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REPORT ON LOW CARBON INVESTMENTS - SYNTHESIS REPORT

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1.2.1: Report on Low Carbon Investments Funding

Synthesis of regional baseline assessment reports on public funds supporting low carbon investments

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Partners involved

- PPn°1 - PP PIEMONTE
- PPn°3 - PP MAE
- PPn°5 - PP APEFVG
- PPn°4 - PP EIHP
- PPn°7 - PP EEE
- PPn°8 – AACM (task leader)
- PPn°9 - HSMD

Interreg CENTRAL EUROPE

Priority:	2. Cooperating on low-carbon strategies in CENTRAL EUROPE
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Contents

Contents

1. INTRODUCTION

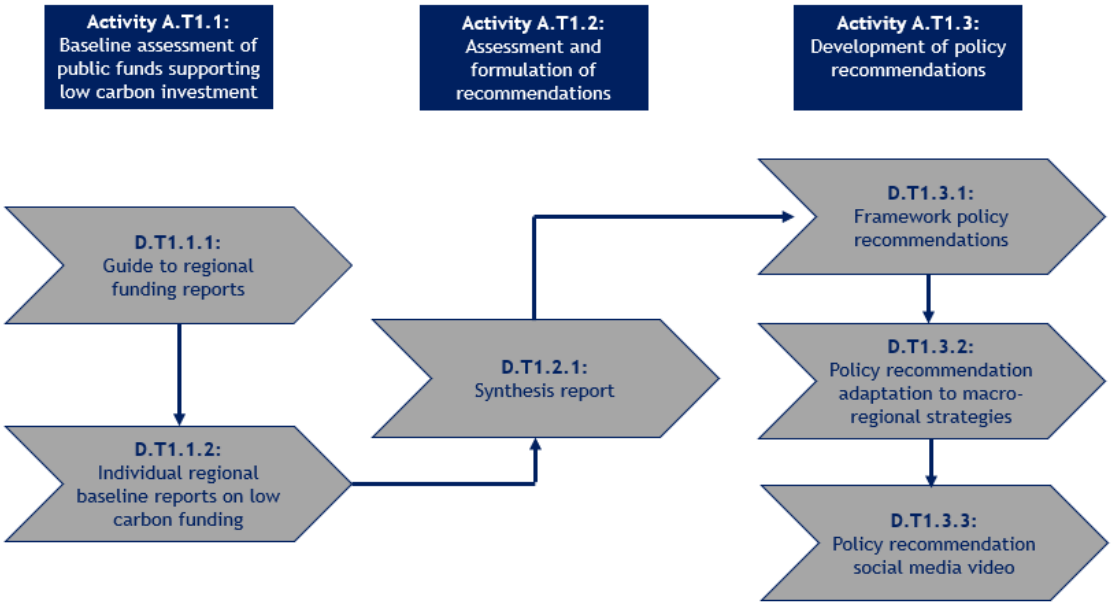
1.1. BACKGROUND

The overall objectives of Thematic Work Package 1 "Assessment of availability and use of public funds supporting climate change mitigation" (T1) is to deliver policy recommendations targeting mainly the macro-regional strategies (EUSDR, EUSAIR, EUSBSR, EUSALP) developed in Central Europe (CE) with particular focus on development of renewable energies (RES). Specifically, T1 aims to

i. conduct a structured assessment of the use of public funds dedicated to the development of the low carbon sector in seven selected target regions of PROSPECT2030 over the 2014-20 programming period;
ii. prepare based on individual reports developed by the Lead Partner (LP) and Project Partners (PPs) for each participating region a Synthesis Report; and
iii. develop policy concept and recommendations on the use of public funds for climate change mitigation, and thereby to provide policy inputs for the programming for 2021-2027 in the area of green economic transition. The policy recommendations will be adapted to fit the specific macro-regional strategies (EUSDR, EUSAIR, EUSBSR, EUSALP) of CE, and at the same time it will also be customised by the consortium partners in order that it can be taken into account in programming at regional national levels.

The structure of Thematic T1 is illustrated by Figure 1.

Figure 1: Elements of Thematic T1



Based on a Data Collection and Reporting Guide (D.T1.1.1) prepared under T1 earlier, each participating region has developed an individual assessment report on their respective region. The

participating regions and the PP responsible for the elaboration of the reports are given in the table below.

Table 1: Participating regions, PPs and linked individual reports

Region	PP	Abbreviated name of PP	Deliverable ID
Piemonte Region	LP	REGPIE	D.T1.1.2
Mazovia Region	PP3	MAE	D.T1.1.2
Split and Dalmatia County	PP4	EIHP	D.T1.1.2
Friuli-Venezia Giulia Region	PP6	RAFVG	D.T1.1.2
EcoEnergyland	PP7	EEE	D.T1.1.2
Southern Great Plain Region	PP8	AACM	D.T1.1.2
Saxony-Anhalt	PP9	HSDM	D.T1.1.2

The starting point of T1 is a baseline assessment of the use of available funding for low-carbon investments in the seven participating regions from 2014 onwards. The funding schemes reviews by the seven regions include the followings in particular:

- Decentralised funds made available from the ESI Funds through the Partnership Agreements (national, sectoral or regional operational programmes);
- EU low-carbon initiatives (H2020, LIFE, EFSI, ELENA, Jessica, EBRD GEFF schemes);
- National/federal funding schemes (grants, subsidized loans, feed in tariffs, building integrated RES schemes); and
- Cooperation with private stakeholders (EPC, ESCO schemes, crowdfunding, venture capital, etc.).

The analysis, carried out by all Project Partners (PP) under the coordination of PP8, aimed to assess the appropriateness of funding policies, administrative procedures, planning and implementation structures, dedicated resources and impacts in environmental and economic terms. Where relevant, the environmental impacts addressed the whole lifecycle of the supported energy conservation measure (ECM) and renewable energy source (RES) projects. The economic analysis particularly focused on the cost-effectiveness of the use of grants and explored best practices concerning innovative low-carbon financing solutions leveraging to maximum extent private financial resources.

The data collection for the individual regional baseline reports was based on publicly available data and interviews. Compliance with the GDPR rules remained the responsibility of each Project Partner (PP) involved.

This document was updated twice in February 2020 and in December 2021. This final version contains the latest KPI-s of the partner regions and the new conclusions drawn from the numbers and the project partners shared experience.

1.2. OVERALL POLICY CONTEXT

The European Union (incl. the UK) consumes one fifth of the world's energy and the largest energy importer in the world, importing 53 % of its energy at an annual cost of around €400 billion.

Global energy consumption grew significantly in 2018, spurred by the sustained economic growth and rising demand in China, the world's largest energy consumer since 2009. Chinese energy consumption demonstrated its highest growth since 2012, mainly driven by power generation, strong industrial demand and increasing transport fuel consumption triggered by a growing vehicle fleet. Total energy consumption in the United States reached a record high of 2.3 Gtoe in 2018, up 3.5% from 2017, partially driven by weather conditions (hot summer, cold winter).

On the contrary, energy consumption decreased in the European Union (-1%) and in particular in Germany (-3.5%) partly due to decreasing consumption in the power sector, a milder winter, reducing final energy consumption, and energy efficiency improvements.

China is the main CO_2 emitter corresponding to 29% of world energy related CO_2 emissions in 2019, followed by the United States with 15% and the EU with 10%. Primary production of energy within the EU-28 in 2017 was slightly over 758 million tonnes of oil equivalent (Mtoe). This was only 0.1 % lower than the year before and continued the generally downward development observed in recent years.

The European Union aimed to reduce by 2020 its greenhouse gas emissions by 20% (from 1990 levels); increasing the share of renewable energy to at least 20 % of the consumption and achieving energy savings of 20 % or more. The 2030 climate and energy framework proposed new targets and measures to make the EU's economy and energy system more competitive, secure and sustainable. It includes targets for reducing greenhouse gas emissions and increasing use of renewable energies, and proposes a new governance system and performance indicators. The proposed overall commitment for reducing the greenhouse gas emissions is 40% by 2030 relative to 1990 levels, and the renewable energy target is at least 27% of energy consumption with flexibility for member states to set national targets.

The new European Commission's Green Deal sets out an ambitious agenda to place the EU on track for 'climate neutrality' – net-zero greenhouse gas emissions – by 2050 in order to avoid the worst impacts of climate change, global temperature rise must be limited to no more than 1.5°C, requiring global carbon emissions to decline to net-zero by the middle of the century. Key elements include legislation to bring the 2050 goal into law and ensure policy coherence with the target; and increasing the EU's 2030 emissions reduction target from 40 percent below 1990 levels to 50-55 percent. The Green Deal also identifies the need for wide-ranging reforms to the European Taxation Directive and the taxation of international transport fuels, the Emissions Trading Scheme (ETS) and fossil fuel subsidies in order to ensure better carbon price signals. Policies and investment would be targeted at the circular economy and low-carbon transport and energy infrastructure such as rail and waterways, smart transport networks, smart grids, hydrogen networks, carbon capture, storage and use, and electricity storage. A draft of accompanying reforms to help mobilize low-carbon finance and investment are also anticipated, as part of the EU's Action Plan on Sustainable Finance and the European Green Deal Investment Plan.

To support the transition to low carbon economy, the Union's European Structural and Investment Funds (ESIFs) and the European Fund for Strategic Investments (EFSI) have sought to improve the availability of finance for these investments. Over the 2014-2020 programming period, a total funding of € 461 billion (with national contribution a total of € 643 billion) was committed via the ESIFs. The next period a greater emphasis is expected to be placed on financial instruments, with rules being simplified to encourage greater and more specified participation.

1.3. ASSESSMENT CRITERIA

The key questions posed to identify conclusions and policy recommendations include in particular:

- Are the rationale and challenges of the energy transition process adequately communicated? Is there space for improving public awareness?
- What is the social acceptance of renewable investments? Are appropriate measures required in this respect?
- Are local stakeholders appropriately engaged?
- Are regional green governance structures in place? Where are the gaps?
- Regional strategy formulation and programming are supported by adequately national governments?
- Are there sufficient data to profoundly support programming activities and the utilization of public grants?
- Appropriateness of low-carbon funding policies (KPIs properly set, are regional demands met by national governments, do regional and national priorities form a cohesive framework?)
- What are the key areas in the low-carbon sector where transnational cooperation can bring a tangible added value to the cooperation between European regions?
- What is the focus of capacity development needs?
- What kind of platforms, tools, guides are deemed necessary to support the decision-making at various levels (i.e., policy, programming, investments)?
- How to characterise administrative procedures and institutions involved in the delivery of the funds to final beneficiaries (supportive, transparent, central/local levels, etc…)?
- What are the key targets for energy efficiency and renewable investments?
- What energy saving options are present?
- What is the efficiency of the use of public funds (resource efficiency, leveraging private funds)?
- What kind of innovative finance techniques are planned by the regions?
- What innovative cooperation networks are built to strengthen the regional/local energy independence?
- How the environmental/climate impacts (e.g., life cycle analysis) and economic viability of the use of public funds?
- What are the key research and innovation targets?

2. PRESENTATION OF THE PARTICIPATING REGIONS

The seven POSPECT2030 Partner Regions include two NUTS 1 (Mazovia and Saxony-Anhalt), three NUTS 2 (Piemonte, Friuli-Venezia Giulia, and the Southern Great Plain, one NUTS 3 (Split and Dalmatia County) level regions and a local non-administrative region (EcoEnergyLand). Table 2 below presents the territorial statistical classification of the participating regions.

Table 2: Participating Regions and their European territorial statistical classification (NUTS system)

Partner Region	PP	NUTS level	Comment
Piemonte Region	LP	NUTS 2	NUTS 1: Northwest Italy
Mazovia Region	PP3	NUTS 1	Broken into two NUTS 2 regions: - Warsaw Capital - Mazovia Region
Split and Dalmatia County	PP4	NUTS 3	NUTS 1: Croatia NUTS 2: Adriatic Croatia
Friuli-Venezia Giulia Region	PP6	NUTS 2	NUTS 1: Northeast Italy
EcoEnergyland	PP7	N/a	NUTS 1: Eastern Austria NUTS2: Burgenland
Southern Great Plain Region	PP8	NUTS 2	NUTS 1: Great Plan and North
Saxony-Anhalt	PP9	NUTS 1	Further divided into NUTS 3 regions

LP – Piemonte Region

Piemonte is the second Italian region by area, sixth by number of inhabitants (with 4 356 406 inhabitants). It is also the fourth region for exports, with a 10% share of the national total, and fifth by value of the gross domestic product (GDP), with about 143 billion euros total. The region economy is based on agriculture, mechanical industry, food industry and tourism. The final energy consumption in Piemonte has remained substantially constant over the last six years with values close to 10.5 Mtep. Natural gas and oil products still make up more than 60% of total consumption and, considering the way in which electricity and heat are produced, dependence on fossil fuels is still particularly high, albeit on a downward trend. The contribution of renewable sources, just under 2 Mtoe, is 18.5%.

PP3 - Mazovia

Mazovian Voivodeship is the largest of the sixteen Polish regions and covers an area of 35,558 km^2, which accounts for 11.4% of Poland's territory. Mazovian Voivodeship has the largest population in Poland with 5.4 million inhabitants, which constitutes about 14% of the total Polish population. The energy related data are available only on national level and in general view of regional level. The final energy consumption from official statistics in the Mazovia Region for 2016 is app. 22,612 GWh. The share of the regional consumption is around 7% of the total national final consumption. The amount of CO_2 emissions, based on energy consumption, was estimated to be an amount of app. 268.5 million tons per year.

Mazovian Voivodeship is one of the largest electricity consumers in Poland and the electricity is produced mostly from coal. In the Mazovian voivodeship, no natural gas mines are connected to the transmission and distribution pipeline system. This means that the entire supply of natural gas in Mazovia comes from the gas transmission system, fed by imported gas, or by gas from

domestic production located in different parts of Poland. The winter season is protected from PMG (underground gas storage), which is also located outside Mazovia. Economically, the Mazovian Voivodeship is full of contrasts. There are typically agricultural areas here, as well as regions with strong industrialization.

PP4 - Split-Dalmatia

Split-Dalmatia County is the largest Croatian county, geographically located in the southern part of the country and the central part of the Adriatic coast. The population of Split-Dalmatia County is 454,798 and it represents approx. 10% of the population of the Republic of Croatia, however, marks a negative trend in the number of inhabitants in the past years. The share of the regional economy in the national GDP is around 8.4%. Split-Dalmatia County is a touristic oriented county and the highest share of GVA on regional level is dedicated to wholesale and retail trade, transportation, accommodation and food service activities. Transport is highly road and maritime based at regional level with a significant increase in air passenger transport each year. The annual regional energy demand is approx. 5,607 GWh. The share of the regional consumption is 7% of the total national final energy consumption. The largest share is accounted for by crude oil and petroleum products, followed by electricity while minor shares are accounted for renewable energies, gas and derived heat. The share of renewables in the total final consumption is 11% and mainly covered by the residential sector, mainly due to use of wood for heating purposes since there are no district heating systems in Split-Dalmatia County. In terms of regional supply mix, electricity is generated by renewable energy sources solely, respectively hydro, wind and solar photovoltaic. The electrical energy generated per year is approx. 80% from hydro, approx. 18% from wind and approx. 2% from solar photovoltaic power plants. The total installed capacity of hydro power plants in Split-Dalmatia is 919 MW and is based on the hydropower system of the river Cetina. Concerning self-supply of electricity, the installed capacities in Split-Dalmatia County are producing almost double in relation to the actual electricity demand (generated capacity of 3,014 GWh/annum). Moreover, due to the absence of district heating plants electrical energy is used for heating purposes.

PP 6 – Friuli-Venezia Giulia

Friuli-Venezia Giulia is an autonomous region with a special statute. Namely, it can develop its own laws in specific fields of activity like urban planning, agriculture and forestry, industry and trade among the others. Energy is a shared competence with the State, thus new laws are subject to an agreement between the Regional Authority and the Central Government.

The region includes 215 municipalities and is currently divided into 18 Unioni Territoriali Intercomunali - UTI (inter-municipality unions) but it was previously divided into four provinces (Trieste, Udine, Pordenone and Gorizia) like most of the rest of Italy. In 2017, the regional GDP amounted to € 37.641 million contributing to about 2,2% of the national GDP (Eurostat 2019). Key sectors in the regional economy include wood-furniture, manufacture of metal products, manufacture of machinery and equipment, manufacture of electrical and non-electric household appliances, food and beverage industry, manufacture of other non-metallic mineral processing products, metallurgy and shipbuilding.

PP7 - Eco-Energy-Land

The Eco-Energy-Land (EEL), as the participating region in Austria, is an association of 19 municipalities on local administrative unit (LAU) level. EEL is situated in Burgenland which is a

NUTS2 level region. From the 7 participating regions EEL is the smallest with an area of 350 km2 and approx. 18,100 inhabitants. The region has a strong focus on agriculture and regarding the infrastructure has well-developed electricity grids and road transport but there is no gas grid and no rail network on site.
Due to the lack of respective infrastructure, the energy demand of the EEL is mainly based on biomass. The total energy demand of the EEL is estimated to a value of 547,266 MWh/annum and the total energy generation in electricity and heat plants amounts to 134,263 MWh/annum, thereof 20% electricity and 80% heat.

PP8 – Southern Great Plain (represented by AACM)
The Southern Great Plain (SGP) is one of the planning and statistical (NUTS2 level) regions in Hungary situated in the south – south-eastern part of Hungary. It is part of the so-called Hungarian Great Plain and includes three counties (NUTS3 level): Bács-Kiskun, Békés and Csongrád. With its total area of 18,337 km^2, the SGP region is the largest among the seven NUTS2 statistical regions in Hungary. The Southern Great Plain region is bordered by Romania and Serbia to the east and south, respectively.
The population of the region based on the latest estimate was 1,244,000 people representing approximately 12% of the total population of Hungary. The SGP is the 3rd largest Hungarian region regarding its population.

The share of the regional economy in the national GDP was 9.1 % in 2017. In the Southern Great Plain region agriculture with its 12% share of the total regional GVA plays an important role in economics. The regional share to the total number of employees at the national level is 8.9%. The share of the residential sector in the regional final energy consumption is higher (42%) than the national average (35%). The key renewable sources of the SGP Region include solar, geothermal, solid biofuel and agricultural residues-based biomass and biogas.

PP9 - Saxony-Anhalt
The region Saxony-Anhalt is located in de north-eastern part of Germany and with an area of 20,452 km^2 it makes up ~5.7 % of the total area of Germany. The northern part is mostly characterised by lowland while in the south-west the low mountain ranges of the Harz captivates the land. In the south-east it borders the urban area of Halle (Saale). In the south, next to the river Saale, the wine production area Saale-Ustrut is located. The total population of Saxony-Anhalt is 2,197,438 residents, which makes it the 6th lowest population in Germany.
The energy supply is mostly covered by natural gas, brown coal and renewable energy (power generation).

2.1. POTENTIALS FOR LOW-CARBON SECTOR DEVELOPMENT

The Europe 2020 strategy emphasises smart, sustainable and inclusive growth in order to improve Europe's competitiveness and productivity. For energy, the goals for 2020 are reaching the 20 % share of energy from renewable sources and improving energy efficiency by 20 %.

Reaching net-zero emissions requires the development and deployment of many low-carbon technologies. Some of these will offer 'continuous improvement' of existing processes – for

example measures to improve efficiency – whilst others might offer step changes in emissions intensity through radical process redesign – such as the circular economy – or the introduction of novel technologies such as carbon capture, utilization and storage (CCUS) or alternative energy carriers such as hydrogen. Both kinds of innovation are needed. Developing new, breakthrough technologies such CCUS or hydrogen could help heavy industries such as cement, steel and chemicals achieve deep decarbonization. However, investment costs are high meanwhile current carbon prices are not high enough to overcome this cost. Future carbon prices are uncertain due to questions regarding the further reform of the Emission Trading System (ETS) and in particular the availability of free allowances. This uncertainty about future prices makes planning of the necessary investment and funding difficult. Hydrogen faces similar challenges of high costs and uncertain demand. Ultimately, the development of new technologies depends on more than the carbon price, though this is important. Scaling these technologies is contingent upon investments in other sectors and other parts of the value chain – for example, to provide sufficient renewable electricity for hydrogen production or develop new markets for carbon. It also requires other development or repurposing of infrastructure for storage and transport of the gases. In most cases significant investments needed elsewhere 'along the value chain' in tandem with a 'widespread multi-disciplinary collaboration, including stronger regulations and effective carbon pricing.'

Table 3: Primary energy production of the Partner Countries in 2017

Country	Total production of primary energy in 2017 [Mtoe]	Total production of primary energy in 2017 per capita [Toe]
Austria	12.3	1.40
Croatia	4.2	1.01
Germany	115.8	1.40
Hungary	11.1	1.13
Italy	36.7	0.61
Poland	64.0	1.69
EU	758.2	1.48

2.1.1. Energy efficiency

The EU recognized that buildings are a main challenge, being responsible for approximately 40% of the final energy consumption and total CO_2 emissions. The European Commission has calculated that 75% of Europe's housing stock is inefficient and has noted with concern that renovation rates remain far too low to reach decarbonisation targets, with an annual renovation rate of 3% needed to accomplish the EU's ambitions. To this end, the updated Energy Performance of Buildings Directive (2018) requires Member States to devise long-term renovation strategies, aiming for decarbonisation by 2050. Building renovation has been an eligible cost under the European Regional Development Fund, the European Social Fund and the Cohesion Fund. Most countries have offered grant-based systems using ESIFs to contribute partly, or completely, to the costs of renovations. However, the scale of the renovations (implemented projects) shows that these grant-based funds in ERDF operational programmes are not enough, and there is a need for other sustainable financial instruments and revolving funds.

In all target regions building renovation and other - energy related - interventions (deep renovation, energy retrofit, connection to district heating network, maintenance or replacement of energy using devices) have an immense potential for energy saving. Another key issue in energy efficiency in the regions is to reduce the specific demand of fossil fuels (mainly natural gas) for heat generation or change the resource e.g. using solar photovoltaic energy, heat pumps, geothermal energy.

In Friuli-Venezia Giulia (FVG), the heating demand in buildings accounts for 31% of total energy consumption and a basic and economic level of residential building renovation would lead to a 20% reduction of energy needs. A more incisive retrofit scenario would lead to a reduction of more than 35% and with a deep renovation much more could be achieved. In the Southern Great Plain, the building sector represents over 40% of total final energy consumption and based on estimates has an overall energy saving potential ranging between 40% and 45%.

Saxony-Anhalt plans to reduce the emissions of 26.8 Mio. tonnes CO_2-equivalent compared to 1990 and further 4.5 Mio from 2020 to 2030. In order to reach these targets, in regional level greenhouse gases will be decreased by changing the energy mix exclusively to renewable energy sources, simultaneously with the reduction of the GHGs in the five biggest sectors (energy, transport, buildings, industry/economy as well as agriculture/land use/forestry/nutrition).

The EU agreed to set a common target of 10 % for the share of renewable energy (including liquid biofuels, hydrogen, biomethane, 'green' electricity, etc.) in the transport sector by 2020. The average share of energy from renewable sources in transport increased from 1.4 % in 2004 to 7.6 % by 2017. All regions defined their needs of energy efficiency in the transport sector not only for greater use of public transport and slow and electric mobility mostly in urban areas, but the development of rail and inland waterway networks for freight to decrease the intensity of road transport. Air and sea transport arguably face the greatest decarbonization challenges, as demand is increasing rapidly, and readily substitutable low-carbon technologies appear some way off. This field needs greater regulatory intervention, including bringing both sectors more fully into the ETS and examining options to tax international fuels, which is an ongoing and long process. However, this objective will also require an enhancement of the e-mobility charging infrastructure connected to the electricity grid, which currently needs to be further developed. Among the Partner Regions the relative share of renewable energy in transport fuel consumption was the highest in Austria with 9,7% and the lowest in Croatia with 1,2% (Source: ESIF 2014-2020: Fin. Implementation by Theme for a Member State (2019).

