R&D investment has increased in the last decade but depends on European Structural and Investment Funds (ESIF). [125]
Public R&D expenditure	While public R&D investment rose from 0.27% in 2007 to 0.4% in 2017, business R&D intensity remains among the lowest in the EU at 0.48% of GDP.
Business expenditure in R&D	Business expenditure in R&D appears too low to substantially boost innovation performance. In addition, at 0.14% of GDP in 2016, business expenditure in R&D by small and medium-sized enterprises remains significantly below the EU average.[123]
Academia-business links	The low quality of the science base hinders science-business cooperation. [125]
R&D policy coordination	A lack of R&D strategy and targeted measures, the limited engagement of research institutions and limited research capacity contribute to low private R&D expenditure.[123]
	A fragmented governance system renders public R&D investment inefficient. Policy development and implementation suffer from a lack of coordination between ministries and implementing agencies, and the lack of a comprehensive, long-term research and innovation strategy. Major reforms have been regularly postponed. No substantial

	policies were adopted to decrease the fragmentation of the public research system and the reform of the Slovak Academy of Sciences was stopped in its final stage. [125]
	Various measures are underway to improve the SME research ecosystem, mostly financed by the European Structural and Investment Funds. [125]
Funding from Horizon 2020	According to the H2020 country profile of Slovakia as of Sept. 2019, the net EU contribution (funding received by the project's participants after deduction of their linked third parties' funding) is 0.81% of the EU total.[67]
Research infrastructures roadmap	No roadmap available[55]
Smart specialisation priority areas	1.Manufacturing & industry 2.Key Enabling Technologies 3.Information & communication technologies 4.Services 5.Sustainable innovation [131]
Just Transition Investment Guidelines	Over 4,000 people are directly employed in coal mining activities in the area of Horná Nitra (Prievidza and Partizánske districts), which constitute a supply chain for the Nováky coal power plant due to be closed by 2023 on environmental efficiency grounds. In Trenčín, there is an important high carbon intensive cement producer. In the region of Košice, steel production is a source of significant CO2 emissions, with the U.S. Steel Corporation being the largest CO2 emitter in Slovakia. The Vojany coal power plant and the cement production in Turňa and Bodvou represent other important employers in an otherwise relatively economically weak region. In order to tackle the transition challenges and support the sustainable competitiveness of these regions, high priority investment needs have been identified. Key actions of the Just Transition Fund could target: Investments in regeneration and decontamination of sites, land restoration and repurposing projects; Investments in research and innovation activities and fostering the transfer of advanced technologies; Upskilling and reskilling of workers; Investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; Technical assistance. [125]

 **CZECH REPUBLIC**	**Desk 4**
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Category	**Description**
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	On 18th of May 2015 the government of the Czech Republic approved the updated version of the State Energy Policy.[132] The strategic objectives are based on the EU energy strategy and are aimed at meeting the targets of the State Energy Policy and fulfilling the long-term vision for the energy sector in the Czech Republic. The top strategic objectives are security, competitiveness

	and sustainability.[133]
GHG target 2020	National greenhouse gas (GHG) emissions target: maximum 9% increase in 2020 compared with 2005.[134] Emissions are expected to be at 2005 level in 2020, according to national projections taking into account existing measures. This means that the Czech Republic is expected to overachieve its target by 9 pps.[134]
	In 2018, GHG emissions increase compared with 2005, was 4% according to provisional data. [135]
GHG target 2030	By 2030, reduce emissions of the Czech Republic by at least 44 Mt CO2 eq. by comparison with 2005 (corresponding to a reduction of 30% by comparison with 2005). While the country is still likely to meet its 2020 target, recent emission increases (+11% between 2014 and 2017) will make it more challenging to meet the much more ambitious and binding 2030 target.[134]
	The country is likely to meet the 2030 target in the sectors not covered by the EU Emissions Trading System (EU ETS), according to the projections of theNational Energy and Climate Plan. [135]
	According to NECP, GHG emmissions target: 30% reduction in 2030 compared with 2005.[133]
1.2 Uptake of RES	
RES 2020 target	2020 renewable energy target: 13%.[134] With a renewable energy share of 14.8% in 2017, the Czech Republic is on track to meet its target for 2020.[134]
RES 2030 target	The Czech Republic plans to achieve the RES share in gross final consumption at 22 % by 2030, which is an increase of 9 percentage points compared to the national target of 13.0 % for 2020.[133] This level of ambition is below the share of 23% in 2030 that results from the formula contained in Annex II of the Governance Regulation.[133]
National support schemes	From January 2014 the support for new RES plants generating electricity has been stopped. The only exemption is small hydro power plants with an installed capacity up to 10 MW and ongoing projects using biomass, wind and geothermal energy. Semi-finished and yet unfinished projects have to meet certain conditions to be eligible for support (installed capacity, granting the state authorisation for the construction – a building permit or planning proceedings, and the date of commissioning).[39] The abolishment of support schemes in 2014 and a retroactive tax on solar energy have resulted in a static market.[134] In the area of renewables, retroactive changes have created significant uncertainty and have resulted in higher capital costs for current and future investments as well as a negative public perception.[134]
	In this sense, authorities have been preparing legislative changes of the Renewable Energy Support Act with the aim of introducing a new support schemes. In addition, the administrative burden and various technical and legal obstacles to domestic energy generation from renewable resources persist (i.e. grid connection and charges, and the involvement of many authorities in the licensing process). Investment grants for distributed renewable energy are currently the only support instrument for new installations, but there are plans to introduce auctions for projects above 1 megawatt. [135]
Connection of RES to the grid	Operators of renewable energy plants are entitled to priority connection to the grid. The use and the expansion of the grid are subject to general legislation on energy.[39]
RES in transport	The penetration of renewable energy in transport sector according to Eurostat data in 2017 was 6.6%.[40]
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 6.52% [42]
Support of RES in transport	In the Czech Republic, the main support scheme for renewable energy sources used in transport is a quota system. This scheme obliges companies importing or producing petrol or diesel to ensure that biofuels make up a defined percentage of their annual fuel sales. Furthermore, biofuels are exempt from consumption tax.[39]
	Support scheme for the construction of publicly accessible recharging and refuelling stations for vehicles running on alternative fuels is in place since 2017. [135]
	According to NECP, 2030 target for RES in transport: 14%[133]

Charging points	The current number of publicly available recharging points covers the needs of the existing vehicle fleet but the planned growth of the recharging infrastructure may not be sufficient to cater for the needs of the expected take-up in the vehicle market. Ranked 17/28 in Electric vehicle charging points. (23.63 EV charging points per 100000 inhabitants). [43]
	There are only around 620 installed chargers. [135]
Plug-in vehicles	Share of newly registered plug-in electric vehicles (PEV) in the 2017 was 0.23% (EU rank 25 of 28)[44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.3% [45]
	Less than 4,000 passenger cars (0.4 % of the vehicle fleet) is fully electric or plugin hybrid. [135]
2 Energy Efficiency	
Energy efficiency indicative target	The Czech Republic's 2020 energy efficiency target is 44.3Mtoe expressed in primary energy consumption (25.3Mtoe expressed in final energy consumption)[134] The Czech Republic increased its primary energy consumption to 40.1Mtoe in 2017. Final energy consumption increased to 25.5Mtoe, above the set target.[134]
	In 2018, Czech Republic's primary energy consumption was 40,4 Mtoe [74] and final energy consumption was 25,3 Mtoe [75]
Energy savings	Progress towards total cumulative savings requirement by 2020 is 11%.[46]
	The country achieved only 68% of the estimated cumulative energy savings for 2014-2017, far from the energy savings obligations under the Energy Efficiency Directive. [135]
	Nonetheless, the implementation of energy efficiency policies remains split among several authorities. There is also a low awareness about the wider benefits of energy efficiency, coupled with a lack of motivation to draw available funding, due to long payback times and administrative burden. [135]
2030 target	The national contribution is set at a level that would allow the country to increase its energy consumption by 2.9 % in relation to 2017 levels for primary energy consumption while final energy consumption would have to decrease by 7.2 %. On the other hand, the target for 2030 is set at a lower level as compared to their 2020 energy efficiency target both for primary and final energy consumption. Such a trend appears to contradict the collective EU effort needed to achieve the EU 2030 target. [136]
	The 2030 national target is 41,44 Mtoe (PEC) and 23,65 Mtoe (FEC).[133]
3 Energy security and interconnection	
Interconnection	The country is well interconnected in the internal electricity market. It currently has an interconnection capacity of 19.3%. However, congestion management in Central Europe needs a solution at regional level that facilitates cross-border electricity flows, while ensuring system security. Measures that can increase the flexibility of energy demand are still pending (e.g.: smart meters rollout) [134]
Energy security target 2030	As regards energy security, the objective is to limit import dependency below 65% by 2030 and 70% by 2040. According to NECP, main energy security targets for electricity are: Maintaining the high quality of energy supply and meeting the parameters of the adequacy of production capacities; Ensuring self-sufficiency in electricity generation, based in particular on advanced conventional technologies with high efficiency of conversion and increasing share of renewable and secondary sources; Gradual decline in electricity exports and maintaining the balance between +/- 10 % of domestic consumption in line with the conditions of the internal market; Maintaining a positive power balance and ensuring the adequacy of the power reserves and control outputs (providing for the necessary support services) and permanently ensuring the power adequacy of -5 % to +15 % of the maximum load of the electricity system (free available capacity according to the ENTSO-E methodology); Ensure a systematic solution to the loop electricity flows and transit from a safety and cost compensation perspective; Ensure diversification of primary energy sources in accordance with the target corridors of the State Energy Policy of the Czech Republic, which, inter alia, means the continued development of nuclear energy in the Czech Republic.[133]
Trade deficit	The Czech Republic's energy dependence raised from 28% in 2005 to 37% in 2017.[47]
	In 2018, Czech Republic's energy import dependency was 36,8% [48]

