D.T2.4.9

Comparative Report on Regional Energy Action Plans

Version n°1/2021

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A.T2.4 Regional Energy Action Plan definition

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1. EXECUTIVE SUMMARY

In the course of PROSPECT 2030, seven Central European Regions developed and provided Regional Energy Action Plans (REAPs) in order to tackle the challenges related to the transition towards a low-carbon economy and the adoption of climate change mitigation policies.

Although characterized by differing size in area and population as well as the differing position on levels of governance, the involved regions were aiming at the same targets, defined by the European Green Deal. The common target and an adapted approach in method, led to the comparability of the results yielded by the developed REAPs.

The level of governance, as a core aspect, is affecting the contents of the individual action plans. While regional authorities are more likely emphasizing framework and policy related measures, as to be expected, actors on a lower level of governance are rather focussing on organizational and technical measures. The REAPs, thus, are covering micro-regional and local aspects as well as overarching aspects of governance and can be seen as complementary components of the one common transition process in a multilevel ecosystem of actors.

The high importance of “catalysing” (soft) and guiding measures in all REAPs is emphasizing the need of high efforts in awareness building, before implementing technical, financial, fiscal, infrastructural etc. measures on the large scale

The comparison of the individual regional scenarios shows that the target of a 55% reduction of carbon emissions until 2030 is not achievable under the current circumstances. The reason can be found in the subject, that regions are constrained to act within their given framework of competences. Although some of them have also the competences to set regulations, regions are needing more support from the national level, when it comes to incising measures, like gradual carbon emission taxation, for example, for accelerating the shift from fossil to renewable energy, especially in the heat and transport sector

In order to achieve the ambitious targets of the European Green Deal within the set timeframe and with the least societal friction potential possible, planning processes need to be moved away from sector specific pathways and adopted in a way, which is able to manage the complexity of a multi-level governance and multi stakeholder process with a strong focus on complementarity, as it can be found in the emerging “socio-economic-ecosystem” approaches.

2. Introduction

The report at hand provides a comparative description of the Regional Energy Action Plans (REAPs) of the seven Regions involved in the PROSPECT 2030 project. These regions are:

- EcoEnergyLand (EEL): association of 19 municipalities (Austria)
- Friuli-Venezia-Giulia (FVG): autonomous region (Italy)
- Mazovian Voivodeship (MAV): administrative division (Poland)
- Piemonte (PIE): region (Italy)
- Sachsen-Anhalt (SAH) federated state (Germany)
- Southern Great Plain (SGP): administrative region (Hungary)
- Split-Dalmatia (SPD): county (Croatia)

These regions are representing the wide spectrum of levels of governance and scopes for action, representing all subnational NUTS levels, down to the level of local administration units (LAUs)

The comparative report describes similarities and differences of situations and consequences regarding energy transition planning in the involved regions. It also aims at investigating the use of instruments in the fields of policy, financing, business etc. for promoting the transition towards a low-carbon economy and the adoption of climate change mitigation policies, as proposed in the REAPs.

Based on the proposed actions, each region prepared scenarios to which extent the chosen measures are contributing to the goals of the European Green Deal. At this point the respective expected results and consequences, as well as challenges and gaps to fill are compared.

The results of the comparisons, due to the wide differences between the regions´ specific characters and levels of governance, are having limited quantifiable properties, such as key figures. Therefore, a stronger focus is put on similarities and differences in the specific approaches on how to reduce carbon emissions and to increase the share of renewables in supply and consumption.

3. Method

This report is comparing the main inputs from the seven Regional Energy Action Plans elaborated in the PROSPECT2030 project.

The development of the Regional Energy Action Plans is following a defined sequence of worksteps which are:

- Collecting relevant information and data on energy consumption and supply, demographic and economic data, infrastructure, costs and prices etc.
- Drawing the regional baseline of energy consumption and generation as well as carbon emissions
- Consideration of regional potentials and needs in consideration of the European and national targets and policy framework
- Formulation of regional key energy priorities and related measures for energy transition and expression of commitment of regional stakeholders to priority implementation
- Performance of a weighted SWOT analysis to test regional readiness for transition measures and estimation of related efforts and impacts
- Definition of actions to take for maximizing impact and minimizing efforts
- Assignment of target groups, responsibilities and instruments to use
- Development of scenarios for impact estimation, based on two components: SHIFT from fossil to renewable energy sources and CHANGE of the energy system towards higher efficiency, new technology and sector coupling
- Estimation of investment costs for achieving the scenario values
- Estimation of carbon emissions resulting from the measures regarded in the scenarios
- Outlining of challenges, bottlenecks and gaps to be taken into account, as detected in the course of scenario development.
- Consideration of the expected impact on the regional economy and relevant financing and business models

4. Overview on the Project Regions: Status, developments, energy

On the statistical level, all types of units on the subnational level are represented, as shown in table 1.

Region	NUTS level	Urban	Intermediate	Rural
EcoEnergyLand	- (LAU)	-	-	1
Friuli-Venezia-Giulia	2	no data	no data	no data
Mazovia	2	1	2	3
Piemonte	2	1	4	3
Sachsen-Anhalt	1	-	8	6
Southern Great Plain	2	-	3	-
Split-Dalmatia	3	-	1	-

Table 1: Classification of regions by NUTS level and degree of urbanisation

Regarding the degree of urbanisation according to EUROSTAT criteria, there are (at least) 2 urban, 18 intermediate and 13 rural areas to be found. This underlines the challenge of finding a common ground in the methodology for developing the seven REAPs.

Table 2 is giving an overview on population characteristics and GDP per capita in the partner regions:

Region	Population number	Population /km²	GDP per capita	Population development
EcoEnergyLand	17 500	42,3	29 871	decrease
Friuli-Venezia-Giulia	1 221 200	155,3	30 855	decrease
Mazovia	5 403 400	152,0	17 785	**increase**
Piemonte	4 404 200	173,5	30 124	decrease
Sachsen-Anhalt	2 208 300	108,0	28 756	decrease
Southern Great Plain	1 243 800	67,8	8 340	decrease
Split-Dalmatia	454 800	100,2	8 597	decrease

Table 2: Population, population density, GDP per capita and population development

All regions are characterized by a population decrease, except in the Mazovian Voivodeship. Population density and GDP are differing considerably.

A comparison of the per capita values of final energy consumption and carbon emissions as well as the shares of RES in final consumption and region-internal electricity generation is given in table 3:

Region	MWh Final consumption / capita	Carbon emissions of final consumption / capita	Carbon emissions t / capita*MWh	Share of renewables in final consumption	Share of renewables in electricity generation
EcoEnergyLand	44	5,6	0,13	38%	100%
Friuli-Venezia-Giulia	31	7,1	0,19	21%	34%
Mazovia	25	4,1	0,17	12%	21%
Piemonte	29	6,1	0,21	17%	40%
Sachsen-Anhalt	65	11,5	0,18	23%	80%
Southern Great Plain	18	3,6	0,20	17%	33%
Split-Dalmatia	12	2,6	0,21	11%	100%

Table 3: Final energy consumption, related per capita emissions and shares of renewables

Although broken down to per capita figures, the calculated values cannot be assigned to a specific criterion or groups of criterions. They appear to be rooted in complex interdependencies within the respective energy systems, located beyond the scope of the project. Even consumption and emissions are apparently highly dependent on regional specific conditions (like degree of urbanization, degree of industrialisation, state of building stock, share of RES in consumption etc.) with individually varying weights.

5. Levels of governance, key energy priorities, enabling and restraining factors

The level of governance is one of the most important factors on how energy action plans are shaped. Basically, all elaborated REAPs can be located between the polarities of approach, which are either bottom-up (active use of existing framework) or top-down (supply and/or management of framework).

The project consortium is mirroring this wide spectrum of actors on different levels of governance within the ecosystem of energy transition planning and thus, is representing also the spectrum of perspectives and capacities to act. The composition of the consortium is listed in table 4 (PP=project partner; assoc.=associated partner)

Region	Regional authortiy	Local authority	Public agency	Private agency	R+D institution	Other stakeholders
EcoEnergyLand		assoc.		PP		
Friuli-Venezia-Giulia	PP	assoc.	PP			
Mazovia	assoc.		PP			
Piemonte	PP				PP	assoc.
Sachsen-Anhalt			assoc.		PP	assoc.
Southern Great Plain				PP		assoc.
Split-Dalmatia	assoc.			PP		

Table 4: Levels of governance of project partners and associated partners in the consortium

The level of governance is also a core aspect, affecting the contents of the individual REAPs. While regional authorities are more likely emphasizing framework and policy related measures, as to be expected, actors on a lower level of governance are rather focussing on organizational and technical measures. The REAPs, thus, are covering micro-regional aspects as well as overarching aspects.

Image 1 is giving an overview on the specific targets which the individual regional key energy priorities are aiming at:

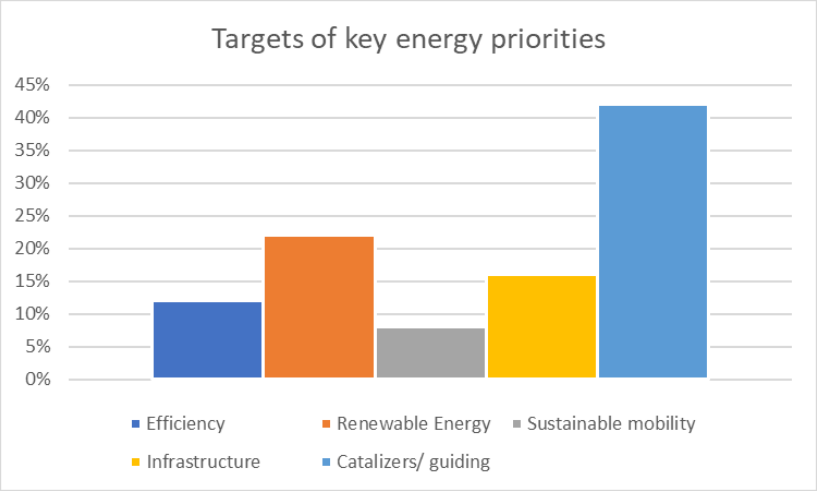

Image 1: Targets of key energy priorities

The main target is the implementation of catalysing and guiding measures, which are characterized by information campaigns, awareness building, education and training, events and competitions as well as counselling services. In practically all regions the main component for an effective energy transition is located in the population´s mindset, which is a basic requirement for the acceptance of measures leading to lower emissions by means of rising energy costs or carbon pricing/taxing as well as promoting investments in the thermal retrofaction of the building stock or regulations to reduce individual motorized transport in urban or semi-urban spaces. The high importance of catalysing and guiding measures are emphasizing the need of high efforts in awareness building, before implementing technical, financial, fiscal, infrastructural etc. measures on the large scale.

Sustainable mobility is the priority which is, although a topic in all REAPs, the least named in the list of priorities. The reason, as discussed in the capacity building workshops, is seen in the complexity of the topic, of which e.g. electromobility and related infrastructure is just one aspect of the total modal split which needs modification – but is currently not a direct aspect of energy planning.

Within the key energy priorities, related measures were developed and assigned to the respective responsibilities, target sectors, target groups, stakeholders to involve, spatial focus etc.