2.1.2. Renewables

The primary production of renewable energy within the EU-28 in 2017 was 226.5 million tonnes of oil equivalent (toe). The total production of renewable energy within the EU-28 increased by 64.0 % from 2007 to 2017, equivalent to an average increase of 5.1 % per year.

Among renewable energies, the most important source in the EU-28 was wood and other solid biofuels, accounting for 42.0 % of primary renewables production in 2017. Wind power was, for the first time, the second most important contributor to the renewable energy mix (13.8 % of the total), followed by hydro power (11.4 %). Although their levels of production remained relatively low, there was a particularly rapid expansion in the output of biogas, liquid biofuels and solar energy, which

accounted respectively for a 7.4 %, 6.7 % and 6.4 % share of the EU-28 renewable energy produced in 2017. Ambient heat (captured by heat pumps) and geothermal energy accounted for 5.0 % and 3.0 % of the total, respectively, while renewable wastes increased to reach 4.4 %.

Tables 4-9 provide comparative figures for the Partner Countries in

- Overall share of energy from renewable sources, 2013-2019 (%);
- Share of energy from renewable sources in transport, 2013-2019 (%);
- Share of energy from renewable sources in gross electricity consumption, 2013-2019 (%);
- Share of energy from renewable sources for heating and cooling, 2004-2019 (%);
- Primary production of renewable energy — solid biofuels and hydropower, in 2014 and 2019 (thousand toe); and
- Primary production of renewable energy — geothermal, wind and solar energy, in 2014 and 2019 (thousand toe).

Table 4: Overall share of energy from renewable sources, 2013-2019 (%) - Directive 2009/28/EC

	Year/Country	2013	2014	2015	2016	2017	2018	2019	2020 target
AT	Austria	32.8%	33.7%	33.5%	33.4%	33.1%	33.8%	33.6%	34.0%
HR	Croatia	28.0%	27.8%	29.0%	28.3%	27.3%	28.0%	28.5%	20.0%
DE	Germany	13.8%	14.4%	14.9%	14.9%	15.5%	16.7%	17.4%	18.0%
HU	Hungary	16.2%	14.6%	14.5%	14.3%	13.5%	12.5%	12.6%	13.0%
IT	Italy	16.7%	17.1%	17.5%	17.4%	18.3%	17.8%	18.2%	17.0%
PL	Poland	11.4%	11.5%	11.7%	11.3%	11.0%	11.5%	12.2%	15.0%
EU27_2020	EU27 from 2020	16.7%	17.5%	17.8%	18.0%	18.5%	18.9%	19.7%	20.0%
EU28	EU28	15.4%	16.2%	16.7%	17.0%	17.5%	18.0%	18.9%	20.0%

Table 5: Share of energy from renewable sources in transport, 2013-2019 (%) - Directive 2009/28/EC

	Year/Country	2013	2014	2015	2016	2017	2018	2019	2020 target
AT	Austria	9.7%	11.0%	11.4%	10.6%	9.7%	9.9%	9.8%	10.0%
HR	Croatia	4.4%	4.3%	3.6%	1.3%	1.2%	2.6%	5.9%	10.0%
DE	Germany	7.3%	6.9%	6.6%	7.0%	7.0%	7.9%	7.7%	10.0%
HU	Hungary	6.2%	6.9%	7.1%	7.6%	7.6%	7.7%	8.0%	10.0%
IT	Italy	5.4%	5.0%	6.5%	7.4%	6.5%	7.7%	9.0%	10.0%
PL	Poland	6.6%	6.2%	5.6%	3.9%	4.2%	5.7%	6.1%	10.0%
EU28	EU28	5.5%	5.9%	6.5%	6.9%	7.1%	8.0%	8.9%	10.0%

Table 6: Share of energy from renewable sources in gross electricity consumption, 2013-2019 (%) - Directive 2009/28/EC

	Year/Country	2013	2014	2015	2016	2017	2018	2019
AT	Austria	68.9%	71.1%	71.5%	72.5%	71.6%	74.2%	75.1%
HR	Croatia	42.1%	45.2%	45.4%	46.7%	46.4%	48.1%	49.8%
DE	Germany	25.3%	28.2%	30.9%	32.3%	34.6%	37.8%	40.8%
HU	Hungary	6.6%	7.3%	7.3%	7.3%	7.5%	8.3%	10.0%
IT	Italy	31.3%	33.4%	33.5%	34.0%	34.1%	33.9%	35.0%
PL	Poland	10.7%	12.4%	13.4%	13.4%	13.1%	13.0%	14.4%
EU28	EU28	25.3%	27.4%	28.8%	29.5%	30.7%	32.1%	34.2%

Table 7: Share of energy from renewable sources for heating and cooling, 2004-2019 (%) - Directive 2009/28/EC

	Year/Country	2013	2014	2015	2016	2017	2018	2019
AT	Austria	33.4%	33.6%	33.3%	33.5%	33.7%	34.2%	33.8%
HR	Croatia	37.2%	36.1%	38.5%	37.6%	36.5%	36.7%	36.8%
DE	Germany	13.4%	13.4%	13.4%	13.0%	13.4%	14.1%	14.6%
HU	Hungary	23.7%	21.3%	21.3%	21.0%	19.9%	18.2%	18.1%
IT	Italy	18.1%	18.9%	19.3%	18.9%	20.1%	19.3%	19.7%
PL	Poland	14.1%	14.0%	14.5%	14.7%	14.6%	15.1%	16.0%
EU28	EU28	17.5%	18.5%	18.9%	19.1%	19.5%	19.7%	20.6%

Table 8: Electricity production from renewable energy — solid biofuels and hydropower, in selected years, 2014 and 2019 (thousand toe)

Country	Solid biofuels (Thousand toe)		Hydropower (Thousand toe)	
	2014	2019	2014	2019
Austria	309.8	324.6	3 545.0	3 633.0
Croatia	4.1	41.0	601.6	593.0
Germany	928.5	955.1	1 868.5	1 703.3
Hungary	146.3	152.1	19.6	20.4
Italy	328.7	364.6	3 935.1	4 045.7
Poland	787.6	553.8	204.0	200.5
EU-28	7 268.9	9 170.7	29 972.8	29 899.4

Table 9: Electricity production from renewable energy — geothermal, wind and solar energy, in selected years, 2014 and 2019 (thousand toe)

Country	Other RES		Wind		Solar	
	2014	2019	2014	2019	2014	2019
Austria	81.2	83.4	327.5	592.7	67.5	146.4
Croatia	9.8	42.4	57.6	120.6	3.0	7.1
Germany	3 231.3	3 379.4	5 116.3	9 993.9	3 100.3	3 989.0
Hungary	36.5	41.1	60.6	59.3	5.8	128.7
Italy	1 786.3	1 834.1	1 276.3	1 645.9	1 918.0	2 036.9
Poland	70.2	106.6	651.2	1 224.5	0.6	61.1
EU-28	7 668.6.	8 508.0	21 714.0	35 367.3	8 445.7	11 920.5

Regarding the target regions, solid biofuels provided the main renewable energy supply without any significant changes over the last few years.

Key technologies for the Split-Dalmatia supply mix are hydro (80%), wind (18%) and solar (2%). Hydropower is the largest renewable energy source for electricity in Piemonte and FVG with 607 and 148 ktoe, followed by solar energy 156 and 48 ktoe, biogas 88 and 35 ktoe, respectively. In Piemonte, biomass has a bigger share as electricity source with 64 ktoe while in FVG the bioliquids with 21 ktoe. Regarding the RES for heat, the most significant source is the solid biomass 683 and 223 ktoe (residential) followed by heat pumps 175 and 105 ktoe and with smaller share the solar thermal energy respectively 21 an 11 ktoe in both (Piemonte and FVG) region. Derived heat is also a significant RES heat source in Piemonte which consists of 137 ktoe while in FVG the utilization of the bio waste is 40 ktoe.

FVG still has solar energy potential for further utilization mainly in the residential sector especially in combination with other domestic technologies such as hybrid systems (puffers and heat pumps or condensing boilers) or with integrated heat systems such as district heating networks and seasonal thermal storages. For local energy communities, the modernization of the existing and the installation of new innovative hydroelectrical power plants can provide energy security in the future. There are great opportunities with the utilization of waste heat and its combination with other RES heating technologies (e.g. solar or thermal). The utilization of biogas from urban and agricultural waste for biomethane production is of particular interest for FVG.

Despite the fact that hydropower and wind energy are significant in Austria, the primarily renewable energy source in the Eco-Energy-land region is biomass which has been providing energy mainly from forestry, arboriculture activities or from wood processing for eleven district heating systems and three electric CHP power plants established during the last three decades. Another use of the biomass – which is mainly grass and partly maize silage and manure - is in biogas plants. The second source for renewable energy is solar radiation which has a huge further development potential combined with electric storage systems and the use of heat pumps.

In Germany, a federal-state agreement on the coal phase-out by 2038 were signed by different parties, so for this reason the government has to take serious steps to ensure that renewable energies can cover the full capacity of energy consumption. The full supply of renewable energies will focus in particular on the expansion of photovoltaics and wind energy. Regarding Saxony-Anhalt around 12 % of the € 40 billion will be allocated by the German Government for the realization of the steps to implement this. Currently, in Saxony-Anhalt only 18.7% of total consumption is provided by renewable energy. For the use of power generation renewable energies make up 53.0% of the total which equals 54.0% of net electricity generation. Installed wind power of 2,860 wind turbines amounts to 5,122 MW provides the region with 8,800 GWh (in 2017), which makes up the major part of 62% of renewable generated electricity. The installed power of all photovoltaic systems in Saxony-Anhalt is 2,503 MW. This leads photovoltaic to be on the third among electricity producers from renewable energies (after wind and bio mass plants) with almost 2 billion kWh being generated, almost 8% of the consumed energy in 2017.

Mazovian Voivodeship has favourable conditions for RES development. The expansion of wind turbines has slowed down due to the enacted law on the location of wind farms in 2016 but according to the latest auctions, the sector will grow again from this year. There is a huge energy potential in the installation of new, mostly smaller hydropower plants and a utilization of the solar and geothermal energy due to the favourable conditions of the region. Mazovian Voivodeship has the largest population in Poland with the biggest waste production. For further utilization of the waste new legal regulation is needed to implement different waste-to-energy investment projects.

The key renewable resources of the Southern Great Plain (SGP) Region include solar, geothermal, solid biofuel and agricultural residues-based biomass and biogas. The solar potential of the region is high, and although in the last decade large-scale photovoltaic stations were installed, there is room for significant growth in building integrated solar solutions. Currently only a fraction of the geothermal capacity is used for building heating due to the complicated permitting process and legislation difficulties and more importantly due the relatively high risks associated with thermal water well development (temperature, discharge, drilling depth). Despite the relatively high

importance of agriculture in the Southern Great Plain, the biomass potential is rather unexploited regarding the electricity and district heat generation.

2.2. REGIONAL LOW-CARBON POLICIES, INSTITUTIONAL FRAMEWORK AND POLICY

LP – Piemonte Region

Following a strategic assessment, Piemonte Region has adopted the Regional Environmental Energy Plan Proposal, a planning document that proposes short-term targets (2020), and also mid-term ones (2030), in line with the objectives of the so-called Clean Energy Package proposed at European level.

The Plan Proposal selects as "main objectives" of the new regional energy planning cycle, the reduction of consumption and the gradual transition from natural gas to renewable sources. In order to achieve the above targets, the strategy sets out goals to reduce final energy consumption in the building and transport sector, as well as promoting the production from RES with a view to their environmental impact. Thus, priority is given to RES that do not require a combustion process, and consequently have zero emissions, either for greenhouse gases and other pollutants. The following strategic objectives have been defined:

- increase of energy production from renewable sources for additional 494 ktoe in 2030 (from the 2015 baseline) for a total production of 2,382 ktoe;
- reduction of gross final energy consumption by approximately 1.960 ktoe with a target value of 8.645 ktoe in 2030. This target would be achieved with an expected reduction of about 30% in respect of the business sector;
- achieving by 2030 a share of 27.6% of final energy consumption produced by RES.

PP3 - Mazovia

The Development Strategy for the Mazovian Voivodeship until 2030 was created by the Mazovian Voivodeship Government. One of the framework goals of the Strategy is to provide the region's economy with a diversified energy supply coupled with the sustainable management of environmental resources. The Strategy is being updated at present due to the technological and political changes in the energy sector – e.g. shift from shale gas to LNG.

Another document that includes low-carbon policy of the Mazovian region is the „Air Protection Program for the Mazovian Voivodeship till year 2022". The stated main goal of the program is: "Ensuring the region's economy of a diversified energy supply coupled with sustainable management of environmental resources". Resolution on introducing restrictions and bans on the operation of installations in which fuel is burnt in the Mazovian Voivodeship - "Anti-smog resolution" - introduced restrictions and bans on the operation of installations in which solid fuels are burned, in particular stoves, fireplaces and boilers.

The energy planning process is in accordance with the currently applicable legal regulations mainly implemented at the commune level. Planning and organizing the supply of heat, electricity and gas fuels within a commune is one of the own mandatory tasks of the commune administration. According to the Energy Law, the head of the municipality (mayor, city president) is responsible for developing draft assumptions for the plan for supplying heat, electricity and

gas fuels. The Law specifies the frequency of preparation of the draft assumptions (at least for a period of 15 years) and its update (every 3 years) and lists the elements it should contain.

The obligation to create a low-carbon economy plan for local authorities is not enforced by law, but it is a prerequisite to access EU funds in 2014-2020. Low-carbon economy plans cover the entire geographical area, managed by local authorities, and contain low-carbon and resource-efficient activities, including energy efficiency improvements and the use of local renewable energy potential.

PP4 - Split-Dalmatia

Apart from the Annual Energy Efficiency Action Plan, which is a planning document for a period of one year and defines the implementation of energy efficiency improvement policies in the County, no formalized regional low carbon policies are existent, nor applicable for these purposes. The preparation and implementation of the annual plan is set through the Energy Efficiency Act (OG 127/2014, 116/18). The Annual Energy Efficiency Plan with the prior approval of the National Coordination Body, is issued by the executive body of the local (regional) government, thus the executive body of the main city (Split). The Annual Plan is an annual recurrent planning document, adopted by the end of the following year, which sets the implementation of energy efficiency policies on local or regional level.

PP 6 – Friuli-Venezia Giulia

In Italy, each region has its own regional low-carbon policy. The Regional Energy Plan of Friuli-Venezia Giulia (Piano Energetico Regionale – PER) was adopted in 2015 and will be reviewed in this year with regard to the implemented interventions in the energy sector (infrastructure, renewables & share of RES in energy production and consumption, energy efficiency, energy saving, etc.). The goal is to create a sustainable economic model which integrates environmental protection and pollution / GHG emissions' reduction. In line with the objectives of the Europe 2020 Strategy and EU 2030 climate and energy framework, the Plan pursues seven general objectives and builds on 6 key actions. The Plan is structured in 57 measures which are embedded within the overall EU and regional visions and directly linked to the general and specific objectives listed in the Plan.

The e-mobility regional plan for Friuli-Venezia Giulia is the main regional policy instrument to promote the uptake of e-mobility. The plan calls for the roll-out of an efficient e-vehicle charging infrastructure integrating public and private charging points.

The green cities' regional strategy for a sustainable urban development in Friuli-Venezia Giulia (Strategia Regionale per le green city per lo sviluppo sostenibile urbano della regione Friuli-Venezia Giulia) will be officially presented and launched in the first months of 2020. The strategy has been developed on the basis of a public consultation process which involved more than 30 local municipalities. The strategy integrates already existing and applicable tools and interventions as well as ongoing and planned best practices. The priority sectors that have been identified are: environmental quality of cities, efficient use of resources based on circular economy principles and climate change. It also provides a plan for fostering the uptake of the green city approach in the region.

The regional law on the general framework for waste management and circular economy principles (Legge regionale 20 ottobre 2017, n°34) is the reference instrument for planning waste management and the development and implementation of the regional model on circular economy. The plan sets a 70% recycling target and 20% reduction target in municipal waste generation per capita by 2024.

PP7 -Eco-Energy-Land

The Austrian climate and energy strategy Mission 2030 can be regarded as the cornerstone of future regional low-carbon policy. In the coming years, the climate and energy strategy will focus primarily on transport and space heating, as these two sectors offer the greatest potential for savings. Heating, hot water and cooling in buildings account for around 27 percent of Austria's total final energy demand. Heating and hot water in buildings would account for 16 percent of domestic greenhouse gas emissions in 2018.

The Province of Burgenland decided to draw up a regional development programme (LEP 2011) in 2011 to provide orientation and security for the population, the business community and, last but not least, the administrative authorities of Burgenland. It sets out a roadmap for Burgenland's development over the next ten to fifteen years, which is developing in a number of areas of tension - between globalisation and regionalisation, tradition and modernity as well as growth and limited resources. The LEP 2011 included contents that were also discussed throughout Austria, in neighbouring countries and at EU level. The German and Swiss spatial development strategies, for example, cite close cooperation between environmental protection, tourism, agriculture, renewable energies and social sustainability as important development principles.

Priority areas of the Energy Strategy Burgenland 2020 (Energiestrategie Burgenland 2020) are energy efficiency and energy saving; energy production and resources; energy storage, conversion and logistics. As targets the use of 50 % renewable energy by 2020 and the use of 100 % renewable energy by 2050 for the entire energy consumption of Burgenland were set. The regional low carbon policy decisions are primarily taken by the regional government and the municipalities. Implementation is the responsibility of the Burgenland Provincial Government Office, Department 3 - Finances, Main Department of Housing Promotion and the District Authorities.

The ultimate objective of the Climate Vision Burgenland 2050 is to reduce greenhouse gas emissions- by 2050, no fossil fuels are to be needed, and greenhouse gases are to be reduced to around one tenth of their current levels. Energy consumption is to be reduced by 5 petajoules.

PP8 – Southern Great Plain (represented by AACM)

There are no formalized low-carbon policies available for the Southern-Great Plain Region (NUTS 2). However, each county municipality (NUTS 3 level) in the SGP has prepared and adopted a Climate Strategy. All these strategies call for decarbonization and mitigation of energy consumption and GHG reduction, as well as for climate adaptation measures.

Although local municipalities have no obligation to draw up low-carbon policies, some cities do have elaborated local climate strategies. The following county and local municipalities have decided to join the Covenant of Mayors and/or prepared SEAP/SECAP documentations.

Table 10: Adopted SEAPs/SECAPs in the SGP Region

Municipality	Population	Commitments
Bács-Kiskun County	513,690	2030, Adapt
Bátya	2,105	2030, Adapt
Békéscsaba	61,325	2030, Adapt
Kunadacs	1,510	2030, Adapt
Szarvas	16,950	2020
Szeged	161,140	2030, Adapt
Szentkirály	1,940	2030, Adapt
Kecskemét	110,813	2030, Adapt –only political decision jet

PP9 - Saxony-Anhalt

In 2017, the government of Saxony-Anhalt passed a climate and energy concept (KEK) and one of its aims to limit the CO_2-emissions to 31,3 million t CO_2eq/year by 2020. Despite the efforts Saxony-Anhalt would not reach the set target so the government agreed on efforts beyond the KEK with two methods to increase the CO_2-savings. One is changing the energy mix to renewable energies 100%, the other way is reducing the GHGs in the five largest sectors responsible for GHG emission namely, energy, transport, buildings, industry/economy as well as agriculture/land use/forestry/nutrition. In addition to the CO_2-emission target in 2020, KEK's efforts will probably result after 2030 so compared to 1990, 50% of the GHGs are to be saved. That means Saxony-Anhalt has to reduce the emissions of 26.8 million tonnes CO_2-equivalent compared to 1990 and further 4.5 million between 2020 and 2030.

In regard to evaluating new measures five technical working groups were formed following the main sectors responsible for improving their energy efficiency. They were joined by different ministries, municipal cooperation and the university and scientific institutions of e.g. Otto-von-Guericke-Universität, Hochschule Magdeburg Stendal and Fraunhofer-Institute for factory operation and automatization (IFF) and church associations. In the coalition contract the ruling parties agreed on the back out of brown coal until 2038, so that the government has to collect measures to ensure that renewable energies can cover the full capacity of energy consumption. Due to the phase-out of lignite by 2038, the full supply of renewable energies will focus in particular on the expansion of photovoltaics and wind energy.

3. DECENTRALIZED EU ESI FUNDS

As mentioned above the transition to a low carbon economy, the Union's European Structural and Investment Funds (ESIFs) and the European Fund for Strategic Investments (EFSI) have sought to improve the availability of finance for these investments. Over the 2014-2020 programming period, a total funding of € 461 billion (with national contribution a total of € 643 billion) was committed via the ESIFs.

The programming and implementation of the EU Structural and Investment Funds (ESIFs) is completed within a multi-annual framework covering the period of 2014-2020. Regulation (EU) N°1303/2013 lays down common provisions applicable to the European Regional Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund (CF), the European Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF). These Funds operate under a common framework known as the European Structural and Investment Funds. The Regulation also sets out the provisions necessary to ensure the effectiveness of the ESIF and their coordination with one another and with other EU instruments.

The European Regional Development Fund (ERDF) concentrates its intervention on innovation and research, the digital agenda, support for small and medium-sized enterprises (SMEs) and the low-carbon economy. The resources allocated to each of these priorities depends upon the region — for example, in more developed regions, at least 80 % of any funding should focus on at least two of these priorities, whereas in less developed regions this share falls to 50 %.

The European Social Fund (ESF) aims to improve employment and education opportunities, as well as the situation of the most vulnerable people (for example, those at risk of poverty). During the period 2014–2020 the ESF focused on supporting four thematic objectives: promoting employment and supporting labour mobility; promoting social inclusion and combating poverty; investing in education, skills and lifelong learning; enhancing institutional capacity and an efficient public administration.

The European Agricultural Fund for Rural Development (EAFRD) aims to improve the competitiveness of agriculture; enhance the sustainable management of natural resources; enhance climate action and ensure balanced territorial development of rural areas. Support from the EAFRD is channelled across six Union Priorities (UPs) and 18 corresponding Focus Areas (FAs). All the UPs have potential for climate action, even though this may not be immediately obvious, and it is anticipated that they all make a contribution to the cross-cutting objective of climate change mitigation and adaptation.

The Cohesion Fund (CF) supports investment in the environment, trans-European networks and other infrastructure projects, through a focus on the following areas: the shift towards a low-carbon economy; promoting climate change adaptation and risk prevention; preserving and protecting the environment and promoting resource efficiency; promoting sustainable transport and removing key bottlenecks in network infrastructures; enhancing institutional capacity. It is subject to the same rules of programming, management and monitoring as the ERDF and ESF. Cohesion policy funding for the period 2014–2020 is foreseen to be almost EUR 352 billion —

equivalent to almost one third (32.5 %) of the EU's total budget during this period. The bulk of cohesion policy funding is targeted at those regions with relatively low levels of economic development.

The European Maritime and Fisheries Fund (EMFF) helps the fisheries sector in the transition to sustainable fishing, supports coastal communities in diversifying their economies, finances projects that create new jobs and improve quality of life along European coasts, supports sustainable aquaculture developments and makes it easier for applicants to access financing.

Table 11: Breakdown of ESIF's funding for low-carbon economy

ESIF Instrument	Allocated (€)
ERDF	31 821 372 280
CF	7 990 929 298
EAFRD	4 212 633 258
EMFF	78 461 088
Total	**44 103 392 923**

ESIFs include both program elements decentralised on to the EU Member States and program elements managed directly by the European Commission or its executive bodies in accordance with the subsidiarity principle. However, the major part of ESIFs (approximately 75%) is utilised by the Member States within a decentralised implementation system. The ESIFs are constructed around eleven Thematic Objectives (TOs). The TOs include:

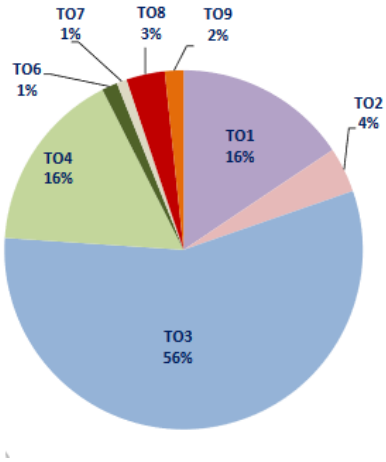
- TO1 - Strengthening research, technological development and innovation;
- TO2 - Enhancing access to, and use and quality of ICT;
- TO3 - Enhancing the competitiveness of SMEs, of the agricultural sector (for
    - EAFRD), and of the fishery and aquaculture sector (for EMFF);
- **TO4 - Supporting the shift towards a low-carbon economy in all sectors**;
- TO5 - Promoting climate change adaptation, risk prevention and management;
- TO6 - Preserving and protecting the environment and promoting resource efficiency;
- TO7 - Promoting sustainable transport and removing bottlenecks in key network infrastructures;
- TO8 - Promoting sustainable and quality employment and supporting labour mobility;
- TO9 - Promoting social inclusion, combating poverty and any discrimination;
- TO10 - Investing in education, training and vocational training for skills and lifelong learning;
- TO11 - Enhancing institutional capacity of public authorities and stakeholders and efficient public administration.