Electricity generation capacities	More than 90% of electricity is generated from conventional and nuclear power plants and the contribution of RES was less than 10%.[137]
4 Integrated electricity market	
Wholesale electricity market	In the Czech Republic, electricity is traded at Prague-based Power Exchange Central Europe (PXE), and in spot markets (day-ahead and intraday) organised by OTE (Czech electricity and gas market operator). The market coupling of the Czech, Slovak and Hungarian day-ahead markets started in September 2012 and has been successful so far.[134]
Retail electricity market	Czech power market is fully liberalised. Market concentration remains very high, but the dominant position of three main power suppliers, ČEZ, E.ON and PRE is gradually decreasing.[134]
Intelligent metering systems	CEZ CEO Daniel Benes said that the current system was still based on the assumption that power generation is coming for a only a few large power plants, which is no longer the case, as a number of solar power panels and other micro facilities have been installed in recent years. What Benes proposes is the introduction of smart power meters, which would allow for fine-tuning of when consumption is being made and account for far more precise bills.[138]
Tariffs	The calculation of electricity tariffs needs to change, CEZ CEO Daniel Benes told Lidove Noviny, a newspaper. He argued that with the emergence of new technology in power generation, it was no longer feasible to maintain the current system, which calculates tariffs based on assumed consumption, rather than on actual one. He said that the government should either admit that it has been determining electricity tariffs in a way to lead a certain social policy, or face the new reality and adopt better ways to measure power consumption.[138]
5 Research, innovation and competitiveness	
R&I Strategies	Single overarching strategy: The National Research, Development and Innovation Policy of the Czech Republic 2016-2020 [51]
	The Innovation Strategy 2019-2030, adopted in January 2019, supported by the majority of stakeholders, aims to move the country up the value chain and help it become an innovation leader by 2030. However, it remains to be seen how effective the shared ownership and implementation of the separate pillars of the strategy will be. The effectiveness of the strategy will depend on the successful implementation of the action plans prepared by the authorities. [135]
Innovation performance	Investment needs to support technology uptake and increase the innovation performance of firms, notably the domestic small and medium-sized enterprises.[134] The Czech Republic is a moderate innovator.[52]
National target	R&D target set in the national research policy: 1% of GDP for public R&D expenditures. In 2017, R&D intensity in the Czech Republic was 1.79% of GDP composed of 63% private investment (1.13% of GDP) and 37% public investment (0.66% of GDP).[134]
Total R&D expenditure	The overall R&D intensity in 2017 stood at 1.79% of GDP.[134] In 2007, R&D intensity comprised 1.31% of GDP.[53]
	1.93% of GDP total R&D expenditures in 2018. [135] The total R&D expenditure has grown steadily since 2010. [135]
Public R&D expenditure	Public R&D investment lacks a coherent strategy to increase the modest research performance. Its level of intensity stood at 0.66% of GDP in 2017 and if the current trend is maintained, the 2020 target of 1% of GDP might not be reached. While public R&D expenditure as a share of GDP strongly increased from 2008 to 2015 (from 0.52% to 0.87%), it decreased to 0.66% in 2017. It is not likely that the 1% target will be reached by 2020.[134]
	0.73% of GDP public R&D expenditures in 2018 [135]
Business expenditure in R&D	Business expenditure on R&D increased from 0.77% of GDP in 2010 to 1.13% of GDP in 2017. However, close to two thirds of these expenditures are incurred by foreign firms. While some of these firms have set up medium and high-tech research and innovation facilities, their activities are mainly directed towards experimental development rather than industrial research.[134]
	Business R&D intensity increased to 1.19% in 2018 [135]

Academia-business links	Links between academia and business are insufficient to support knowledge and technology transfer. A low degree of public private scientific co-publications suggests a weak public private cooperation. Regulatory barriers persist for spin-off creation and cooperation is often informal. In the public sector, researchers' careers largely depend on their publications track record, discouraging them to work with the industry. [135]
R&D policy coordination	The country has not yet created a fully functioning innovation ecosystem based on domestic research and development. Public R&D investment lacks a coherent strategy to increase the modest research performance. The financing of innovation is still under development.[154] Despite some encouraging initiatives, the low cooperation between the private sector and the academia hampers technology diffusion.[134]
	Activities related to R&D in the area of energy are very low, representing only around 0.1% of GDP (down from 0.3% in 2011). Moreover, out of the €21 million invested in research in 2016, around half went to activities related to nuclear and fossil fuels [135]
	Regional authorities managed to strengthen their role in promoting and cultivating the business and innovation environment, despite the fragmented governance. At the same time, the current economic situation helps firms become less dependent on grants. [135]
	Public R&D expenditure is not supported by systemic and comprehensive reforms. Although some measures have been adopted, and expenditure is increasing, it is still too early to assess their impact. The on-going Metodika 17+ reform is yet to be fully implemented by research organisations and higher education institutions (a comprehensive rollout is expected in 2020) [135]
	Competence for research and innovation policy is shared between different authorities without an adequate coordination mechanism or synergies. A leading central institution with a cross-cutting coordination and practical overview role is lacking. Consequently, the decision-making bodies mostly work in silos. While research and innovation policy is supported by several strategies, these strategies lack coherence and coordination, leading to potential overlaps, uncertainties and lack of ownership by different entities. [135]
Funding from Horizon 2020	The Czech Republic belong to widening countries group in Horizon2020. According to Horizon2020 dashboard The Czech Republic received 0.8% of the total funding.[67]
Research infrastructures roadmap	Roadmap published in 2010, updated in 2011, 2015 and 2019 [55]
Smart specialisation priority areas	1.Manufacturing & industry 2.Information & communication technologies 3.Key Enabling Technologies 4.Services 5.Human health & social work activities [139]
Just Transition Investment Guidelines	The coal mining regions of Czechia include Moravskoslezský and Severozápad (the latter includes Karlovarský and Ústecký). The transition process is expected to affect local communities dependent on the coal mining and coal-fired energy sector. The Moravskoslezský region is the biggest hard coal mining region in Czechia. In the Ústecký region where 80% of Czechia's lignite is extracted (Northern Bohemia coal basin), there are four coal mines, the largest Czech coal fired power plants and a high concentration of chemical industry firms. In the Karlovarský region (with two lignite mines and the lowest GDP per inhabitant in Czechia), the mining company located in the district of Sokolov . Based on this preliminary assessment, it appears warranted that the Just Transition Fund concentrates its intervention on these regions. Key actions of the Just Transition Fund could target in particular: Investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; Investments in the creation of new firms, including through business incubators and consulting services; productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; Upskilling and reskilling of workers; Investments in regeneration and decontamination of sites, land restoration and repurposing projects. [135]

11.8 Country Profiles for Desk 5 (Hungary, Croatia, Italy)

 **HUNGARY**	**Desk 5**
	Responsible partner: RSE

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments*"	IPE	31.05.2019
2.	1st content update from [142]	IPE	27.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [148]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1. Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	Hungarian "National Energy strategy" was developed by the Ministry of National Development in 2012.[140] National Climate Change Strategy was adopted by the Government of Hungary in May 2017 and was adopted by the parliament in October 2018.[141]
	In 2020, The Innovation and Technology Ministry has published Hungary's recently approved new National Energy Strategy that outlines priorities until 2030. Strategy aims to increase electricity generation from low-carbon sources to 90% of the total by 2030. [142]
	The national action plan on climate change adopted in January 2020 to implement the 2018 strategy foresees mostly preparatory action on adaptation (studies, mapping etc.) [142]
GHG target 2020	National greenhouse gas (GHG) emissions target: maximum 10% increase in 2020 compared with 2005 (non-ETS)[143] By 2017, emissions fell by 9 % compared with 2005.According to the latest projection, the 2020 target is expected to be met by a wide margin.[143]
	By 2018, emissions fell by 10% compared with 2005. [142]
GHG target 2030	The GHG emission target under the Effort Sharing Regulation for sectors non-ETS sectors for 2030 is 7% decrease compared to 2005.[144] Hungary also has a national economy-wide target of 40% decrease GHG emissions by 2030 compared to 1990 (excluding LULUCF), and a long-term objective to reduce greenhouse gas emissions by 52 to 85 % by 2050 compared to 1990. [145] The projected gap with existing measures to the national greenhouse gas target in 2030 is quantified at 8.2 Mt CO2eq, while the corresponding gap to the 2030 target set in Effort Sharing Regulation can be estimated at around 5 % points or around 3 Mt CO2eq (excluding LULUCF).[145]
	According to NECP, GHG emissions should be reduced by at least 40% by 2030 over the year 1990 (-25,8% compared to 2005 level)[144]
1.2 Uptake of RES	
RES 2020 target	2020 renewable energy target: 13%[143] .Although in 2017 the preliminary renewable

	share (13.3%) was higher than the 2020 target, it decreased from the last year (14.3%), owing to lower share of renewables in heating and cooling, and transport.[143]
	Although in 2018 the preliminary renewable share (12.5%) was close to the 2020 target, it decreased from 2017, owing to lower share of renewables in heating and cooling. [142]
	In 2017, just 1% of gross inland energy consumption was covered from low-carbon renewable sources, while the highly polluting biomass contributed to approximately 10%. From this low base, solar installations show a rapid increase and this trend is set to continue in the future. [142]
RES 2030 target	According to NECP, Hungary set the target of reaching a 21% share of renewable energy sources within primary energy consumption by 2030.[144]
National support schemes	In Hungary, electricity from renewable energy sources is supported by a feed-in-tariff (FiT) for installations with an installed capacity of 50 kW-500 kW. For installations with a capacity of 0.5-1 MW, the market ('green') premium applies. House-hold-sized power plants up to 50 kW can benefit from net metering.[39]
Connection of RES to the grid	Renewable energy plants shall be given priority grid connection and grid access. The costs to connect renewable energy plants to the grid and the grid's expansion are borne either by the plant operator or by the grid operator, depending on certain criteria.[39]
RES in transport	The penetration of renewable energy in transport sector in Croatia according to Eurostat data in 2017 was 6.8%.[40] The target according to the first Renewable Directive (RED I) [41] is 10%.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 7.68% [42]
	According to NECP, 2030 target for RES in transport: 16.9%[144]
Support of RES in transport	In Hungary, the main support scheme for the promotion of renewable energy sources in the transport sector is a quota system. This support scheme obliges fuel retailers to ensure that biofuels and hydrogen make up a certain percentage of their yearly sales. [39]
Charging points	According to Eurostat data, there are 15.12 EV charging points per 100000 inhabitants in Croatia in 2017 (EU rank 13 of 28).[43]
Plug-in vehicles	The share of newly registered plug-in electric vehicles (including Battery Electric Vehicles) and Plug-in hybrid electric vehicles) in the 2017 was 0.98% (rank 11 of 28).[44]
	Share of newly registered plug-in electric vehicles in the 2018 was 1.4% [45]
2 Energy Efficiency	
Energy efficiency indicative target	Hungary's 2020 energy efficiency target is 24.1Mtoe expressed in primary energy consumption (14.4 million tons of oil equivalent expressed in final energy consumption)[143] Both primary and final energy consumption rose amid strong economic growth for the third consecutive year in 2017, respectively reaching 24.5 and 18.5 million tons of oil equivalent. These values are above the respective 2020 targets, implying that more efforts need to be done in the remaining three years. Final energy consumption target will be difficult to meet without additional measures.[143] Energy efficiency in the residential sector remains weak. Hungary is at risk of failing to reach its 2020 energy saving target, largely because household energy consumption per capita remains 12% higher than the EU average even though income levels are considerably lower.[143]
	The increasing trend in both primary and final energy consumption amid strong economic growth came to a halt in 2018 and both indicator remained unchanged compared to 2017 (reaching respectively 24.5 and 18.5 Mtoe). [142]
Energy savings	In the period 2014-2016, it had made 17% of the total savings it had committed to achieve over the 2014 to 2020 period.[46]