An overview on the target sectors of the priorities is given in image 2:

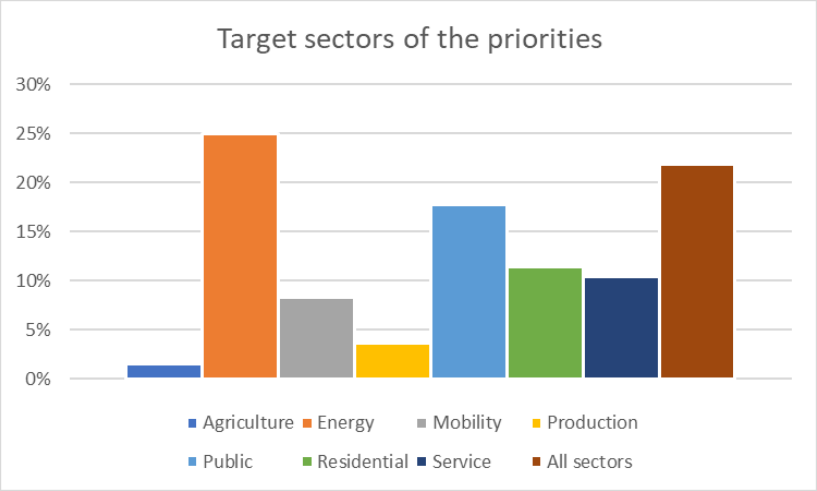

Image 2: Target sectors of the key energy priorities

In a second step, a weighted SWOT was conducted with the goal to test the regions´readiness for the measure as well as to map out enabling and restraining factors.

Image 3 is giving an overview on the 8, thematically mostly frequented mentions of factors and their assignment to being enabling or restraining factors.

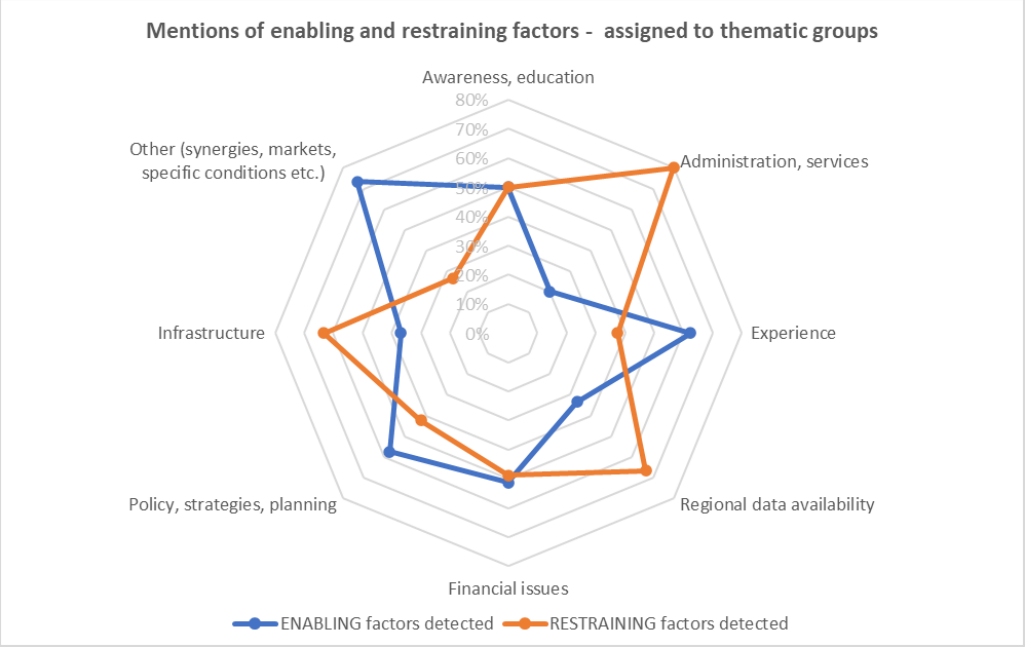

Image 3: Mapping of general enabling and restraining factors for energy priorities by thematic group

The three main enabling regional factors for the implementation of energy transition measures are detected as:

- Synergies, markets etc.
- Experience (planning, technology etc.)
- Framework for policy, strategy and planning

The three main restraining factors for successful measure implementation are detected as:

- Administration and (public) services
- Availability of regional data
- Existing (energy-) infrastructure

Enabling factors can be matched against restraining factors in the form of an impact and effort diagram, using enabling factors and their weight as the value for estimated impact and the weight of restraining factors as a value for estimated effort. Both values are dimensionless and scaled from 0 (minimal) to 1 (maximal).

Images 4 to 10 are showing the impact- effort estimation diagrams for the implementation of measures contained in the regions´priorities.