Each Member State has concluded a Partnership Agreement with the European Commission. The Partnership Agreements uniformly provide funding for eleven Thematic Objectives (TOs) defined by the European Commission. Two of those (TO4 and TO5) relate directly to climate change. However, all the other TOs also have climate action considerations. Mainstreaming aims to ensure that such potentials are identified, assessed and included as a horizontal criterion in each programme.

The current report focuses on the transition to the low carbon economy (TO4). All Partnership Agreements provide a matrix of the above Thematic Objectives (TOs) versus the structural instruments (ERDF, CF, EAFRD, EMFF; regional development, cohesion, agricultural & rural development and fishery funds).

For the period 2014-2020, the ESIFs have provided around € 44 billion for supporting the development of the low-carbon economy (TO4: "Supporting the shift towards a low-carbon economy in all sectors") in Europe. TO4 has been an eligible cost under the European Regional Development Fund (ERDF), the European agricultural fund for rural development (EAFRD); the Cohesion Fund (CF) and the European maritime and fisheries fund (EMFF). The breakdown per ESIF instrument is provided in the figure below.

Figure 2: Breakdown of ESIF's funding per thematic objective (TO) and split of TO4 per intervention area



TO4 - supporting the shift towards a low-carbon economy in all sectors

Area of support	Share
Renewables	4%
Energy efficiency	81%
.. in existing housing	44%
... in public infrastructure	13%
... in SMEs	24%
... in large enterprises	0%
Other support to SMEs under TO4	11%
Other support	4%

In the following table (Table 12), the budget provisions for the target countries under the European Structural and Investment Funds (ESIF) between 2014-2020 are presented.

Table 12: ESIF country budget per Project Partner country

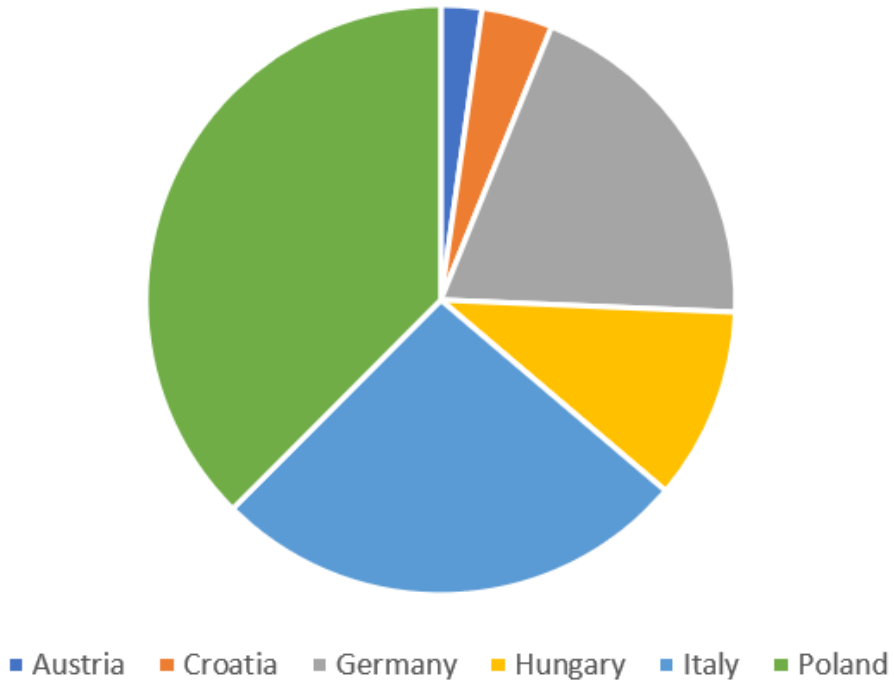
	2014-2020 (Updated at 9.11.2021)						
Country/Allocation	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Total Country Budget (€ million)	13 934	14 095	51 880	30 166	88 300	110 818	718 836
EU contribution in Country Budget (€ million)	6 634	12 091	33 360	25 424	58 194	90 665	525 326
Thematic Objective TO4 - Partnership Agreement (€ million)	206.5	756.9	2 903.6	2 808	3 948.9	9 189.9	44 353.0

	2014-2020 (Updated at 9.11.2021)						
Country/Allocation	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
TO4 allocation/EU contribution (%)	3.1%	6.3%	8.7%	11.0%	6.8%	10.1%	8.4%
Total EU contribution to TO4/capita (€/capita)	68	224	53	307	82	305	133

Source: https://cohesiondata.ec.europa.eu/

As it can be seen per capita Hungary received the biggest proportion for TO4 from the country budget with 11.0%, closely followed by Poland with 10.1% and Germany with 8.7%, whilst Austria received the least with 3.1%. Comparing the population and the planned budget of TO4 at the project partner countries, we can conclude that Hungary and Poland received the highest amounts per capita followed by Croatia and Italy.

Figure 3: Breakdown of TO4 funding (according to the Partnership agreements) between the PROSPECT2030 Partner Countries



The above pie chart presents the allocation of TO4 in absolute terms. Poland has the biggest allocation – € 9,189.9 million - to improve the low-carbon economy at country level comparing to all other EU countries. The second largest recipient is Italy with less than the half which

follows behind Spain and ranks as a third between the EU countries total low-carbon country budgets.

3.1. NATIONAL/FEDERAL HORIZONTAL/SECTORAL OPERATIONAL PROGRAMMES

3.1.1. Presentation of national/federal horizontal operational programmes

The Member States are responsible to define national, sectoral or regional Operational Programmes (OPs) and ensure the translation of the Thematic Objectives onto OPs. TOs are incorporated into Operational Programmes (OPs) by each country in a different way. The low-carbon sector related activities may be addressed through one or several OPs. The OPs are typically broken down into Priority Axes (PAs) and measures within the specific PAs.

Austria

The whole territory of Austria is covered by one single national operational program: OP "Investments in Growth and Employment Austria 2014-2020 - Operational Programme for the use of the ERDF funds". The Operational Programme contributes to the achievement of certain elements of the Europe 2020 strategy in Austria. In particular, EU funds are used to increase innovation and research and development activities in small and medium-sized enterprises, including technology transfer and investment in certain R&D infrastructure. The Operational Programme also supports SMEs in promoting their competitiveness through investments in innovation, energy efficiency and the use of renewable energies. In certain urban areas, the Programme supports CO_2 reduction strategies and integrated sustainable development, and in certain other functional urban areas, cooperation and efficient use of resources. Overall, the OP is to a very high degree (more than 80%) focussed on 3 main areas:

- Research, development and innovation;
- Competitiveness of SME; and
- Transition towards a low carbon economy.

Austria receives € 536 million from the European Regional Development Fund (ERDF) for the Operational Programme "Investments in Growth and Employment" (IWB) for the entire funding period.

Croatia

For the period 2014-2020, Croatia has been allocated € 8.61 billion for cohesion policy and € 2 billion for the development of the agricultural sector and rural areas.

For the purpose of efficient use of available funds, four operational programs have been developed:

- Operational Program "Competitiveness and Cohesion 2014-2020";
- Operational Program "Effective Human Resources 2014-2020";
- Rural Development Program; and
- Fisheries Operational Program.

The main source of funding for TO4 is included by the Operational Programme for Competitiveness and Cohesion (OPCC) with the following blending of ESIFs' funding: € 532 million

from the ERDF, € 216 million € from EAFRD and € 8 million from the European Maritime and Fisheries Fund.

Priority Axis 4 "Promoting energy efficiency and renewable energy" of the Operational Program Competitiveness and Cohesion (OPCC) focuses on energy efficiency and renewable energy in public infrastructure and residential buildings. Priority Axis 4 has three investment priorities:

1. Promotion of energy efficiency and renewable energy in the business sector; it is expected that companies will contribute to the set goals in the use of renewable energy and energy efficiency.
2. Support for energy efficiency, advanced energy management and the use of renewable energy in public infrastructure (including public buildings) and in the housing sector; the construction sector is expected to make the greatest contribution in achieving the energy efficiency targets set and to make an important contribution to increase the share of renewable energy (primarily for heating and cooling purposes and security of supply).
3. Development and implementation of advanced low and medium voltage distribution systems; system improvements will contribute to increased security of supply and more efficient energy management.

The budget breakdown planned for energy efficiency and renewable energy under the OPCC includes the following items:

- Renewable Energy - Solar Energy: € 35 million;
- Renewable energy sources - biomass energy: € 60 million;
- Energy efficiency of public infrastructure: € 181.8 million;
- Energy efficiency of residential buildings: € 90 million;
- Advanced distribution systems: € 20 million;
- High efficiency cogeneration and district heating systems: € 80 million;
- Energy efficiency and demonstration projects in small and medium-sized enterprises: € 20 million;
- Environmentally friendly processes and resource efficiency in small and medium-sized enterprises: € 20 million; and
- Energy efficiency in large enterprises: € 25 million.

Germany

The total country budget for Germany between 2014-2020 was € 44,740 million EUR from which the Thematic Objective TO4 according to Partnership Agreement shared with € 2,903.6 million. The national contribution is around 39% of the planned EU funds and the total decided amount was so far € 4,395,7 million EUR. Saxony-Anhalt received a € 246,3 million EUR from the EU which is approximately 9.4% of the whole allocation for TO4 on country level.

Table 13: Indicative allocation of EU ERDF and EAFRD funds per Federal State in Germany

Recipients / Programmes	ERDF (€)	EAFRD (€)
Baden-Württemberg	246 585 038	617 955 862
Bavaria	494 704 308	1 292 421 451
Berlin	635 213 023	965 810 161
Brandenburg	845 643 228	
Bremen	103 021 352	cf. Lower Saxony, incl.
Hamburg	55 472 740	
Hessen	240 723 366	268 275 991
Mecklenburg-Western Pomerania	967 806 184	846 982 072
Lower Saxony	690 789 930	93 592 554
North Rhine-Westphalia	1 211 731 011	512 072 729
Rhineland-Palatinate	186 025 744	258 733 232
Saarland	143 289 081	28 628 276
Saxony	2 089 020 063	816 860 146
Saxony-Anhalt	**1 427 495 230**	**777 610 363**
Schleswig-Holstein	271 244 600	348 435 164
Thuringia	1 165 077 915	625 673 049
network rural area		5 000 000
Total	10 773 842 813	8 303 051 050

Hungary

Based on the Thematic Objectives of the Programming Period 2014-2020 the Hungarian Government has elaborated and adopted nine Operational Programmes as shown by Table 14. (The Operational Programmes set in bold address Thematic Objective 4).

Table 14: Operational Programmes in Hungary for the Programming Period 2014-2020

Abbreviation	Name of the OP	ESI Fund	ESI fund	Total
			million EUR	
GINOP	**Economic Development and Innovation OP**	**ERDF, ESF, YEI**	**7 684**	**8 813**
VP	Rural Development Programme	EAFRD	3 455	4 147
TOP	**Territorial and Settlement Development OP**	**ERDF, ESF**	**3 389**	**3 971**
IKOP	Integrated Transport OP	ERDF, CF	3 332	3 920
KEHOP	**Environmental and Energy Efficiency OP**	**ERDF, CF**	**3 217**	**3 785**
EFOP	Human Resources Development OP	ERDF, CF	2 613	3 070
KÖFOP	Public Administration and Civil Service Development OP	ESF, CF	795	935
VEKOP	**Competitive Central-Hungary OP**	**ERDF ESF**	**464**	**928**
MAHOP	Hungarian Fisheries OP	EMFF	39	51
Total			24 988	29 643

Funds related to the low-carbon economy are projected under the Economic Development and Innovation (GINOP), the Environment and Energy Efficiency (KEHOP); and the Territorial and Settlement Development Operational Programmes (OPs).

The Priority Axis 4 (Energy) of the Economic Development and Innovation Operational Programme (abbreviated in Hungarian as GINOP) has been committed via four open Calls with a total budget of € 296 million for SMEs in convergence (less developed) regions. The overall impact indicators of Priority Axis 4 include:

- Development of a total of 239,95 MW renewable energy production capacity;
- Reduction of the greenhouse gas emission by 345 kilotons CO2/year;
- Decrease of the primary energy consumption of buildings in the enterprise sector by 8,424 MWh/year;
- Decrease of primary energy consumption due to energy efficiency renovations by 2.23 PJ/year; and
- Production of renewable energies worth 2.10 PJ/year.

The highest funding for low-carbon projects is provided through the Environmental and Energy Efficiency Operational Programme (KEHOP), a KEHOP Priority Axis 1 "Adaptation to climate change" (budget: € 1,044 million) and KEHOP Priority Axis 5 "Adaptation to climate change" priority axes (budget: € 994 million). The overall expected overall impacts of the climate components of KEHOP by 2023 (upon the completion of the programme) comprise:

- Reduction of greenhouse gas emission by 546 kilo tonnes CO2 eq/per annum;
- Increase in renewable energy production capacity by 200.31 MW; and
- Increase in renewable energy production by: 3,390 000 GJ/annum.

Low carbon sector development is considered under Axis 5 for:

- Non-building related, on-grid green electricity production based on renewable resources;
- Energy efficiency refurbishment of buildings combining with renewables;
- Development district heating supply and distribution systems and their conversion to renewable fuel; and
- Public awareness raising activities.

The Territorial and Settlement Development Operational Programme (TOP) concerns all six less developed NUTS2 regions in Hungary that exclude the Central Hungarian Region which as a conversion region, is addressed by a separate operational program (VEKOP). Low carbon issues are addressed by the following two Priority axes of TOP:

- Priority Axis 3: Low carbon transition with special attention to urban areas; and
- Priority Axis 6: Sustainable urban development in cities with county rights.

The Southern Great Plain Region is also eligible for TOP funding.

Italy

In Italy, there are 12 National Operational Programmes co-financed by ERDF and/or ESF - OP Research and Innovation, OP Active policies for employment, OP Inclusion, OP Education, OP Businesses & Competitiveness, OP Networks & mobility, OP YEI, OP Metropolitan cities, OP Culture, OP Legality and OP Governance. The National Operational Programmes that touch upon low-carbon priorities provide funding to less developed and transition regions.

From the perspective of the Piemonte Region, the most significant horizontal OP is the National operational programme (NOP) "Metropolitan cities 2014 – 2020" was adopted by the European Commission in Decision C (2015) no. 4998 dated 14th July and has a financial allocation amounting to over € 858.9 million, of which € 650.2 million is allocated by the Regional Development Fund (ERDF) and € 208.7 million is from the European Social Fund (ESF).

The Programme, run by the Italian Territorial Cohesion Agency, supports the priorities of the National Urban Agenda. Within the framework of the sustainable urban development strategies outlined in the Partnership Agreement for programming period 2014-2020, it is in line with the goals and strategies of the European Urban Agenda which identifies urban areas as the key territories to take up the challenges of smart, inclusive and sustainable growth set in the Europe 2020 Strategy.

The metropolitan cities concerned are 14: Turin, Genoa, Milan, Bologna, Venice, Florence, Rome, Bari, Naples, Reggio Calabria, Cagliari, Catania, Messina and Palermo.
Within each Axes the City of Turin has defined its own priorities, as follows:

- guarantee greater accessibility to digital services, improving access to information and communication technologies (Axis 1);
- improve private, public and public transport mobility through the introduction of intelligent IT systems (Axis 2);
- expand and improve "slow" mobility, through the creation of new cycle paths (Axis 2);
- making public buildings more energy efficient, through restructuring and energy conversion (Axis 2);
- countering the various forms of marginality and hardship, promoting social inclusion (Axis 3); and
- reduce the number of individuals exposed to housing problems, through the conversion of municipal buildings into homes with subsidized housing (Axis 4).

An amount of € 37.7 million has been assigned to the City of Torino with low carbon elements accounting for more than one third of the overall budget. Nearly € 8 million has been allocated to the energy renovation of public buildings.

No city in Friuli-Venezia Giulia is eligible for the OP dedicated to metropolitan cities.

Poland

The Infrastructure and Environment Program 2014-2020 is a national OP supporting the low-carbon economy, environmental protection, counteracting and adapting to climate change, transport and energy security with a total budget of € 27.4 billion. Areas of support and types of projects that can be implemented from the program include:
1. Reducing the emission of the economy via:

- production of energy from renewable energy sources (RES);
- improving energy efficiency and the use of renewable energy sources in enterprises, the public and housing sectors;
- promoting low-carbon strategies;
- development and implementation of intelligent distribution systems.

2. Environmental protection, including adaptation to climate change through:
   - development of environmental infrastructure;
   - adaptation to climate change;
   - protecting and stopping the decline of biodiversity;
   - improving the quality of the urban environment.
3. Development of the TEN-T road network and multimodal transport.
4. Road infrastructure for cities.
5. Development of rail transport in Poland.
6. Development of low-emission collective transport in cities via:
   - infrastructure and rolling stock for public collective transport in cities and in their functional areas.
7. Improving energy security by:
   - development of intelligent systems for the distribution, storage and transmission of natural gas and electricity;
   - construction and development of natural gas storage facilities;
   - expansion of the LNG terminal.
8. Protection of cultural heritage and development of cultural resources.
9. Strengthening the strategic health care infrastructure.

The Infrastructure and Environment Program is financed from three sources:
- the European Regional Development Fund, of which € 4,905.9 million is intended for the program,
- Cohesion Fund, amounting to € 22,507.9 million,
- National funds - public and private, with a minimum commitment of € 4,853.2 million.

The final commitment of national resources, mainly through private investments, is expected to rise by the closure of the program. The minimum contribution of national funds in 15 less-developed voivodeships is 15%, and in Mazovian Voivodeship 20%. However, many projects in this program will include state aid, which will require a higher national contribution from project implementers, mainly from private funds.

3.1.2. Overall performance of national/federal horizontal operational programmes

The overall performance figures of the implementation of ESIF funding dedicated to TO4 at the end of 2019 are presented in Table 15. The key figures include the committed (“decided”) and the disbursed (“spent”) funding and their ratios relative to the allocated funding. The table shows the relatively high level of committed funding (between 80 and 100%). Croatia and Poland have already fully committed the available funding. The disbursement status is more even ranging between 27% and 36% that more or less corresponds to the European average.

Table 15: Implementation by country for Low-Carbon Economy, Period Covered: up to 19/11/2021

	2014-2020 (Period Covered: up to 19/11/2021)						
Country/ Allocation	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Thematic Objective TO4 planned EU (€ million)	586	913	4 306	2 316	4 752	8 467	45 748
Thematic Objective TO4 committed (decided) (€ million)	468	975	4 510	2 505	4 549	9 066	48 317
Thematic Objective TO4 disbursed (spent) (€ million)	232	584	2 053	1 169	2 123	4 925	23 060
Decided EU funds for TO4/Planned (%)	79.9%	106.8%	104.7%	108.2%	95.7%	107.1%	105.6%
Spent EU funds for TO4/Planned)	39.6%	64.0%	47.7%	50.5%	44.7%	58.2%	50.4%

Source: https://cohesiondata.ec.europa.eu/

Publicly available nationwide impact indicators (status 2018) related to the implementation of the ESIF by the partner countries are presented in Table 16 below. Data was captured for the following impact indicators:

- Development or renewable capacities in MW;
- Reduction of GHG in ton CO_2eq;
- Total investment (private and public) in renewable energy production (€ million);
- Reduced consumption public buildings (million kWh/year); and
- Total investment (private and public) for energy efficiency in agriculture and food processing (€ million).

Table 16: Impact indicators of Partner Countries

	Implementation status in November 2021						
Country/Indicators	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Development of renewable capacities							
Planned Additional capacity for renewable energy production [MW]	no data	no data	103	969	397	1 345	7 116
Decided Additional capacity for renewable energy production [MW]	no data	no data	318	646	64	1 977	5 785
Implemented Additional capacity for renewable energy production [MW]	no data	no data	107	189	58	697	1 983
Reduction of GHG							
Planned Reduction of the annual emission of greenhouse gases [ton CO_2eq]	218 000	no data	2 210 987	1 412 179	4 030 546	2 871 495	19 998 128
Decided Reduction of the annual emission of greenhouse gases [ton CO_2eq]	305 097	no data	2 737 616	622 777	705 982	5 465 320	17 077 541
Implemented Reduction of the annual emission of greenhouse gases [ton CO_2eq]	78 757	no data	137 109	153 461	130 782	552 655	2 927 248

Updated on 19/11/2021
Source: https://cohesiondata.ec.europa.eu/

	Implementation status in November 2021						
Country/Indicators	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Total investment (private and public) in renewable energy production							
Planned Total investment (private and public) in renewable energy production (€ million)	585.3	161.2	29.1	37.8	236.6	no data	2 293.0
Decided Total investment (private and public) in renewable energy production (€ million)	363.5	15.4	7.0	23.8	80.3	no data	1 043.0
Implemented Total investment (private and public) in renewable energy production (€ million)	206.4	1.1	4.7	23.8	29.3	no data	601.0
Reduced consumption public buildings							
Planned Reduced consumption public buildings (million kWh/year)	no data	55.1	203	565.7	186.8	1 523	6 316
Decided Reduced consumption public buildings (million kWh/year)	no data	212	164.6	787.7	275.4	2 560	6 048
Implemented Reduced consumption public buildings (million kWh/year)	no data	39.6	8.4	258	57.8	509	1 225

Updated on 19/11/2021
Source: https://cohesiondata.ec.europa.eu/

	Implementation status in November 2021						
Country/Indicators	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Total investment (private and public) for energy efficiency in agriculture and food processing							
Planned Energy efficiency in agriculture and food processing (€ million)	no data	no data	557.2	888.3	20.2	no data	2 816.3
Decided Energy efficiency in agriculture and food processing (€ million)	no data	no data	391.1	63.6	9.3	no data	1 341.6
Implemented Energy efficiency in agriculture and food processing (€ million)	no data	no data	200.7	63.6	3.3	no data	770.6

Updated on 19/11/2021
Source: https://cohesiondata.ec.europa.eu/

The tables above suggest that

- Germany and Poland made successful efforts to increase the development of renewable capacities above the target originally planned (Germany even tripled than the respective planned capacities). As far as investments in the renewable sector are concerned, Italy almost reached the target additional renewable capacity, whilst the other countries only reported around one third of the decided renewable energy production until 2021.
- In terms of commitment of the funding, Poland will achieve considerably higher reduction of the GHG emission than it was initially planned. In 2021, Poland accounted for almost 32% of the total planned GHG reduction in the EU28. However, regarding the implementation only 10% of the targeted GHG reduction was reached in 2021.
- Energy saving in the building sector had largely exceeded the originally projected values. In particular, Croatia and Poland recorded the highest increase by 3.8 times and by 1.7 times, respectively.
- For energy saving in the agrifood sector, Hungary requested the highest amount of EU funding, followed by Germany, whilst the other participating countries requested none or a relatively small amount. Hungary received only 7% of the planned investment from which 100% was implemented by 2021.
- In 2021, the actual implementation is still generally low.

3.2. DECENTRALISED REGIONAL OPERATIONAL PROGRAMMES

3.2.1. Presentation of decentralised operational programmes

Four of the seven partner regions (Piemonte, Mazovia, Friuli-Venezia Giulia and Saxony-Anhalt) have dedicated budget decentralized onto regional level. The Table 17 below summarizes their regional budgets and the budgets allocated to low-carbon development.

