D.T2.4.4

Regional Energy Action Plan EcoEnergyLand Version n°1: 10/2021

D.T2.4.4: Regional Energy Action Plan EcoEnergyLand

A.T2.4 Regional Energy Action Plan definition

Partners involved

PP 7 - EEE Güssing

Interreg CENTRAL EUROPE

Priority:	2. Cooperating on low-carbon strategies in CENTRAL EUROPE
Specific objective:	2.2 To improve territorial based low-carbon energy planning strategies and policies supporting climate change mitigation
Acronym:	**PROSPECT2030**
Title:	**PROmoting regional Sustainable Policies on Energy and Climate change mitigation Towards 2030**
Index number:	CE1373
Lead Partner:	Piemonte Region
Duration:	01.04.2019 30.09.2021

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1. EXECUTIVE SUMMARY

This action plan was developed for the „EcoEnergyLand“ (EEL), an association of 19 municipalities in a rural and peripher region in the south east of Austria. The EEL is part of the Climate and Energy Model Region program of the Austrian Climate and Energy Fund and thus part of the decentral network aiming at managing the transition towards becoming a low-carbon region. EEE Güssing GmbH is acting as the local energy agency on behalf of the municipalities.

The activities are designed to being carried out on a local level of governance, respectively on the coordinated activities of local authorities in cooperation with a network of local, regional and transregional stakeholders in a horizontal network and overarching authorities and public bodies in a vertical network. All involved actors are regarded to be part of an ecosystem for transition implementation.

The priorities and therein coimprised measures have been chosen on one hand according to the experience gathered in the course of three decades in the region, regarding project development, technology implementation, research and piloting. On the other hand, the selection criterion was the necessity of actions needed to be in line with the superordinated climate goals as well as the linked general technological development to achieve these goals, even if a start from the scratch, due to the lack of benchmarks (e.g. energy communities) is needed.

The six priorities are focussing on:

- Smart Energy Systems
- Accelerating the replacement of fossil fuels
- Energy efficient municipalities
- Increased regionalization of renewable energy generation
- Exchange of expertise and intensified networking
- Catalizers: awareness building and promotion

The readiness of the region regarding the set measures within the priorities was tested by use of a weighted SWOT and actions were defined to promote the impact strengths and opportunities and to reduce the impact of weaknesses and threats. The results are visualized in an impact/effort diagram.

The scenarios for 2030 and 2040 are developed under consideration of (still) evolving regulatory and strategic framework, market trends and progoses by the Austrian Conference on Spatial Planning (ÖROK), coupled with the SWOT results. The scenario results are, as follows:

2030 scenario: A shift from heating oil applications to renewable heat supply in the residential and the service sector alone, can reduce the total regional carbon emissions by 23%, compared to the baseline, in 2030. Together with a demand-covering renewable electricity generation and a (moderate) shift towards electromobility, the total regional carbon emissions can be reduced by 35%, compared to the baseline, until 2030.
The expected investment until 2030 is 368 million € in total, or, as a per capita value, the amount of 21 000.- €, based on the average investment costs in 2020.

Based on the incentivation programs offered by the federal, but also the regional government, in 2021, the share of funding by public authorities is ~ 25%. In the case of the EEL, this amount is 90 million € in total.

2040 scenario: The scenario assumes a reduction of heat demand by 49% and a reduction of liquid fuel consumption in the transport sector by 29%. On the other hand, the electrification of the transport sector leads to an increase of the the electricity demand by 30%. In the balance, total final consumption is expected to be reduced by 18%.

The main impact of the measures to implement is, again, expected to be found on the side of GHG emissions, which are expected to decrease by 110 660 t/a (63%) compared to the baseline, mainly caused by the electrification of the transport sector

Based on the average investment costs in 2020, a total investment of 767 million € is required to put all measures (including 2030) into place until 2040. Monetized on the average EEX carbon price in September 2021 (~ € 61.-), the emission reduction equals to an annual amount of 6,8 million €, resulting in a payback period of 112,8 years.