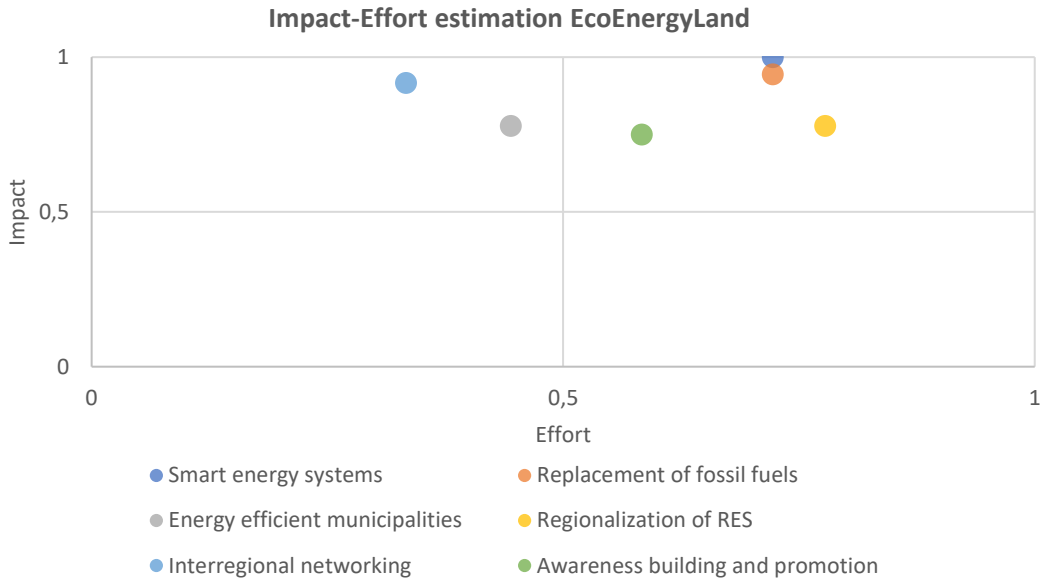

Image 4: Impact-effort estimation EcoEnergyLand

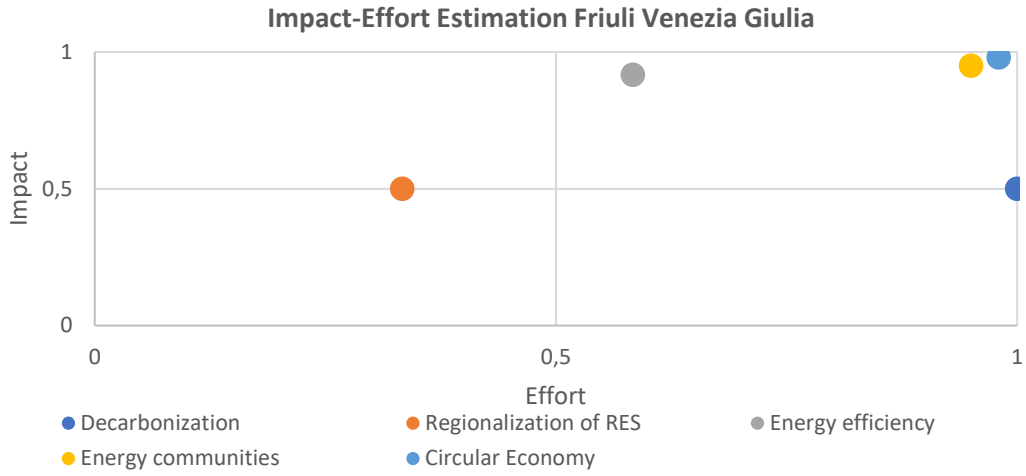

Image 5: Impact-effort estimation Friuli Venezia Giulia

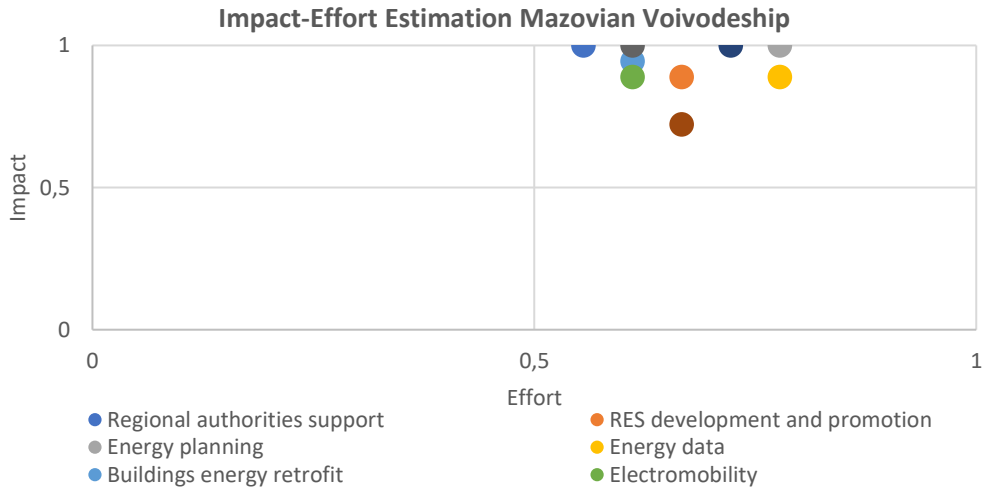

Image 6: Impact-effort estimation Mazovian Voivodeship

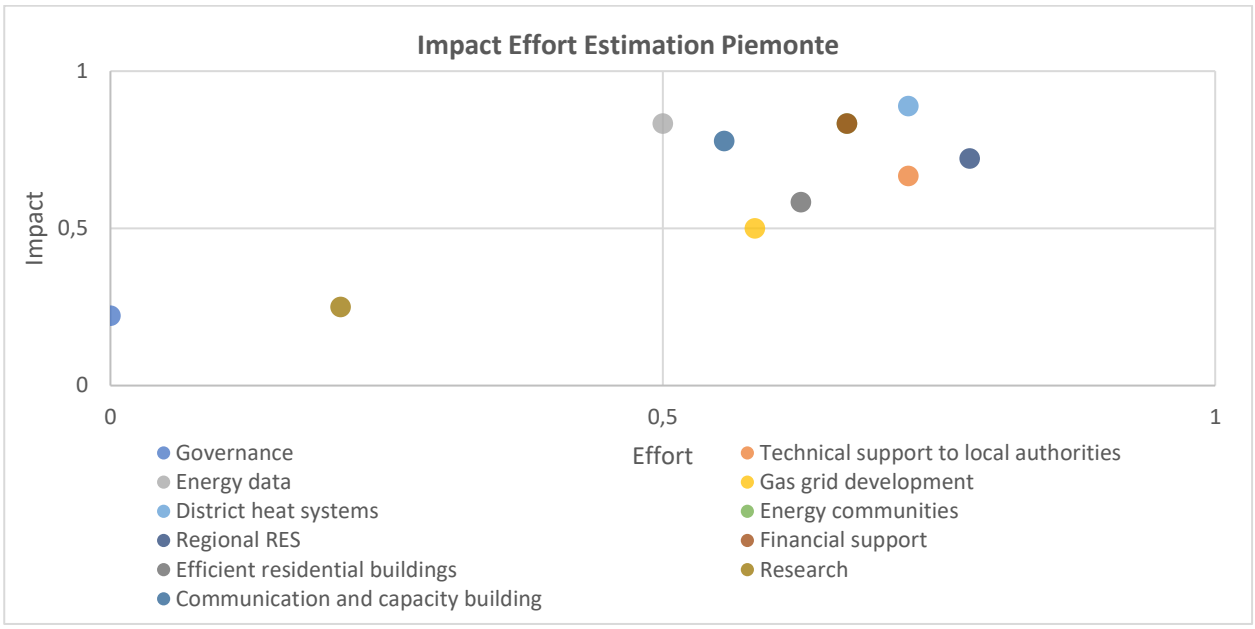

Image 7: Impact-effort estimation Piemonte

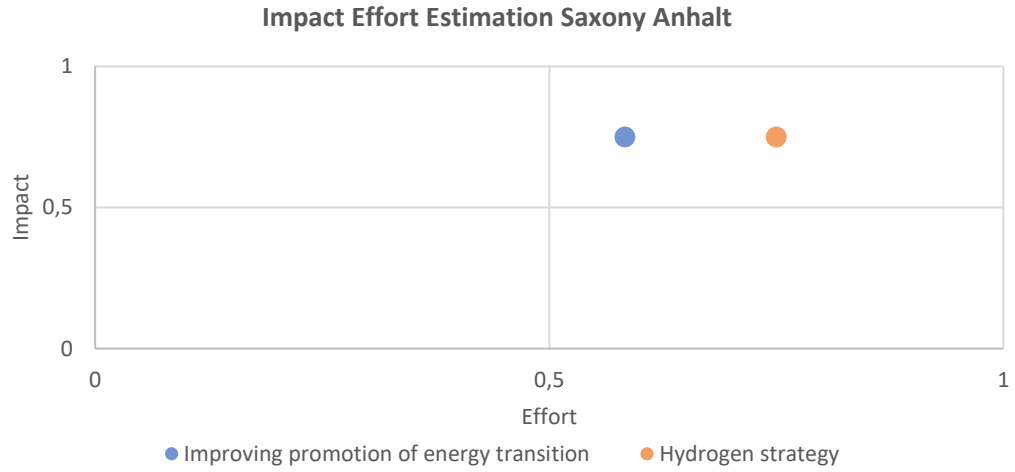

Image 8: Impact-effort estimation Sachsen-Anhalt

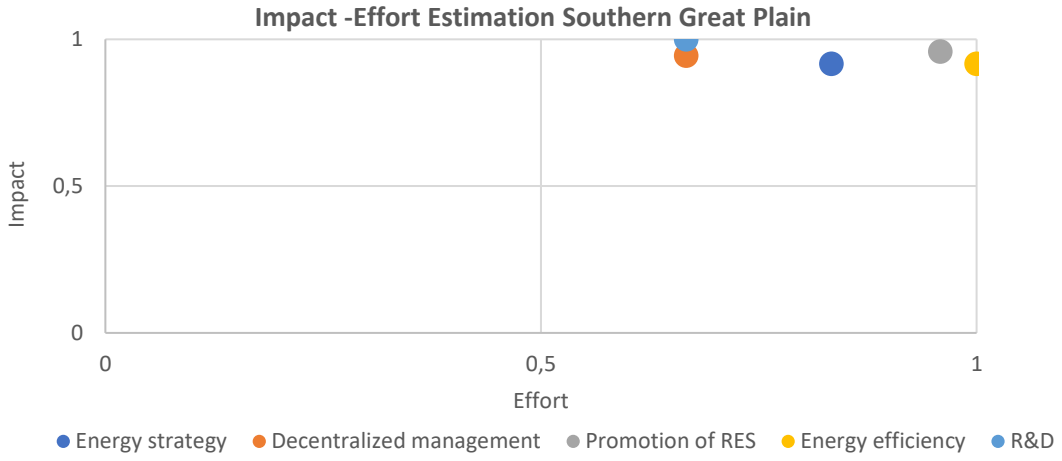

Image 9: Impact-effort estimation Southern Great Plain

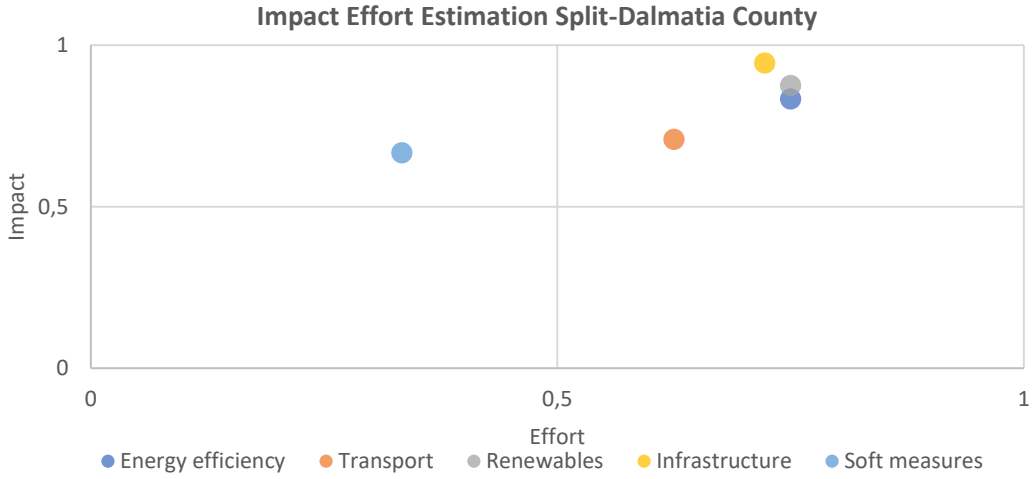

Image 10: Impact-effort estimation Split-Dalmatia County

In each region, the majority of the key energy priorities can be found in the first quadrant of the impact-effort estimation, indicating that the transition measures are expected to have high impact on the energy system, but are also requiring above-average efforts.

6. Activities: a closer look at measures and instruments

The elaboration of suitable measures within the priorities and the determination of suitable instruments for proper implementation are the core activities in the development of the REAPs in PROSPECT 2030.

Measures can be compared to vehicles on the pathway, which is defined by the key energy priorities, to approach the goals of decarbonisation of energy systems. Since the measures are often tailored specifically to the respective regional conditions, they are grouped thematically for this report. In image 11, the thematic group is indicated on the y-axis, while the frequency of related measures is indicated on the x-axis.

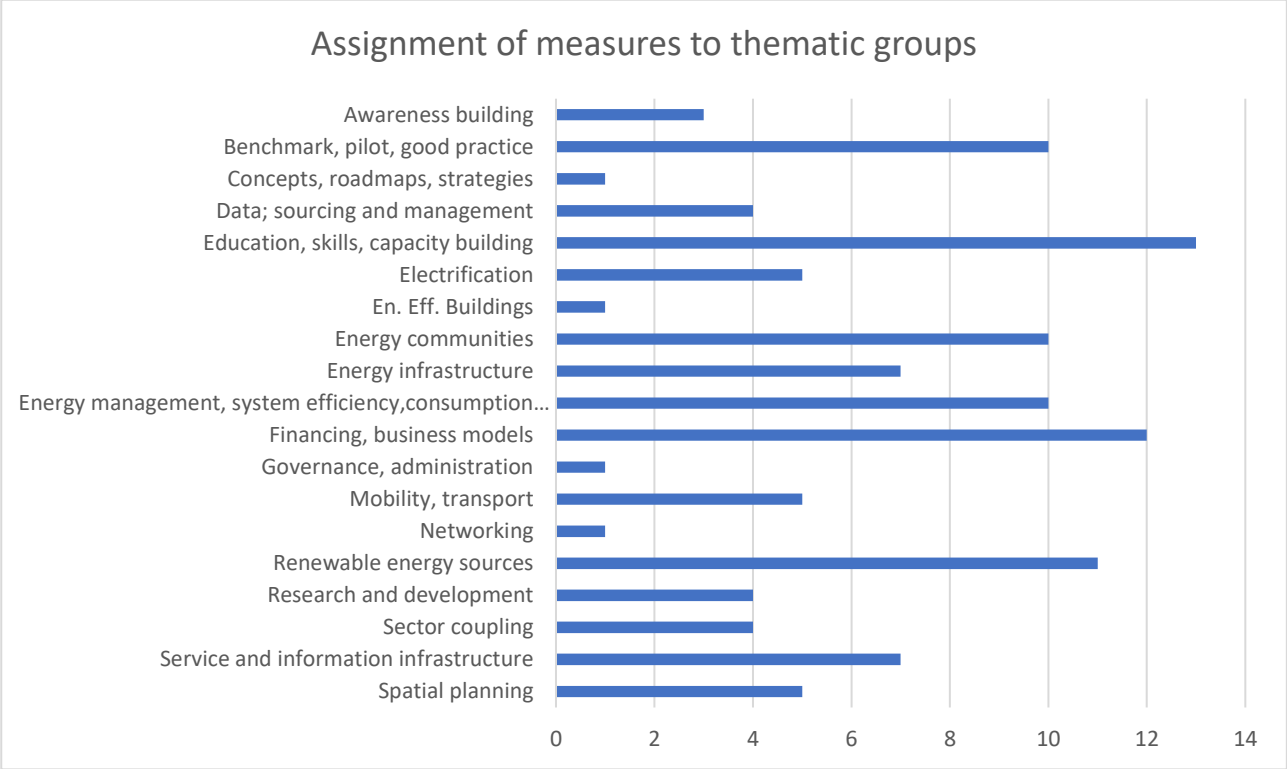

Image 11: Assignment of planned measures to thematic groups

As a consequence of the SWOT results, necessary actions were elaborated in order to profit to a maximum of the enabling factors for measure implementation and to reduce the effect of the restraining factors. This includes also the choice of suitable instruments from an arsenal of policy, planning, organisational, financial, business, soft and technical instruments.

Image 12 gives an overview on the use of the types of instruments in the totality of the project partners´action plans and image 13 is showing the individual preferences of types of instruments in the participating regions for achieving a maximal impact of measures for the energy transition.

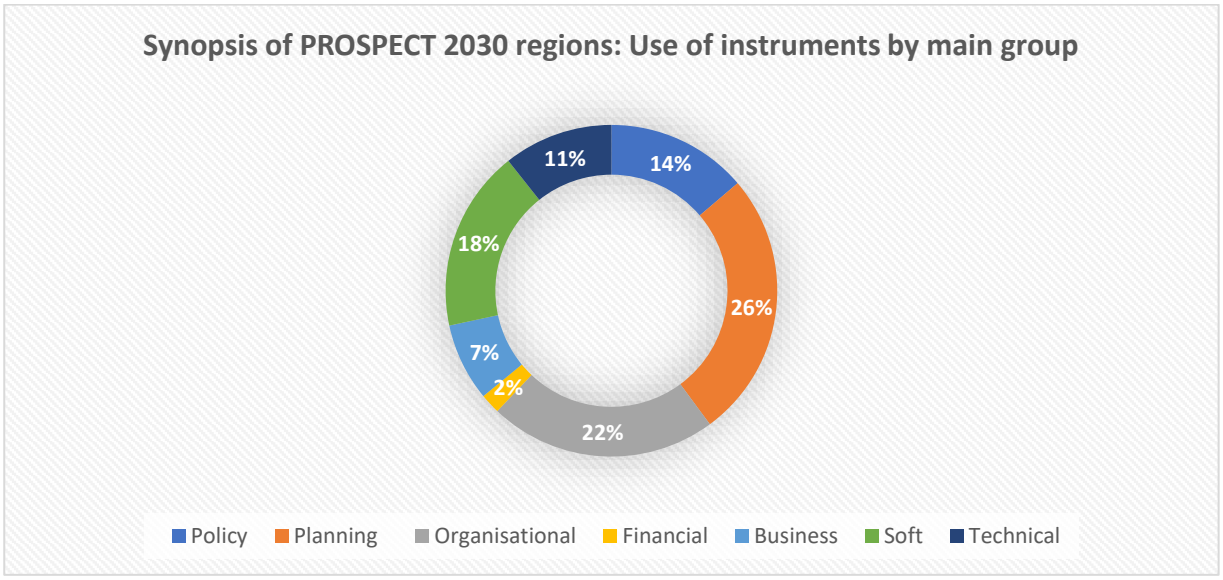

Image 12: Use of instruments in the REAPs by main group

Annotation: With deeper exploration of the respective action plans it becomes visible, that planning instruments are the bridging factor between policy instruments and organisational instruments. Roughly said, policy, planning and organisational instruments are forming a common core-triad, to which then other instruments can be (more or less) easily attached.