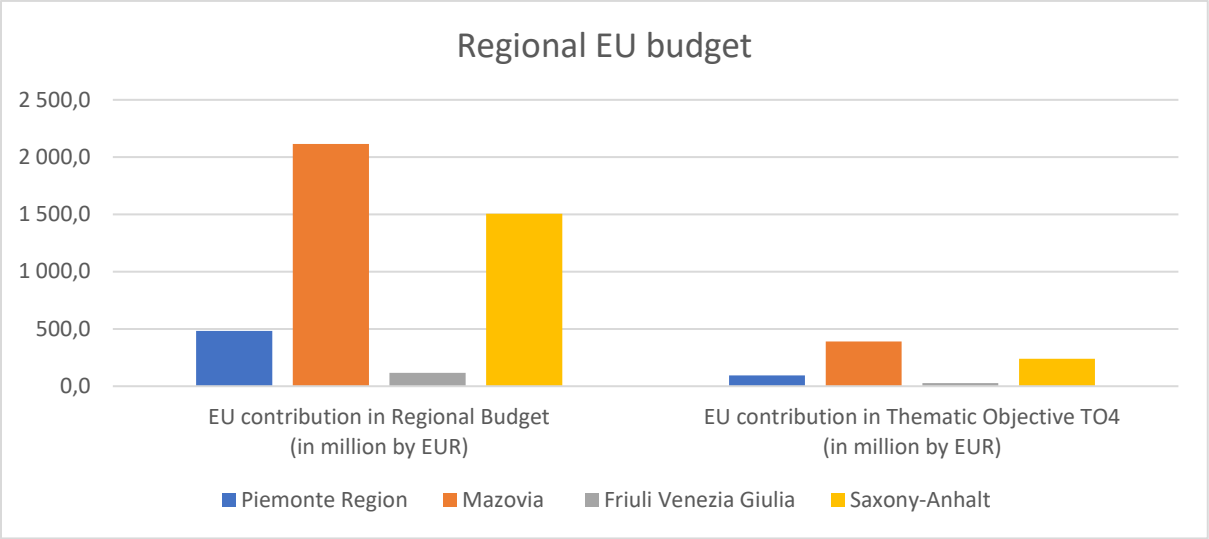
Table 17: Regional operational programme budgets

	2014-2020 (Period updated at 19.11.2021)			
Region/Allocation	**Piemonte**	**Mazovia**	**Friuli-Venezia Giulia**	**Saxony-Anhalt**
Total Regional Budget (€ million)	965,8	2 640,3	230,8	1 915,0
EU contribution in Total Regional Budget (€ million)	482.9	2 114.9	115.4	1 506.3
National contribution in Total Regional Budget (€ million)	482.9	525.4	115.4	407.7
EU contribution in Thematic Objective TO4 (€ million)	94.5	391.9	27.6	240.6
National and/or regional contribution in Thematic Objective TO4 (€ million)	94.5	98	27.6	85
Total Regional Budget/Total Regional TO4 (%)	20%	19%	24%	17%
National contribution (%)	50%	25%	50%	35%

Source: https://cohesiondata.ec.europa.eu/

As Table 17 and the above diagram (Figure 4) indicate Mazovia received the highest EU contribution for TO4 with € 391.9 million followed by Saxony-Anhalt with € 240.6 million, Piemonte with € 94.5 million and Friuli-Venezia Giulia with 27.6 MEUR. It is also worth mentioning that the national contribution is the highest in Italy (50%) followed by Saxony-Anhalt (35%) and Mazovia (25%).

Figure 4: Regional operational programme budgets



Updated on 19/11/2021

LP- Piemonte Region

In the Piemonte Region the allocation of the ROP ERDF public resources amounts to € 193 million divided almost equally between public entities and companies. The results of the interventions showed 198% compared to the forecasts regarding the number of companies and 130% as regards the expenditure certified in 2018.

Regarding companies, the specific objective "Reduction of energetic consumptions and greenhouse emissions for companies and integration with renewable sources" the allocated amount was € 97 million, from which the allocated EU funding was 50%, the national contribution was 35% at country level, 15% at regional level. The incentives, partly with non-refundable funds (20%) and partly as subsidized credit (80%), finance high-efficiency cogeneration plants, measures to increase the energy efficiency of production processes and buildings, and the replacement of low efficiency systems and components with more efficient ones, the installation of new high efficiency production lines. The implementation status at the end of 2019 was 70.8% of the budget. It is to be spent for a number of companies 234 of which at the end of 2019, 205 companies received funds with 70,254 t saved CO_2 result (the target is 81,647 t).

The promotion of eco-efficiency in public buildings was implemented through five calls, which financed at least the 80% of the value proposed (adding a further 10% as a reward in the case of transformation buildings to NZEB). Regarding public bodies as beneficiary, two other specific objectives were set under Priority axis 4 ("Sustainable Energy and Quality of Life"). Reduction of energy consumption in public buildings or public facilities, residential and non-residential and source integration, source integration renewable – received € 76 million with the same allocation share than above. The implementation status on the end of 2019 was the following: 50% of budget available is assigned; additional capacity for renewable energy production: 61%; reduction of annual primary energy consumption in public buildings: 71.2%; reduction of the annual emission

of greenhouse gases: 68.5%; energy saved: 39,143 MWh/y; 0.86 kWh/€ spent; greenhouse emission reduction/€spent: 0.18 kgCO_2eq/€spent.

The other objective – "Reduction of energy consumption in public lighting" – received € 20 million in the same structure as the other. At the end of the call for applications (2019) the admitted applications amounted to 133 and 100% of the budget is committed. Main indicators at the end of 2019: light points subject of the intervention 36,020 instead of the set 3,333 [n]; saved energy 12.094 MWh/y; saved primary energy 29.267MWh; 1.46 kWh/€spent; greenhouse emission reduction / €spent: 5.237 tonCO_2eq.

The notices published have yielded quite differentiated outcomes for multiple reasons that would be worth investigating further: shortage of public resources co-financed by the actions, difficulties in the application of the procurement law, application constraints which also slowed down the payment of contributions by the Region to the beneficiaries. All those factors are bottlenecks that prevent the beneficiaries from implementing the actions in the foreseen time. This would require the need of prolongation to complete the projects and could lead to the withdrawal of the grant in the future. In particular, it is necessary to underline that the co-financing is essential to cover over 20% of the amount, plus those expenses that are not eligible, but are essential and considered as "enabling interventions" (i.e. seismic adjustment, removal of architectural barriers, asbestos, etc.).

Piemonte Region in its report analysed the results of the two calls (Line A and Line B, respectively) according to the population size of the targeted municipalities. Municipalities with a population of more than 5,000 inhabitants and Municipalities with a population of less than 5,000 inhabitants. Comparing the two calls for public buildings, the following is observed:

- the average useable area of the building is generally greater for the "large municipalities" call (approximately 3,470 m2 for each building) than for the "small municipalities" call (approximately 810 m2 for each building);
- the average specific primary energy savings per square meter of usable area is practically the same for the both calls and stands at about 213 kWh/m2;
- the average costs allowed per square meter of usable area are comparable (€ 312/m2 for "small municipalities" and € 301/m2 for "large municipalities");
- as far as the distribution of budget granted between Line A and Line B is concerned, the values are almost equal for both calls, settling at 91% for Line A and 9% for Line B.

The average primary energy savings per Euro invested is 0.86 kWh/€ (respectively 0.78 kWh/€ for the "large municipalities" call and 0.98 kWh/€ for the "small municipalities" call), while the CO_2 emissions per Euro invested are equal to 0.14 kgCO_2/€ for the "large municipalities" call and 0.24 kgCO_2/€ for the "large municipalities" call, with an overall average figure for the two calls equal to 0.18 kgCO2/€.

PP3 - Mazovia

Mazovian Voivodeship ROP (MV ROP) 2014-2020 is a tool for implementing the development policy pursued by the Mazovian Voivodeship Government. MV ROP 2014-2020 assumes further improvement of potentials through economic growth based on entrepreneurship, absorptive labor market, as well as sustainable development of regional resources. MV ROP 2014-2020 is implemented via eleven Priority Axes, including ten thematic axes and one dedicated Technical

Assistance axis. The program was financed from the European Regional Development Fund and the European Social Fund. The Voivodeship is included in the more developed regions with a special status as a formerly underdeveloped region. The distribution of funds between the country and the region ensures the participation under the MV ROP 2014-2020 59% of ERDF and 47% of ESF resources. Funds for the Program constitute about 55% of the allocation for the region, which means the ERDF allocation in the amount of € 1,545 million and ESF in the amount of € 545 million, respectively. In total, under the MV ROP 2014-2020, the estimated allocation is € 2 089 million. The ERDF to ESF ratio is 74% to 26% respectively, while the level of EU co-financing is up to 80% for the Priority Axes. Public and private domestic funds are also involved in the implementation of the Program.

The transition to a low carbon economy is included in Axis IV with an allocated € 400,647,506 and it has three specific objectives:

- Specific objective 1: Increasing the share of renewable energy sources in total energy production - budget € 54,475,309.
- Specific objective 2: Increased energy efficiency in the public and housing sectors - budget € 104,541,043.

Type of projects financed are: Energy retrofit of public or residential buildings and high-efficiency cogeneration.

- Specific objective 3: Better air quality – total budget € 241,631,154.

Sub-measure 4.3.1 Limiting air pollution and developing urban mobility - € 127,698,810.
Type of projects financed are: Limiting "low emissions", development of sustainable multimodal urban mobility, energy-saving in public lighting (streets, squares and roads).

Sub-measure 4.3.2 Urban mobility as part of the ITI € 113,932,344. Support was given to projects focused on strengthening multimodal urban transport systems in the area covered by the ITI strategy.

PP4 - Split-Dalmatia

Since Split-Dalmatia County is a NUTS3 region, there are no decentralized regional operational programmes made available from ESI funds through Partnership Agreement. For this reason the EIHP analysed Split-Dalmatia County low-carbon initiatives which were financed directly through the county's budget. The County has been implementing a Programme for Systematic Energy Management with the aim to increase energy efficiency and the use of RES through its territory since 2014. The Program has been implemented in two stages: the first phase from 2014 to 2017 and the second from 2018 till 2021 each of them regulated through ordinances and financed through the County’s budget.

PP6 - Friuli-Venezia Giulia

The Regional Operational Programme (ROP) ERDF for Friuli-Venezia Giulia supports environmental sustainability in two manners: (i) directly, through interventions for energy efficiency funded by Axis III; (ii) indirectly, through the application of specific selection criteria in the calls for the enterprises under Axes I and II, aimed at facilitating investments towards the development of "green technologies" and the adoption of sustainable production processes. The total available budget amounts to € 230,779,184 including ERDF, national and regional funding. Under Priority Axis III - Supporting the shift towards a low-carbon economy in all sectors received

€ 57 million and has a specific objective addressing energy conversion of public buildings and RES integration.

According to the latest analysis carried out to evaluate the implementation progress of the ROP ERDF in Friuli-Venezia Giulia shows that measures targeted at the energy efficiency of school buildings and social and health infrastructures are consistent with the needs of the territory and with the regional strategies in the energy sector. Furthermore, there was a strong thematic concentration in the areas selected. The strong focus placed on energy efficiency of public buildings, in proportion to the total resources, has no equal in Italy within the regional programmes funded by ERDF. There is no significant difference in how energy efficiency policies were actually designed compared to other Italian Regions with one exception. Namely, in Friuli-Venezia Giulia it is not mandatory for the proposing entities to already have a design of the building at the moment of the application. The result is that, on one hand, applicants are more diverse and it is easier even for smaller institutions to apply. On the other, it requires a higher effort by the Region itself and by implementing authorities *(Unitary Evaluation Service of the 2014-2020 European Union co-financed Operational Programmes, Ismeri Europa, February 2019)*.

Some elements hampering the implementation of projects, in fact, occurred. According to the project leaders' answers, only one fourth of the projects is in line with what was initially planned, while another fourth experience considerable delays. A first analysis based on procedural data, albeit partial, identifies the phase of preparing the preliminary project as the most critical one. The delays are mostly recovered at a later stage of project implementation but a constant monitoring and supporting effort by the Regional Authority is strongly required. The most critical factors were the lack of technical expertise for many social and healthcare institutions, especially true for the smaller ones, and the need to comply with anti-seismic regulations in the case of school buildings. Another big drawback is represented by the stringent requirements set by lower value tenders (*Unitary Evaluation Service of the 2014-2020 European Union co-financed Operational Programmes, Ismeri Europa, February 2019*).

This interim analysis shows that direct effects of interventions are quite positive. There was a reduction in primary energy consumption of 22%, higher than the 15% target set by the ROP. Other positive effects include: cost-effectiveness (1.3 €/kWh) is in line with the national trend for similar interventions; cut of 10,000 tons of CO_2 emissions, which will guarantee a reduction of € 5 to 8 million of social costs caused by climate change in the next 25 years that could be used for other purposes by the Region. Moreover, energy savings accounting for about € 4 million per year, which will allow for a shorter payback of investments enabling public bodies to use these savings for further investments or the improvement of public services; and reduce fossil fuel reliance with a share of energy consumption from RES increasing from 2% to 8% *(Unitary Evaluation Service of the 2014-2020 European Union co-financed Operational Programmes, Ismeri Europa, February 2019)*.

PP8 - Southern Great Plain (represented by AACM)

Although Southern Great Plain is a NUTS 2 region so there are no decentralized regional operational programs made available from ESI funds through Partnership Agreement. With regard to low-carbon investments SGP benefits from the following Operational Programmes:

- Economic Development and Innovation Operational Programme (abbreviated in Hungarian as GINOP);

- Environmental and Energy Efficiency Operational Programme (KEHOP); and
- Territorial and Settlement Development Operational Programme (TOP).

Based on the review of results of the public calls a total € 292 million was awarded to final beneficiaries in the SGP region until February 2020.

Economic Development and Innovation Operational Programme (GINOP):
The Priority axis 4 (Energy) of the Economic Development and Innovation Operational Programme (as GINOP) has been committed via four open Calls with a total budget of € 296 million.

The overall impact indicators of Priority axis 4 include:
- Development of a total of 239,95 MW renewable energy production capacity;
- Reduction of the greenhouse gas emission by 342 543,1 tonnes CO2/year;
- Decrease of the primary energy consumption of buildings in the enterprise sector by 8,424 MWh/year;
- Decrease of primary energy consumption due to energy efficiency renovations by 2,23 PJ/year; and
- Production of renewable energies worth 2,10 PJ/year.

Under GINOP a total funding of € 8.7 million was awarded to final beneficiaries in the SGP region until February 2020 (three GINOP calls were identified).

Environmental and Energy Efficiency Operational Programme (KEHOP):

The highest funding for low-carbon projects is provided through the Environmental and Energy Efficiency Operational Programme (KEHOP), a KEHOP 1 és KEHOP 5 priority axes.
The expected overall impacts of the climate components of KEHOP by 2023 (upon the completion of the programme) comprise:
- Reduction of greenhouse gas emission by 546 kilo tons CO2 eq/per annum;
- Increase in renewable energy production capacity by 200,31 MW; and
- Increase in renewable energy production by: 3,390 000 GJ/annum.

The main funding for low-carbon investments is channelled through the Priority axes 1 and 5 of the Environmental and Energy Efficiency Operational Programme.

KEHOP Priority axis 1 - Adaptation to climate change - addresses the strengthening the knowledge base of water management and the impact of climate change, efficient adaption to the climate change as well as the sustainable management of water resources and more efficient protection against the damages caused by floods. Under this priority axis two calls addressing the climate change issues. The common goal of these two calls is to reach out at least 120,000 citizens and to support municipalities with at least a total population of 3,000,000 to formulate their own climate strategy.

KEHOP Priority axis 5 - Adaptation to climate change is broken into the following four investment priorities:
- KEHOP 5.1 - Non-building related, on-grid green electricity production;
- KEHOP 5.2 - Energy efficiency refurbishment of buildings combined with renewables,

- KEHOP 5.3 - Development district heating supply and distribution systems and their conversion to renewable fuel; and
- KEHOP 5.4 – Public awareness raising.

The impact indicators of KEHOP Priority axis 5 include:

- Increase in renewable energy production capacities by 449.11 MW
- Increase in renewable energy production of 3,52 PJ per annum;
- Number of households with better energy performance classification: 51 745 households;
- Drop of primary energy consumption of residential buildings by 112.6 GWh per annum;
- Drop of the final energy production of public buildings by 29.8 GWh/year;
- Drop of primary energy consumption due to energy efficiency investments: 3,59 PJ/year; and
- Reduction of greenhouse gas emission by 511 kilo tonnes CO_2 eq/per annum.

Based on call level screening (20 calls), final beneficiaries from the SGP regions were awarded a total KEHOP finding of € 153 million.

Territorial and Settlement Development Operational Programme (TOP):
A Territorial and Settlement Development Operational Programme (TOP) concerns all regions in Hungary except the Central Hungarian Region which as a conversion region is addressed by a separate operational program (VEKOP). Low carbon issues are addressed by the following two Priority axes of TOP:

- Priority axis 3: Low carbon transition with special attention to urban areas; and
- Priority axis 6: Sustainable urban development in cities with county rights.

As for Priority axis 3, the SGP Region was provided 16.8% and 23.9% of the total available funding in 2015 and 2016, respectively. As regards Priority axis 6, the SGP Region shared with 33.2% and 25.4% of the total available funding in 2015 and 2016, respectively.

Until February 2020, final beneficiaries selected in the SGP region through five calls were awarded a total TOP funding of € 130 million.

Table 18: Implementation status of the Southern Great Plain Regions based on own research

Beneficiary group	KPI - Implementation of MFF (2014-2020) until the end of December 2020				
	Number of beneficiaries	Average size of grant support (€)	Grant support (€)	Intensity	Total investments cost (€)
Enterprises (renewable investments)	**191**	**300 681**	**57 430 069**	**variable**	**104 661 710**
- geothermal	11	3 430 327	46 749 028	60%	77 915 047
- biomass	1	3 167 300	3 167 300	60%	5 278 833
- solar (MVM)	1	6 142 111	6 142 111	35%	17 548 888
SME - mainly solar (GINOP)	178	7 706	1 371 630	100%	3 918 941
Enterprises (energy efficiency investments in buildings)	89	82 599	7 351 318	variable	15 406 978
Combined grant loan instrument supporting building energy refurbishment using renewable solutions	38	63 192	2 401 280	35-45%	5 506 901
Grant support for building energy refurbishment using renewable solutions	51	97 060	4 950 038	50%	9 900 076
Enterprises (energy efficiency investments in process equipment)	**0**	**0**	**0**	**0**	**0**
Public authorities - buildings	**452**	**477 833**	**215 980 428**	**variable**	**217 668 958**
Building energy refurbishment by state institutions (with minimal RES)	25	387 106	9 677 640	100%	9 677 640
School swimming pools with RES	2	210 125	420 250	80-100%	501 067
Energy refurbishment of public building (demonstration projects)	18	3 733 870	67 209 654	100%	67 209 654
Public building csak RES	18	461 500	8 306 457	100%	8 306 457
Energy refurbishment of municipal buildings - TOP big cities (with minimal RES)	30	791 431	23 742 916	100%	23 742 916
Energy refurbishment of municipal buildings - TOP cities (with minimal RES)	47	521 913	24 529 923	60-100%	29 417 753
Energy refurbishment of municipal buildings - TOP small municipalities (with minimal RES)	137	268 629	36 969 471	60-100%	38 815 871
Energy refurbishment of municipal buildings - TOP small municipalities (with minimal RES)	167	239 507	39 997 601	100%	39 997 601
Public authorities - infrastructure incl. e-mobility measures	**2**	**1 833 651**	**3 667 302**		**7 334 604**
District heating	2	1 833 651	3 667 302	50%	7 334 604
Public authorities - RES	**8**		**5 126 517**	**100**	**5 126 517**
- geothermal	2	809 465	1 618 931	100%	1 618 931
- biomass	4	620 215	2 480 860	100%	2 480 860
- solar park	2	513 363	1 026 726	100%	1 026 726
Residential buildings	**0**	**0**	**0**	**0%**	**0**
Other target group	**9**	**632 401**	**5 691 609**	**100%**	**5 691 609**
Churches - energy efficiency investments in buildings	9	632 401	5 691 609	100%	5 691 609

PP9 - Saxony-Anhalt

During the funding period of 2014-2020 81% of the total ERDF Operational Programme allocation of Saxony-Anhalt addresses for supporting research & innovation, for reducing CO_2 emissions and for enhancing the competitiveness of SMEs.

The regional operational programme focuses on seven different priority axes (PA), each with multiple thematic objectives (TO) and investment priorities (IP). The priorities axes 3 (PA3) theme is the promotion of efforts in order to reduce CO_2 emissions in all branches of the economy.

Considering only TO4 'promotion of efforts in order to reduce CO_2 emissions in all branches of economy', as part of PA3, three different investment priorities with four result indicators (IR) have been set:

- IP 4b: Promotion of energy efficiency and the use of renewable energies in enterprises
  a. RI06: CO_2 emissions of the processing party industry from the final energy consumption (polluter balance) in the ten-year average
- IP 4c: Promotion of energy efficiency, of intelligent energy management and the use of renewable energies in public infrastructure, including public buildings, and in residential construction
  b. RI07: CO_2 emissions from the energy consumption in public sector
- IP 4e: Promotion of strategies for reducing CO_2 emissions in the all areas, especially urban areas, including promotion a sustainable multimodal urban mobility and relevant to climate protection adaptation measures
  c. RI08: CO_2 emissions of traffic from the final energy consumption (polluter balance) in ten-year average
  d. RI09: CO_2 emissions from the final energy consumption - households, businesses, trading, services, remaining consumers (polluter balance) in the ten-year average

Table 19: Structure of ERDF Operational Programme for Saxony-Anhalt

Priority axis	Thematic objective	EU funding (€)	National contribution (€)	Total financial resources (€)
PA1	TO1	524 198 193	131 816 082	656 014 275
PA2	TO3	355 554 130	118 597 063	474 151 193
PA3	**TO4**	**246 250 449**	**91 732 524**	**337 982 973**
PA4	TO6	94 502 116	24 429 158	118 931 274
PA5	TO5	23 125 000	30 781 250	153 906 250
PA6	TO9	26 765 534	2 973 949	29 739 483
PA7	technical support	57 099 808	14 274 952	71 374 760

Saxony-Anhalt received a total funding of € 1,427 billion from ERDF fund which is 13.25% of the country total ERDF budget and € 778 million from EAFRD fund which is 9.3% of the country total EAFRD budget. Regarding the EAFRD, low-carbon economy is not specifically mentioned, but Saxony-Anhalt received support for two topics which respectively include Environment Protection & Resource Efficiency and Climate Change Adaptation & Risk Prevention.

3.2.2. Overall performance regional operational programmes

Data on the TO4 implementation status of the four participating regions with specific regional programmes is provided in Table 20. The largest amount (approximately € 0.5 billion) is dedicated to Mazovia, followed by Saxony-Anhalt and Piemonte. The table suggests that

dedicated TO fundings are committed by the end of the 2019 up to nearly 80% to 100% (or even above due to budgetary reallocation). Mazovia and Piemonte have disbursed above 40% of the committed funding.

Table 20: Regional implementation status of Thematic Objective 4 (TO4)

	2014-2020 (Period Covered: up to 31/12/2019)			
Region/Allocation	**Piemonte Region**	**Mazovia**	**Friuli-Venezia Giulia**	**Saxony-Anhalt**
(Total) Planned - Thematic Objective TO4 (€ million)	193.2	500.8	68.5	347.3
Decided - Thematic Objective TO4 (€ million)	151.4	480.8	79.3	313.4
Spent - Thematic Objective TO4 (€ million)	81.4	231.8	13.5	32.7
Decided TO4/Planned TO4 (%)	78%	96%	116%	90%
Spent TO4/Planned TO4 (%)	42%	46%	20%	9%

Source: https://cohesiondata.ec.europa.eu/

Implementation status (2021) – Piemonte and Friuli-Venezia Giulia

Piemonte Region planned to build 7 MW additional renewable capacity over the whole programming period of which funding for 1 MW was committed. In 2021, the Region committed funding for 118 thousand tons of CO2 reduction which exceeds with some 25% the global target set for the 2014-2020 programming period. The commitment level by 2018 reached 43% of the planned energy saving in public buildings.