The main challenge for the regional and local authorities is seen in the support, the creation and maintenance of strong cooperative platforms for coordinating activities, enabling best possible information flow and managing initiatives. On a sectoral level, these platforms are often already existing (commerce, agriculture, thematic associations etc.), but not connected for achieving an optimum of synergies and promoting bottom up initiatives adequately.

The detected looming gaps on technical and educational level cannot be filled on sub-regional or local level, but require action on higher levels of governance.

2. INTRODUCTORY OVERVIEW

2.1 Status quo summary

The „Eco Energy Land“ (EEL) is an association of currently 19 municipalities in the south of the NUTS 2 region Burgenland, situated in the south-east of Austria. The self-set goals of this LAU-based association.

The EEL has been a „Climate and Energy Model Region“ in the eponymous programme of the Austrian Climate and Energy Fund since 2010 and has set itself the goal of becoming independent of fossil energy imports, obtaining the best possible supply of renewable energy from its own, regionally available resources, focusing on energy efficiency and energy savings, creating jobs and increasing regional value creation. It is one of 95 Climate and Energy Model Regions in Austria, that actively address the issues of climate protection, renewable energy, energy saving and targeted awareness raising.

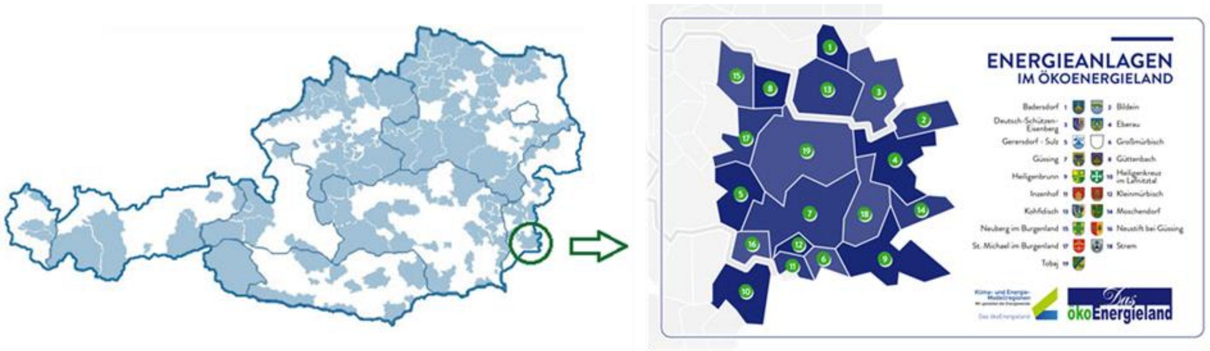


Image 1: Climate and Energy Model Regions in Austria and location of EcoEnergyLand

The current state of population is app. 17 500 persons, living in 7 500 households. The population density is 44 inhabitants per km², within an area almost equal to the area of Vienna (the latter with a population density of 4 630/km²). Only 6 out of the 19 municipalities have more than 1 000 inhabitants.

The total number of enterprises in all sectors is app. 1 600, employing about 6 500 persons. Most of them are very small SMEs. The number of enterprises >=20 and <100 employees is 20 and the number of enterprises >=100 employees is 4. Only 10% of the labour force are having their workplace also in the home municipality, around 40% are working within the region and 50% have to commute outside the region to reach their worplaces.

Regarding infrastructure, there is no connection to a higher level transport network. The only municipality with a railway connection is the southernmost municipality Heiligenkreuz.

Heiligenkreuz is also the only municipality with access to the gas grid.

On the electricity distribution grid level, there are two grid operators (DSOs). The bigger DSO is Netz Burgenland, which is operatin almost the whole electricity distribution system. Energie Güssing is operating the grids in two municipalities, Güssing and Strem.

In the region there are also 11 district heat systems in operation, 5 oft hem with a Combined-heat-power integration and the rest based on regional primary solid biomass.