	Hungary is at risk of failing to meet its 2020 energy saving target. This is largely due to high household energy consumption per capita, which remains 12% higher than the EU average despite considerably lower income levels. [142]
2030 target	The Hungarian energy efficiency contribution for 2030 is set in a similar way as the 2020 target, and would represent a 8-10 % reduction compared to the projections of the baseline scenario for 2030. Based on the additional information provided, this translates into 27Mtoe of primary and 18.8Mtoe of final energy consumption in 2030. These contributions are of very low ambition compared to what is expected at the EU level to collectively reach the Union's 2030 energy efficiency targets.[145]
	Hungary's energy efficiency target is to ensure that the country's final energy consumption does not exceed the value of 2005 in 2030 (785PJ or 18,75 Mtoe), either.[144]
3 Energy security and interconnection	
Interconnection	Hungary is already significantly exceeding the 15% EU target relating to the interconnection of electricity systems; the share of cross-border capacities, nominal installed power plant capacities exceeds 47%. It follows that the Government of Hungary does not consider it necessary to define a new quantified target. The increase of cross-border capacities, however, is justified, as an interconnected energy network operated with neighbouring countries improves the national security of supply. According to NECP, Hungary plans to increase the share of interconnection to 60 % by 2030. [144]
Energy security target 2030	Hungary is a net importer of fossil fuels and electricity. Energy security objectives for electricity in the NECP are framed around the role of national assets (nuclear, renewable energy) and market integration. For gas, diversification of sources and import routes is a key element.[144] Hungary country plans to further develop nuclear capacities by building two new units of 1 200MW each by 2030.[145]
Trade deficit	The Hungary energy dependence constituted 62.2% in 2005 and 62.6% in 2017.[47]
	In 2018, Hungary's energy import dependency was 58,1% [48]
Electricity generation capacities	In 2018 45.3% of total produced electricity in Hungary was delivered from conventional thermal power plants, 49,9% from nuclear and remaining 4,8% from renewables.[49]
	In 2019, share of renewables rose above 8% in electricity generation. [142]
	By 2030 up to 90% of Hungary's electricity generation might come from low carbon technologies (nuclear and renewables together). Hungary intends to rely more on renewable energy sources, mainly solar energy. However, as it turns out from the recently adopted National Energy Strategy, wind generation capacities will stay at current levels in the electricity mix, which leaves an untapped opportunity for the country. According to the Plan, the share of renewables will reach only 21% in the energy mix in 2030. [142]
	The expansion of the Paks nuclear power plant is expected to ensure sufficient power generation capacities and to contribute to the low carbon electricity generation. [142]
4 Integrated electricity market	
Wholesale electricity market	HUPX (Hungarian Power Exchange) day-ahead power market was launched in July 2010 as part of the liberalisation of the Hungarian energy sector. Currently, 61 companies from 19 countries trust HUPX to define a transparent and reliable power price, which is used as a benchmark for the whole region and the Balkan.[146]
	In spite of a good level of overall electricity interconnection, implementing planned infrastructure projects would lead to cheaper electricity imports from Western Europe. Hungary is striving to diversify its gas imports through new supply routes through neighbouring Romania and Croatia. These projects would reduce the price premiums of the Hungarian wholesale electricity and gas markets compared to Western Europe, which would be beneficial for affordability and competitiveness reasons for both

	households and businesses. [142]
Retail electricity market	Retail energy price regulation discourages investment in the sector. Retail electricity and gas prices in the household sector are low in EU comparison.[143]
Intelligent metering systems	Hungary has not yet made a definitive decision on whether to roll out of smart meters.[147]
Tariffs	Hungary is defining the regulatory framework for encouraging demand response in the new National Energy Strategy[144]
5 Research, innovation and competitiveness	
R&I strategy	National Research and Development and Innovation Strategy (2013-2020). In order to enhance R&D&I performance, the National Smart Specialisation Strategy (S3) and the Research Infrastructures Hungary were adopted. There is also the Széll Kálmán Plan 2.0 of 2012, which defines the mid-term and long-term aims of the government and is aligned to the EU-2020 documents.[51]
Innovation performance	Hungary is a moderate innovator.[52]
National target	R&D target: 1.8% of GDP[143] Expenditure on R&D increased by 0.15 percentage points to 1.35 % of GDP in 2017. Hungary needs to make further, significant efforts to meet the national target.[143]
Total R&D expenditure	In 2007, R&D intensity in Hungary was 0.96 % of GDP[53] In 2017, R&D intensity in Hungary was 1.35 % of GDP[143]
	Expenditure on R&D increased by 0.18 percentage points to 1.53% of GDP in 2018. [142]
Public R&D expenditure	26% of the total are public investment (0.35 % of GDP)[143]
Business expenditure in R&D	73% of the total are private investment (0.99 % of GDP)[143]
Academia-business links	Cooperation with the business sector is mostly limited to large companies due to the lack of demand and capacity of smaller firms. Researchers seldom bring their results to the market. The roll-out of the 8 Higher Education and Industry Cooperation Centres (FIEKs), aimed at improving academia-business cooperation, continued in 2019. [142]
R&D policy coordination	The smart specialisation strategy would benefit from being updated, reinforced and more focused.[143] Recent policy measures create uncertainty in academic and research fora.[143] Science business cooperation remains below the EU average due to the traditional divide between research, education and innovation entities in Hungary.[143] In 2017, eight university-business cooperation centres were set up with EU cofinancing to foster collaboration. The centres should develop sustainable institutional operations and to run innovation projects.[143]
	Recent changes have increased government influence over scientific Institutions. A National Science Policy Council (NTT) was set up to advise the government on strategic issues and supervise the operation of the National Research, Development and Innovation Fund. In addition, the research institute network of the Hungarian Academy of Sciences was separated from the Academy and reorganised under the newly founded Eötvös Loránd Research Network (ELKH). Through the appointment of members to the new bodies, the government has increased its influence over the R&D field, creating uncertainty to guarantee scientific freedom. An increasing proportion of public sector researchers are considering leaving for the private sector or abroad; these intentions are particularly high among talented, young and competitive researchers. [142]
	Hungary has a scope for improvement by increasing the supply of high-skilled labour, raising R&D expenditure in the public sector and encouraging cooperation among

	potential innovators. [142]
	The rollout of the 8 Higher Education and Industry Cooperation Centres (FIEKs), aimed at improving academia-business cooperation, continued in 2019. [142]
Funding from Horizon 2020	0.64% of the overall Horizon funding[67]
	Participation in Horizon 2020 projects is modest, highlighting the low level of international cooperation by research entities. [142]
Research infrastructures roadmap	Roadmap published in 2018[55]
Smart specialisation priority areas	1.Manufacturing & industry 2.Sustainable innovation 3.Energy production & distribution 4.Agriculture, forestry & fishing 5.Information & communication technologies [148]
Just Transition Investment Guidelines	The Mátra power plant in Heves county with the associated two coal mines is the biggest CO2 emitter. The Baranya county relies heavily on energy-intensive industries (treatment and disposal of nonhazardous waste and manufacture of cement) where process related greenhouse gas emissions intensity significantly exceed the EU average. Key actions of the Just Transition Fund in these regions could target in particular: investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair and recycling; investments in regeneration and decontamination of sites, land restoration and repurposing projects; upskilling and reskilling of workers; job-search assistance to jobseekers; active inclusion of jobseekers; technical assistance. [142]

 **CROATIA**	**Desk 5**
	Responsible partner: RSE

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments*"	IPE	31.05.2019
2.	1st content update from [151]	IPE	30.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [156]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	Energy strategy of Croatia was adopted in 2009.[149] In May 2019, the Croatian Government proposed a new national Energy Strategy to run until 2030, including an