In Friuli-Venezia Giulia (FVG) the performance indicator for reduction of energy consumption in public buildings was identified. By 2021, FVG planned investments into the energy retrofit of public buildings which equal to some 170% higher of the originally foreseen annual energy savings by public buildings.

Table 21: Achievements at regional level – Piemonte and Friuli-Venezia Giulia

	Italy - Implementation status in 2021				
Region and Country/Allocation	**Piemonte Region**	**Friuli-Venezia Giulia (FVG)**	**Italy**	**Contribution of Piemonte**	**Contribution of FVG**
Additional capacity of renewable energy production					
Planned Additional capacity for renewable energy production [MW]	7	no data	397	1.8%	not applicable
Decided Additional capacity for renewable energy production [MW]	1	no data	64.0	1.6%	not applicable
Implemented Additional capacity for renewable energy production [MW]	0	no data	58.0	0.0%	not applicable
Reduction of GHG					
Planned Reduction of the annual emission of greenhouse gases [ton CO_2eq]	93 966	no data	4 030 546	2.3%	not applicable
Decided Reduction of the annual emission of greenhouse gases [ton CO_2eq]	107 595	no data	705 982	15.2%	not applicable
Implemented Reduction of the annual emission of greenhouse gases [ton CO_2eq]	6 284	no data	130 782	4.8%	not applicable
Reduced consumption of public buildings					
Planned Reduced consumption public buildings (million kWh/year)	61	30	186.8	32.7%	16.1%
Decided Reduced consumption public buildings (million kWh/year)	34.8	51.3	275.4	12.6%	18.6%
Implemented Reduced consumption public buildings (million kWh/year)	0.12	1.1	57.8	0.2%	1.9%

Updated on 19/11/2021
Source: https://cohesiondata.ec.europa.eu/

Implementation status (2021) – Mazovia

Mazovia Voivodeship committed the available funding by 2021 up to 70% or more for additional capacities of renewable energy production, reduction of GHG emission as well as for reduced consumption of public buildings. KPIs are summarized in Table 22.

Table 22: Achievements at regional level – Mazovia

	Poland - Implementation status in 2021		
Region and Country/Allocation	**Mazovia**	**Poland**	**Share of Mazovia**
Additional capacity of renewable energy production			
Planned Additional capacity for renewable energy production [MW]	30	1 345	2.2%
Decided Additional capacity for renewable energy production [MW]	79	1 977	4.0%
Implemented Additional capacity for renewable energy production [MW]	21	697	3.0%
Decrease of GHG			
Planned Reduction of the annual emission of greenhouse gases [ton CO_2eq]	92 600	2 871 495	3.2%
Decided Reduction of the annual emission of greenhouse gases [ton CO_2eq]	104 237	5 465 320	1.9%
Implemented Reduction of the annual emission of greenhouse gases [ton CO_2eq]	3 674	552 655	0.7%
Reduced consumption of public buildings			
Planned Reduced consumption public buildings (million kWh/year)	157	1 553	10.1%
Decided Reduced consumption public buildings (million kWh/year)	152	2 560	5.9%
Implemented Reduced consumption public buildings (million kWh/year)	43.4	509	8.5%

Updated on 19/11/2021
Source: https://cohesiondata.ec.europa.eu/

Implementation status (2021) – Saxony-Anhalt

The federal state set a target of 31,235 tons of CO_2eq deduction of greenhouse gas emission. By the year 2021, 83.5% and 32.8% of the total funding was committed and respectively disbursed. Comparing the same figures with the average planned/spent level of Germany, Saxony-Anhalt demonstrated an efficient progress in terms of the implementation of investment measures dedicated for CO_2 reduction (Table 22).

Table 23: Achievements at regional level – Saxony-Anhalt

	Germany - Implementation status in 2021		
Region and Country/Allocation	**Saxony-Anhalt (S-A)**	**Germany**	**Share S-A**
Planned Reduction of the annual emission of greenhouse gases [ton CO_2eq]	31 235	2 210 987	1,4%
Decided Reduction of the annual emission of greenhouse gases [ton CO_2eq]	26 093	2 737 616	1,0%
Implemented Reduction of the annual emission of greenhouse gases [ton CO_2eq]	10 247	137 109	7,5%

Updated on 19/11/2021

Source: https://cohesiondata.ec.europa.eu/

4. OTHER EU LOW-CARBON INITIATIVES

4.1. EU INITIATIVES MANAGED BY THE EUROPEAN COMMISSION

4.1.1. Horizon 2020 Programme

Horizon 2020 is the biggest research and innovation programme with nearly €80 billion funding available over 7 years (2014 to 2020). **Work Programme 10 Secure, clean and efficient energy** addresses:

- **Energy efficiency** focusing on buildings, industry, heating and cooling, SMEs and energy-related products and services, integration of ICT and cooperation with the telecom sector;
- **Low-carbon technologies** covering: photovoltaics, concentrated solar power, wind energy, ocean energy, hydro power, geothermal energy, renewable heating and cooling, energy storage, biofuels and alternative fuels, carbon capture and storage;
- **Smart cities and communities** supporting the sustainable development of urban areas in particular in the areas of energy, transport and ICT.

LP - Piemonte Region

In Piemonte more than € 25 million have been used for Innovation Actions or Coordination and Support Actions (59 grants signed). This amount stands for more than 8% of the overall budget allocated in Italy, and Piemonte is at the fourth place in regional ranking for attracting the highest share of Horizon 2020 funding. Considering the NUTS3 level, Torino province stands out as the third Italian province for number of Horizon 2020 participations.

PP3 - Mazovia Region

Out of the target regions Mazovia accessed the highest aggregated H2020 funding. A total of more than € 225 million was allocated for Innovation Actions or Coordination and Support Actions (630 grants signed). The amount stands for more than 47% of the overall budget allocated in Poland. Mazovian Voivodeship is the first Region in the ranking of Poland. If we have a deeper look at NUTS3 level, the Warsaw city area stands out as the most active province for the number of Horizon 2020 participation with € 222 million contribution. Mazovia Energy Agency participated in 4 Horizon projects with a total of € 534,250 EU funds.

PP4 - Split and Dalmatia County

Based on publicly available data on NUTS 3 regions in Croatia (HR035: Split-Dalmatia County) suggests that Split-Dalmatia County has 28 participations in H2020 projects with a total of € 3.48 million of EU contribution and a total of 25 signed grant agreements. In terms of participation, the University of Split leads with a total of 9 projects, followed by the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture in Split with 4 participations.

PP- 6 Friuli-Venezia Giulia Region

Friuli-Venezia Giulia participates in the H2020 programme under the „Secure, clean and efficient energy" thematic priority with a total awarded funding of € 5.13 million. Trieste Province accounts for the highest funding for 12 projects with a net EU contribution of € 3.37 million,

followed by Udine Province with 5 projects with a total budget of € 1.26 million and Pordenone Province with 3 projects worth € 0.5 million. Currently, eleven projects are contracted which support among others e-mobility, development of biofuels and bioconversion techniques, onshore CO_2 storage, innovative financing tools for deep energy renovations, smart city development, and assistance to public authorities to plan and implement sustainable energy policies and measures.

PP7 - EcoEnergyland

The amount of funds in the Horizon 2020 programme tasked for Burgenland is app. € 5.8 million, which equals a share of less than 1% of the program´s financial resources for Austria. In the EcoEnergyLand, an amount of € 3.3 million for projects in the program could be detected. This equals 59% of the amount spent in Burgenland.

PP8 - Southern Great Plain Region (represented by AACM)

A total of eight Horizon 2020 projects that concern the SGP Region was identified from public sources. The total funding these projects have received is € 803 thousand. The main topics include: combined heat, power and metal extraction from ultra-deep ore bodies, sustainable urban mobility, "renaturing" of cites, community-based development schemes for geothermal energy, and innovative grid services.

PP9 - Saxony-Anhalt

Institutions from Saxony-Anhalt participated in the most H2020 projects (143) with an € 61.89 million of EU contribution in total. This results in a total number of signed grants of 133. The projects are identified by beneficiaries; their screening per topic was not possible.

4.1.2. LIFE Programme

The **LIFE Programme** is the EU's funding instrument for the environment and climate action created in 1992. The current funding period 2014-2020 has a budget of €3.4 billion. The LIFE programme is divided in two sub-programmes, one for environment (representing 75% of the overall financial envelope) and one for climate change (representing 25% of the total envelope). The Climate Change Mitigation priority area is helping to reduce greenhouse gas emissions, notably by contributing to the implementation and development of related policy and legislation, improving the knowledge base, developing integrated approaches, and developing and demonstrating innovative technologies, systems, methods and instruments.

LP - Piemonte Region

Based on an extensive search from the late 90s to 2017, a total of 25 projects related to the promotion of low carbon economy were identified where one or more partners were from the Piemonte Region. Overall, project partners from Piemonte Region were or are involved in 36% of the overall funded projects with the participation of Italian partners (70).

PP3 - Mazovia Region

LIFE Programme has financed 125 projects in Poland, from which 86 with Poland as the Lead Partner. In Mazovia 46 projects were realized, 18 related to climate and low carbon issues such as climate policy and climate mapping, reduction of industrial emissions, emission of

refrigerants, hydropower assessment, sustainable water production, promotion of waste to energy technologies.

PP4 - Split and Dalmatia County
No LIFE programme activity was identified in Split and Dalmatia County.

PP6 - Friuli-Venezia Giulia Region
Even though it does not specifically fall under the climate mitigation strand of LIFE, but rather under the area labelled as air – air quality plans required under the Air Quality Directive, it is worth mentioning the LIFE IP-prepAIR project with the funding of € 9,974,624. The Friuli-Venezia Giulia Autonomous Region is partner in the project which aims to constitute a new permanent network of competent authorities and private operators working on the improvement of air quality in four sectors: biomass burning, energy efficiency, transport and agriculture. No stakeholders from Friuli-Venezia Giulia participate in other LIFE projects.

PP7- EcoEnergyland
No LIFE project was realized in the Eco-Energy-Land.

PP8 - Southern Great Plain Region (represented by AACM)
No LIFE project was identified.

PP9 - Saxony-Anhalt
Since the establishment of the LIFE programme in 1992, Germany has shared with a total of € 433 million for altogether 377 projects. For climate action 16 projects were awarded with a total budget of € 9.5 million. In the federal state Saxony-Anhalt nine projects have been granted of which two which were led by SME address energy conversion and energy saving. The others are administered by NGOs and not directly linked to low carbon issues.

4.2. INDIRECT EU FUNDING: INTERREG AND OTHER EU INITIATIVES

INTERREG is one of the two goals of the EU Cohesion Policy in the 2014-2020 period and it is funded by the European Regional Development Fund (ERDF). It has a budget of EUR 10.1 billion invested in several cooperation programmes responsible for managing projects.
INTERREG builds on three different directions:

- Cross-border cooperation (direction A);
- Transnational cooperation (direction B); and
- Interregional cooperation (direction C).

The programme **INTERREG Central Europe** is based on the aims of Europe 2020 and focus on the following thematic points and has a grant of € 246 million in the period from 2014 to 2020:

- research and innovation
- low carbon economy
- environment- and resource efficiency
- transport and mobility.

Eligible Member States or regions include: Austria, Poland, the Czech Republic, Slovakia, Hungary, Slovenia and Croatia as well as parts of Northern Italy and the eastern parts of Germany.

INTERREG Europe cooperates with all 28 members of the EU as well as Switzerland and Norway and focuses on the support of interregional exchange of experience, knowledge and best practises between stakeholders at pan-European level. The aim is to improve the implementation of political initiatives and programmes for regional development. For 2014-2020 the programme receives in total € 359 million from the ERDF funds. Main priorities areas are:

- research and innovation
- improving the competitiveness of small and medium sized enterprises
- low carbon economy
- environment and resource efficiency.

LP - Piemonte Region

Piemonte Region due to its favourable geographic position is involved in several Interreg Programs (Alpine Space, Mediterranean, Central Europe and Europe). In general, Piemonte Region is well represented in Interred Programmes.

In Italy, all Programs assigned to the low carbon priority have a value of 200 M€ and financed 128 projects. The budget allocated to Piemonte PP is about € 5.6 million, equals to 3% of the overall Program budget. 17 out of 128 projects (13%) involve PPs coming from Piemonte. In the period 2014 – 2020:

- Alpine Space program financed - with the low carbon priority – with € 31.4 million a total of 14 projects. The budget allocated to Piemonte PP is nearly € 3.3 million, equal to 10.5% of the overall Program budget. 9 out of 14 projects (64%) involved PP coming from Piemonte;
- Interreg MED Program assigned to the Priority Axis 2 (Energy Efficient Building, Renewable Energy, Urban Transport) € 46.8 million and financed 25 projects. The budget allocated to Piemonte PP is about € 1.3 million, equal to 2.7% of the overall Program budget. 3 out of 25 projects (12%) involved PP coming from Piemonte;
- Central Europe program in the same period to the low carbon priority 23 projects was financed in the value of € 43 million. Piemonte received € 659,300, equal to 1.5% of the overall Program budget. 3 out of 23 projects (13%) involved PP coming from Piemonte;
- Interreg Europe program assigned to the low carbon priority € 76.7 million and financed 60 projects. The budget allocated to Piemonte PP is about € 413,000, equal to 0.5% of the overall Program budget. 2 out of 60 projects (3.3%) involved PP coming from Piemonte.

PP3 - Mazovia Region

Regarding Poland 119 Polish partners participate in 64 projects at the INTERREG Central Europe program. Eight projects are managed by Polish institutions. The total co-financing granted to Polish partners is nearly € 20 million from the European Regional Development Fund.

The INTERREG Baltic Sea Regions program in 2014-2020 supports cooperation projects in the areas of innovation, effective management of natural resources, sustainable transport and institutional capacity building. A total of 173 Polish partners participates in 90 standard projects, and seven projects are managed by Polish institutions. 4 project institutions participate in 4 project platforms. The total funding awarded to Polish partners is over € 30 million from the European Regional Development Fund.

The INTERREG Europe program approved 107 projects with Poland as partner and 3 with Poland as a leader. In Mazovia Region 14 projects were developed (all with Poland as a partner) with the € 1.7 million EUR ERDF contribution.

PP4 - Split and Dalmatia County

Split and Dalmatia County extensively participates in INTERREG (Mediterranean, Central Europe and to a lesser extent in Europe) projects. In total, 22 projects falling under TO4 have been identified with a total budget of € 45.6 million. More than half of the projects were funded by INTERREG Mediterranean. The highest share of projects accounts for "Coastal management and maritime issues" (total budget € 11.4 million) followed by "Waste and pollution" (budget: € 6.52 million).

PP6 - Friuli-Venezia Giulia Region

In FVG the

- Interreg Italy – Slovenia call: FVG has 6 projects. With the title of Energy efficiency in public buildings and sustainable mobility with the support of local communities of the ongoing project FVG received a funding of € 1,195,737.5 in order to reduce production of CO2, energy consumption and the spread and impact of energy poverty in the program area.
- Interreg Italy – Austria Programme: there is not a specific priority in support of low-carbon measures. It is, therefore, quite hard to identify projects relevant to PROSPECT2030 scope but FVG identified two projects addressing energy efficiency and mobility issues.
- Alpine Space Programme: it financed - with the low carbon priority – with € 4.1 million for 2 projects.
- Central Europe Programme: FVG received € 7 million for 4 projects.
- Interreg Europe Programme: assigned to the low carbon priority € 2.7 million and financed 2 projects.

PP7 - EcoEnergyland

The Eco Energy Land has access to funds in two cross-border programs, which are: Austria-Hungary (AT-HU) and Austria-Slovenia (SI-AT). The respective fundings for projects in the EEL are:

- € 1,116,000 - in AT-HU of which an amount of € 280,000 is dedicated to the establishment of a renewable energy resource management network (project: Ökoachse).
- € 1,667,200 - in SI-AT of which a total of € 835,400 is dedicated to an electromobility project (project: "E-Carriage").

Under the Danube Transnational Programme, a total of € 565,460 was awarded for a project promoting energy security and energy efficiency (project: 3Smart).

No relevant Alpine Space, Central Europe, INTERREG Europe or other programs were realized in EEL.

PP8 - Southern Great Plain Region (represented by AACM)

Regarding the Southern Great Plain Region only one TO4 related INTERREG Central Europe programme was realized, namely Szegedi Közlekedési Kft. (Public Transport Company of Szeged) is a project partner in the 'LOW CARB' Project aiming to promote urban mobility.

PP9 - Saxony-Anhalt

In the State of Saxony-Anhalt, the Ministry of Regional Development and Transport works on the transnational cooperation programme INTERREG Central Europe (direction B) and the interregional programme INTERREG Europe (direction C). Regarding Thematic Objective 4 Saxony-Anhalt has 24 INTERREG projects implemented by 32 partnerships and received a total of € 46.1 million funding. With € 23.9 million of total grant the programme INTERREG Europe receives the biggest amount of INTERREG grants. INTERREG VB Central Europe is subsidised with € 21.4 million. The programme INTERREG VB Alpine Space only subsidises only one project with one partnership with a grant of € 743 thousand.

4.3. JOINT INITIATIVES OF THE EU WITH INTERNATIONAL FINANCIAL INSTITUTIONS

4.3.1. European Fund for Strategic Investments (EFSI)

EFSI is one of the three pillars of the Investment Plan for Europe, the so-called Juncker Plan, and aims to overcome current market failures by addressing market gaps and mobilising private investment. It helps to finance strategic investments with higher risk profiles in key areas such as infrastructure, research and innovation, education, renewable energy and energy efficiency as well as risk finance for small and medium-sized enterprises (SMEs).

Table 24: Utilization of EFSI funds by participating countries

European Fund for Strategic Investments (EFSI)		
Country	**Number of projects**	**Funding in € billion**
Austria	29	1.7
Croatia	20	0.3
Germany	104	7.1
Hungary	0	0
Italy	195	11.8
Poland	77	4.5

LP - Piemonte Region

In Italy, the EFSI supported 24 projects in the energy sector. Half of them are prepared in partnership with other countries for developing funding schemes or have a national relevance (such as those implemented by Cassa Depositi e Prestiti). Three projects have been submitted by applicants based in Piemonte. The total amount provided is above 500 M€. In terms of financial resources allocated, not considering the projects with national contribution, Piemonte is a frontrunner, accounting for about 24% of the allocated budget.

PP3 - Mazovia Region

No EFSI activity relevant to the Mazovia Region was identified.

PP4 - Split and Dalmatia County

In Croatia, there are 18 approved EFSI financing, with approved EFSI financing of € 284 million and expected investment related to EFSI of € 1,2 billion. In total nine projects with participants form Croatia are identified between 2015 and 2019, with 3 of them related to energy but only potential two may be applicable at Split-Dalmatia County. These focus on:

- Investment fund focusing on energy transition infrastructure projects in the EU; and
- Fund for developer finance to small renewables (mostly solar photovoltaic (PV)) and energy efficiency projects.

PP6 - Friuli-Venezia Giulia Region

No EFSI project in FVG was identified.

PP7 - EcoEnergyland

No relevant project could be detected in EEL within the program for the period.

PP8 - Southern Great Plain Region

In Hungary, there have not been any EFSI related projects so far.

PP9 - Saxony-Anhalt

While 104 EFSI projects are listed in Germany, no one takes place in the State of Saxony-Anhalt.

4.3.2. European Local Energy Assistance (ELENA)

ELENA is a joint initiative by the European Investment Fund and the European Commission under the Horizon 2020 programme. ELENA provides grants for technical assistance focused on the preparation and implementation of bankable energy efficiency, distributed renewable energy and urban transport programmes. ELENA typically supports projects above € 30 million investments cost with a 3-year implementation period for energy efficiency and 4-year for urban transport and mobility.

The grant may be used to finance costs related to feasibility and market studies, programme structuring, business plans, energy audits and financial structuring, as well as to the preparation of tendering procedures, contractual arrangements and project implementation units.

LP - Piemonte Region

No Elena projects have so far been implemented in Piemonte. Nevertheless, it is worth noting that one of the first PDA (MLEI - IEE) projects has been successfully implemented in Piemonte Region with the involvement of the metropolitan City of Torino, Environment Park, the Region itself and several beneficiaries (small and medium municipalities). Thanks to the project more than 12 M€ of investment in energy efficiency have been realized in public buildings and street lighting, using the EPC scheme, with a leverage factor of about 25.

PP3 - Mazovia Region

Based on the publicly available data of EIB, 5 projects with approx. € 11 million ELENA contributions were granted in Poland of which four ELANA facilities cover the entire territory of Poland thus, these are also relevant to the Mazovia region (representing the highest GDP per capita). These projects include funding for energy efficiency refurbishment investments in residential buildings partnering with three different commercial banks and one project promoting the upgrading of the district heating service.

PP4 - Split and Dalmatia County
No ELENA project was identified.

PP6 - Friuli-Venezia Giulia Region
No ELENA projects have been implemented in Friuli-Venezia Giulia so far.

PP7 - EcoEnergyland
No relevant project could be identified in the program for the period.

PP8 - Southern Great Plain Region
No ELENA project was identified.

PP9 - Saxony-Anhalt
No ELENA project was identified.

4.3.3. Joint European Support for Sustainable Investment in City Areas (Jessica)

JESSICA is a policy initiative of the European Commission (EC) developed jointly with the EIB and in collaboration with the Council of Europe Development Bank (CEB). It supports integrated, sustainable urban-renewal projects. A range of sophisticated financial tools are used including equity investments, loans and guarantees, offering new opportunities for the use of EU Structural Funds.

Out of the target regions no projects under JESSICA were identified with the exception of Mazovia Region where one Jessica project was completed. The Mazovia Energy Agency was involved in this initiative which aimed the improvement of air quality in the Mazovia Voivodeship (Region).

4.3.4. EBRD Green Energy Finance Facility (GEFF)

The EBRD GEFF (Green Energy Financing Facility called earlier as SEFF: Sustainable Energy Financing Facility) operates in EBRD's countries of operation including, Croatia, Hungary and Poland. It partners with local financial institutions such as commercial banks, to establish sustainable energy financing channels. These partnerships help direct more finance towards investment opportunities where energy and other resources are used more rationally. Finance for sustainable energy projects is provided for two key areas: energy efficiency and small-scale renewable energy. Local financial institutions on-lend the funds which they have received from the EBRD to their clients, including small and medium-sized businesses, corporate and residential borrowers, and renewable energy project developers.

PP3 - Mazovia Region
The Polish Sustainable Energy Financing Facility - PolSEFF - was initiated by the European Bank for Reconstruction and Development (EBRD) supported by the European Union. The programme's objective was to overcome barriers faced by Polish SMEs to invest in energy efficiency and renewable energy and increase the number of energy efficient technologies and sources of renewable energy in the market. PolSEFF is a combined loan and grant facility channelled to the

final beneficiaries via local commercial banks. In order to meet the demand for financing under the programme, the EBRD increased the PolSEFF credit line to EUR 180 million in 2012. Within PolSEFF three types of investments were financed:

- investments based on the List of Eligible Materials and Equipment (LEME);
- large scale energy efficiency, renewable energy and building sector projects; and
- investments of Suppliers.

Entrepreneurs who financed their investments within PolSEFF received non-reimbursable investment incentives up to 10% or 15% of the leasing or loan amount. PolSEFF facility financed between 2011 until its end in May 2014 more than 2,000 investments projects for approximately 1,900 Polish SMEs that aimed to improve energy efficiency or generate renewable energy. The financed projects resulted in energy savings of 343 GWh and reduced CO_2 emissions by over 102 thousand tonnes.