Furthermore, the use of one instrument can be applied to more than one measures, for example, financial instruments, like a non-repayable grant covering building efficiency and replacement of fossil heatings, or spatial planning instruments covering all types of municipal infrastructure, including efficient heat and electricity supply.

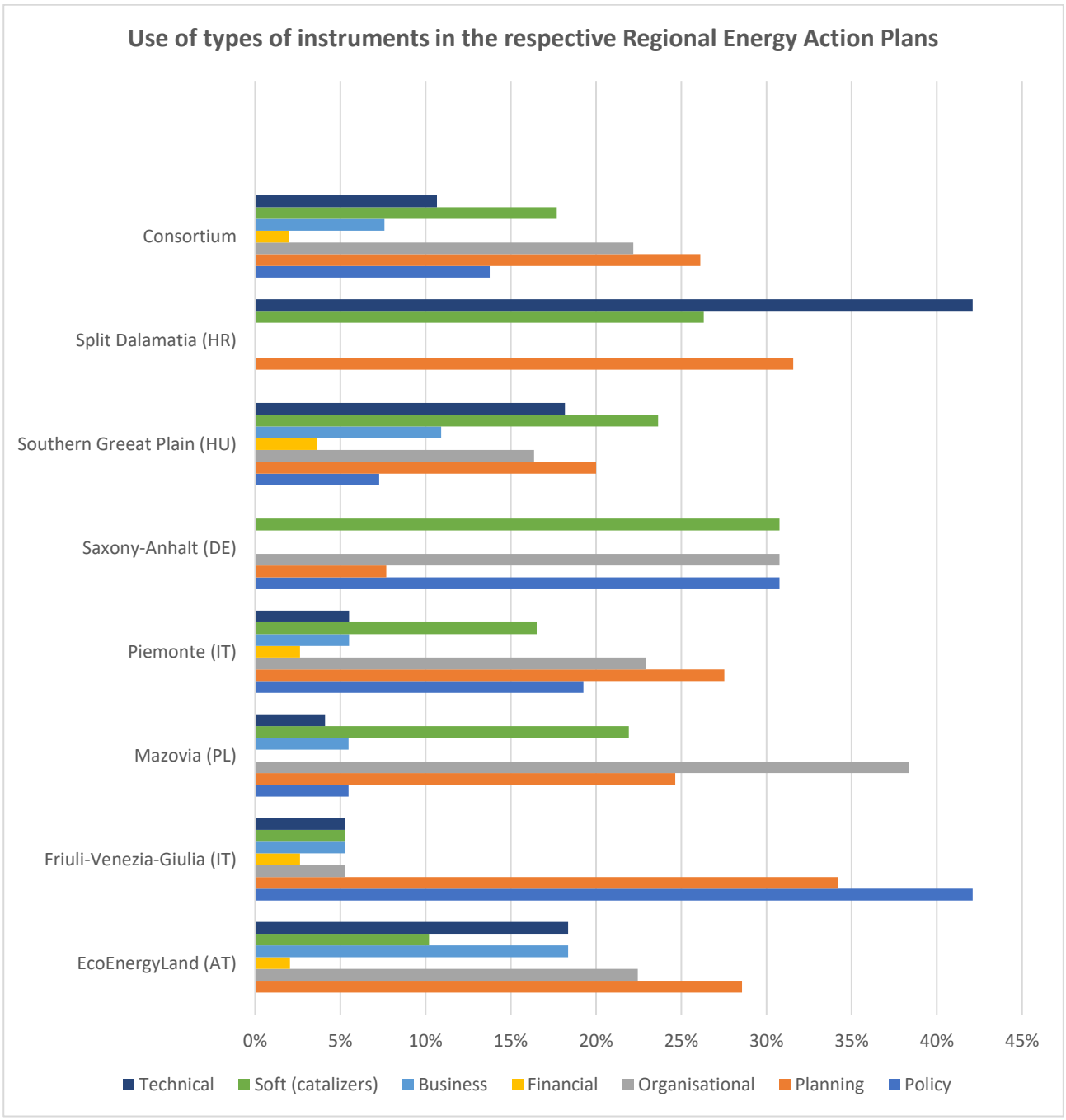

Image 13: Use of types of instruments in the respective Regional Energy Action Plans

The images 14-20 are offering closer insights to the instruments chosen for measure implementation in the REAPs

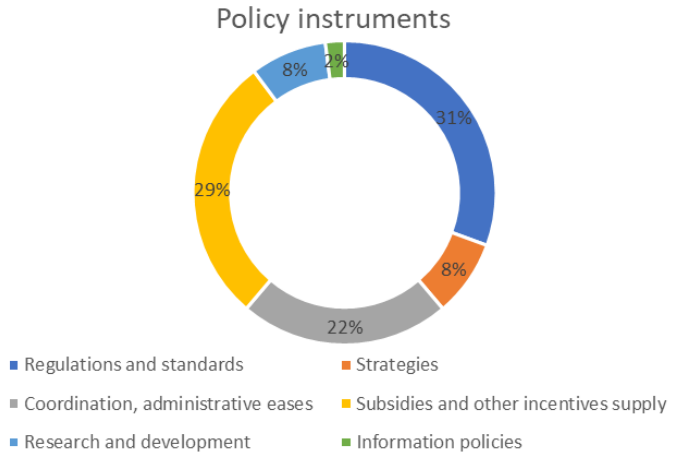

Image 14: policy instruments

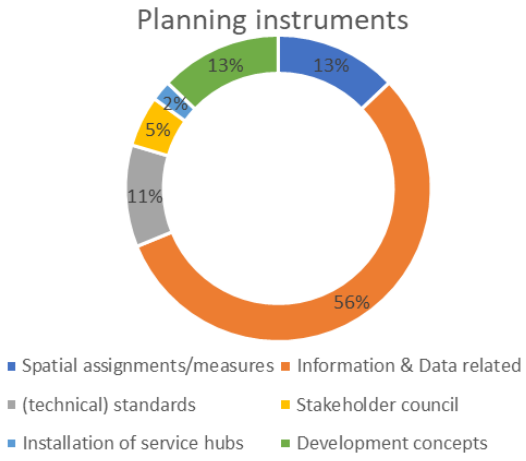

Image 15: planning instruments

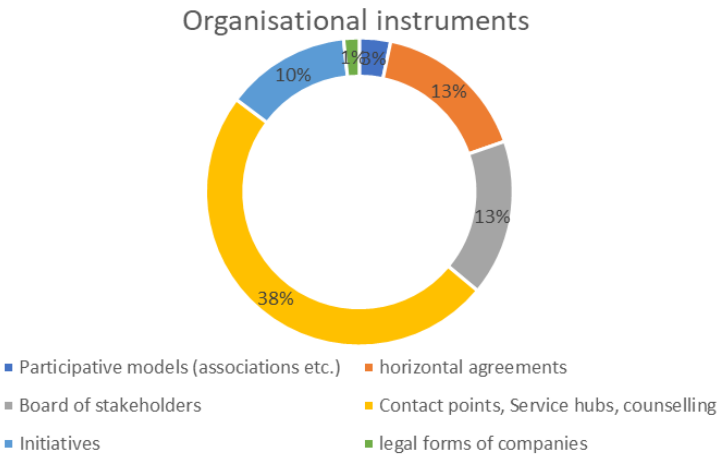

Image 16: organisational instruments

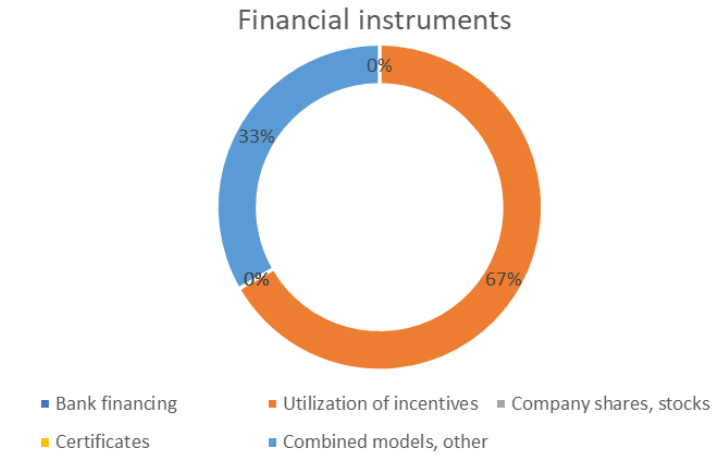

Image 17: financial instruments

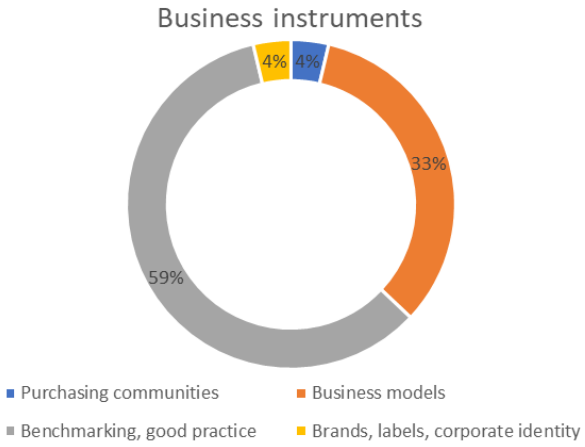

Image 18: business instruments

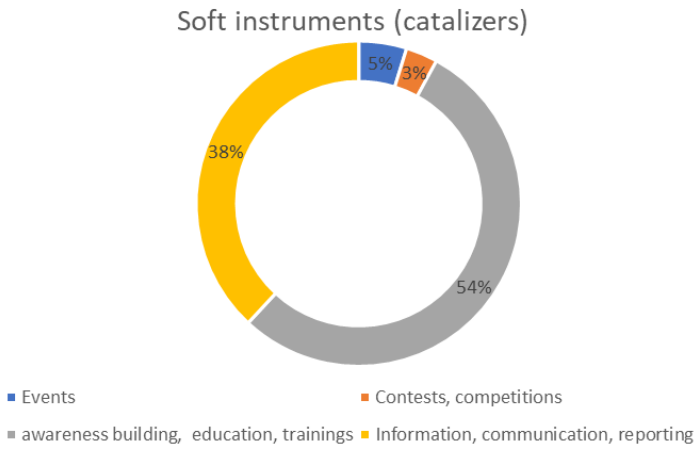

Image 19: soft instruments (catalizers)

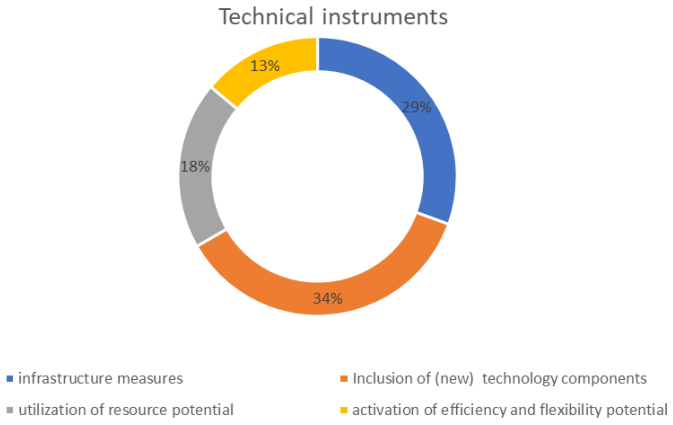

Image 20: technical instruments

7. Scenarios built on activities

The development of scenarios aimed at casting the expected outcomes of the activities into figures and thus, for setting a landmark to reach and to communicate to the stakeholders.