	overview to run to 2050. The proposal is currently under public review.[150]
	The new Energy development Strategy highlights two scenarios: a 'moderate' and an 'accelerated' energy transition, identifies key priorities and projects effects of the energy transition [151]
GHG target 2020	Greenhouse gas emissions, national target: maximum 11% increase between 2005 and 2020 (non-ETS) [152] Total GHG emissions in Croatia were reduced by 23.3% from 1990 to 2017. Based on the latest national projections submitted to the Commission, and taking into account existing measures, Croatia is expected to meet its GHG emission target by a wide margin (-12.5 % between 2005 and 2020).[152]
	Croatia reduced its total greenhouse gas emissions by 22.5% from 1990 to 2018. Transport remains the sector contributing the most to greenhouse gas emissions (30%), followed by industry (23%) and agriculture (13%). [151]
GHG target 2030	According to Effort sharing regulation 2030 target which requires Croatia to reduce its emissions by 7 % by 2030 (relative to 2005 levels).[152] According to the NECP, Croatia projects to achieve Effort sharing regulation 2030 target (7%).[153]
1.2 Uptake of RES	
RES 2020 target	With a renewable energy share of 28% in 2018, Croatia is well above its target for 2020 [151]
RES 2030 target	The national contribution for renewable energy proposed in the NECP is set at an ambitious share of 36.4% of energy from renewable sources in gross final consumption of energy in 2030. This level of ambition is above the share of 32% in 2030 that results from the formula in Annex II of the Governance Regulation.[153]
National support schemes	In Croatia, electricity from renewable sources is promoted through a premium tariff and a guaranteed feed-in tariff (for installations of less than 500 kW) allocated through tenders. So far, no tenders have been organised.[39]
Connection of RES to the grid	The access of electricity from RES to the grid is regulated by the general legislation on energy and RES installations are given priority. Electricity from RES is subject to special provisions only in case of wind power plants.[39]
	The often excessively rigid regulations or the interpretation thereof by local energy distributors and authorities have been creating obstacles for deployment of small-scale projects. In 2018, requirements were somewhat eased through new rules for connecting households to the grid. However, bigger projects remain more affected by both restrictive regulations and the gap left by the phasing out of the old feed-in tariffs system, which has not yet been succeeded by the planned premium system. [151]
RES in transport	The penetration of renewable energy in transport sector in Croatia according to Eurostat data in 2017 was 1.2 %.[40] The target according to the first Renewable Directive (RED I)[41] is 10 %.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 8.06% [42]
	According to Croatian NECP, 2030 target for share of RES in final energy consumption in transport is 13.2%[153]
Support of RES in transport	In Croatia, the main promotion scheme in the field of RES in transport is a biofuel quota obligation. Additionally, the state provides a tax regulation mechanism to encourage the usage of biofuels. [39]
Charging points	According to Eurostat data, there are 54.25 EV charging points per 100000 inhabitants in Croatia in 2017 (EU rank 13 of 28).[43]
Plug-in vehicles	The share of newly registered plug-in electric vehicles (including Battery Electric Vehicles) and Plug-in hybrid electric vehicles) in the 2017 was 0.05% (rank 28 of 28)[44]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.2% [45]

	Although the number of electric vehicle charging points in Croatia is above the EU average, the market share of newly registered electric passenger cars remains the lowest in the EU. [151] The funding of incentives for purchasing electric vehicles is limited. Incentives are prone to budget constraints and the timing of funding calls is unpredictable. [151]
2 Energy Efficiency	
Energy efficiency indicative target	Energy efficiency, 2020 energy consumption targets: 11.2 Mtoe (primary energy consumption);7 Mtoe (final energy consumption). Croatia's primary and final energy consumption remains below the country's 2020 energy efficiency targets: 8.07 Mtoe (primary energy consumption, 2016) and 6.64 Mtoe (final energy consumption, 2016)[122] Increasing energy efficiency is crucial to reduce energy intensity. Croatia uses a third less energy per capita than the EU average, but its energy intensity (energy use as a share of GDP) is 61 % higher.[152]
	Croatia's primary and final energy consumption remains below its 2020 energy efficiency targets: 8.2 Mtoe (primary energy consumption, 2018); 6.9 Mtoe (final energy consumption, 2018) [151]
	Energy efficiency of private and public buildings improved in 2019. However, there have been delays in adopting the necessary legislation and the energy efficiency obligation scheme is not yet fully operational. [151]
Energy savings	In the period 2014-2016, it had made only 5% of the total savings it had committed to achieve over the 2014 to 2020 period.[46]
	In the period 2014-2017, Croatia achieved only 38% of the cumulative energy savings required under the Energy Efficiency Directive for the period 2014-2020. [151]
2030 target	The energy efficiency contribution in the NECP is given in both primary energy consumption (8.23 Mtoe) and in final energy consumption (6.85 Mtoe).[153] The level of ambition seems low considering the efforts needed to achieve the EU level 2030 target of 32.5%.
3 Energy security and interconnection	
Interconnection	The interconnection level of Croatia exceeds the 15% EU level aimed for 2030 and further interconnectors with neighbouring states are considered as part of Croatia's role as an important link between electricity systems of Central and South East Europe in the development of the internal energy market.[153]
Energy security target 2030	The Projects of Common Interest currently being developed, in particular the Krk LNG terminal and the SINCRO large-scale smart grid project, are essential to Croatia's security of supply of electricity and gas.[152]
	The "Clean Energy for EU Islands Initiative" was launched in May 2017 with the aim of helping islands and their inhabitants to generate their own sustainable low-cost energy, to embrace renewable energy, create jobs and economic growth and reduce greenhouse gas emissions. Four island communities in Croatia (Cres/Lošinj, Hvar, Korčula and Brač) were selected to participate in a pilot project. For these unique territories investing in renewable sources would reduce the island's energy dependency from the mainland, especially in summer months when consumption is highest. [151]
	According to Croatian NECP, energy security objectives are: ensure a lasting, secure and quality supply of all energy-generating products; diversification of supply routes of energy and energy-generating products; increasing gas and energy storage capacity in the energy system; increasing the flexibility (and thus resilience) of energy systems; protection of critical infrastructure and mitigating risks related to cyber security and climate change.[153]
Trade deficit	The Croatia energy dependence constituted 52.6% in 2005 and 53% in 2017.[47]
	In 2018, Croatia's energy import dependency was 52,7% [48]

Electricity generation capacities	In 2018 57.9 % of total produced electricity in Croatia was delivered hydropower plants, 31.3% from conventional thermal power plants and 0.5% from solar power plant.[49]
4 Integrated electricity market	
Wholesale electricity market	In June 2018 CROPEX (Croatian Power Exchange) and Croatian transmission system operator (HOPS) together with Slovenian power exchange and transmission system operator achieved the EU MRC (Multi-Regional Coupling) day ahead market coupling project on the Croatian-Slovenian border.[154]
Retail electricity market	Starting from 2016, energy price regulation for households for electricity has been phased out[152]
	Inefficiencies in electricity markets affect the deployment of renewable energy sources, the environment and raise costs for consumers. [151]
Intelligent metering systems	Hungary has not yet decided to go for a full roll-out of smart metering. However, Croatia has already invested €3 million since 2013 in the introduction of smart meters.[155]
Tariffs	The analysis of the potential to provide ancillary services and flexibility services by consumption response of network users will be conducted. The method of providing services from final customers will be defined and the regulatory framework will be appropriately modified, primarily through the introduction of an aggregator as a market participant.[153]
5 Research, innovation and competitiveness	
R&I strategy	Several national strategies shape the development of the national innovation system. The Strategy for Education, Science and Technology6 (SECT) sits at the centre of this heterogeneous policy framework. Additional references include the Strategy for fostering innovation 2014-2020 and the Industrial Strategy (2014).[51]
Innovation performance	Croatia is a moderate innovator.[52]
National target	With 0.86% of GDP (2017) Croatia is not on track to meet the target of 1.4%.[152]
Total R&D expenditure	In 2007, R&D intensity reached 0.79 % of GDP.[53] In 2017, R&D intensity in Croatia was 0.86% of GDP[152]
	Investment in R&D equals 0.97%. Croatia is not on track to meet the target. [151]
Public R&D expenditure	The public funding level in 2017 reached 0.43 % of GDP.[152]
	In 2018, public expenditure on R&D rose to 0.51% of GDP [151]
Business expenditure in R&D	The business expenditure in R&D in 2017 reached 0.43 % of GDP.[152]
	Business R&D investment expenditure increased to 0.47% of GDP [151]
Academia-business links	The legal autonomy enjoyed by university faculties lead to low cooperation across universities (both within and outside the country, as well as with the business sector) and hinder interdisciplinary research. A draft law on science and higher education in Croatia aims to reform the system by introducing measures to recognise and reward research excellence and it would bring in a new system of university governance, expand performance-based funding to include science-business cooperation as an assessment criterion and spell out guidelines for research ethics. [151]
R&D policy coordination	Lack coordination and effective management in research and innovation policies leads to poor targeting and inadequate prioritisation of support instruments. In addition, some of the undertaken reforms of public research institutes and universities remain unfinished.[152]Measures to reduce fragmentation and improve the efficiency of research and innovation policies are lagging (RIS3).[152]
	Investment in R&D increased substantially, but its efficiency remains low and

	highly dependent on EU funds. Investment is focused towards 'close–to-market' initiatives run by bigger companies, leaving research activities underfunded [151]
	Croatian companies are concentrated in low- to medium-tech sectors, and government support to R&D-based innovative firms is lacking. State-owned Enterprises lack incentives for competition through innovation and research. Croatian firms, especially smaller and younger companies, indicate a positive link between R&D-based innovation and productivity growth. Nonetheless, government support programmes are heavily skewed towards helping mature and larger companies, with less support given to diversification and new ventures. In addition, many support programmes are overcomplicated and poorly adapted to business needs. [151]
Funding from Horizon 2020	0.19% of the overall Horizon funding[67]
Research infrastructures roadmap	National roadmap with identified ESFRI projects was published in 2014[55]
Smart specialisation priority areas	1.Energy production & distribution 2.Human health & social work activities 3.Transporting & storage 4.Public administration, security & defence 5.Key Enabling Technologies [156]
Just Transition Investment Guidelines	In Croatia, two regions were identified on the basis of greenhouse gas (GHG) missions intensity: Sisak– Moslavina and Istria county. GHG emissions in Sisak-Moslavina county are generated mostly due to chemical industries and refined petroleum products. In Istria county environmental challenges are closely linked with electricity production and cement industry. The carbon intensity of local industry highlights scale of decarbonisation challenge, which requires reorientation of long-term investments towards innovative, climate-neutral technologies, while tapping into potential of local workforce. Based on this preliminary assessment, it appears warranted that the Just Transition Fund concentrates its intervention on these regions. Key actions of the Just Transition Fund could target in particular: productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; investments in research and innovation activities and fostering transfer of advanced technologies; investments in the deployment of technology and infrastructures for affordable clean energy and in greenhouse gas emission reduction; investments in digitalisation; investments in enhancing the circular economy; upskilling and reskilling of workers. [151]