Subsequently, a PolSEFF2 facility is the second variant of the successful Polish Sustainable Energy Financing Facility programme developed by the European Bank for Reconstruction and Development (EBRD) which was launched in 2014. It is implemented as a part of the NF Programme, operated by the National Fund for Environmental Protection and Water Management. PolSEFF2 is a €200 million credit line made available to participating banks. The banks then offer loans to SMEs for financing energy efficiency investments. Two types of investment projects are eligible to participate in the programme:

- Energy Efficiency Improvement Projects - Investments in equipment, systems and processes that enable the beneficiaries to reduce primary and/or end use of electric energy, fuels or other types of energy. These investments must result in energy savings of at least 20%.
- Building Thermo-modernisation Projects Energy efficiency measures in commercial and residential buildings that require energy performance certification, and may include investments that generate energy from renewable sources. These investments must result in energy savings of at least 30%.

PP4 - Split and Dalmatia County

WeBSEFF II (Western Balkans Sustainable Energy Financing Facility) was launched in July 2013. It provides a € 45 million credit line facility from the EBRD to participating financial institutions in Croatia under the € 117 million regional WeBSEFF framework for on-lending to businesses, Energy Service Companies (ESCOs), municipalities and public entities investing in energy efficiency in commercial operation and buildings as well as renewable energy projects.

Overall, the facility's investments in projects have contributed to saving more than 204.7 million kWh of energy and more than 33 million kg of CO_2 emissions per year. Loans were provided by 3 partner financial institutions: Zagrebacka banka, Erste Bank and Privredna banka. The advisory services and investment incentives were funded by the following donors: European Union under the "Regional Energy Efficiency Programme for the Western Balkans" programme.

PP8 - Southern Great Plain Region

In Hungary, the MFFEEE (Municipal Finance Facility – Energy Efficiency) initiative funded by EBRD SEFF operated between July 2009 and February 2014. The Facility supported the energy efficiency refurbishment of municipal buildings and infrastructure. The main results were the energy retrofit of municipal buildings and upgrading street lighting based on a third-party (ESCO) financing scheme.

4.3.5. Private Finance for Energy Efficiency (PF4EE)

The EIB and European Commission agreed on an instrument for private finance for energy efficiency (PF4EE-instrument) in order to counteract the limited access to affordable loans of commercial banks for projects in the field of energy-efficiency. It is supposed to support and help develop projects that aim to achieve national energy-efficiency action plans or other energy-efficiency programmes of the EU member states. The administration is taken over by the EIB and financed by the Environment and Climate Policy Programme (LIFE). A total of € 80 million of the LIFE-Programme have been earmarked from the LIFE programme to finance credit risk protection and the provision of expert services. An additional amount of € 480 million at least will be added by the EIB to provide long-term financings.

To date two financial intermediaries in the participating countries, BPER Banca (Italy) Zagrebacka Banka (Croatia), joined the FP4EE scheme. No project was reported in any of the participating regions.

4.3.6. Other private finance initiatives

PP3 - Mazovia

Energy loan initiative began when Voivodeship got back money from the loans from the Jessica project. As a reminder, in Poland Jessica is implemented regionally in the framework of Regional Operational Programs (ROP). After Voivodeship got back money from the loans in Jessica the money had to be allocated again. The new idea was created for loans for projects in the field of comprehensive energy modernization of residential buildings available under measure 4.2 Energy efficiency.

Mazovian Regional Loan Fund and Mazovia Energy Agency, acting as a Financial Intermediary for the funds of the Mazovian Voivodeship Trust Fund, announce the call for applications for financial support in the form of a preferential loan for the implementation of projects in the field of energy and air protection on the 9th of October 2019.The total amount of trust fund funds of the Mazovian Voivodeship for loans is PLN 50 million app. € 11.6 million.

- For the loan the SMEs and local government units from Mazovia Region can apply. The scope of projects possible to support in the form of a loan includes:
  - building insulation;
  - replacement of windows, external doors and lighting for energy-efficient;
  - reconstruction of heating systems (including replacement and connection to a heat source);
  - reconstruction of ventilation and air conditioning systems;
  - energy management systems;
  - installation of RES in energy-efficient buildings;
  - installation of cooling systems, including renewable energy sources;
  - installation of measuring systems.
- Terms of the loan are:
  - Loans are granted in PLN.
  - The unit loan amount is the range PLN 1,000,000 -10,000,000.
  - The period of the loan, calculated from the date of signing the contract to the date of the final repayment of the loan, may not exceed 20 years (240 months).

- A grace period for repayment of loan principal is possible for a period of 12 months from the date of signing the contract.
- There is no grace period for paying interest.

The call for proposals will be carried out on a continuous basis until the funds allocated for loans are depleted

PP9 - Saxony-Anhalt ENERGY

The Saxony-Anhalt ENERGY funding scheme supports small and medium sized companies investing a minimum volume of € 10,000 (large companies € 100,000), energy service providers that offer energy contracting and municipal owned companies. ERDF and the federal state Saxony-Anhalt together provide a grant of max. € 500,000, depending on the subject and company size, for investment measures to increase energy efficiency and to integrate renewable energies in all relevant business areas. However currently no more applications can be submitted in this programme.

PP9 - Saxony-Anhalt CLIMATE II

Irrespective of funding schemes that relate to active implementation or improvement measures, the programme Saxony-Anhalt CLIMTE II encourages research and development in the field of climate protection. Commercial enterprises and research institutions/ universities as co-proposer within the framework of joint and collaborative projects receive a grant of up to 50% of eligible expenditure for industrial research and 25 % for experimental development. This is offered by the Federal State Saxony-Anhalt and ERDF. It focuses on innovative projects for developing new products and processes with the following thematic priorities. For example:

- Integration of renewable energies;
- Significant GHG reduction, in particular CO2;
- Material or energetical use of biomass; and
- Implementation of climate adaptation strategies.

5. NATIONAL FUNDING SCHEMES

Austria

Austrian national funding schemes are categorized by the responsible agencies, which are entrusted with the completion of funding tasks.

Klima- und Energiefonds (Austrian climate and energy fund) (KPC)

The Climate and Energy Fund was set up by the Federal Government in 2007 to support the implementation of its climate strategy - in the short, medium and long term. It is owned by the Republic of Austria, represented by the Federal Ministry for Sustainability and Tourism (BMNT) and the Federal Ministry of Transport, Innovation and Technology (BMVIT). The strategies of the Austrian Federal Government in the fields of research and technology, climate protection and energy provide the essential foundations which are reflected in the programmes of the Climate and Energy Fund. The overriding objective of all actions is to reduce domestic greenhouse gas emissions as quickly and sustainably as possible.

For the EEL region, the following funded projects could be detected for the relevant period:

- Klima und Energie Modellregion (Climate and Energy Model Region): € 250.000.
- Klimawandel Anpassungsregion (Climate Change Adaption Region): € 150.000.

Forschungsförderungsgesellschaft (FFG)

The Austrian Research Promotion Agency (FFG) is the central organisation for the promotion and financing of research, development and innovation in Austria. The aim of the FFG is to strengthen Austria as a location for research and innovation in global competition and thus to sustainably safeguard high-quality jobs and prosperity in Austria.

The FFG was founded on 1 September 2004 by the Federal Law No. 73/2004 "Forschungsförderungsgesellschaft Errichtungsgesetz" (FFG Act for short). It is wholly owned by the Republic of Austria. The FFG is supported by the Federal Ministry of Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Digitisation and Economic Location (BMDW). As a provider of promotional services, FFG is also active on behalf of other national and international institutions. EEL identified 4 other projects in the respective field of interest but with no information on the funding.

OeMAG Abwicklungsstelle für Ökostrom AG (Implementation Agency for Green Electricity)

Green electricity makes an important contribution to achieving climate and environmental protection goals. In order to increase the production of green electricity, a statutory nationwide support scheme has been created. The aim of eco-electricity promotion is to promote the production of eco-electricity by plants in Austria in accordance with the principles of European Union law.

Recognition pursuant to §7 ff ÖSG 2012 is necessary so that the electricity generated in the plant concerned is regarded as green electricity in accordance with the Green Electricity Act. This is the only way to ensure that electricity can be fed into the grid at the subsidised rate. The funding consists of two components: an investment subsidy and a subsidized feed in tariff.

Currently, in the case of photovoltaic, for each kWpeak installed a subsidy of € 250 is granted (precondition: the plant was recognized by OeMAG as an eco-power plant.) Between 2014 and

2019, the investment incentives from this source amounted to € 230,000. Subsidized feed in remunerations for green electricity from all acknowledged eco-energy facilities are amounting to a sum of € 26.5 million in the same period.

The Burgenland Green Energy Fund serves to promote renewable energy sources and new technologies for green electricity generation as well as to increase energy efficiency in Burgenland. In 2018, almost 1,300 funding applications were approved with a total amount of over € 1.5 million.

Germany

In Germany 47 national funding schemes exist for three target groups. Differentiation is made between the private and commercial sector and local authorities/ public institutions/ non-profit organisations. Each sector is allowed to apply for their specific or one of the shared funding programmes. The most known programmes are offered by the Credit Institute for Reconstruction (KfW) and Federal Office of Economics and Export Control (BAFA). Other less common programmes are from the Federal Ministry of Food and Agriculture (BMEL), Federal Ministry of Finance (BMF) and German Federal Foundation for the Environment (DBU). The support programme for renewable energies (n°9 & 10) and offshore wind power are probably one of the most popular, just to name some of them.

Analysing the funded projects in Saxony-Anhalt by the Credit Institute for Reconstruction (KfW) for the year 2019, results in € 3 million in total grant for about 150 projects, nationwide € 39.851 billion were granted. One requirement of the Renewable Energy Law is the expansion of the use of renewable energies, which results in the aim to generate 40-45% of the energy by RES until 2025 (until 2035 55-60% and 2050 80%). It also obligates network operators to prioritise the connection of RE into their electricity network. However, the feed-in tariff or market premium, is only paid for electricity from plants where the production costs of the electricity do not allow economic operation without subsidies. Usually, the duration for these subsidies is 20 years.

Italy

In Italy, nowadays there are several supporting schemes for renewables and energy efficiency. Most of them are managed by the Gestore Servizi Energetici (GSE), a public company in charge of the task from an institutional point of view. The GSE manages more than ten incentive mechanisms aimed at promoting electricity generated from renewable sources and pursuing energy efficiency utilizing a series of market tools and mechanisms, such as white certificates and the renewable energy for heating and cooling support scheme. Another important scheme supporting energy efficiency and RES for private households is the tax deduction system, which allows to receive back on the taxes to be paid the following years an important share of the capital cost. Finally, additional forms of incentives are coming out recently and managed at Ministerial level.

5.1. SUPPORTING SCHEMES FOR RES BY GSE (ITALY)

One of our most important activities implemented by GSE is the qualification of plants. It is a fundamental process to identify the plants that meet the requirements provided for by law in order to access incentive mechanisms. This is performed in the following ways.

QUALIFICATION OF PLANTS POWERED BY RENEWABLE SOURCES (RES-E): The RES-E qualification, issued by GSE, is a technical prerequisite necessary to be admitted to green certificates (afterwards described) or the all-inclusive feed-in tariff, depending on the net electricity produced and fed into the grid.

QUALIFICATION OF ELECTRICITY – GUARANTEE OF ORIGIN (GO): GSE issues the Guarantee of Origin (GO) to plants that, upon requesting the qualification, obtain it by giving evidence of electricity generation from renewable sources. This tool represents the only guarantee of origin of the electricity generated from these sources. The operators that sell energy to the final market are obliged to purchase GOs for an amount equal to that of the electricity sold as renewable.

INCENTIVE MECHANISMS

GSE supports the production of electricity from renewable sources through various incentive mechanisms, at disposal of private subjects, companies and public administrations. They are briefly described in the following bullet points.

- FEED-IN SCHEME: This mechanism is used to allocate incentives to private subjects, companies and public administrations that would install a photovoltaic solar plant connected to the electricity grid, proportioned to the electricity produced. As of 6 July 2013, the reductions provided for by the Feed-in scheme are no longer accessible.
- GRIN: The Green Certificate mechanism, provided for by the Ministerial Decree of 6 July 2012, has been substituted by a new form of incentive as of 2016. The subjects that have already been recognised by a Green Certificate (holders of plants with RES-E qualification) will maintain the benefit for the remaining concessional period, but in a different form. In fact, according to the new mechanism, GSE pays a tariff in Euros on the net production of electricity additional to the revenues deriving from the increase in value of electricity (which can take place through the Simplified Purchase & Resale Arrangements or through the operator's recourse to the Free Market). In order to pass on to the new incentive mechanism, the holders of RES-E plants, that have already been recognized by a Green Certificate, must sign an Agreement with GSE entitling them to benefit from the incentive tariff for the remaining period. The Agreement must be entered into through an IT application: GRIN - Gestione Riconoscimento Incentivo (Management of the Incentive Recognition).
- ALL-INCLUSIVE FEED-IN TARIFF: This mechanism represents an alternative to the green certificates. It consists tariffs for the electricity fed into the grid whose value includes both the incentive component and the increase in value component of the electricity fed into the grid.
- CIP 6: This incentive mechanism for electricity produced by renewable sources and similar was introduced by the Inter-ministerial Committee's resolution 6/92. It was a form of remuneration through a tariff whose value was periodically updated. Currently, it is no longer possible to access this incentive mechanism.
- INCENTIVES AS PER M.D. OF 23 JUNE 2016 AND AS PER M.D. OF 6 JULY 2012: These are incentives for electricity generation from RES-E plants, other than photovoltaic solar ones, with a capacity of at least 1 kW.
- SIMPLIFIED PURCHASE AND RESELL ARRANGEMENTS: This tool allows GSE to purchase and resell the electricity to be fed into the grid paying producers a minimum guaranteed price for every kWh purchased. Producers with small-sized plants and a nominal electrical

capacity up to 1 MW, benefit from GSE's guaranteed minimum prices for the first 2 million kWh per year fed into the grid, without prejudicing the possibility to receive more if the hourly zonal prices prove to be more advantageous.

- NET-METERING: Through this mechanism, those who generate electricity from renewable sources feeding it into the grid and at the same time purchase electricity from the grid for personal consumption, benefit from the compensation of the economic value of what produced and fed into the grid with the economic value of what purchased and consumed in a period differing from that of production.

SUPPORTING SCHEMES FOR ENERGY EFFICIENCY BY GSE

In addition to promoting renewable sources through incentives, GSE manages as well incentives for the efficient management of energy resources. They are briefly described in the following bullet points.

- WHITE CERTIFICATES: White certificates, also known as "Energy Efficiency Certificates", give proof of end-use energy savings achieved through projects aimed at increasing energy efficiency in the final uses of energy.
- RENEWABLE ENERGY FOR HEATING AND COOLING SUPPORT SCHEME (CT): The scheme aims at supporting the production of thermal energy from renewables, as well as small-scale interventions of energy efficiency for private organizations and the Public Administration. The CT finances up to 65% of energy retrofit of the building envelope and on thermal plants that increase energy efficiency. For the transformation of existing buildings into almost zero energy buildings (NZEB), the contribution reaches 65% also for any demolition and seismic adjustment costs. In any case, the mechanism covers 100% of the costs of the Energy Diagnosis performed to determine the interventions to be performed and can be combined with other public (including state) financing, provided that the sum of the public contributions does not exceed 100% of the cost of the interventions. The CT can be accessed via two different methods:
  - direct access: following the conclusion of the interventions, the Responsible Person transmits to the GSE, through the special section of an IT tool a specific application for the granting of incentives;
  - reservation: the Public Administration, and the ESCOs that operate on behalf of the PA, can present to the GSE, for the reservation of the incentive, a request form.
- BIOFUELS – SUSTAINABLE BIOFUEL BLENDING CERTIFICATE: Italy has established that within 2020 the renewable biofuels used in transport must be equal to 10%. In 2015 fossil fuel suppliers blended a 5% share of biofuels, complying with the minimum goal envisaged for that same year. This obligation is useful for a greater diffusion of biofuels in the sector and for a reduced impact of CO2 emissions. GSE manages the sustainable biofuel blending certificate in order to recognise suppliers that blend their share of biofuels and, doing so they can freely exchange the fuel in the market.
- HIGH-PERFORMANCE COGENERATION: The recognised high-performance cogeneration units are allowed access to the Energy Efficiency Certificates (EEC) or white certificates, depending on the conditions and procedures provided for by the Ministerial Decree of 5 September 2011. GSE issues a high-performance cogeneration certificate to the applicant units and fosters those who invest in this type of technology, providing market benefits, cost reductions or technical benefits.

5.2. TAX DEDUCTION SYSTEMS

Italy

In Italy the legislative reference of the tax deductions is constituted by the Law 296/2006 for the energy retrofit of the buildings heritage (Ecobonus) and the so-called Home Bonus for general building retrofit. Both measures have been integrated over the last few years, compared to the initial formulation. In 2018, the deadline for such measures has been extended until 2019 (with further prolongation expected for the upcoming years) with the possibility to receive a 50% deduction (in 10 yearly rates) with the maximum expenditure of 96,000.00 euros for each unit real estate for building renovation. Among those interventions some of them have an impact of the energy performance of the building (i.e. PV installations), so that an analysis is made on the available data. Recently, a superbonus for investments in condominiums has been introduced.

The so-called Superbonus is a subsidy which raises the deduction rate of expenses incurred for specific interventions in the field of energy efficiency, anti-seismic interventions, installation of photovoltaic systems or infrastructures for recharging electric vehicles to 110% in buildings. Among the innovations introduced, it is possible, instead of the direct use of the deduction, to opt for an advance contribution in the form of a discount applied by the suppliers of the goods or services or, alternatively, for the assignment of the credit corresponding to the deduction due. The deduction is recognized in the measure of 110%, to be divided among the entitled parties in 5 annual instalments of the same amount and for the expenses incurred in 2022 in 4 annual instalments of the same amount, within the limits of the capacity of the annual tax deriving from the return. of income.

Based on past years data, Piemonte is the second Italian Region with almost than € 2.2 billion spent on home renovation measures triggering 846.9 GWh of annual energy savings. Friuli-Venezia Giulia region absorbed a total of € 567 thousand by generating an energy saving of 192.3 GWh per annum. In terms of the overall typology of measures, the replacement of windows and the installation of condensing boilers with thermostatic valves are the main measures implemented, followed by the envelope insulations.

5.3. EUROPEAN INVESTMENT LOAN

Italy

In Italy the "European Funds Investment Loan" is managed by the public bank Cassa Depositi e Prestiti. The funding is addressed to those Public Administrations that have successfully applied for investments financed by the European Regional Development Fund and the European Agricultural Fund for Rural Development.

With the European Funds Investment Loan, financial coverage is provided for any share borne by the beneficiary for the realization of a public investments, allowing the launch and rapid completion of the same. The sums paid must be repaid at the time of payment of the Contribution, without any additional charge. The amortization period can be anticipated if the investment has been fully realized. The residual amount payable by the beneficiary will be reimbursed in maximum 40 six-monthly instalments.

5.4. NATIONAL FUNDS FOR ENERGY EFFICIENCY

Italy

In 2019, an Italian National Fund for energy efficiency was established at the Ministry of Economic Development. It supports energy efficiency measures implemented by companies, including ESCOs, and by public bodies, on buildings, plants and production processes. Specifically, the interventions supported must concern the reduction of energy consumption in industrial processes, the construction and expansion of district heating networks, the improvement of public services and infrastructures, including public lighting and energy upgrading of buildings.

The Fund has a revolving nature and is divided into two sections that operate by:

- the granting of guarantees on individual financing operations, for which 30% of the resources that annually flow into the Fund are allocated;
- the provision of soft loans at a rate of 70% of the resources that flow into the Fund annually. 20% of the resources allocated for the granting of loans is reserved for the PA.

6. COOPERATION WITH PRIVATE STAKEHOLDERS

Austria

In total, for the period from 2014 to 2019, an investment of approximately 1.34 million €, based on private and private-public partnership investment, has been achieved in EEL

- Wagenhofer PV

A total of € 1 million for 1 MWpeak open-space photovoltaic plants have been invested by a private investor in the municipality of Strem. The plant was installed without the use of the funding schemes described at EEL. It aims to achieve profitability on the basis of an energy community which, however, is not yet established due to the lack of concrete legal framework conditions. However, a corresponding regulation, which will also ensure legal certainty, is expected in 2020.

- Public participation photovoltaic facilities

Between 2014 and 2019, five public participation photovoltaic facilities have been installed in the EcoEnergyLand. With a contribution of € 1000 it is possible to purchase a photovoltaic system in a municipality where the participants live. The electricity generated by the system is completely fed into the grid of Energie Burgenland. In return, the plant operator - the municipality itself - receives a so-called feed-in tariff for a period of 13 years. After 13 years this should not only enable the payment of a profit share in the amount of the contribution, but also the annual payment of a profit advance of approx. 4% independent of the result. In total, a capacity of 243 kWpeak, with an investment volume of € 338,000 has been installed.

Italy - FVG

With regard to private sector initiatives in low-carbon investments in the FVG region, Energy Performance Contracts (EPCs) which can be the contractual form chosen within a PPP (Private Public Partnership) or generally used by an ESCO (Energy Service Company), are successfully applied.

EPCs have been implemented in several different projects in the last few years in Friuli-Venezia Giulia Region. A significant number of EPC proposals have been directly analysed by APE FVG as an independent external technical/financial adviser, on request of the municipalities. None of these EPCs were implemented within the framework or with the support of EU programmes. All investments foreseen by EPCs concluded in FVG region, including those most assessed by APE FVG, were entirely financed by private funds simply because they were deemed financially sustainable and yielded a convenient IRR (Internal Rate of Return) in comparison to the average risk (low) that these kinds of projects have.

EPCs for efficiency improvement measures in the field of public lighting and thermal plants of public bodies, are implemented even without the support of incentive mechanisms. A critical factor in this case is the risk-reward profile of the investment.

Poland - EPC

Energy Performance Contracting aims mainly for energy economy improvement by lowering energy demand and consumption in buildings, city building districts and industrial installation. This type of contracting is generally applicable in modernization processes of:

- building envelopes by improving their thermal insulation;
- lowering energy distribution losses in buildings and building districts;
- application of efficient combined heat and power energy generation in building districts and industrial complexes.

These above-mentioned modernization processes also improve the operational economy of property, leading to financial gains.

Recently investors/owners are forced to lower CO_2 emission in energy generation processes which leads to application of Renewable Energy Sources – RES and low emission fuels in energy generation as e.g. NG – natural gas in energy cogeneration (gas & heat) processes. Usage of RES is rewarded with colour certificates – bonds (green, yellow, red etc.) to cover additional investment costs.

Public clients are usually unable to develop necessary for EPC documentation which specifies energy performance targets and project technical vision, feasibility study, financing and contract documentation – so called the early design stage documentation. Usually, they call for support to external auditing firms which as an early design stage contractor support the client in modernization processes.

Public-Private Partnership is a venture organized to perform difficult just for public organisations on its own complex projects due to technical (lack of expertise), financial (lack of financial resources – third party financing - TPF) or formal reasons. PPP is usually performed under a long term agreement – contract which target is to modernize public infrastructure e.g.: EPC of public property infrastructure.

For public institutions as kindergartens, schools, universities and hospitals or local governments buildings it would be difficult to collect funds for modernization of their premises as well as to receive loans for improving energy performance of their premises, so an idea of financing modernizations out of energy savings had been developed in USA and spread out in Europe.

Public-Private Partnership also defines the type of contracting relation between public property owner and private contractor which rewards himself out of operational savings after modernization. The contractor that undertakes this type of activity is called an ESCO. Unfortunately, this term in Poland has double mining.

ESCO (1) – Energy Saving Company, defines the type of the contractor which performs EPC rewarding himself out of energy savings in demand and consumption:

and later on, the more complex one:

ESCO (2) – Energy Service Company which performs the contracting responsibility as the one above and in addition takes care about energy operational demand, consumption and in addition, RES investments, energy supply safety and financing (TPF) being rewarded out of energy and media savings, RES bonds as well as energy and media seasonality management.

In ESCO mode contractors finance projects execution out of their own funds or out of banking loans usually not more than up to 80%. In this case, banks usually require good references and proven history of ESCO project execution from contractors.

There are several modes of ESCO contracting modes, e.g.:

- BOO (Build - Operate - Own);
- BOT (Build - Operate - Transfer);
- BOOT (Build - Own - Operate - Transfer).