The project partners developed their regional scenarios in the background of the achievement of a proper carrying out of activities and implementation of measures according to the set time frames. Most of these scenarios are referring to a main time horizon of 2030 and a second one to 2040 or 2050.

The scenarios are based on past and current trends of policy, stakeholder commitment, activities carried out in the field of energy efficiency and renewable energy, technology development and technology costs, awareness levels in the population, prognosis of future development of economy and population etc.

All scenarios are developed under the assumption, that the COVID pandemic will soon be overcome and will leave no lasting traces in the economic and financial system

The modelling of the scenarios was carried out by use of a calculation tool, based on MS Excel and developed in a cooperation of the project partners EEE and PoliTo. The calculation focuses on the two main aspects of energy transition, which are “shift” and “change”. “Shift” is characterized by abandoning fossil fuels and replacing them with renewable ones. “Change” means increase in efficiency through energy savings and sector coupling as well as the region-internal extension of renewable energy generation infrastructure. Both components are superimposed and lead to a calculatory estimation of:

- Final consumption
- Primary consumption
- Carbon emissions
- Region-internal generation vs. imports
- Share of renewables in final consumption

for a maximum of three points in time. Furthermore it is possible (not automatically integrated) to estimate the amount of investments needed for achieving the scenario values. Numeric outputs are in a tabellary form and visualized in integrated Sankey diagrams

The 2030 scenario is the one, which all project partners are having in common. Thus, the comparative report is focussing on the individual regional scenarios of this timeline.

Image 21 is showing the results of the respective scenarios regarding final consumption, primary consumption and carbon emissions in comparison to the baseline. The overview is carried out in % values, with the baseline indicating 100% and the scenario results as shares of the baseline.

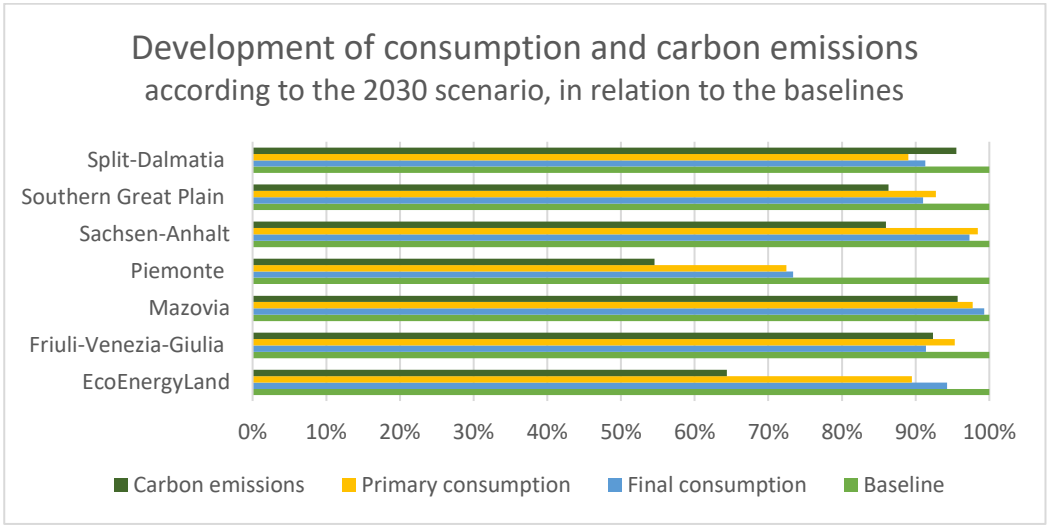

Image 21: Development of consumption and carbon emissions according to the 2030 scenario, in relation to the baselines

The comparison of regional scenarios shows that the target of a 55% reduction of carbon emissions until 2030 is not achievable under the current circumstances. The reason can be found in the subject, that regions have to act within their given framework of competences. Although some of them have the competences to set regulations, regions are needing more support from the national level, when it comes to incising measures, like gradual carbon emission taxation, for example, for accelerating the shift from fossil to renewable energy, especially in the heat and transport sector. On the other hand, the role of the industrial sector was, due to the lack of reliable data, hard or not to estimate.

An overview on the results of the 2030 scenario regarding the share of renewable energy in final consumption is given in image 22:

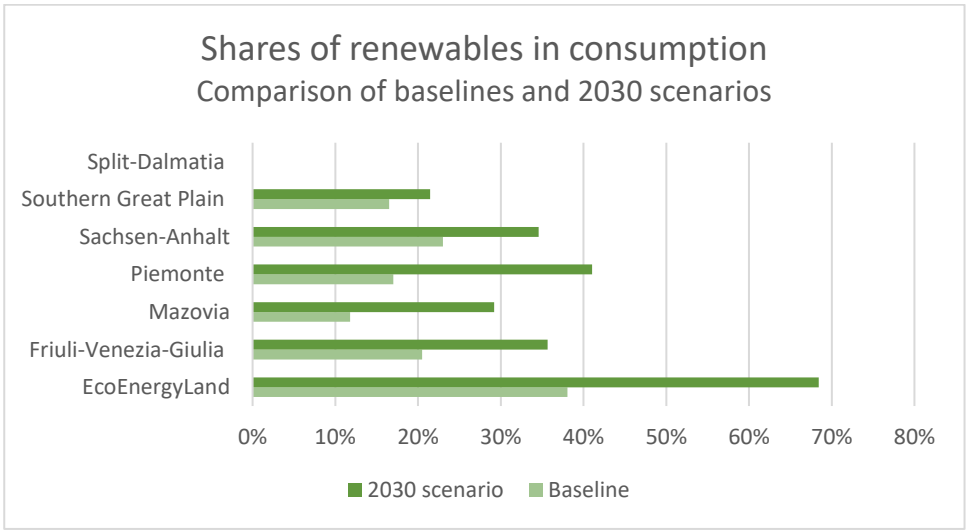

Image 22: Shares of renewables in consumption; comparison of baselines and 2030 scenarios

Image 23 is visualizing the scenario results for region-internal energy generation, comprising mainly heat and electricity. The visualization gives an overall picture and does not distinguish between fossil and renewable sources, although all increases in region-internal generation are on the account of renewable energy. In the case of the Mazovian Voivodeship, the total generation capacity remains on the same level of the baseline, but foresees a shift from fossil to renewable in the distribution of generation.

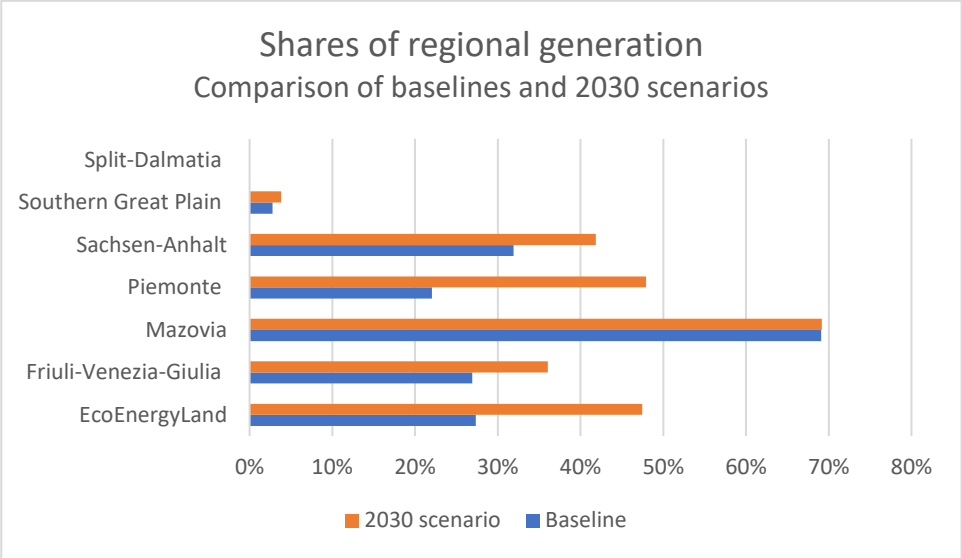

Image 23: Shares of regional generation; comparison of baselines and 2030 scenarios

The modelling of the scenarios also allows the estimation of the necessary investments for achieving the scenario results. The estimation is done by use of key figures, as for example the average investment cost per kWp for PV. The calculation is based on the increase of generated energy according to the scenario and divided by full load hours, which is leading to the power to be installed, which then is multiplied with the respective investment costs per unit (at calculation date). This allows also the estimation of incentives to be spent by the public sector, in case such incentives are offered.

The resulting per capita values are depending on one hand on the types of measures provided in the action plan and to what extent all components of the measures are included. On the other hand the values are depending on the availability of key figures on national or regional level, which might differ considerably, if, for example, workforce costs for establishment are included or not.

An overview on the estimated per capita investments for achieving the 2030 scenarios is given in image 24.

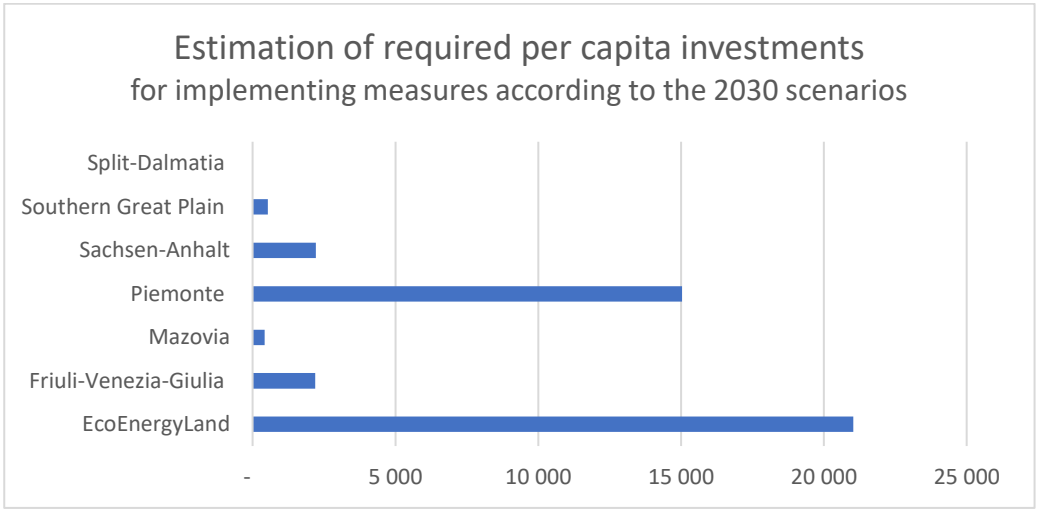

Image 24: Estimation of required per capita investments in Euro for implementing measures according to the 2030 scenarios

The shift from fossil to renewable energy sources has a triple effect, which is:

- Reduction of primary energy input and thus, contribution to better efficiency
- Reduction of carbon emissions
- Promotion of region-internal resources and mobilization of potentials

Sankey-diagrams are the medium of choice for visualising multiple energy flows, not only from sources to sinks, but also for their mutual substitution. In the course of PROSPECT 2030, for baseline and scenario visualization a series of Sankey diagrams was developed as an integrated component of the scenario modelling tool. The diagrams regarding the shift from fossil to renewable energy sources between the baseline and the 2030 scenario for the respective regions are presented in the following images. An exception is the diagram for the Split-Dalmatia County, where LEAP (Low Emissions Analysis Platform) was used for scenario modelling. The latter diagram is visualizing the energy flows, as projected for 2030. The units of the numbers displayed in the diagrams is ktoe. The values and bars to the left are representing the baseline, the ones to the right are representing the state of the 2030 scenario.