 ITALY	Desk 5
	Responsible partner: RSE

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [160]	IPE	25.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [165]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	The National Energy Strategy (SEN)[157] [158] published by Ministry of economic development defines the national energy targets to drive the energy transition. The SEN is closely coordinated with the European Strategic Energy Technology Plan (SET Plan) and is complemented by the Integrated National Energy and Climate Plan[159]. The plan sets the energy scenario towards 2030, fostering a wide-ranging transformation in which the combination of decarbonisation, circular economy, efficiency and rational and fair use of natural resources represent objectives and instruments for the future of the economy.
GHG target 2020	National greenhouse gas (GHG) emissions target: -13 % in 2020 compared with 2005 (non-ETS). According to the projections submitted in 2017, Italy is on track to meet its 2020 GHG emission target, with a 8 percentage points margin (i.e. a reduction of 21%). In 2017, according to preliminary data, emissions were reduced by 20 % from 2005.[159]
	According to the projections submitted in 2019, by 2020 Italy will have reduced its emissions by 20 %, therefore overachieving its target by 7 percentage points. [160]
GHG target 2030	The GHG emission target under the Effort Sharing Regulation for sectors non-ETS sectors for 2030 is -33 % compared to 2005.[161] Based on the information provided, the planned policies and measures would be sufficient for Italy to meet this target, with a particularly important contribution coming from the transport and building sectors.[162]
	According to NECP, planned 2030 GHG emission reduction could reach 34.6% (target described in NECP: 33%)[161]
	Decarbonising transport is key to reducing greenhouse gas emissions. [160]
	Additional policy measures already planned could help further decrease emissions by up to 36% by 2030 [160]
1.2 Uptake of RES	
RES 2020 target	RES target for 2020 in gross final consumption 17% with a renewable energy share of 18.3 %. In 2017, Italy is well above the trajectory to reach its 2020 renewable energy target. [161]
	With a renewable energy share of 17,78% in 2018, Italy remains above its 2020 renewable energy target. [160]

RES 2030 target	The NECP proposed contribution expressed as 30% share of energy from renewable sources in gross final consumption of energy in 2030, is slightly above the share that results from the formula in Annex II of the Governance Regulation.[161]
National support schemes	In Italy, support schemes for RES in electricity are managed by Manager of Electricity Services (GSE). Electricity generated from renewable energy sources is promoted through VAT- and real estate tax deductions. The electricity from renewable energy sources fed into the grid can be sold on the free market or to the GSE on a guaranteed minimum price ("ritiro dedicato"). Alternatively, renewable energy producers can opt for net-metering ("scambio sul posto") which provides economical compensation to PV-producers for the electricity fed into the grid. In March 2018 the Ministry for Economic Development approved a draft of the Renewable Energy Ministerial Decree ("Decreto FER 2018-2020") governing support schemes for renewable energies. However, the draft is still subject to amendments and is therefore not included in here. [39]
	Italy is revising its 2013 action plan on green public procurement. A dedicated fund will support investment in the green economy, including through public guarantees. [160]
Connection of RES to the grid	Grid operators are obliged to give priority access to renewable energy plants. They are also obliged to give priority dispatch to electricity from renewable sources. Plant operators can request the grid operator to expand the grid if the connection of a plant requires this expansion.[39]
RES in transport	The penetration of renewable energy in transport sector in Italy according to Eurostat data in 2017 was 6.5 %.[40] The target according to the first Renewable Directive (RED I) [41] is 10 %.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 7.66% [42]
	Italy has recently set a target of 6 million electric cars by 2030. [160]
	In order to contribute to the challenging general target of 30% total gross final consumption met by RES, it is expected that the transport sector will surpass the value of 14% by increasing the obligation imposed on suppliers of fuels and electricity for the transport sector up to a renewables share of 22.0%.[161]
Support of RES in transport	A quota system for biofuels is currently in place in Italy. Its compliance is controlled through a biofuel certificates system. Advanced biofuels receive special incentivation.[39]
	The 2020 budget progressively reduces tax incentives on the most polluting company cars and on transport diesel for the most polluting vehicles. [160]
Charging points	According to Eurostat data, there are 9,4 EV charging points per 100000 inhabitants in Italy in 2017 (EU rank 22 of 28).[43]
Plug-in vehicles	The share of newly registered plug-in electric vehicles (including Battery Electric Vehicles) and Plug-in hybrid electric vehicles) in the 2017 was 0.25%[44] Italy is also setting a target of 6 million electric cars by 2030.[162]
	Share of newly registered plug-in electric vehicles in the 2018 was 0.6% [45]
2 Energy Efficiency	
Energy efficiency indicative target	Italy's 2020 energy efficiency target is 158Mtoe expressed in primary energy consumption (124Mtoe expressed in final energy consumption)[159] The target was set at a level that would allow energy consumption to grow in the coming years. After the growth of both primary and final energy consumption in the period 2013-2014, energy consumption in the country decreased between 2015 and 2016. However primary energy consumption registered again a small increase, moving from 148.0 Mtoe in 2016 to 148,94 Mtoe in 2017. Final energy consumption decreased slightly from 115.9 Mtoe in 2016 to 115.2 Mtoe in 2017. In light of the possible economic recovery in Italy and of the recent upward trend in primary energy consumption, further efforts are however needed both to remain within the levels set for the 2020 energy efficiency

	target and in view of the new 2030 objectives.[159]
	Primary energy consumption registered a small decrease, moving to 147.5 Mtoe in 2018. However, final energy consumption increased slightly to 116.5 Mtoe in 2018. [160]
Energy savings	In the period 2014-2016, it had made 18% of the total savings it had committed to achieve over the 2014 to 2020 period.[46]
2030 target	Italy intends to pursue an indicative reduction target for 2030 of 43% for primary energy consumption and of 39.7% for final energy consumption. With respect to the reference PRIMES (Price-Induced Market Equilibrium System) 2007 scenario. With regard to the absolute level of energy consumption for 2030, Italy is pursuing a target of 132.0Mtoe of primary energy and 103.8Mtoe of final energy.[161] The proposed contribution towards the 2030 collective EU energy efficiency target, appears to be of sufficient ambition. The planned policies rely on instruments already partly existing, which have the potential to be stepped up and completed.[162]
	By contrast, with regard to the absolute level of energy consumption for 2030, Italy is pursuing a target of 125.1Mtoe of primary energy and 103.8Mtoe of final energy, following the trajectory indicated in the following figure, starting with the estimated consumption for 2020.[161]
3 Energy security and interconnection	
Interconnection	Interconnection capacity is currently primarily located at the country's northern border (4 lines with France, 12 with Switzerland, 2 with Austria, 2 with Slovenia). In total, there are 7 circuits at 380kV, 9 circuits at 220 kV and 3 circuits at 150/132kV on the northern border. There is also a direct current connection with Greece and one that connects Sardinia and the peninsula with Corsica. Sardinia is also connected to Corsica by an alternating current cable. A 220kV double circuit cable connects Sicily with Malta.[159]
	According to NECP, Italy's interconnectivity level in 2030 will reach 10%.[161]
Energy security target 2030	In terms of security of supply, the aim is, on the one hand, to become less dependent on imports by increasing renewable sources and energy efficiency and, on the other hand, to diversify sources of supply (for example through the use of natural gas, including LNG, with infrastructure consistent with the scenario of full decarbonisation by 2050). National 2030 energy security targets: increasing the diversification of energy sources and supply thereof from third countries, with a view to reducing energy import dependency; increasing the flexibility of the national energy system; addressing constrained or interrupted supply of an energy source, for the purpose of improving the resilience of regional and national energy systems, including a timeframe for when the objectives should be met; [161]
Trade deficit	The Italy energy dependence constituted 83,3% in 2005 and 76,9% in 2017.[47]
	In 2018, Italy's energy import dependency was 76,3% [48]
Electricity generation capacities	In 2018 66% of total produced electricity in Italy was delivered from conventional thermal power plants,17.6% from hydro, 8.2% from solar, 6.2% from wind and 2% from geothermal and other sources.[49]
4 Integrated electricity market	
Wholesale electricity market	GME (Italian Energy Markets Operator) operates power, gas and environmental markets. On the power market platform managed by GME (also known as Italian Power Exchange, IPEX), producers and purchasers sell and buy wholesale electricity. With reference to power, GME operates a forward physical market (MTE), a market for the trading of daily products (MPEG) with continuous trading mode, a day ahead auction market (MGP), an intraday auction market (MI) based on 5 sessions. It also operates on behalf of the Italian TSO Terna a platform for ancillary services.[163] In February 2015 Multi-Regional Coupling (MRC) was started on the North Italian border with France, Austria and Slovenia.[164]

Domestic electricity market	The 2017 national strategy – currently under revision – proposes to narrow the price gap between Italy and European peers through, among other measures, the full liberalisation of final markets and the progressive reduction of system charges.[159]
Intelligent metering systems	The smart metering system is in place. The authority established the functional requirements for low-voltage smart meters and performance requirements for associated second-generation smart electricity metering systems ('2G meters').[161]
Tariffs	The phasing out of the regulated tariffs in the energy sector has been postponed from 2019 to mid-2020.[159]
5 Research, innovation and competitiveness	
R&I strategy	Single overarching strategy: National Research Programme 2014-2020 (approved in 2016)[51]
Innovation performance	Italy is a moderate innovator.[52]
National target	R&D target: 1,53% of GDP[159] Italy is not on track to meet its EU2020 target, as, R&D intensity would need to grow at more than double the growth rate of the current trend. In 2017, R&D intensity in Italy was 1.35% of GDP[159]
Total R&D expenditure	In 2007, R&D intensity in Italy was 1.13% of GDP[159] In 2017, R&D intensity in Italy was 1.35% of GDP[159]
	In 2018, R&D intensity correspond to 1.39% of GDP. Italy is not on track to meet its R&D expenditure target [160]
Public R&D expenditure	37 % of the total are public investment (0.50% of GDP) [159]
	Public R&D expenditure reached 0.5% of GDP in 2018, the second lowest level among EU15 countries. [160]
Business expenditure in R&D	61% of the total are private investment (0.83% of GDP) [159]
	Business R&D expenditure reached 0.86% of GDP in 2018 [160]
Academia-business links	Research and innovation (R&I) in the southern regions are mainly supported by programmes cofinanced through EU Structural Funds, but they are not able to reverse the gap in R&I. This is mainly because the enterprise base in the South is weak and its demand for innovation is scarce. No significant measures have been taken to address this challenge. Since 2017 most of the R&D growth is due to the activity of new firms investing in R&D, while firms that were already R&D performers recorded stable expenditure. [160]
R&D policy coordination	The public R&D is coordinated by the ministry of economic development (MiSe) together with the ministry of education, universities and research (MIUR) Public schemes supporting innovative investment remain temporary and still lack an in-depth assessment of their efficiency. R&D tax incentives generally have a positive but modest effect on investment in intangibles [159] The divergence in investment between the North and the South is particularly marked for intangibles and innovation. [159]
	The previous plan Impresa 4.0 (National Industry 4.0 Plan) has been renamed Transizione 4.0, to signal the new focus on green investment in addition to innovation. Tax incentives to promote investment in physical and intangible capital have been extended for the next years and transformed into a tax credit, which could increase the number of beneficiary firms by up to 40%. The new tax credit also intends to support the circular economy and environmental sustainability, and spending in skills enabling the digital transition. Investment in key technologies, such as Artificial Intelligence and cybersecurity, has been announced in the National Innovation Plan 2025, next to key initiatives in the field of High Performance Computing. [160]