The regional energy demand, as portrayed in the regional energy report (D.T2.2.3), was revised in mid 2020, due to the fact, that a new database on energy consumption and related issues had been released by a joint national research platform, providing data on municipal level. Since the action plan is intended for practical use, an elaboration on the base of commonly agreed data appears to be plausible. By use of these data, the baseline on final and primary consumption and on carbon emissions was updated. Primary consumption and carbon emissions are calculated by means of the scenario modelling tool, developed as a by product in the course of PROSPECT 2030.

Table 1 is giving an overview on the baseline

Baseline overview	Final consumption (MWh/a)	Share	Primary consumption (MWh/a)	Share	Carbon emissions (t/a)	Share
Agriculture	10 700	1%	17 329	2%	2 415	1%
Industry	306 302	40%	437 187	43%	60 655	35%
Construction	13 158	2%	16 947	2%	2 547	1%
Transport	197 500	26%	240 759	23%	61 689	35%
Services	40 900	5%	63 283	6%	9 305	5%
Residential	195 200	26%	251 189	24%	38 962	22%
Total	**763 760**		**1 026 694**		**175 574**	

Table 1: Regional baseline – final and primary consumption and carbon emissions

2.2 Current development trends

The region is still characterized by a shrinking population, lack of workplaces, a high share of commuters and infrastructural remoteness to urban spaces. On the other hand, strong efforts are made to take advantages of the overall framework of the European Green Deal, the European Digital Strategy and their strong interrelation with the emerging European Strategy for the revitalization of rural areas.

Promotion, coordination and interconnection of activities in the field of energy transistion as well as in the field of climate protection is a central pathway of this development.

In this context, the EEL is currently part of two initiatives of the Austrian Climate- ans Energy fund. The first one is the already above mentioned participation in the „Climate and Energy Model Region"(Klima und Energie Modellregion = KEM) initiative. The second initiative is the development of a „Climate change Adaption Region" (Klimawandelanpassungsregion = KLAR). Both initiatives are aiming at a transition towards a carbon neutral and sustainable livelihood in the region, both proactive in their approach. While the KEM initiative is strongly energy related, the complementary KLAR initiative is focussing on sustainability in the use of natural resources and adaption of society and infrastructure to the expected changes of climate conditions on regional level. Both initiatives are managed by EEE.

The region is furthermore involved in various pilot projects in the Horizon 2020 program, focussing on grid integration of variable renewable energy sources, storage based grid services and digitalisation of the energy systems, as well as the integration of decentralized energy generation and sustainable mobility into an emerging rural digitalized ecosystem. All these pilots are intended to be kept and acting as the starting points for the further development of the regional smart energy system.

The observable increase of electric vehicles on the streets is indicating, that the trend towards electromobility has finally arrived also in periphere rural areas, like the EEL. Although the impact of the current 7 charging stations with public access on the electricity supply infrastructure is still neglectible, this will be a challenge within the coming years,

In the first two decades of the 21st century also intense reserarch was done on the gasification, refinery and multipurpose utilization of the hydrocarbons based on the innovative biomass gasification process applied in Güssing. With the end of the incentivation of electricity generated from solid biomass, the operation of the facilities wasn´t viable any more and research came to an end. Nevertheless, the use of local and regional biomass for replacing fossil oil based products has regained importance in the context of abbandoning the use of heating oil within 2030. The operators of the existing biomass based district heat systems are already reporting increased interest and requests of oil-heaters to date to connect to the district heating grid. A promoting factor for this development are incentives from the federal as well as the regional government for the shift.

One of the most important and ongoing trends is the devolopment of photovoltaic electricity generation on rooftops and open spaces. Between 2014 and 2018 a strong increase of installed capacity could be observed (400 kWp in 2014; 2 600 kWp in 2018). According to the plans of the Land Burgenland government, in the EEL areas are to be assigned for open space PV for a capacity of app. 150 MWp.

The current regional development trends, thus, are aiming at facilitating the energy transition on the basis of the development in the fields of renewable energy from the 1990ies on, and in the (currently happening onset of) integration of digital technologies for all relevant components and complementary services of the energy system.