In general, there are 3 types of EPC rewarding:

- payment after fulfilment of EP conditions;
- first out payment initiated right from savings appearance in full amount to shorten the period of payment;
- shared savings payment between owner and the contractor according to the contract agreement.

General remark: it's important to keep the right relation between: return time from investment, warranty period and life cycle of delivered products.

In Energy Performance Contracting the phase of Early Design Engineering plays a decisive role. It consists of several engineering activities to be performed by experienced engineering firms. Failure at this phase may lead to serious consequences and it is vital in EPC modernization contracting (which should cover buildings, buildings technical installations and in particular energy distribution and generation as well as energy installation management). The early design engineering phase should include:

- building and installation inventory and exploitation characteristics;
- energy performance auditing;
- technical concepts of improvements;
- feasibility studies with life cycle analysis of life cycle concepts and project financing concept;
- early design modernization engineering concept;
- project financing;
- contracting documentation proposal.

For large scale EPCC should be performed according to EPCC procedures and consists of 6 stages:

- financing institutions selection including usually an Investment Fund and Banks if necessary;
- preliminary offers collection, analysis and contracting condition adjustments;
- final offers collection and contractor selection;
- modernization part of contract execution with commissioning;
- exploitation in warranty period;
- contract completion.

Depending on the project size, ESCO projects in Poland are financed by international banks in cooperation with Investment Funds, where they usually play roles of payment guarantors. It's possible to finance EPCC projects in combined mode e.g.: in ESCO mode out of savings and in leasing mode the parts not generating savings as e.g.: reconstructions and extensions. At the moment basic banking interest is at the level of 1.5%, total interest varies between 7% to 15%.

The large scales of EPCC usually are financed by consortiums of Investment Funds and Banks. In the case of public firms EPCC can be financed from Public Support mechanisms.

Poland - Crowdfunding

Crowdfunding is a form of financing for different types of projects organized by a group of people. In the case of crowdfunding a project is financed by a group of people donating relatively small sums of money by those interested in project execution.

In principle, crowdfunding is an activity consisting in some kind of funds collection and allocation for financing a project execution in order to achieve certain goals, e.g.: improvement in energy distribution installations within a building by occupiers in order to decrease costs of living.

In most of the European countries crowdfunding is not legally regulated. In Poland a Polish Society of Crowdfunding operates, which provides legal support to interested groups of people.

Poland - Venture capital/equity contribution

Within five years, a joint fund of PGE (Polish Energy Group), Polish Development Fund (PFR) and the National Center for Research and Development (NCBiR) is targeting projects including in the area of Industry 4.0, digitization, energy storage, electromobility and big data.

PGE Ventures, SpeedUp Group and the National Centre for Research and Development have jointly created the SpeedUp Energy Innovation fund powered by PGE Ventures (SEI). The goal of the new corporate venture capital (CVC) fund is to invest in start-ups at an advanced stage of growth. Ultimately, the capitalization of the new fund will amount to PLN 100 million. The entity responsible on the part of PGE for the implementation of such projects is PGE Ventures, which will act as an investor and will have an impact on the investment policy of the SEI fund. The resources that the SEI fund will have at its disposal will be allocated to the development of the most innovative technological start-ups. The PFR's strategic goals include a significant increase in the availability of financing for young and innovative companies. This is to translate into the construction of a modern 4.0 economy, which is to make Poland an innovation hub of European significance. This goal is implemented, among others, by PFR Ventures, which, together with independent investors, plans to invest approx. PLN 4.5 billion in start-ups. The joint fund of PGE Ventures, PFR Ventures and the National Research Center is the world's first institution of CVC Fund (FoF). Half of its funds come from European funds (Intelligent Development Operational Program 2014-2020). During the 5-year investment period, the SEI fund plans around 12 capital entries and several follow-on investments. The planned investment threshold for carrying out the first financing round will be between PLN 3-3.5 million, there is also the possibility of additional recapitalization of selected projects from the first financing round to the amount of even PLN 10 million. The SEI Fund also includes the possibility of conducting co-investments, especially during planned continuation investments.

The new fund will be particularly interested in companies with high potential for generating financial flows and characterized by high technological potential. As part of the investment criteria, the SEI fund provides that potential investment projects must be at least in the early growth phase. In addition, these projects must generate revenues from operations, and capital needs should be allocated primarily to market expansion.

Enea has established the venture capital fund Enea Innovation, which will invest in innovative projects in the energy industry. The fund will invest in projects at an early stage of development, but it will be possible to co-invest companies at the stage of expansion and development. The

fund's capitalization will amount to PLN 50 million, and for each project up to PLN 5 million. The fund will have a five-year investment horizon. After this period, Enea will decide which projects are for sale and which technologies will be kept. The fund will invest in projects related to the core business of the group, in projects supplementing the sales offer, and in completely new technologies for the industry.

The new Enea fund is the next step in the development of the R&D project support system. The fund will complement the portfolio of financing instruments for research and development projects that start-ups offer to the above-mentioned institutions such as NCBR, PGE or the PFR Group. The fund's investment activities will result in the presence of young companies at every stage of development, while having access to innovative technologies that are developed by the most mature start-ups. This means that selected projects that will be in the fund's investment portfolio will be able to be tested in a natural environment, i.e. using the Enea infrastructure, including power plants, combined heat and power plants, and distribution assets.
Those public owned funds, described before, are to identify and support the development of the most unique technologies that will contribute measurably to resolving Poland's significant problems in the energy sector. They aim to make a lasting impact on the Poland innovation ecosystem and the comprehensive support provided to new technology ventures at the very early stage goes far beyond the financial investment and is delivered with the intention to help turn these companies into market leaders.

7. EVALUATION

7.1. PARTNER REGIONS OF PROSPECT2030

The seven PROSPECT2030 Partner Regions include two NUTS 1, three NUTS 2, one NUTS 3 level regions and a local non-administrative region as Table 25 presents.

Table 25: European territorial statistical classification of the Participating Regions

Partner Region	PP	NUTS level	Comment
Piemonte Region	LP	NUTS 2	NUTS 1: Northwest Italy
Mazovia Region	PP3	NUTS 1	Broken into two NUTS 2 regions: - Warsaw Capital - Mazovia Region
Split and Dalmatia County	PP4	NUTS 3	NUTS 1: Croatia NUTS 2: Adriatic Croatia
Friuli-Venezia Giulia Region	PP6	NUTS 2	NUTS 1: Northeast Italy
EcoEnergyland	PP7	N/a	NUTS 1: Eastern Austria NUTS2: Burgenland
Southern Great Plain Region	PP8	NUTS 2	NUTS 1: Great Plan and North
Saxony-Anhalt	PP9	NUTS 1	Further divided into NUTS 3 regions

7.2. FUNDING FOR TO4 AT NATIONAL LEVEL

Over the 2014-2020 period, the overall funding to TO4 ("Supporting the shift towards a low-carbon economy in all sectors") in the Partner Countries represents 4.2 % to 11.2% of the total ESIF funding including the associated respective national contributions. TO4 funding in the highest ratio was allocated in Hungary, whilst in the lowest proportion in Austria.

Table 26: Share of TO4 in the total EU funding in the Partner Countries

	2014-2020 (Updated at 05.10.2020)						
Country/Allocation	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Thematic Objective TO4 - Partnership Agreement (€ million)	206.5	756.9	2 903.6	2 808.0	3 948.9	9 189.9	44 353.0
TO4 allocation/EU contribution (%)	3.1%	6.3%	8.7%	11.0%	6.8%	10.1%	8.4%

Source: https://cohesiondata.ec.europa.eu/

7.3. IMPLEMENTATION AT NATIONAL LEVEL (FINANCIAL INDICATORS)

By the end of 2020, the EU funding and national contribution allocated to TO4 was committed up to approximately 80% or above by the Partner Countries. Two countries, Croatia and Poland have even fully committed the available funding by the end of 2019. By the same date, about one third of the available funding was almost evenly disbursed to final beneficiaries (Table 27).

Table 27: Commitment of TO4 funding in the Partner Countries until the end of 2019

	2014-2020 (Period Covered: up to 31/12/2019)						
Country/ Allocation	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Thematic Objective TO4 planned EU (€ million)	586	913	4 306	2 316	4 752	8 467	45 748
Thematic Objective TO4 committed (decided) (€ million)	468	9715	4 510	2 505	4 549	9 066	48 317
Decided EU funds for TO4/Planned (%)	79.9%	106.8%	104.7%	108.2%	95.7%	107.1%	105.6%

Updated on 19/11/2021
Source: https://cohesiondata.ec.europa.eu/

7.4. IMPLEMENTATION AT NATIONAL LEVEL (TECHNICAL INDICATORS)

Information was identified concerning the following technical performance indicators:

- Development or renewable capacities in MW;
- Total investment (private and public) in renewable energy production (€ million);
- Reduction of GHG in ton CO_2eq;
- Reduced consumption public buildings (million kWh/year); and
- Total investment (private and public) for energy efficiency in agriculture and food processing (€ million).

Development of additional renewable capacities

Italy followed by Croatia allocated the highest amount of funding into the development of renewable capacities. Germany and Poland had committed investments by 2020 that ensure the development of significantly higher renewable capacities than originally planned. Germany had even more than doubled the respective target, and Poland exceeded the originally planned capacities by some 30%. According to the available figures from 2019, Italy was progressing well, whilst the other countries were lagging behind in terms of financial implementation.

Table 28: Impact indicators of Partner Countries - Additional renewable capacities (Implementation status in 2021)

	Implementation status in 2021 - Total investment (private and public) in renewable energy production						
Country/Indicators	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Planned Total investment in renewable energy production (€ million)	585.3	161.2	29.1	37.8	236.6	no data	2 293.0
Decided Total investment in renewable energy production (€ million)	363.5	15.4	7.0	23.8	80.3	no data	1 043.0
Decided/planned Total investment in renewable energy production [%]	62.1%	9.6%	24.0%	63.0%	33.9%	no data	45.5%
Planned Additional capacity for renewable energy production [MW]	no data	no data	103	969	397	1 345	7 116
Decided Additional capacity for renewable energy production [MW]	no data	no data	318	646	64	1 977	5 785
Decided/planned Additional capacity for renewable energy production [%]	no data	no data	308.7%	66.7%	16.1%	147.0%	81.3%

Source: https://cohesiondata.ec.europa.eu/

Reduction of GHG

In terms of commitment of the funding. Poland plans to achieve considerably higher reduction of the GHG emission as originally planned. In 2018. Poland accounted for almost 40% of the total planned GHG reduction in the EU28.

Table 29: Impact indicators of Partner Countries – GHG reduction (Implementation status in 2018)

	Implementation status in 2021 - Reduction of the annual emission of greenhouse gases						
Country/Indicators	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Planned Reduction of the annual emission of greenhouse gases [ton CO_2eq]	218 000	no data	2 210 987	1 412 179	4 030 546	2 871 495	19 998 128
Decided Reduction of the annual emission of greenhouse gases [ton CO_2eq]	305 097	no data	2 737 616	622 777	705 982	5 465 320	17 077 541
Decided/planned Reduction of the annual emission of greenhouse gases [%]	140.0		123.8	44.1	17.5	190.3	85.4

Source: https://cohesiondata.ec.europa.eu/

Reduced consumption public buildings

Energy saving in the public building sector had largely exceeded the originally projected target values. In particular, Croatia and Poland recorded the highest increase by 3.8 times and by 1.7 times. respectively. In 2021. The participating countries accounted for almost 90% of the total committed energy saving in the whole EU.

Table 30: Impact indicators of Partner Countries – Reduced consumption of public buildings (Implementation status in 2021)

	Implementation status in 2021 - Reduced consumption public buildings						
Country/Indicators	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Planned Reduced consumption public buildings (million kWh/year)	no data	55.1	203	565.7	186.8	1 523	6 316
Decided Reduced consumption public buildings (million kWh/year)	no data	212	164.6	787.7	275.4	2 560	6 048
Decided/planned Reduced consumption public buildings (million kWh/year)	no data	384.8%	81.1%	139.2%	147.4%	168.1%	95.8%

Source: https://cohesiondata.ec.europa.eu/

Total investment (private and public) for energy efficiency in agriculture and food processing
For energy saving in the agri-food sector. Hungary requested the highest amount of EU funding (€ 888.3 million). followed by Germany (557.2 million). whilst the other participating countries use none or a relatively small amount for this purpose.

Table 31: Impact indicators of Partner Countries – Energy efficiency investments in the agri-food sector (Implementation status in 2018)

	Implementation status in 2021 - Total investment (private and public) for energy efficiency in agriculture and food processing						
Country/Indicators	**Austria**	**Croatia**	**Germany**	**Hungary**	**Italy**	**Poland**	**EU**
Planned Energy efficiency in agriculture and food processing (€ million)	0.0	0.0	557.2	888.3	20.2	no data	2 816.3
Decided Energy efficiency in agriculture and food processing (€ million)	0.0	0.0	391.1	63.6	9.3	no data	1 341.6
Implemented Energy efficiency in agriculture and food processing (€ million)	0.0	0.0	200.7	63.6	3.3	no data	770.6

Source: https://cohesiondata.ec.europa.eu/

7.5. PLANNING AT REGIONAL LEVEL

In Mazovia Voivodeship. Split and Dalmatia County and in the Southern Great Plan the creation of a low-carbon economy plan is not enforced by law. It is the decision of municipal councils and local communities that recognize the benefits of drawing up such a document like obtaining EU funds in the 2014-2020 period. However, many municipalities have prepared and adopted a Climate Strategy at county or local level.

7.6. IMPLEMENTATION OF TO4 AT REGIONAL LEVEL

Data on the TO4 implementation status of the four participating regions having specific regional programmes is provided in Table 32. The largest amount (approximately € 0.5 billion) is dedicated to Mazovia. followed by Saxony-Anhalt and Piemonte. The table suggests that dedicated TO fundings are committed by the end of the 2019 up to nearly 80% to 100% (or even above due to budgetary reallocation). Mazovia and Piemonte have disbursed above 40% of the committed funding.

Table 32: Regional implementation status of Thematic Objective 4 (TO4)

	2014-2020 (Period Covered: up to 31/12/2019)			
Region/Allocation	**Piemonte Region**	**Mazovia**	**Friuli Venezia Giulia**	**Saxony-Anhalt**
(Total) Planned - Thematic Objective TO4 (€ million)	193.2	500.8	68.5	347.3
Decided - Thematic Objective TO4 (€ million)	151.4	480.8	79.3	313.4
Spent - Thematic Objective TO4 (€ million)	81.4	231.8	13.5	32.7
Decided TO4/Planned TO4 (%)	78%	96%	116%	90%
Spent TO4/Planned TO4 (%)	42%	46%	20%	9%

Source: https://cohesiondata.ec.europa.eu/

Implementation status (2021) – Piemonte and Friuli-Venezia Giulia

Piemonte Region planned to build 7 MW additional renewable capacity over the whole programming period of which funding for 1 MW was committed. In 2021. The Region committed funding for 118 thousand tons of CO2 reduction which exceeds with some 25% the global target set for the 2014-2020 programming period. The commitment level by 2018 reached 43% of the planned energy saving in public buildings.

As Friuli-Venezia Giulia (FVG) performance indicator for reduction of energy consumption in public buildings was identified. By 2021. FVG planned investments into the energy retrofit of public buildings which equal to some 170% higher of the originally foreseen annual energy savings by public buildings.

Table 33: Achievements at regional level – Piemonte and Friuli-Venezia Giulia

	Italy - Implementation status in 2021				
Region and Country/Allocation	**Piemonte Region**	**Friuli Venezia Giulia (FVG)**	**Italy**	**Contribution of Piemonte**	**Contribution of FVG**
Additional capacity of renewable energy production					
Planned Additional capacity for renewable energy production [MW]	7	no data	397	1.8%	not applicable
Decided Additional capacity for renewable energy production [MW]	1	no data	64.0	1.6%	not applicable
Implemented Additional capacity for renewable energy production [MW]	0	no data	58.0	0.0%	not applicable
Reduction of GHG					
Planned Reduction of the annual emission of greenhouse gases [ton CO_2eq]	93 966	no data	4 030 546	2.3%	not applicable
Decided Reduction of the annual emission of greenhouse gases [ton CO_2eq]	107 595	no data	705 982	15.2%	not applicable
Implemented Reduction of the annual emission of greenhouse gases [ton CO_2eq]	6 284	no data	130 782	4.8%	not applicable
Reduced consumption of public buildings					
Planned Reduced consumption public buildings (million kWh/year)	61	30	186.8	32.7%	16.1%
Decided Reduced consumption public buildings (million kWh/year)	34.8	51.3	275.4	12.6%	18.6%
Implemented Reduced consumption public buildings (million kWh/year)	0.12	1.1	57.8	0.2%	1.9%

Updated on 19/11/2021
Source: https://cohesiondata.ec.europa.eu/

Implementation status (2021) – Mazovia

Mazovia Voivodeship committed the available funding by 2021 up to 70% or more for additional capacities of renewable energy production. reduction of GHG emission as well as for reduced consumption of public buildings.

Table 34: Achievements at regional level – Mazovia

	Poland - Implementation status in 2021		
Region and Country/Allocation	**Mazovia**	**Poland**	**Share of Mazovia**
Additional capacity of renewable energy production			
Planned Additional capacity for renewable energy production [MW]	30	1 345	2.2%
Decided Additional capacity for renewable energy production [MW]	79	1 977	4.0%
Implemented Additional capacity for renewable energy production [MW]	21	697	3.0%
Decrease of GHG			
Planned Reduction of the annual emission of greenhouse gases [ton CO_2eq]	92 600	2 871 495	3.2%
Decided Reduction of the annual emission of greenhouse gases [ton CO_2eq]	104 237	5 465 320	1.9%
Implemented Reduction of the annual emission of greenhouse gases [ton CO_2eq]	3 674	552 655	0.7%
Reduced consumption of public buildings			
Planned Reduced consumption public buildings (million kWh/year)	157	1 553	10.1%
Decided Reduced consumption public buildings (million kWh/year)	152	2 560	5.9%
Implemented Reduced consumption public buildings (million kWh/year)	43.4	509	8.5%

Updated on 19/11/2021

Source: https://cohesiondata.ec.europa.eu/

Implementation status (2021) – Saxony-Anhalt

The federal state set a target of 31.235 tons of CO2eq deduction of greenhouse gas emission. By the year 2021. 83.5% and 32.8% of the total funding was committed and respectively disbursed. Comparing the same figures with the average planned/spent level of Germany. Saxony-Anhalt demonstrated an efficient progress in terms of the implementation of investment measures dedicated for CO2 reduction (Table 35).

Table 35: Achievements at regional level – Saxony-Anhalt

	Germany - Implementation status in 2021		
Region and Country/Allocation	**Saxony-Anhalt (S-A)**	**Germany**	**Share S-A**
Planned Reduction of the annual emission of greenhouse gases [ton CO_2eq]	31 235	2 210 987	1.4%
Decided Reduction of the annual emission of greenhouse gases [ton CO_2eq]	26 093	2 737 616	1.0%
Implemented Reduction of the annual emission of greenhouse gases [ton CO_2eq]	10 247	137 109	7.5%

Updated on 19/11/2021
Source: https://cohesiondata.ec.europa.eu/

Implementation status (2020) – Southern Great Plain

Key performance data such as the types and number of beneficiaries, average grant size, grant intensity, has been collected by the review of the publicly available documentation.

Funds related to the low-carbon economy were projected under the Economic Development and Innovation (GINOP), the Environment and Energy Efficiency (KEHOP); and the Territorial and Settlement Development Operational Programmes (OPs).

The Priority axis 4 (Energy) of the Economic Development and Innovation Operational Programme (as GINOP) was committed via four open Calls with a total budget of € 296 million.

The highest funding for low-carbon projects is provided through the Environmental and Energy Efficiency Operational Programme (KEHOP), a KEHOP 1 és KEHOP 5 priority axes. KEHOP Priority axis 1 – 'Adaptation to climate change' - addresses the strengthening the knowledge base of water management and the impact of climate change, efficient adaptation to the climate change as well as the sustainable management of water resources and more efficient protection against the damages caused by floods and Priority axis 5 – 'Adaptation to climate change' is broken into the following four investment priorities:

- KEHOP 5.1 - Non-building related, on-grid green electricity production;
- KEHOP 5.2 - Energy efficiency refurbishment of buildings combined with renewables,
- KEHOP 5.3 - Development district heating supply and distribution systems and their conversion to renewable fuel; and
- KEHOP 5.4 – Public awareness raising.

A Territorial and Settlement Development Operational Programme (TOP) concerns all regions in Hungary except the Central Hungarian Region which as a conversion region is addressed by a separate operational program (VEKOP). Low carbon issues are addressed by the following two

Priority axes of TOP:

- Priority axis 3: Low carbon transition with special attention to urban areas; and
- Priority axis 6: Sustainable urban development in cities with county rights.

Table 36: Achievements at regional level – Southern Great Plain

Beneficiary group	KPI - Implementation of MFF (2014-2020) until the end of December 2020				
	Number of beneficiaries	Average size of grant support (€)	Grant support (€)	Grant intensity	Total investments cost (€)
Enterprises (renewable investments)	191	300 681	**57 430 069**	variable	104 661 710
- geothermal	11	3 430 327	46 749 028	60%	77 915 047
- biomass	1	3 167 300	3 167 300	60%	5 278 833
- solar (MVM)	1	6 142 111	6 142 111	35%	17 548 888
SME - mainly solar (GINOP)	178	7 706	1 371 630	100%	3 918 941
Enterprises (energy efficiency investments in buildings)	89	82 599	**7 351 318**	variable	15 406 978
Combined grant loan instrument supporting building energy refurbishment using renewable solutions	38	63 192	2 401 280	35-45%	5 506 901
Grant support for building energy refurbishment using renewable solutions	51	97 060	4 950 038	50%	9 900 076
Enterprises (energy efficiency investments in process equipment)	0	0	**0**	0	0
Public authorities - buildings	452	477 833	**215 980 428**	variable	217 668 958
Building energy refurbishment by state institutions (with minimal RES)	25	387 106	9 677 640	100%	9 677 640
School swimming pools with RES	2	210 125	420 250	80-100%	501 067
Energy refurbishment of public building (demonstration projects)	18	3 733 870	67 209 654	100%	67 209 654
Public building csak RES	18	461 500	8 306 457	100%	8 306 457
Energy refurbishment of municipal buildings - TOP big cities (with minimal RES)	30	791 431	23 742 916	100%	23 742 916
Energy refurbishment of municipal buildings - TOP cities (with minimal RES)	47	521 913	24 529 923	60-100%	29 417 753
Energy refurbishment of municipal buildings - TOP small municipalities (with minimal RES)	137	268 629	36 969 471	60-100%	38 815 871
Energy refurbishment of municipal buildings - TOP small municipalities (with minimal RES)	167	239 507	39 997 601	100%	39 997 601
Public authorities - infrastructure incl. e-mobility measures	2	1 833 651	**3 667 302**		7 334 604
District heating	2	1 833 651	3 667 302	50%	7 334 604
Public authorities - RES	8		**5 126 517**	100	5 126 517
- geothermal	2	809 465	1 618 931	100%	1 618 931
- biomass	4	620 215	2 480 860	100%	2 480 860
- solar park	2	513 363	1 026 726	100%	1 026 726
Residential buildings	0	0	**0**	0%	0
Other target group	9	632 401	**5 691 609**	100%	5 691 609
Churches - energy efficiency investments in buildings	9	632 401	5 691 609	100%	5 691 609

In addition, comparable benchmark data was collected by the partner regions concerning the use of the EU funding over the 2014-2020 period. The data collection was based on a tailored questionnaire. Benchmark data received of four regions is presented in Table 37. The table shows that the type of beneficiaries in each region are similar, and typically a large number of beneficiaries have received funding.