Image 25: Scenario „shift“ 2030 - Piemonte

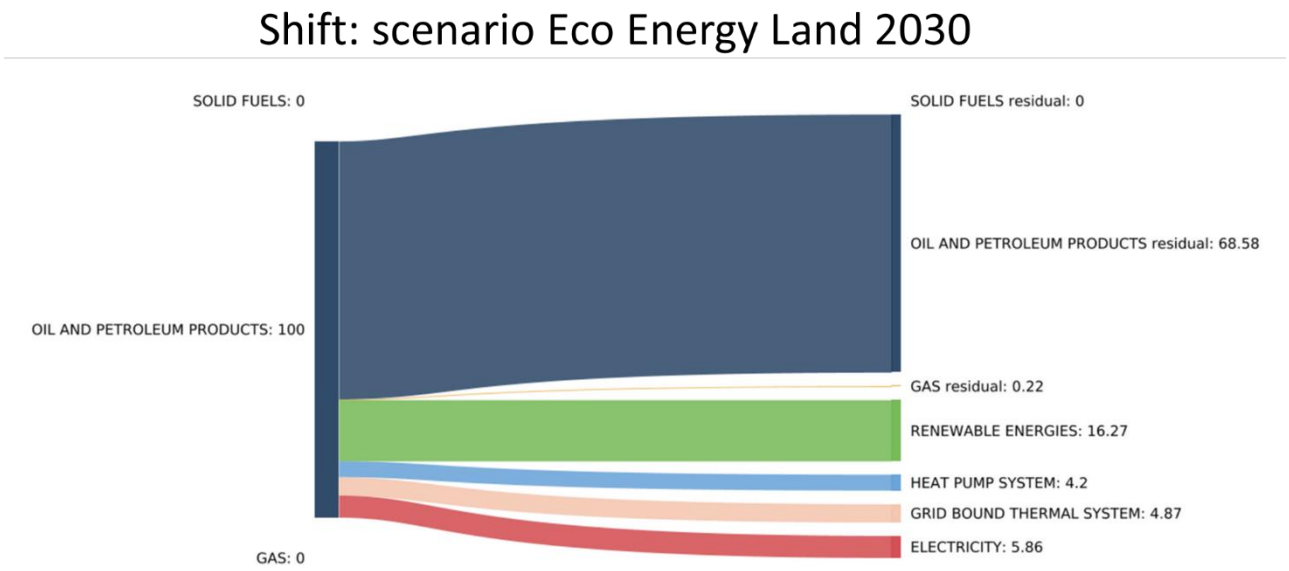

Image 26: Scenario „shift“ 2030 – Eco Energy Land

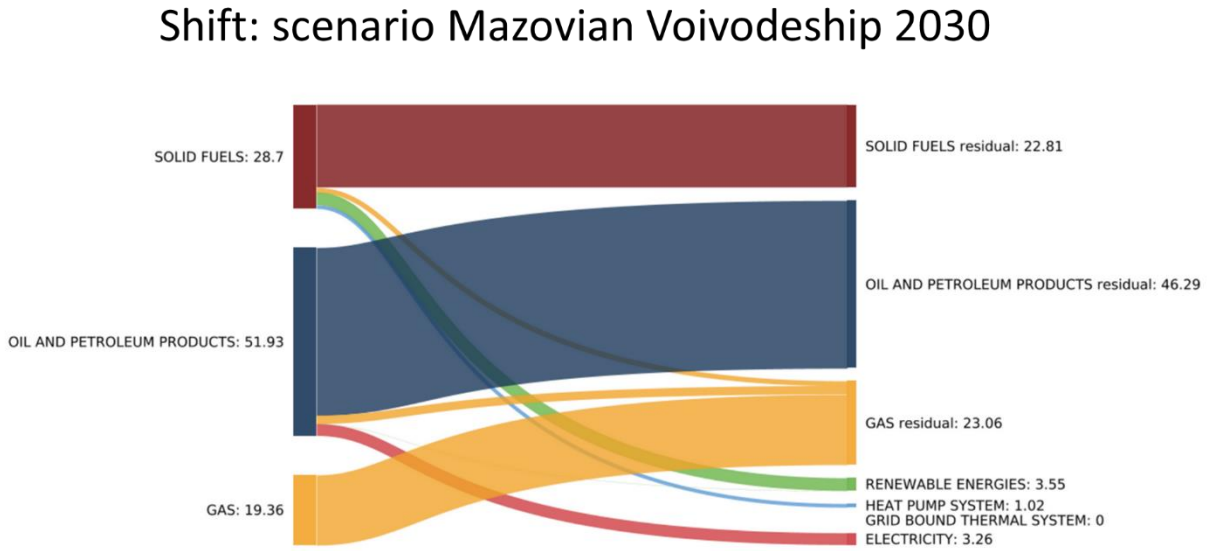

Image 27: Scenario „shift“ 2030 – Mazovian Voivodeship

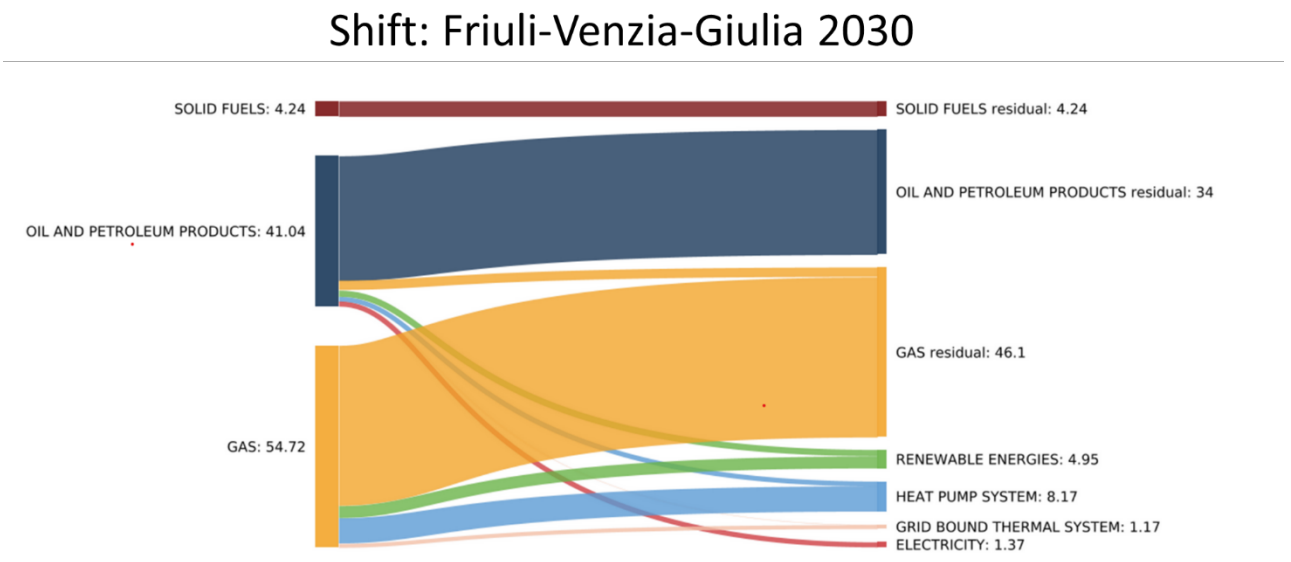

Image 28: Scenario „shift“ 2030 – Friuli-Venezia-Giulia

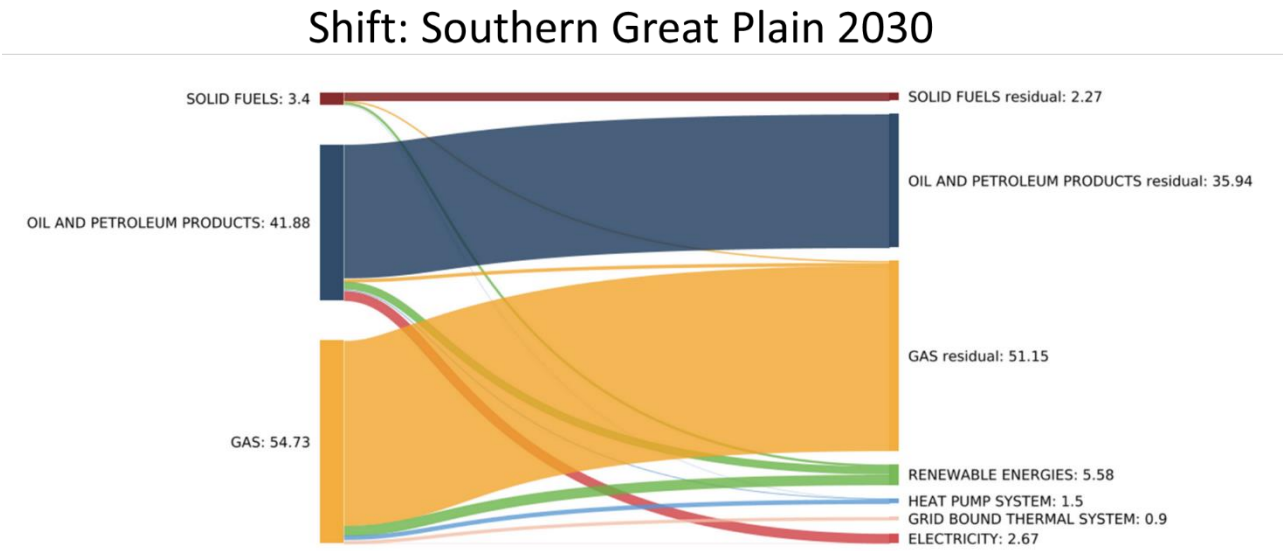

Image 29: Scenario „shift“ 2030 – Southern Great Plain

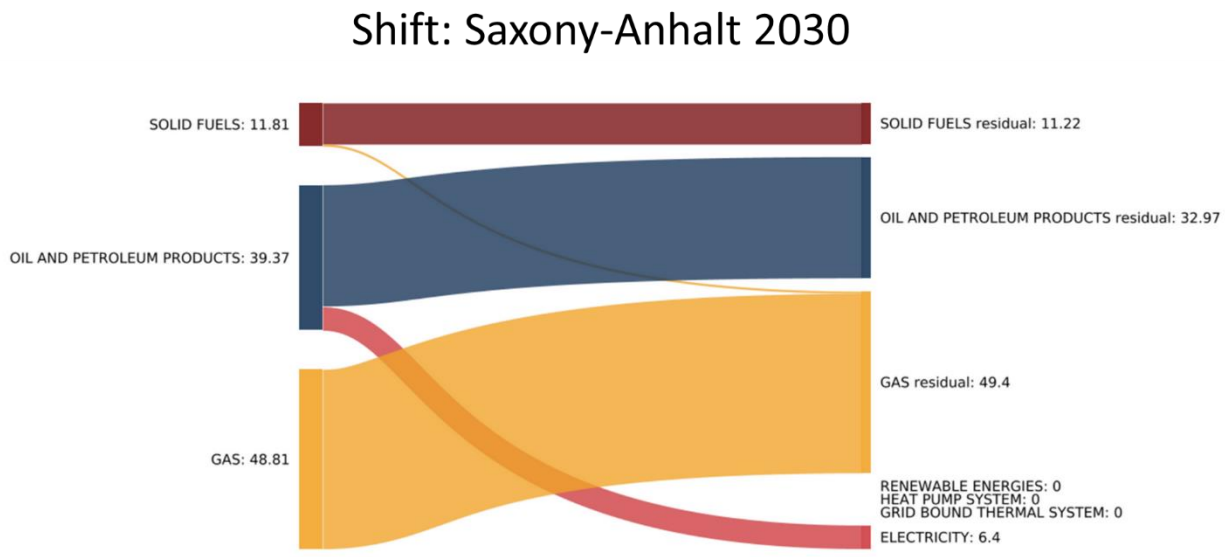

Image 30: Scenario „shift“ 2030 – Saxony-Anhalt

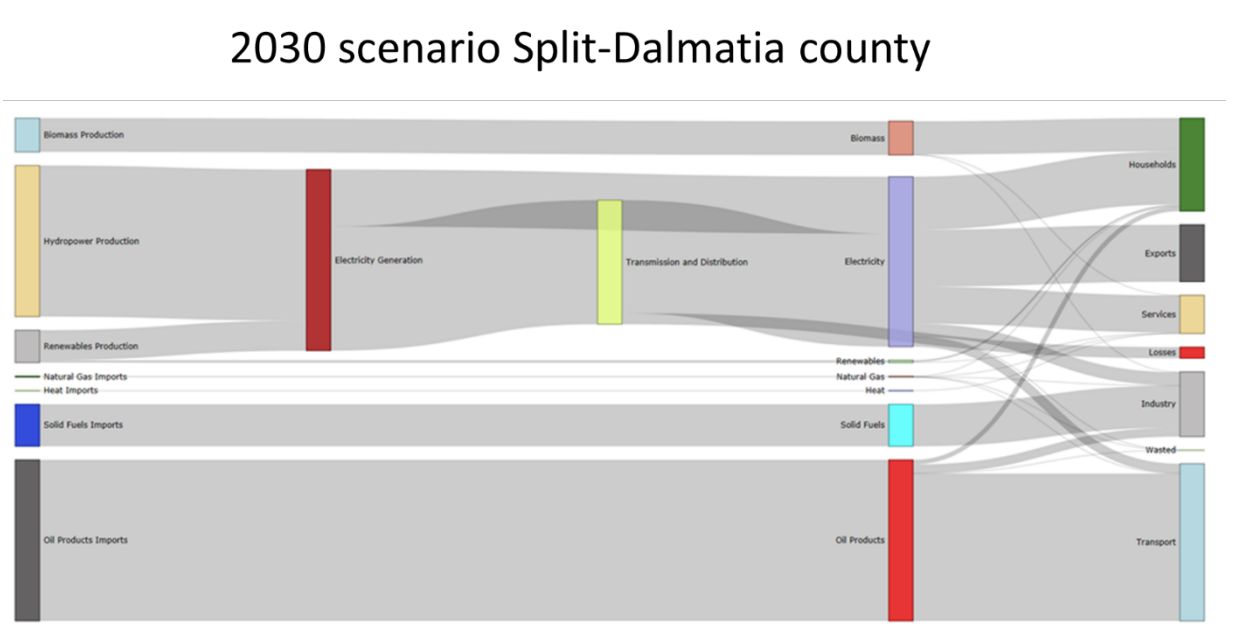

Image 31: Scenario 2030 – energy flows for Split-Dalmatia county

8. Monitoring, KPIs, business models

For the monitoring of the proper implementation of the measures within the key energy priorities, each region has specified an existing or a to be set up monitoring body and also an evaluation period, as can be seen in table 5

Project region	Monitoring body	Evaluation period (years)
EcoEnergyLand	Local energy agency of the Eco Energy Land (19 municipalities association)	1 (continuous); 3 (in depth)
Friuli-Venezia-Giulia	Regional energy observatory to be set up, regional energy agency	1
Mazovia	Local region authorities and energy companies, Mazovian Voivodeship Board, regional energy agency	1
Piemonte	Energy Department of Piemonte Region, Environmental Department, Statistics Sector	1
Sachsen-Anhalt	'Interministerial Working Group on Climate Protection' in order to assure a close cooperation of the Regional Energy Agency Saxony-Anhalt and scientific advisory boards	1
Southern Great Plain	Climate Agency to be set up in the course of the implementation of the present Regional Energy Action Plan	1
Split-Dalmatia	-	-

Table 5: Monitoring plan of regions

Regarding the key performance indicators for monitoring and evaluation, the regions are having some indicators in common, like carbon emissions values or the share of renewables in energy supply, but there are also indicators, which are specific for the individual region and its needs.

Table 6 provides an overview on the KPIs intended for monitoring and implementation progress evaluation:

Indicator	EEL	FVG	MAE	PIE	SAH	SGP	SPD	Number
Alternative fuels, renewables in transport	x		x			x	x	4
Amount of green hydrogen generated					x			1
Amount of RES electricity not integrated into the electric grid					x			1
Average age of RES based power plants					x			1
Average carbon emissions per households;						x		1
Average final energy consumption of households;						x		1
Buildings after thermomodernization			x					1
Buildings connected to district heat networks			x					1
Carbon emissions and emission reductions	x	x	x	x	x	x	x	7
Carbon emissions per capita	x			x	x	x		4
Carbon emissions per electricity generation	x			x		x		3
Carbon emissions per final energy consumption unit	x			x				2
Cost of generated energy					x			1
Electricity in final consumption		x				x	x	3
Electricity in transport	x					x	x	3
Emission costs per capita	x							1
Final energy consumption per sectors and energy carriers	x	x		x		x		4
Final energy consumptions per GDP	x					x		2
Final thermal consumptions per day degree				x				1
Individual heating devices meeting EE requirements			x					1
Installed energy capacity as energy storage system					x			1
Installed power capacity as energy storage system					x			1
Installed RES power					x			1

Investments in energy decarbonisation	x	x	x		x		x	5
Investments per kWh of saved energy and per additional kWh of renewable energy			x					1
Number of Energy Communities and self consumed generation	x			x		x		3
Number of Municipalities joining the Covenant of Mayors Initiatives for Energy and Climate				x				1
Primary and final energy reduction			x					1
Public funds per capita used for energy efficiency and renewables investments;						x		1
Ratio energy generation by RES to total energy demand					x			1
Ratio installed power capacity of RES to used surface dedicated to agriculture					x			1