	The South lags behind in R&D and innovation. R&D expenditure in percentages of GDP is highest in northern Italy. The best performing regions (Piedmont, Emilia-Romagna, and the Autonomous Province of Trento) spend more than three times as much on R&D as the lowest performing, Calabria. [160] Research and innovation (R&I) in the southern regions are mainly supported by programmes cofinanced through EU Structural Funds, but they are not able to reverse the gap in R&I. This is mainly because the enterprise base in the South is weak and its demand for innovation is scarce. No significant measures have been taken to address this challenge. So far, the potential of the smart specialisation strategies to foster innovation has not been fully exploited in the South. [160]
	The discontinuity of policies to support knowledge transfer and innovation ecosystems hampers innovation performance. [160]
Funding from Horizon 2020	9.07% of the overall Horizon funding[54]
Research infrastructures roadmap	Roadmap published in 2011, updated in 2017 [55]
Smart specialisation priority areas	1.Key Enabling Technologies 2.Manufacturing & industry 3.Sustainable innovation 4.Agriculture, forestry & fishing 5.Information & communication technologies [165]
Just Transition Investment Guidelines	The Just Transition Fund can support industrial transitions away from coal. Coal related activities are very limited in Italy. However, they are a significant source of GHG emission and are concentrated in a few areas. Sardinia has the only coal resources exploited (by Carbonsulcis SpA), located in a poor socioeconomic context. In Apulia, there is a steel mill (ILVA) employing 10,000 employees (double if considering ancillary firms). In the same area, there is also one of the biggest coal power plants in Italy. This area is economically strongly dependent on coal power plants and iron/steel production, which are significant sources of GHG emissions. Measures could support SMEs and reskilling, in an integrated local strategy including decontamination and urban regeneration. [160]

11.9 Country Profiles for Desk 6 (Ireland, Portugal)

 **IRELAND**	**Desk 6**
	Responsible partner: UCD, IERC

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" within D6.1 *"Review of EU strategic priorities and relevant policy developments"*	IPE	31.05.2019
2.	1st content update from [168]	IPE	27.03.2020
3.	2nd content update from [48], [74], [75], [45], [42]	IPE	06.04.2020
4.	3rd content update from [180]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1 Climate action, decarbonising the economy	
1.1 Decarbonization and energy strategies	
National strategies	Ireland is currently embarking on an "energy transition". The Government's energy White Paper (2015)[166] sets out a framework for energy policy to 2030 and outlines a transition to a low carbon energy system for Ireland by 2050. Significantly, it is the first time an Irish government has outlined a path to the eventual elimination of fossil fuels from our energy system. The Government has also recently detailed its commitments to transition Ireland to a low-carbon and climate-resilient society in the National Development Plan 2018-2027[167]
	Ireland adopted the Climate Action Plan 2019, which represents a major step towards more ambitious policies and measures to advance in the transition towards a climate neutral economy. The plan should help steer public, business and household investment towards low greenhouse gas projects. However, the impact of the plan on actual investment decisions will materialise fully only once the implementation of the range of measures and policies progresses over the coming years. [168]
GHG target 2020	National greenhouse gas (GHG) emissions target: - 20% in 2020 compared with 2005 (non-ETS).[169] National projections indicate that cumulated emissions (on the basis of existing measures) over the 2013-2020 compliance period will exceed allocations by 16 million tons of CO2 equivalent and that emissions in 2020 will be around their 2005 level, i.e. 20 percentage points short of the reduction target.[169]
	National projections indicate that cumulated emissions (on the basis of existing measures) over the 2013-2020 compliance period will exceed allocations by around 8 million tons of CO2 equivalent and that emissions in 2020 will be only about 5% lower than the 2005 level, i.e. around 15 percentage points short of the reduction target. [168]
GHG target 2030	According to Effort sharing regulation 2030 target which requires Ireland to reduce its emissions by 30% by 2030 (relative to 2005 levels). Not reaching 2020 target meant that Ireland will need to buy allocations from other Member States in surplus in order to comply with the Effort Sharing Decision and it will put Ireland in a difficult starting position for the 2021-2030 compliance period under the Effort Sharing Regulation.[169]
	According to NECP, Ireland's 2030 GHG target is to reduce emissions from sectors outside the EU's Emissions Trading System by 30% (relative to 2005 levels) by 2030.[170]
1.2 Uptake of RES	

RES 2020 target	Ireland will miss its 16% target and reach a minimum of 12.3% and maximum of 14.3% by 2020.[169]
	National projections indicate that Ireland's overall achievement approximately 13% in 2018. [168]
RES 2030 target	NECP sets the ambition levels of achieving a 34% share of renewable energy in energy consumption by 2030. This target is above the share of 31% in 2030 that results from the formula contained in Annex II of the Governance Regulation. [170]
	The Climate Action Plan sets a new 70% target for renewable electricity by 2030. [168]
National support schemes	In Ireland, electricity from renewable sources was mainly promoted through a feed-in-tariff scheme (REFIT) until 31 December 2015. Currently there is one support scheme i.e. subsidy for the purchase and installation of PV and battery storage, while another new support scheme i.e. tender is expected to take place in 2019.[39]
	The decision to raise the shadow price of carbon in the Public Spending Code will enable Ireland to better integrate climate impacts in public investment decisions. Work also continues towards the adoption of a new Renewable Electricity Support Scheme. [168]
Connection of RES to the grid	Under the Group Processing Approach (GPA) connection capacity has been reserved for renewable generation, including enough to specifically meet the 40% RES in electricity target in the context of the overall target addressed to Ireland under Directive 2009/28/EC. To date, there have been three 'Gates' provide total capacity of 5573MW renewable generation. In addition, certain providers of system services under the DS3 Programme (Delivering a Secure, Sustainable Electricity System) will be eligible and prioritised for a connection offer under the non-GPA process, until the enduring connection policy in line with the provisions of the new RES support scheme is in place. The DS3 programme is a multi-annual programme by EirGrid which envisages to ensure that the power system can be operated with increasing amounts of variable non-synchronous renewable generation over the coming years. There is also a policy that aims to facilitate renewables by providing for grid connections outside the gate process for certain small, renewable, low carbon generators. [39]
RES in transport	More than 99% of RES in transport in 2017 was from bioenergy, almost 90% was from biodiesel and 10% was from bio gasoline. • 84% of liquid biofuels used in transport in 2017 were imported. • Less than 1% of renewable transport energy is from electricity. Most electricity used for transport is used by DART (Dublin Area Rapid Transit) and Luas, but EVs are growing quickly from a low base. In 2017 RES in transport stood at 7.4%, compared to the 2020 target of 10%.[172]
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 7.17% [42]
	The Climate Action Plan predicts of having close to one million electric vehicles on Irish roads by 2030. [168]
	The National Development Plan 2018-2027 has committed to promote urban compact growth, to transit to low emission buses fleets and to electrify partially the Dublin Commuter Train network. [168]
	In the transport sector the NECP sets out actions to accelerate the penetration of electric vehicles into sales of cars and vans on the route to reach 100% of new vehicle sales by 2030[170]
Support of RES in transport	In Ireland, the support scheme for renewable energy sources used in the transport sector is a quota system. This scheme obliges suppliers of fuels to ensure that biofuels make up to a defined percentage of the company's total annual sale of fuel.[39]
	The new tax on emissions of nitrogen oxide (NOx) from passenger cars, to be introduced from January 2020, should reduce the incentives to buy diesel cars, in particular older imported cars. The Climate Action Plan includes a number of measures to promote the early uptake of electric vehicles, including an expansion of the charging network and tax and subsidy policies. [168]