2.3 Development potentials

The past technology-leading activities have left notable traces in the region, regarding the acceptance of renewable energy solutions and the disposision of citizens and stakeholders to engage in such projects.

The use of primary biomass resources for energy purposes has a long tradition in the region, which is to 40% covered by forests. From 1990 on, a series of local district heat systems, mostly organised as cooperatives of the participants have been established, partly coupled with biogas based CHP units, partly coupled with larger solar-thermal heat panels. The transition from fossil to renewable heat is carrying a huge potential for a grid-densification on one hand and expansion of the grids on the other hand. Furthermore, the eficiency of these DH systems can be increased indirectly through thermal retrofaction of buildings and general settlement densification as an issue of local spatial planning.

With the resolution of the National Renewable Energy Development Act in July 2021, finally the necessary legal framework for establishing energy communities has been set. Since there is already good experience with the implementation of citizen-participation-funded PV facilities on public buildings, EEL municipalities are very interested in enabling or being part of additional energy supply solutions in cooperation with their citizens

The introduction of energy communities carries also the potential of developing business models for sector coupling. Since sector coupling is requiring a higher degree of complexity of energy systems and related information exchange, it offers and requires a possibility for digitalisation of grid infrastructure beyond smart metering.

By creating ecosystems providing complementary services regarding generation, consumption and flexibility management, on digital platforms, also negative impacts from decentralised generation and loads caused by simultaneous vehicle charging could be reduced or attenuated. The current pilot projects are intended to deliver basic experience and to set staring points for further development. This includes also the integration of larger electricity storages for grid services.

A further potential for a transition towards low-carbon systems is given through so called catalyzing measures, like the implementation of a regional low-carbon corporate identity (e.g. a common brand for low-carbon enterprises) or the appointment of an eco-energy agent in each municipal office as a first point of contact for energy related issues.

Finally there is also a small potential for wind-turbines detected, directly at the border to Hungary, carrying a potential of app. 5 MW capacity.

3. MISSION STATEMENT

3.1 Key energy priorities, priority matrix and timeframes

During its general meeting on 29.01.2020 the stakeholders of the association board of the EEL agreed on the key energy priorities, as proposed by EEE, for the region´s development towards a considerable decrease of carbon emissions by 2030.

These priorities are seen as pathways along which suitable measures shall be implemented in order to achieve a suitable mode of transition of the regional energy systems from the domination of fossil energy sources to a, as far as possible within the timeframe of one decade, renewable based one. The priorities, thus, are the backbone of the Regional Energy Action Plan (REAP).

Originally, 10 key energy priorities have been proposed, differentiated by level (crucial=new technologies to integrate; standard=expansion of already implemented activities; catalyzing=increasing acceptance and committment), type and timeframe for implementation.

For better coordination and as an adaptiopn to the difficulties caused by the COVID-19 emergency, in early 2021, the priority-catalogue had been re-structured and some priorities downgraded to measures of other priorities. Furthermore, all short term issues have been extended to a mid-term timeframe.

The now 6 priorities are listed in table 2 below:

Priority	Type	Timeframe (years)	Level
Smart Energy Systems	policy/technical	6-10	crucial
Accelerating the replacement of fossil fuels	policy/technical	6-10	crucial
Energy efficient municipalities	policy/technical	4-6	crucial
Increased regionalization of renewable energy generation	policy/technical	6-10	standard
Exchange of expertise and intensified networking	policy	6-10	standard
Awareness building and promotion	policy	4-6	catalyzing

Table 2: Key energy priorities

All priorities are containing a series of related measures, which are subject to chapter 4, mission mapping

3.2 Compliance with European and national targets and strategies

In order to achieve the best possible impact of the REAP, all relevant strategic and regulatory framework documents have been taken into consideration. The basic structure is given by the Clean Energy for all Europeans Package, in particular the Directives on Renewable Energy, Electricity, Energy Performance in Buildings and Energy Efficiency. In the meantime, all directives have been integrated into national law, the last was the Renewable Energy Development Act, which came into force in July 2021, thus, only towards the end of PROSPECT 2030. This act was the long time missing legal basis for the implementation of energy communities.