Ratio of leveraging of public grants by private funding in energy efficiency and renewables investments;						x		1
Indicator	**EEL**	**FVG**	**MAE**	**PIE**	**SAH**	**SGP**	**SPD**	**Number**
Ratio thermal energy generation by RES to total thermal energy demand					x			1
Regional energy balances		x						1
Regional generation, import, export	x			x		x	x	4
Regional renewable energy generation pattern;						x		1
Renewables in electricity supply	x	x	x	x		x	x	6
Renewables in final electricity consumption	x			x		x		3
Renewables in final thermal consumption	x		x	x		x		4
Renewables in general consumption (primary, final)	x	x		x		x	x	5
Renwables share in regional energy mix			x		x			2
RES integration in private buildings			x					1

Share of nuclear energy in the regional energy mix			x					1
Specific investment costs for power plant based on RES					x			1
Total needed investment					x			1
White and green certificates		x						1

Table 6: Key performance indicators of regions for implementation monitoring

9. Proposed business models and estimation of effects on regional economy

The issue of suitable business models for enabling the energy transition is still a matter of traditional and experience-based approaches. Furthermore the associations to the word "business model" are also dependent on the role of the actors within their specific environment. This became clearly visible in the individual REAPs with regard to the level of governance of the authors.

For an authority or an authority related agency, for example, the business model correlates more to administrative efficiency, like easy access to public services, like one stop shops for counselling activities and funding application etc. Of course, this is also due to their regulatory limitations af activity

R&D institutions or private agencies are tending to explore suitable models which are also including components which are more market based or related to public/customer based involvement, like citizen participation, platform based peer-to-peer trading or investment pooling communities.

Tabellary image 32 is giving an overview on the proposed business models as considered in the respective REAPs:

PIE	SGP	MAE	SAH	FVG	EEL
EXISTING	*EXISTING*	*EXISTING*	*EXISTING*	*EXISTING*	*EXISTING*
Tax deduction, tax relief	Use of public funds	Public support mechanisms	P2P energy trading	Public-private-partnership	Customer demand based - for established efficient products
Public private partnership	Target loans	BOS-Bank: majority shareholder is the National Fund for Environment Protection. Loans in cooperation with private banks and Credit from the CEB (Council of Europe Development Bank) line EBI Climate Action investment credit	Full feed into grid model	Public grants for investments	Policy triggered demand based - for investments to promote
	Feed in tariffs	Investment funds	Self consumption and surplus feed into grid		Cooperative models (Energy communities)
		Green bonds for financing projects			
ALTERNATIVE	*ALTERNATIVE*	*ALTERNATIVE*	*ALTERNATIVE*	*ALTERNATIVE*	*ALTERNATIVE*
Bundling approach for public buildings	Private participation	Energy performance contracting	Renewable energy communities	Investment pooling	Platform based local peer to peer (P2P) trading business models
One stop shop (OSS) for citizens for the renovation of private buildings		Public-Private Partnership	Car sharing models	Participative models (energy communities)	Community based distributed ownwership and management
Energy communities		Leasing of investment in energy efficiency and RES	Flexibility trading		Pay-as-you-go business models
		Crowdfunding	Flexible generation (power-to-x)		

Image 32: Proposed business modelst o implement

Together with the determination of suitable business models, an attempt was also made to figure out the possible effects of the action plans on the respective regional economies. Due to the current uncertainties in the economic system and the complexity of the transition process the estimations remained very general.