Charging points	ESB (leading Irish utility company) has developed an island of Ireland-wide charging infrastructure of 1200 public charge points. (about 900 of these are in the Republic). ESB state that fast charge points are located every 50km on all major inter-urban routes. But the problem can be that some of them are out of order. Charging is currently free of charge– electric car owners have to register and get a card to use the chargers.[173] According to Eurostat data, there are 74.83 EV charging points per 100000 inhabitants in Ireland in 2017 (EU rank 6 of 28).[43]
Plug-in vehicles	The share of newly registered plug-in electric vehicles (including Battery Electric Vehicles) and Plug-in hybrid electric vehicles) in the 2017 was 0.72% (EU rank 14 of 28).[53] There were 4825 electric cars in Ireland on the road at the start of 2019. (Out of a total of 2.7 million vehicles). The government currently has a target that electric vehicles will make up 10% of all vehicles on the road by 2020 – that would mean about 230000 electric vehicles on the road.[173]
	Share of newly registered plug-in electric vehicles in the 2018 was 1.6% [45]
2 Energy Efficiency	
Energy efficiency indicative target	Ireland indicative energy efficiency target for 2020 is 13.9Mtoe expressed in primary energy consumption (2.7Mtoe of savings corresponds to 20% efficiency target) and 11.7Mtoe expressed in final energy consumption. [93] According to Eurostat data primary energy consumption in Ireland in 2017 was 14.41Mtoe[174] and final energy consumption - 11.76Mtoe. [175]
	In 2018, Ireland's primary energy consumption was 14,5 Mtoe [74] and final energy consumption was 12,3 Mtoe [75]
	National projections indicate that Ireland is on track to fall short of its energy efficiency target by about 4 percentage points. [168]
	Ireland will contribute towards the EU wide target of achieving at least 32.5% improvement in energy efficiency by 2030[170]
Energy savings	In 2016, it had made 28% of the total savings it had committed to achieve over the 2014 to 2020 period. [46]
2030 target	Since Ireland has not provided a single value for its national contribution for energy efficiency, the assessment of Ireland's ambition is done on the basis of the two scenarios which follow the international fuel and EU ETS carbon price assumptions recommended by the EC. Overall, taking into account both options provided in the NECP plan, Ireland has set an unambitious contribution, which goes in the opposite direction to what is required at EU level to collectively reach the Union's 2030 energy efficiency targets for both primary and final energy consumption.[171]
	According to NECP, Ireland will deliver primary energy savings of 62,171GWh by 2030. [170]
3 Energy security and interconnection	
Interconnection	Ireland's geographical location brings challenges in terms of interconnection with neighbouring countries. Ireland is exclusively connected to the United Kingdom through two electricity interconnectors: The 300 MW North-South interconnector, linking the electricity systems of Ireland and Northern Ireland, and the 500 MW East-West Interconnector connecting Ireland and Wales (United Kingdom). EirGrid owns and operates both interconnectors. Ireland is currently not meeting the indicative EU electricity interconnection target of at least 10% of installed capacity by 2020; its current level of interconnection is 7.4%. When the UK leaves the EU, Ireland will have no direct electrical interconnection with the rest of the EU. 700MW connection with France is expected to be ready by 2025.[170]
Energy security target 2030	In 2017, Ireland's total domestic energy production reached a new peak at 4.9Mtoe, nearly tripling over the past decade. However, Ireland still imports most of its energy needs, as energy production only covers 35% of Total Primary Energy Supply. The largest indigenous energy source is natural gas, representing more than half (58.7%) of total domestic production in 2017. [170] The United Kingdom's expected withdrawal from the EU comes across as a key risk for Ireland but due to ongoing uncertainty, the exact impact on market functioning is

	not yet known.[176]
	The 700 MW Celtic interconnector between France and Ireland, with a total cost of €900 million, will be the first electricity link between Ireland and the European continent. In 2019, it received a €530 million grant from the Connecting Europe Facility (CEF) to fund its construction work. It is expected to be operational in 2025/2026 and enable the Irish system to receive a high share of variable renewables in its electricity supply. Three other electricity interconnection projects with the UK, eligible under CEF, might also improve the security of energy supply in Ireland. [168]
Trade deficit	Ireland was the 10th most energy dependent EU Member State in 2016, importing 69.1% of the energy it consumed, a sharp decline from 2015 when it imported 88.6% (4th most dependent). This consumption level further declined to 66% in 2017.[170]
	In 2018, Ireland's energy import dependency was 67,4% [48]
Electricity generation capacities	The generation portfolio in Ireland is still heavily reliant on fossil fuels. In 2018 68.3% of total produced electricity in Ireland was delivered from conventional power plants (utilizing mostly natural gas), 28.6% from wind and 3.2% from hydro power plants.[49]
	Moneypoint coal-fired power plant is planned to be closed in 2025. [168]
4 Integrated electricity market	
Wholesale electricity market	In Ireland, the all-island wholesale Single Electricity Market (SEM) has been in place since 2007. It is regulated by the SEM Committee. I-SEM (Integrated Single Electricity Market) replaced the SEM on 01 October 2018. The Single Electricity Committee (SEM Committee) is the decision-making body for the I-SEM. It comprises representatives from regulators in Northern Ireland (the Utility Regulator) and the Republic of Ireland (the Commission for the Regulation of Utilities) and two independent members.[177]
Retail electricity market	Similar to other EU countries, the electricity market in Ireland was liberalized and opened to competition in 2000 as a result of EU directive 96/92/EC. Today, the Irish electricity market is governed by the Internal Market in Electricity Directive 2009/72/EC, which has introduced the common rules for the generation, transmission, distribution and supply of electricity in order to create competitive, secure and environmentally sustainable markets.[178]
Intelligent metering systems	ESB Networks announces initial roll out locations for Ireland's electricity meter upgrade programme (3 July 2019). The meter upgrade programme will commence in September of this year across two geographic areas in the midlands and in Co Cork. 20,000 meters will be installed by the end of this year. ESB Networks then plans to replace 250,000 meters between autumn 2019 and the end of 2020, with a further 500,000 meters each year from 2021 to 2024.[179]
Tariffs	Ireland has day-night tariff system.
5 Research, innovation and competitiveness	
R&I strategy	Single overarching strategy: Strategy for research and development, science and technology, 2016-2020 (Innovation 2020) [51]
	The cross-government strategic framework Future Jobs Ireland was launched in 2019 to define a new economic pathway for Ireland. This framework aims to support innovation and technological change, improve the small and medium enterprises (SME) productivity, enhance skills, increase labour force participation and smooth the transition to a low carbon economy. [168]
Innovation performance	Ireland continue to improve in international innovation rankings, most recently climbing from 10th place in 2013 to 8th place in 2015 in the EU Innovation Union Scoreboard. Ireland is a strong innovator[52]
National target	Committed to increasing public and private investment in research to reach Ireland's intensity target of 2.5% of GNP by 2020. It will be difficult for Ireland to achieve its 2020 target. In 2017, IE had an overall public and private R&D intensity of 1.05% of GDP. [169] In 2017, IE had an overall public and private R&D intensity of 1.05% of GDP. [169]

Total R&D expenditure	In 2007, R&D intensity reached 1.23% of GDP. [53] In 2017, R&D intensity reached 1.05% of GDP. [53] Business R&D expenditure is increasing, while its intensity remains below the EU average. The balance between the public and private R&D intensity also varies across EU countries, with only eight Member States where the share of R&D financed by government is below 30% and Ireland is one of them[67]
	In 2018, Ireland's R&D intensity (gross domestic expenditure on R&D (GERD) as a share of GDP) was 1.15%. [168]
Public R&D expenditure	Public R&D intensity stood at 0.3% of GDP in 2017.[169]
	In 2018, public expenditure in R&D corresponded 0.29% of GDP [168]
Business expenditure in R&D	Business R&D expenditure increased from EUR 1.5 billion in 2006 to EUR 2.2 billion in 2017. However, 64% of total business expenditure is by foreign firms operating in a few sectors. In contrast, the R&D efforts of most domestic firms remain moderate, albeit increasing.[169]
	Business R&D intensity stood at 0.7 % of GDP (1.2 % of GNI*) in 2017, below the EU average of 1.3 %.[169]
	Business R&D (BERD) in Ireland amounted to almost €2.8 billion or 0.86% of GDP in 2018. [168]
Academia-business links	Cooperation between firms and public research centres continues to develop but faces challenges. The first two calls for collaborative project proposals under the Disruptive Technologies Innovation Fund in 2018 and 2019 allocated €140 million for 43 projects involving collaborative partnerships (comprising of 159 organisations) between industry and SMEs, and public research bodies, in applying industrial research under the six themes of the revised Research Priority Areas, in areas such as health, climate action, food, ICT and manufacturing. Also, Innovation 2020 aims to double private funding of R&D in the higher education sector to €48 million by 2020. However, although collaboration between Science Foundation Ireland (SFI) and the business sector rose between 2013 and 2017, an increasing share of this collaboration has gone to multinational firms while the share of SMEs has declined. [168]
R&D policy coordination	Foreign firms operating in Ireland tend to benefit more from public sector R&D support. Stronger linkages between multinationals and domestic firms could help improve the diffusion of innovation throughout the economy. In addition, cooperation between firms and public research centres is improving although much work lays ahead in this area. New initiatives are being launched to foster business research and innovation.[169]
	While there are many strong elements in Ireland's research and innovation system, some weaknesses need to be addressed. In particular, this concerns the amount of R&D funding, the structure of public support for business R&D and cooperation between firms and research bodies. [168]
	A mid-term review of Innovation 2020 suggests that most of its objectives are on course to be achieved. Progress so far includes the creation of five new research centres by Science Foundation Ireland and the establishment of a Disruptive Technologies Innovation Fund, with a total value of €500 million until 2027, to encourage collaboration between industry including large companies and multinationals but especially SMEs and the research sector in developing and deploying such technologies and applications on a commercial basis. [168]
	While the R&D tax credit provides valuable support, more priority for direct funding instruments could help stimulate research and innovation and improve productivity of Irish firms especially SMEs [168]
Funding from Horizon 2020	By the end of 2017, Ireland had secured funding of €424 million in Horizon 2020 funding. Ireland also received around €600 million under the previous EU Research Framework Programme FP7. Up to now, Ireland received 1.88% of EU funding[67]
Research infrastructures roadmap	National roadmap with identified ESFRI projects was published in 2007. [55]

Smart specialisation priority areas	1.Manufacturing & industry 2.Information & communication technologies 3.Energy production & distribution 4.Human health & social work activities 5.Key Enabling Technologies [180]
	Ireland's transition away from carbon-intensive sources of energy towards more sustainable, renewable energy sources will have a significant impact in the Midlands region and the workers in its electricity generating industry. Its peat burning power stations will cease to operate by the end of 2020, potentially affecting around 4,000 jobs. Workers affected by this transition would need to be equipped with new and in-demand skills to increase their employability prospects and receive tailored support by employment services to find new employment. Based on this preliminary assessment, it appears warranted that the Just Transition Fund concentrates its intervention on that region. Key actions of the Just Transition Fund could target in particular: upskilling and reskilling of workers; job-search assistance to jobseekers; productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; the creation of new firms, including through business incubators and consulting services; investments in research and innovation activities and fostering transfer of advanced technologies; investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair and recycling. [168]

 **PORTUGAL**	**Desk 6**
	Responsible partner: UCD, IERC

Document history:

No.	Content / Changes	Partner	Date
1.	Development of "Progress towards the Energy Union objectives" due to Portugal's inclusion in PANTERA Desk 6	IPE	18.03.2020
2.	1st content update from [182]	IPE	19.03.2020
3.	2nd content update from [48], [45], [42]	IPE	06.04.2020
4.	3rd content update from [189]	IPE	21.04.2020
5.	4th content update from NECP	IPE	14.10.2020