Table 37: Comparable benchmark data collected by four participating regions

	Piemonte		Mazovia		EEE		SGP	
Beneficiary group	**KPI - Implementation of MFF (2014-2020) until the end of December 2020**		**KPI - Implementation of MFF (2014-2020) until the end of December 2020**		**KPI - Implementation of MFF (2014-2020) until the end of December 2020**		**KPI - Implementation of MFF (2014-2020) until the end of December 2020**	
	Number of beneficiaries	**Average size of grant support (€)**	**Number of beneficiaries**	**Average size of grant support (€)**	**Number of beneficiaries**	**Average size of grant support (€)**	**Number of beneficiaries**	**Average size of grant support (€)**
Enterprises (renewable investments)	200	252 520	18	182 764	2275	76 628	191	300 681
Enterprises (energy efficiency investments in buildings)	37	163 777	1	814 136	533	36 395	89	82 599
Enterprises (energy efficiency investments in process equipment)	44	669 951	2	1 754 155	1 068	31 864		
Public authorities - buildings	96	255 411	468	194 788	22	454 465	452	477 833
Public authorities - infrastructure incl. e-mobility measures	133	142 406	42	3 759 246	686	981 015	2	1 833 651
Residential buildings (social housing)	7	1 025 714	2 206	4 307	24 942	4 616		
Other target group (please specify): Hospitals	5	2 646 000	5 500	225			9	632 401

8. CONCLUSIONS AND RECOMMENDATIONS

The overall objective of the Report on Low Carbon Investment Funding is to develop policy recommendations on the effectiveness of using public grants targeting EU, macro-regional, national and regional levels with a particular focus on the development of renewable energies (RES). Specifically. the Report aims to conduct a structured assessment of the use of public funds dedicated to the development of the low carbon sector in seven selected target regions of PROSPECT2030 over the 2014-20 programming period. The report is based on individual regional reports developed by the Lead Partner (LP) and Project Partners (PPs).

The strategic policy conclusions and recommendation are summarised as follows.

- The assessment of the global impact of the green economy transition on competitiveness. labor market, quality of life, innovation, etc. in order to justify that the low-carbon economy is an efficient driver of environmentally sound and sustainable economic growth.

Nowadays, this is getting to be more of an imperative from the perspective of the economic recovery from the coronavirus pandemic.

- Better horizontal integration of green economic transition policy aspects and measurable low-carbon impacts into financial planning and planning and governance frameworks is needed. This also requires a reinforced common methodological approach to assess the economic, social and environmental impacts of low-carbon investments.

- For reaching the 2050 (zero emission) targets. The perspective of the green economy transition being a challenge needs to be turned into opportunities with different EU investments. However, the scope of existing initiatives such as the European Green Deal. The European Green Deal Investment Plan and the Action Plan on Sustainable Finance include only the targets but not tailored needs of each country and region.

- It has become clear that the capacity of public resources is far insufficient to support the green transition process. Therefore, in the next programming period public funding should be focused to replace grants with financial instruments, and trigger effective leveraging of private funding from diverse sources.

- However, it should also be acknowledged that there are certain low-carbon measures e.g. deep energy retrofit of buildings where public grants may need to remain instrumental. In general, the public sphere and policies must address the unfavourable economics of immature low carbon technologies to enable companies to overcome threats to existing revenue models, and provide sufficient, long-term certainty for large transformational investments in capital intensive breakthrough technologies. Increased public financing is required to de-risk private investment and support the development of new infrastructure. Action on policies and regulation must be matched by action in the private sector and the regions' demand. where the decisions to lend and invest will be taken.
- To achieve low-carbon goals in a more targeted and effective way. the creation of reinforced regional climate and energy programs/action plans are needed. These programs and action plans need to specifically address:
    1. covering the entire low-carbon sector of the regions which generally calls for the coordination role of regional authorities beyond their normal sphere of competence (e.g. public housing, interregional transport);
    2. setting energy efficiency targets specified for each region for different time horizon (short, medium, long term) along with the set policy goals;
    3. reducing regions energy consumption by improving energy efficiency across all its facilities (public and private buildings, public and industrial/commercial facilities, transport, etc.);
    4. increasing the use of local renewable energy wherever possible;
    5. achieving the targets defined for the regions with the help of financial incentives especially at undeveloped regions;
    6. creating specific (local) regulations and financial incentives for the most underdeveloped sectors like building renovation and transportation.

The more specific conclusions and recommendations are described in the following sections.

8.1. EUROPEAN ADDED VALUE

The experience of the Interreg PROSPECT2030 project clearly demonstrates that maintaining cross-European, transregional and interregional cooperation as a resource for exchange of knowledge and replication is the best practices to promote the green economic transition. Further strengthening the information and knowledge exchange at European level brings tangible added value for project developers, project partners, other stakeholders such as regulatory authorities. replicant partners, and final beneficiaries of various kinds. PROSPECT2030 represents a European good cross-section of economic and social similarities and disparities between the European regions, the highly diverse characteristics (e.g. climate conditions, energy mix, and renewable potentials) of the regions coupled with specific challenges of financing.

8.1.1. Good basis for mutual learning cross-European level

The impacts of climate change require a rapid response from the European regions which does not allow time for “reinventing the wheel” in other words the adoption of proven solutions for same or similar concerns or challenges deliver more efficient and timely responses.

Several valuable topics of common interest identified and explored within the framework of the PROSPECT2030 project with regard to the use of public funding. These include among others experience on regional energy planning methodology, modalities for efficient use of public funding, organizational models, focus areas of public funding, stakeholder engagement aspects, and last but not least innovative finance solutions.

8.1.2. Europe wide cooperation networks

The challenge of interconnecting and adapting the European energy infrastructure to new needs is significant, urgent, and concerns all regions. European energy policy aims to increase the contribution of renewable energy sources and create a pan-European competitive electricity market. Flexible, automated, participatory and renewable grids are required for the future of energy systems. The grid development also requires a common European approach for storing RES power as green hydrogen or green methane in order to increase the security of supply. the resilience of the whole energy systems (electric, gas and thermal) and accelerate to the energy transition.

It is essential to identify appropriate scenarios considering all relevant political, technical, financial and socio-economic aspects at transnational, national and regional levels. Furthermore. focused incentives are required to better monitor the load of the distribution networks, transformer substations, calculation of losses in the distribution network, detecting and reducing losses in the grid, and to ensure better maintenance of the distribution networks.

8.2. IMPROVED EFFICIENCY IN USE EU FUNDS

8.2.1. Strengthening regional green governance

The regional green governance is at a level of different maturity in the PROSPECT2030 target region ranging between fully-fledged green governance structures. through structures with

limited competence up to regions with no designated office/department/service in charge of energy or climate matters.

However, at all maturity levels strengthening or reinforcing these structures require further efforts involving the participation of public grants in order to secure the optimal use of finding dedicated to green transition.

In the case of well-established government structures, the focus is on further strengthening the cooperation with local authorities and key stakeholders such as local bodies of the central government, innovation and research centres, educational institutions, economic clusters, business promoters and NGOs in order to secure the optimal use of finding dedicated to green transition. As for less developed regions, institutional development and capacity building appear to be the main tasks.

Ideally, regional governance structures supporting the green transition should

- support to the programming of energy and climate measures at regional level, and provide policy inputs for the programming at national level;
- develop and coordinate/implement key regional projects;
- support the regional stakeholders in project design, attracting funding and project implementation with particular focus on local governments to ensure the fulfilment of their climate commitments.

8.2.2. Linking financial support to energy performance improvement

In case of energy efficiency investments, grants and market-based financial instruments should be linked with the planned or verified energy saving and CO2 reduction; saving performance indicators need to be appropriately defined and monitored.

8.2.3. Key financial indicators (KPIs)

Currently, the financial efficiency of the global utilization of EU funds is measured by commitment and disbursements rates. This is suggested to differentiate the performance of the region based on a leverage factor that shows the ratio of mobilized co-financing by the EU contribution (e.g. million EUR total funding/million EUR grant) EU grants. The co-financing may be in the form of national, regional and level public resources and private financial contributions (own resource, donation, crowdfunding or third-party finance).

8.3. AVAILABILITY OF DATA SUPPORTING PLANNING

8.3.1. Better access to energy data to facilitate energy and climate planning at regional level

The Project Partners PROSPECT2030 in general concluded that no comprehensive energy data in sufficient detail is available at national level that could efficiently support the European regions in formulating their regional energy and climate strategies and related measures.

It is recommended to dedicate more efforts and national resources to more comprehensively publish energy and climate related data and baseline assessment on public domain in order to facilitate. It is furthermore suggested to address the resource efficiency of (EU, national and

regional) public grants with key performance indicators such as to what extent specific types of low-carbon investments are capable of mobilising private financial resources as well as what are the investment costs of generation of unit energy by the various renewable solutions.

8.3.2. Public traceability of ERDF information

There is a need for a more systematic and user-friendly evaluation of ERDF financing in transnational projects and the subsequent dissemination of the results in order to ensure that the results, conclusion and lessons learnt can be accessed. adopted or replicated by the widest possible audience, as well as to maximise the resource efficiency of the mobilized public funding.

8.4. FISCAL ENVIRONMENT

8.4.1. Creating more favourable fiscal environment for EE and RE

In some of the participating countries the fiscal environment is tailored to consider instruments that help to move forward in the zero net emission journey. Examples worth studying in detail by other participating regions include the taxation of motor vehicles in Austria, and the Superbonus system in Italy.

The standard consumption tax (Normverbrauchsabgabe [NoVA]) is part of the Austrian tax model for motor vehicles. It is a percentage surcharge on the purchase price or fair market value that depends on CO_2 emissions and is payable on the purchase or import of certain motor vehicles. In May 2020, the Italian Government issued legislation to assist with the recovery of the Italian economy following the unprecedented shock of the Covid-19 pandemic. The so-called "Superbonus" tax credit is intended to cover 110% of the costs of energy efficiency and structural seismic improvements of Italian properties to help with the recovery of the economy and in the process ensuring tax compliance in the local building industry. This tax credit can be set against tax liabilities of the relevant property owner.

8.5. FINANCIAL INSTRUMENTS

PROSPECT2030 identified several financial instruments worth considering by the European countries.

8.5.1. ESCO/EPC to the energy retrofit of public sector

In order to demonstrate its "flagship" role, the public sector plays an important role in the green economic transition process. Due to the order of magnitude of the anticipated energy saving (and the coupled CO_2 reduction) potential, the energy retrofit of the public building stock (e.g. schools, hospitals, sports facilities, public offices, multifunctional buildings, social housing, etc.) and infrastructure is widely regarded to be one of the key focus areas where public funding can be efficiently leveraged by private resources.

In general, public authorities (central and local governments) have limited own financial resources and knowledge base for implementing the energy efficiency upgrade and/or

installation of renewable energy generation infrastructure in their building stock and infrastructure (e.g. waterworks, wastewater treatment plants, public transport infrastructure, street lighting). The majority of these retrofits are typically non-bankable projects, and the associated investment needs usually well exceed the capacity of the public authorities' budgets. Therefore, the area remains a target for public grants which, however, offers a wide-ranging opportunity for mobilizing private funds based on energy performance contracting (EPC).

The energy upgrading of lighting systems such as street lighting and external and indoor lighting of public buildings and facilities involving the replacement of lighting systems and installation of dynamic lighting control, is one of the most obvious areas to partner with energy service companies (ESCOs). Other public infrastructures (e.g. water works, wastewater treatment plants, public transport) offer public-private partnership options.

In order to maximize the resources efficiency, the predominantly grant-based deep renovation of public buildings including integrated installations producing renewable energy. need to be shifted towards the optimal blend of public grants and ESCO financing.

ESCO schemes are also to be promoted for efficient renewable technologies such as cogeneration of biogas. as onshore and offshore wind farms, solar-photovoltaic parks.

The legal and operational framework of ESCO varies from Member State to Member State. Therefore, all Member States where this framework does not or only partially exist should be completed by relevant legal provisions building on the existing legislation (e.g. public procurement and concession) as well as by practical operation guidance up to applicable models for tendering and contracting. ESCO/EPC models developed for the public sector should be able to give a momentum for similar schemes targeting SMEs or large industrial actors in the energy retrofit of their buildings.

8.5.2. Other financial instruments

Risk-sharing instrument for geothermal projects

The unpredictable geological, hydrogeological, geochemical and technical risks associated with the development of geothermal well development, is identified as the major barrier for geothermal investments. These geological, technical and in some cases economic and social risks cannot be profoundly assessed by financiers, although successfully designed and implemented projects are in general financially viable. Therefore, it is recommended to consider redirecting public funding to publicly-financed geothermal risk-sharing/insurance instruments instead of grant-supported individual projects.

Leasing of investments in energy efficiency and renewables

Leasing schemes may become a simple choice in the business sector to finance the purchase of materials and equipment from the LEME list (List of Eligible Materials and Equipment). They may apply simplified procedures and a very short time for decision-making. The categories of materials and devices registered on the LEME list can be established in partnership with leasing institutions, and can be universally applied at national level.

Crowdfunding

Crowdfunding is a form of financing for different types of projects organized by a group of people. In the case of crowdfunding a project is financed by a group of people donating relatively small sums of money by those interested in project execution. In principle, crowdfunding is an

activity consisting in some kind of funds collection and targeted allocation for financing given projects. In most European countries crowdfunding is not legally regulated. The experience of the Polish Society of Crowdfunding may be worth disseminating at macroregional level.

Financing energy investments by commercial banks

There are several examples for the banking sector developing its involvement in the RES market. responding to the investors' demand. Mutual cross-country learning of commercial banks' best practices is considered as an efficient way to further develop the capabilities of local commercial bank networks.

Investment funds

An Investment Fund may be a public or private investing institution specializing in certain groupS of activities. Usually, they operate in consortiums with banks and insurance institutions providing finances to large scale of EPC projects execution resulting in development of new business opportunities, e.g. an EPC modernization project of district heating installation or renewable investments which creates new business opportunities to the interested bodies, At the completion of the investments the Investment Fund may sell or operate the newly developed installation,

Green Bonds

Several green bond initiatives have been identified, A green bond is a type of fixed-income instrument that is specifically earmarked to raise money for climate and environmental projects. These bonds are typically asset-linked and backed by the issuing entity's balance sheet. So, they usually carry the same credit rating as their issuers' other debt obligations.

On-bill finance

On-bill finance aims to promote scaling up deep energy renovations of residential buildings. It is often used to reduce upfront costs by repayment through the monthly utility bill. The implementation of the on-bill schemes requires a close cooperation between energy utilities and financial institutions.

Energy Efficiency Obligation Scheme

Energy Efficiency Obligation Scheme a new instrument established by the EU Energy Efficiency Directive. The scheme foresees that energy companies as obligated parties must develop their energy reduction program and implement measures that result in proven energy savings on the end-user's side. The beneficiaries of the obligation system can be the domestic corporate sector and the residential end-users.

8.6. COMMUNICATION AND SOCIAL PARTICIPATION

8.6.1. Communication and capacity development

Citizens and other key stakeholders are at the centre of the energy transition, since they can play an essential role in successful implementation of energy measures. To boost the communication strategies and capacity building activities aimed at engaging them and raising their awareness on all energy issues, is thus crucial. Measures to induce behaviour change and to provide information and training can significantly contribute to the decrease of energy

consumption and to a greater awareness of the need to increase energy efficiency and the use of renewable sources.

PROSPECT2030 identified the need for substantial communication, awareness raising, stakeholder engagement, networking and capacity building in the following areas:

- boosting communication and promotional activities targeting citizens and local authorities about actions and behaviours that improve the energy transition;
- engagement of homeowners to invest into energy efficiency and renewable measures to reduce the energy consumption and GHG emission of their homes;
- promoting the benefits for energy and climate planning at local level, preferably based on the methodology developed by the Covenants of Mayors (SECAP), and educate them on appropriate energy planning;
- promote the energy cadaster and energy management practice including smart metering and monitoring at municipal level (municipal building and infrastructure);
- sharing knowledge and best practices how to assess energy saving potentials, design appropriate energy efficiency measures and combining energy retrofits with integrated renewable solutions;
- supporting municipalities in the engagement of the local stakeholders; and eco-driving which represents one of 40 measures that should by 2050 contribute to 60% of traffic-generated emission reduction;
- creating local advisory groups to commit citizens and other stakeholders to contribute to paving the energy transition;
- promoting training activities such as project development assistance targeting local stakeholders including the staff of local authorities and professionals;
- provision of information and training to local stakeholders (local authorities, SMEs, NGOs, etc.) on local, national and international funding opportunities, preparation of proposals/tenders and public procurement rules.

8.6.2. Increase the social participation in decision-making processes

The social acceptance of the projects related to the energy transitions is a key factor to accelerate the decarbonisation process. In general, the majority of the European citizens appreciate the sustainability policies and the more intensive exploitation of renewable energy sources in order to phase out fossil fuels, but they are often against investments if these are planned to be realized in their close neighbourhood.

This opposition is to a large extent attributed to the lack of comprehensible and quality information and the low efficiency of the conventional communication channels. This calls for new solutions based on Virtual Reality in the social acceptance. The innovative IT-based communication techniques are recommended to be addressed at transnational level in order to facilitate their rapid development and exchange of best practices.

8.7. TECHNICAL AREAS OF THE LOW-CARBON SECTOR

8.7.1. Promotion of energy efficiency of buildings and building integrated renewables

The building sector throughout Europe represents the biggest aggregated energy consumer. accounting for nearly 40% of the total final energy consumption. By radical improvement of the

energy performance of the public residential and commercial/industrial building stock, the current consumption level may be reduced depending on countries and regions by 30-50%.

The general public awareness should be strengthened in order to trigger i. behavioural changes and improved control of energy consumption as well as ii. investments to effectively reduce the energy consumption of homes, SMEs and municipal buildings.

The awareness raising should at first place target the population, SMEs and municipalities with appropriately tailored measures. The attention of the general public should be called to among others reducing energy consumption by switching lights off, appropriately operating thermostatic valve, installation of rooftop solar panels, eco-driving, SMEs and municipalities are to be targeted to strengthen their energy management in order to identify their saving potentials and the appropriate measures to reduce the energy consumption.

However, the extremely long repayment periods discourage the building especially in the residential sector to invest into comprehensive energy retrofits. Public grants or other fiscal intervention are deemed necessary to ensure an efficient market uptake of residential energy retrofit,

8.7.2. Improving the energy efficiency and promotion of climate consciousness in the SME sector

The commercial and industrial buildings of SMEs throughout Europe are regarded to a large extent energetically outdated. SME investments are largely focused on technology upgrade and production capacity increase which are associated with limited greenhouse gas reduction potential (if any).

In order to achieve substantial greening in the SME sector, public funding is recommended to dedicate to promoting the implementation of energy management systems, voluntary assumption of provisions of the Energy Efficiency Directive (2012/27/EU) concerning the energy audits, identification and implementation of energy efficiency measures. Moreover, public financial contribution is required to promote the alignment of SMEs with the Sustainable Finance Taxonomy (EU Regulation 2020/852) in order to enhance the environmental consciousness in the SME sector.

8.7.3. Promotion of the installation of renewable technologies

Renewable energy sources (RES) are essential to achieve EU targets set in the energy strategy for 2030 and for the carbon neutrality goal to follow. Given the actual level of energy consumption, the RES installations should be substantially speeded up. The anticipated increase of electric needs in the future per se requires further development for RES, and the new concept of decentralized energy systems triggers the need for installation of additional power plants with different characteristics in terms of capacity, location and operational functionality.

All these planned decentralised RES investments are coupled with a scenario of reduced capital costs for and incentive systems in place, that make RES investments even more attractive than the past. Given that it is urgent to manage the situation and promote the most desirable installations, avoiding the adverse environmental impacts or the negative social acceptance issues that raise whenever power plants are supposed to be installed.

In the regional context the key task includes, in particular:

- development or update of a regional RES cadastres identifying the suitable areas for the installation various RES options (e.g. solar photovoltaic, wind, biomass, biogas, geothermal, small-scale hydro power, energy generated by sea water);
- development of regional technical guides on RES development for institutional and private investors addressing among others the prevailing legal framework, technology option in terms efficiency, lifetime, permitting process, local market potentials, etc.;
- identification of the constraints and critical issues with regard to the national transmission grids and on the distributions network for the installation and connection of additional RES capacities;
- increase the quality standards of RES installations in terms of environmental performance and added value for the whole energy system, etc.;
- increase the social acceptance of RES installations;
- creation of a shared knowledge platform between the regions, local authorities and energy operators to support the identification of the optimal location and size of new RES capacities.

8.7.4. The outdated transport fleets change to electric transport

The transport sector is one of the biggest challenges of the decarbonization process. Low penetration of new technologies. higher prices. interest of industry segments linked to conventional fuels and inertia of behavioural changes affect the sector.

E-mobility is a common term that denotes a functional system that basically consists of electric vehicles, infrastructure for charging electric vehicles and information technologies that support the coordination of transport services. The share of the transport sector in the consumption of conventional fuels, the technical features of electric vehicles such as high efficiency of electric motors compared to internal combustion engines, and the absence of concentrated pollution emission in urban areas make the e-mobility necessary to become an integral part of the long-term energy transition.

Although much of the national networks of electricity generation, transmission and distribution are aged, currently the regions play the leading role in the promotion of electromobility. The major required measures identified by PROSPECT2030 include:

- awareness raising and education in shifting the consumers' preferences in order to ensure more efficient, predictable and resilient energy future, and development of comprehensive approaches to encourage e-mobility at the regional and local levels in terms of developing charging infrastructure for electric vehicles, increasing the attractiveness of procurement and use of electric vehicles by public bodies and supporting the business sector to develop sustainable models for related services;
- elaboration of regional E-mobility roadmaps analysing the current situation and needs, assessing development scenarios and translating these into regional action plans;
- development of charging infrastructure of electric vehicles and solar energy capture by photovoltaic panels and on-grid and off-grid energy storage options.

8.7.5. Supporting research and development

The key research and development area identified by PROSPECT2030 and recommended to pursue are listed below:

- new technologies supporting energy transition such as green hydrogen;
- energy storage technologies;
- management systems for renewable electricity sharing between different users and balancing between solar energy supply and demand;
- conversion of existing anaerobic fermentation plants from biogas to biomethane production;
- standardized quality management systems for biomass-fired plants and biogas digesters;
- development of small and medium sized biomass-fuelled district-heating plants along with sustainable forest management models;
- optimisation of existing district heating networks and integration with renewable energy generation and waste heat recovery opportunities;
- waste heat recovery in industrial processes and new industrial low-carbon technologies;
- provision of standardized IT-based data collection procedures for municipalities;
- development of the IT support of energy transmission and distribution grids; and
- sustainable buildings;
- technology development for using the thermal energy of the sea.

8.7.6. Development of Energy Communities

The establishment of energy communities is a key step towards the decentralization of the future of the energy systems. It allows more participatory and democratic energy markets by engaging private citizens as producers, consumers and market players into their community, and thereby it can sensibly reduce the needs for large infrastructures and lower the final user expenses. Small industries and services can also participate actively in the community market. Selling excess electricity from renewables and injecting heat into the district heating grids, but also building and co-owning some facilities such as small hydro, biogas digester, wood chip boilers, medium-size photovoltaic plants are some of the opportunities that can boost the energy system transition.

Recently, the Energy Community has a clear status in EU and national legislation. They are stipulated as a non-commercial type of market actors that combine non-commercial economic aims with environmental and social community objectives. Energy Communities are defined in the revised Renewable Energy Directive (EU) 2018/2001 (setting up the ‘renewable energy communities’) and the revised Internal Electricity Market Directive (EU) 2019/944, introducing the ‘citizen energy communities’ concept.

Both citizen energy communities and renewable energy communities can exercise similar activities, including generation, distribution, supply, aggregation, consumption, sharing, storage of energy and provision of energy-related services. Depending on the activity performed, they must comply with the obligations and restrictions applicable to the other market participants. Key measures with regard to promotion of energy communities identified at regional level include, in particular:

- increase of renewable energy generation in low-energy buildings and low-energy production processes;
- promoting self-consumption of renewable electricity and heat;
- sharing of renewable electricity between different users on local smart grids;
- boost the existing pilot initiatives by reinforcing them in the stakeholder engagement as well as supporting them from legal and technical point of view;
- support the establishment of innovative solutions. disseminating best practices and case studies at EU, national and regional levels;
- encourage the development of distributed generation within a secure and integrated electricity system;
- simplify the legal/bureaucracy aspects for co-ownership of facilities.