The spectrum of expectations extends from "*no significant impact to expect*" to "*The result of the energy transformation will be considerable benefits for citizens, including by controlling energy costs with declining fossil fuel resources, a cost-effective approach to the consumption of dwindling water resources or a reduction in health costs caused by polluted air. Despite the fact that energy will become more expensive, its independent production and storage will be a tool to control rising costs*"

10. Additional findings: chances, challenges and gaps

The last chapters of the REAPs are dedicated to general and specific framework conditions which need to be considered in the individual case of the respective region. Tabellary image 33 is giving an overview on the chances and challenges for policy and stakeholders:

SGP	MAE	SAH	FVG	EEE	PIE
Transition can only be created for bottom-up by the strong political will and commitment of the local stakeholders	There is a need for intersectoral communication and multi-stakeholder participation, as well as for the increased involvement of citizens whose needs, but also direct actions will be of key importance in achieving the intended results of the energy strategy	Reducing bureaucracy is a highly appreciated measure as well as a better integration of the population.	Monitor the regional energy system. Set up standard procedures and maintain them over the years in order to have usable data, select relevant KPIs and statistics	Energy transition is also a process of decentralization and thus requires action on all levels of governance, but also interaction between sectors, sectoral stakeholders and authorities in urban and rural spaces. Authorities and stakeholders need to be seen as key players in an evolving ecosystem based on technical and social innovation and digitalisation	Multilevel governance at vertical and horizontal level should be reinforced. In this context, proactive leadership must be played supporting and addressing local policies toward the needs of the renovation wave and the energy transition challenges. In order to achieve this goal, it is urgent and necessary that additional, young and qualified staff would be recruited in the public sector
The financial resources available for the development of sustainable energy measures are mostly planned at national level, and therefore, do not always reflect the specific regional needs, and the access to the funding may create imbalances between regions based on the level of preparedness			Put in place a regional observatory on energy flows	The main point for authorities in micro-regions is to support the creation and maintenance of strong cooperative platforms for coordinating activities, enabling best possible information flow and managing initiatives	The Energy observatory needs to be boosted and kept alive along the years in order to monitor the effectiveness of the implemented policies and readdress them taking into account the targets of carbon neutrality ahead
The increased supply of electricity due to the parallel operation of the old and new nuclear reactors and the price of the nuclear energy may exert unpredictable adverse impacts on the roll-out of renewable investments			Plan and design a regional strategy. Develop a proper plan for each sector, infrastructures, set goals and deadlines for each aspect of the energy transition	Therefore, the main challenge for regional authorities and stakeholders can be seen in managing an effective interplay of actors by observing three pillars of decentralized governance: authority, subsidiarity, autonomy	The Region needs to act as an accelerator of investments in the private and public sector, managing efficiently and with sound leverage factors the public fundings available. Besides, supporting information and reducing transaction costs for the full roll out of investments of private citizens and SMEs in the
Compared to the purchasing power of the citizens, the financial return on sustainable investments is generally too long to encourage people to invest into energy efficiency and building integrated renewable solutions			Awareness of current state of issues, technologies and opportunities; Aggregate interest to take advantage of economies of scale; Think "out-of-the-box" to mobilise investments		

Image 33: Chances and challenges overview

Tabellary image 34 is presenting an overview on the perceived gaps to be filled regarding policy issues:

SGP	Piemonte	EEE	FVG	SAH	MAE
The main challenge from the perspective of the implementation of the present Regional Energy Action Plan is to strengthen the cooperation amongst the key stakeholders of the region, and the willingness to mobilize internal resources to create on a voluntary basis the planned institution and capacity building measures as early as possible	Back to back with the development of technologies and solutions which are not yet market-ready for their large scale implementation, it is essential that most of the not-technological barriers that hinder the full roll out of sustainable energy projects are removed	Supply security gap: an increasing share of electricity demand in final consumption, especially in the mobility sector, supply security is a main issue when it comes to load management at peak times. This gap needs to be filled already in the planning stage by preparing technical, as well as managerial (e.g. tariff time slots) measures or combinations thereof. Although considered theoretically, to date no practical approach is observable	The main challenges for the regional authority are to design the regulatory and financing frameworks of such transition. In order to do so, the biggest gap to be filled is a proper and detailed energy action plan, based on consistent energy data collected over the years into a unique and accessible database	The biggest change might be the increased amount of referendums and lesser bureaucracy. The already existing precautions need to be expanded. Referendums are already part of political structures, but not yet used in the way they will be, due to these measures. This will definitely require new restructuring of regulations and the awareness of politicians so that their politics can adapt	For the full implementation of the presented regional energy plan for the Mazovian Voivodeship, it is necessary to receive support from the authorities of the Mazovian Voivodeship, as well as from the regulations and policies on the national level. Due to the consistency of the document with strategic documents, there should be no big dissonance in achieving common goals
	The regulatory framework of the transition must be, thus, set and kept stable or aligned to the long term objectives that we have in front of us. Mitigation to climate change must be the red line that drives any investment project in the coming years.	Flexibility gap: decentralized energy systems based on renewable electricity need to compensate fluctuations on the supply- as well as on the demand side. This is especially the case when renewable energy communities will enter the market with their individual consumption and generation patterns, which are then superimposed by respective weather conditions. Coping with fluctuations in decentralized systems, is depending on realtime data and thus on the existence of a respective digital infrastructure	Effective funding schemes which stabilize over time, sized according to studies and previous experiences, and focussed on the most promising sectors are needed. Having a holistic and pragmatic approach regarding funding schemes and business models is key to achieve any result conceived in the action plan		In addition, it is necessary to monitor the new financial perspective and new sources of financing, which may open up completely new paths towards the energy transformation of the region.
		Financing gap: Private sector involvement is crucial for the energy transition as a major investment challenge, since the public budget cannot meet all the costs by itself.			
		Digital literacy gap: Energy transition goes hand in hand with the digitital transition of society. Future digital (energy-) services will require an increased digital literacy, especially for the generation born before 1980. The 2020 Digital Economy and Society Index (DESI) shows that 42% of Europeans do not have even basic digital skills			The last factor that has to be taken into account and be detailed monitored is the issue of new technologies. The market for new solutions is inexhaustible and every day gives new, more effective, more innovative and profitable solutions that can be used. Therefore, it is not worth focusing on only one option, but keeping track the new technological possibilities that may turn out to be a more advantageous solution.
		Technical skills gap: The 10-year forecast of EuropeOn, the Electrical Contractors Association communicates: to reach the envisaged climate targets, Europe will need to have enough skilled workers to install 3,000 solar panels, 1,000 electrical vehicles' recharging points and 15,000 heat pumps on a daily basis. However, the forecast alerts precisely about the lack of staff with adequate skills			

Image 34: Gaps to be filled

11. Conclusive considerations

The following chapter is a comprehension of the conclusive considerations, based on the experiences, which the project partners made in the course of the planning process. This planning process was carried out in the tension field between the regions´specific characteristics and the degree of their already mobilized potentials (regarding energy efficiency, renewable energy implementation and measures for carbon emission reduction) and the requirements and targets of the European Green Deal for the 2030 time-horizon.

A big challenge is the unprecedented changes in the energy system, as in twenty years from now it will be completely different in terms of energy production and consumption. A massive shift towards electric energy is foreseen in all sectors. Private households, office buildings, transport vehicles and factories will use much more electricity than now

The development of power generation will be based mainly on photovoltaic, which will be the leading technology in a decade. Nevertheless, the increased challenging PV capacity would not be enough to offset the decommissioning of fossil thermoelectric power and the expected increase of consumptions

A major role in the next twenty years will be played by energy efficiency, whose targets in the building sector are extremely challenging and would require a combination of investments, behaviour change and different mindset that is hard to imagine

District heating infrastructure could still play a role in the future, but with a new concept based on thermal renewables and with an extensive network connecting a lot of low demand buildings and factories

In some countries, regional energy and climate strategies or plans are at present not developed at regional or sub-regional level, nor have these units dedicated budgets for structural reforms. Thus, to a large extent they follow the national development trends, but on the other hand the energy and climate planning is performed at municipal levels if the respective authorities and stakeholders are committed to it.

In these cases, the present programming framework provides for the green economic transition (including the Multiannual Financial Framework, the Recovery and Resilience Plan, and other relevant instruments of the NextGeneration EU as well) several local financial instruments and support mechanisms. They provide an appropriate technical and financial basis to make reliable projections up to 2030

Many planned activities are carried out on a micro-regional, local authority level, by identifying potentials and targets in place and defining actions and measures according to existing programs and strategies

Digitalisation is regarded as a core component of the future energy system, especially for the implementation of new business models and sector coupling

A couple of trajectories have been identified and for each one measures and actions have been evaluated. Some are more market-ready to be implemented with respect to others, depending on the maturity of the technology or the availability of sites and cooperation;

There is a high potential for RES deployment. In addition to wind and solar PV, hydro and biomass used in DH networks seem to be the most promising ones and those which the future system will be based on.

This will increase the efficiency of the system, improve air quality and supply cheaper energy to customers. On the other hand, this poses relevant questions on the generation status and the related infrastructures, from the control of the grid to storage technologies;

The transition cannot be considered as a single-sector process, as it touches multiple processes and areas where different actors from very different backgrounds are involved. It is important to have a holistic view and consider the effects of each measure on the other sectors;

There is a major need for an energy observatory, where different stakeholders cooperate in order to generate and manage a centralized database with energy data from all over the region;

There is a major need of a good planning and selection of measures to pursue, and to track the development of the system with respect to these measures;

There is a major need of developing a consistent and stable funding strategy to support and boost the energy transition.

An overall improvement might be made by a better integration of the population, especially in rural areas. There is a need to provide different ways of informing the population also by using new technologies might lead to a higher acceptance and the will to support decarbonisation by themselves.

Creating better incentive support for the projects instead of a high amount of bureaucracy, requirements and paperwork is a target that concerns every aspect of funding programmes. This leads to the fact that many possible target groups avoid using these support programmes. Furthermore, it reduces the amount of work for the office employees and reduces the working effort. This money can be used in different and more needed ways

The introduction of the goals of the Regional Energy Action Plans is to be the starting point to drive regions to the transition towards a low carbon economy. This goal will and can be accomplished by focusing on the elaborated mission statements, actions and measures, leading to significant primary and final energy consumption decrease and, accordingly, to emission reduction.

12. Lessons learnt

In the course of the evolution of the Regional Energy Action Plans (REAPs), the PROSPECT 2030 consortium encountered some expectable and some unexpected challenges. The expectable challenge was to find a standardized procedure, which suits the needs and requirements of the very different levels of governance, regulatory and incentive framework regarding the project regions. Also the position of the project partners, collaborating in the consortium, was on different levels within their home regions. The consortium gathered regional authorities, public energy agencies, private energy agencies and companies as well as R&D institutions. Each of them having their particular and role-specific experiences, focusses and points of view due to their tasks in their specific ecosystems.

Thus, it was necessary to develop methods and tools, able to regard the individual positions of the institutions in the course of the planning process but still leading to comparable results, communicable between all levels of governance and participation.

The unexpected challenge was that energy transition planning in its complexity is needing an adequate approach, going beyond the well-known (but of course still valid) energy planning processes. The respective awareness was growing step by step while proceeding in the development of the action plans.

The future energy system will have a very different shape from the present one, like the coupling of consumption sectors, deep electrification of energy end use and the necessity of digitalization and real-time data processing to manage loads and energy flows of increasingly decentralized energy systems and energy communities. Furthermore, the spatial planning aspect will be moving stronger to the center of attention, because a new complementarity of urban and rural spaces will have to be taken into account, when RES are implemented as the main source of supply.

At the present time, the European Union and the majority of national governments are demonstrating strong leadership in setting the framework for a fast transition process. This challenge has to be taken up not only on all levels of governance, but also on all levels of economy and on all levels of societal life, each of them also characterized by a certain inertia to deal with. Furthermore, energy transition (in all its facets) is coupled and intersecting with digital transition. This is complexity at its heart.

In order to manage complexity, a series of disciplines have adopted a planning approach which has slowly, but increasingly, emerged in the last decades from the fields of economy and social sciences. This approach tends to regard and treat the action field of planning and evaluation as functional ecosystems of interacting bodies on varying levels and types of relationships.

Although recognised at an early stage, due to the lack of available experience and good practice, this approach was only rudimentarily adopted in the course of the project. For example in the development of an impact/effort description as a result of the weighted SWOT (which allowed to evaluate the transition readiness of a region – as a basis for tailored action definition) and the focus on instrument supply and use as the connecting factor between the very differing levels of governance represented in the consortium.

In order to achieve the ambitious targets of the European Green Deal within the set timeframe and with the least societal friction potential possible, planning processes need to be moved away from sector specific pathways and adopted in a way, which is able to manage the complexity of a multi governance and multi stakeholder process, with a strong focus on complementarity, as it can be found in a transition ecosystem approach.

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