Category	Description
1. Climate action, decarbonising the economy	
1.1 Decarbonisation and energy strategies	
National strategies	Portugal's "Roadmap for Carbon Neutrality 2050" main objective is to identify and analyse the implications associated with technically feasible, economically viable and socially accepted alternative trajectories, thus allowing the Portuguese economy to reach the objective of carbon neutrality by 2050 [181]
	The implementation of the Portugal 2020 strategy is well underway and a reprogramming aimed at assigning additional funding to investments in innovation was conducted in 2019. [182]
GHG target 2020	Greenhouse gas emissions target: maximum increase by 1% between 2005 and 2020. [183] According to the latest national projections based on existing measures, non-ETS emissions will decrease by 17 % between 2005 and 2020. [183]
GHG target 2030	According to Effort sharing regulation and NECP 2030 target, which requires Portugal to reduce its emissions by 17% by 2030 (relative to 2005 levels). Target is expected to be achieved. [185]

	Portugal's GHG emissions per capita are below the EU average and the country is on track to achieve its Effort Sharing targets. The energy and transport sectors are the main GHG emitters and thus remain key sectors to decarbonise. [182]
1.2 Uptake of renewable energy resources (RES)	
RES 2020 target	Portugal is above the indicative trajectory to meet its 2020 binding target of a 31 % renewables share in final energy consumption. [183] In 2017, the indicator constituted 28.1%. [38]
	Provisional Eurostat data for 2018 show that Portugal achieved an overall renewables share in final energy consumption of 30.3 %, which puts it 0.7 p.p. away of achieving its renewables target of 31% by 2020. [182]
RES 2030 target	In the NECP, Portugal has set a contribution to the EU renewable energy target of at least 47% in gross final consumption of energy for 2030, significantly above the 42% share that results from the formula of Annex II of the Governance Regulation. [185]
National support schemes	In Portugal, electricity from renewable energy plants registered until 7 November 2012 is promoted through a feed-in tariff. Since then, support to new RES plants can be provided through a general regime, i.e. Wholesale Electricity Market (in Portuguese MIBEL), or under the guaranteed remuneration system. The latter is contingent upon the capacity allocated through public tender initiative. Yet, tender rules have never been published, nor has any auction initiative been launched. The unique remuneration regime for electricity produced from small production installations (UPP) and for self-consumption (UPAC), came into force in January 2015 and is based on a bidding model in which producers offer discounts to a reference tariff. [39]
Connection of RES to the grid	Access of electricity from renewable sources to the grid shall be granted according to the principle of non-discrimination and priority shall be given to electricity produced from RES (except for hydro plants with an installed capacity exceeding 30 MW). The obligation to purchase the electricity generated from renewable sources in the period they benefit from the FiT has created favourable conditions for the deployment of RES-E in the past years. Grid operators are generally obliged to develop the grid system. However, plant operators do not have the right to demand grid expansion. [39]
RES in transport	The penetration of renewable energy in transport sector in Portugal according to Eurostat data in 2017 was 7.9% [40]. The target according to the first Renewable Directive RED I [41] is 10%.
	Share of energy from renewable sources in transport sector according to Eurostat data in 2018 was 9.04% [42]
	According to NECP, 2030 target for RES in transport: 20% [185]
Support of RES in transport	In Portugal, there are two support schemes for the use of renewable energy sources in the transport sector: a tax exemption to small producers of biofuels (PPDs) and a biofuel quota for companies supplying fuels for consumption in the market. [39]
Charging points	According to Eurostat data, there are 32.2 EV charging points per 100000 inhabitants in Portugal in 2017 (EU rank 14 of 27). [43]
Plug-in vehicles	The share of newly registered plug-in electric vehicles (including Battery Electric Vehicles) and Plug-in hybrid electric vehicles) in the 2017 was 1.91% (EU rank 6 of 28) [44]
	Share of newly registered plug-in electric vehicles in the 2018 was 3.5% [45]
2. Energy Efficiency	
Energy efficiency indicative target	Indicative energy efficiency target for 2020 is 22.5 Mtoe expressed in primary energy consumption and 17.4 Mtoe expressed in final energy consumption. [183] In 2017, Portugal's primary energy consumption was 1.3 % higher than the target level (22.8 Mtoe). Regarding the final energy consumption, Portugal seems to be 4.9 % below the target for 2020 (16.6 Mtoe). Portugal still need efforts to keep energy consumption in check in the coming years and ensure that the levels of primary and final energy consumption remain below the indicative national 2020 targets. [183]
	Based on provisional Eurostat data for 2018, the primary energy consumption (22.6 Mtoe) stood at a slightly higher level than the 2020 target level (22.5 Mtoe). Regarding the final energy consumption, Portugal seems to be 3.9 % below the target for 2020 (16.9 Mtoe while the target (2020) is 17.4 Mtoe). Therefore, Portugal still need efforts to keep energy consumption in check in the coming years and ensure that the levels of primary and final energy consumption remain below the indicative national 2020

	targets [182]
Energy savings	In 2016, it had made only 8% of the total savings it had committed to achieve over the 2014 to 2020 period. [46]
2030 target	Regarding energy efficiency, the proposed contribution is modest for primary and very low for final energy consumption. Reviewing of the energy efficiency contribution would also require adequate policies and measures delivering additional energy savings. There is still a wide margin to improve energy efficiency in the buildings and transport sectors. [184]
	In the NECP, Portugal has set its national energy efficiency contribution for 2030 at 15.6 – 21.5 Mtoe of primary energy consumption, which has been converted into final energy consumption of 14.4 – 14.9 Mtoe. The indicative national energy efficiency contribution to achieving the Union's binding energy efficiency target by 2030 is 35%. [185]
3. Energy security and interconnection	
Interconnection	Portugal's interconnection target 15%. According to the NECP data electricity grid interconnection level with neighbouring countries in 2017 was 10%. [185]
	Due to delays in the implementation of an additional electricity interconnection with Spain (Fontefría - Ponte de Lima), Portugal's electricity interconnection level can be expected to remain below the 10% target in 2020. If the project is implemented as currently expected, the target can be achieved by 2021. [182]
Energy security target 2030	Portugal has an ambitious objective of reducing energy import dependency to 65% by 2030, in light of the fact that Portugal has at present an import dependence of 80%. However, this level of ambition is realistic given the envisaged deployment of renewable energy. [185]
Trade deficit	Portugal's energy dependence fell from 85.6% in 2005 to 77.9% in 2017 [47]
	In 2018, Portugal's energy import dependency was 75,6% [48]
Electricity generation capacities	In 2018, 53.2% of total produced electricity in Portugal was delivered from conventional power plants, 23.2% - from hydropower plants, 21.6% from wind, 1.7% from solar, 0.4% from geothermal and other sources. [49]
	The recent Portuguese solar photovoltaic auction set the world price record for the solar energy and confirmed the increasing economic competitiveness of this technology and its potential to further expand Portugal's renewables generation capacity, which today is largely composed of hydro and onshore wind. [182]
4. Integrated electricity market	
Wholesale electricity market	Since 2012, support to new RES plants can be provided through a general regime, i.e. Wholesale Electricity Market (in Portuguese MIBEL), or under the guaranteed remuneration system. [39]
Retail electricity market	Portugal's retail electricity market was liberalised in 2016. [186]
Intelligent metering systems	In 2009-2018 period, more than one million smart meters have been rolled out across Portugal, but by 2019, only 2 out of 6 million households are equipped with smart meters [187] [188]
Tariffs	Dynamic tariff is available.
5. Research, innovation and competitiveness	
R&I strategy	Since the late 1980s, the R&I strategies have built on European Union Support Frameworks (CSF), which shape the R&I policy measures toolkit and the required financial commitments. The CSF currently in place, Portugal 2020, covers the period 2014-2020 and includes four thematic areas and seven regional programmes [51]
Innovation performance	Portugal is a moderate innovator. [52]
National target 2020	The government's goal is to reach an R&D intensity of 2,7 % of GDP by 2020. [181]
Total R&D expenditure	In 2007, R&D intensity reached 1.12% of GDP. [53] In 2017, R&D intensity reached 1.32% of GDP. [53]

	R&D intensity increased to 1.35% in 2018, still below the pre-crisis level of 1.58% of GDP. [182]
	The government announced (Portuguese Government Programme 2019-2023) an objective of R&D investment of 3% of GDP by 2030, but specific performance indicators in R&D are yet to be announced. [182]
Public R&D expenditure	The public funding level in 2017 reached 0.63% of GDP. [183]
Business expenditure in R&D	The level of business expenditure in R&D comprises 0.67% of GDP. [183]
Academia-business links	Portugal is supporting internationalisation and science-business cooperation in the circular economy and improving the implementation of its national and regional smart specialisation strategies. However, as concerns the latter, cooperation between the national and regional levels, along with a lack of smart specialisation skills among public and private actors, lead to governance bottlenecks. [182]
R&D policy coordination	Mutual trust between academia and business is not wide-spread, entrepreneurial research is not incentivised and knowledge transfer is not duly considered. To improve framework conditions for collaboration, Portugal has launched Interface Programme. Collaborative Laboratories were identified under the Interface scheme and the country's cluster policy was strengthened in 2017 to cover advanced technological sectors in the Competitiveness Clustersinitiative. Moreover, 'Portugal 2020' launches calls for co-promotion projects,establishing joint research and innovation centres, demonstration projects and pilot lines. [181]
	Portugal's monitoring is limited and does not measure innovation outcomes. Portugal has started to review its approach, with an emphasis on priorities for research and innovation investment and better coordination of national and regional strategies. [182]
Funding from Horizon 2020	Portugal received 1.79% of the overall Horizon funding according to the Horizon dashboard. [54]
Research infrastructures roadmap	National roadmap with identified ESFRI projects was published in 2014. [55]
Smart specialisation priority areas	1.Agriculture, forestry & fishing 2.Manufacturing & industry 3.Sustainable innovation 4.Human health & social work activities 5.Blue growth [189]
Just Transition Investment Guidelines	EC has proposed that the Just Transition Fund is used to enable Sines and Matosinhos regions and their people to support new economic activities, mainly in the sectors identified in their smart specialisation strategies, and to make their economies more modern and competitive based on sustainable investments, while alleviating the social costs of the transition by ensuring the employability and adaptability of workers affected from the plant closures. [182]