The REAP is also taking up the challenges of the European Green Deal, which was developed during the course of the project.

On national levelt he REAP is in line with the Austrian Climate Protection act and the national climate and energy strategy „#mission2030".

On regional level it is in line with the regional climate and energy strategy „Burgenland 2050 – Klima und Energiestragie".

The priorities and measures are tailored to the EEL´s regional conditions and potentials. This means, that measures, suiting the conditions best, are given a higher weight than those requiring big efforts to reach a reasonable impact.

The most promising measures comprised in the priorities are aiming at a decarbonisation of the energy system mainly by an increased region-internal supply with renewable heat and electricity and a simultaneous replacement of fossil fuels for heat supply by renewable ones.

Subsidiarily, the REAP is supporting the targets of four out of the five pillars of the Energy Union. These are:

- Security of supply
- Energy efficiency
- Decarbonisation
- Innovation

4. MISSION MAPPING

In the up-to-now energy planning practice, a sectoral approach was usually pursued, in which individual measures for supply and efficiency were then embedded. In contrary to this development planning, the European Green Deal is aiming at transition. One of the core elements of this transition is sector coupling, which requires the activation of synergies and connection of potentials yet not tapped. The growing complexity of the future energy systems, thus, is requiring also an appropriate approach in the planning process, that is taking this complexity into account and reflecting it.

Following other disciplines, like economic and social sciences and inspired by the development of digitalized service platforms for rural spaces, EEE adopted the approach to consider the region and its actors and stakeholders as a cross-linked ecosystem, where complexity is not a barrier, but a potential of synergies for effective transition planning.

This (open-boundary) socio-economic ecosystem as such is, roughly, defined by the area made up of the 19 municipalities and all kinds of stakeholders interacting within it.

4.1 Levels of policy/governance

The implementation of the REAP requires activities on a series of levels of policy and governance, including various stakeholders on differing levels of influence and power. In the following, the most relevant actors within the EEL´s ecosystem and their role in the policy/governance framework are portrayed.

Authority level

Municipalities are the lowest units of territorial authorities, making up the EEL. They have to perform a number of tasks assigned to them by federal or regional law. Most relevant for the REAP are:

- management of municipal finances
- maintenance of schools, public buildings and facilities, construction and maintenance of municipal roads
- local spatial planning (municipal planning)
- local building police

The EEL, thus, is an association of local authorities at LAU level and the participating municipalities are bound to each other for coordinated activity by voluntary contracts only. Due to this level of authority, the REAP can be considered as a bottom-up initiative, driven by the municipalities.

Administrative and organisational level

The EEL is embedded on national governance level in the framework of the Austrian climate- and energy policy and on regional level in the framework of the autonomous region (Bundesland) Burgenland and its respective policies. These two bodies of governance are forming the overarching authorities, detirmining the regulatory and administrative structures.

On local level, the municipal councils, represented by the respective mayors, are forming the executive board of the association of municipalities. Usually, one mayor, is the association´s elected chairman and representing the EEL to the outside. The association itself is part of the Climate- and Energy- Model Region initiative, carried out by the Austrian Climate Fund on behalf of the national government.

An appointed Model Region manager is coordinating the activities internally and carrying out communication and reporting issues externally.

EEE Güssing GmbH is the association´s operational body, owned by the participating municipalities. Acting as an information hub, the company is performing counselling and support activities regarding programs, incentives, regulatory issues etc. for residents, enterprises and institutions. Furthermore it is carrying on the activities of research and know-how-transfer in the fields of renewable energy, which have been established from the early 1990ies on. Acting as an agency, it is developing, coordinating and executing energy- and renewable ressources-related services and projects at regional, national European and international level.

Grid infrastructure level

The EEL is served by two electricity grid operators, nine heat grid operators and one biogas-pipeline operator. Currently, there is no natural-gas grid infrastructure in the region.

Besides their regulatory and contractual obligations, these grid operators are also pursuing their own individual business strategies and interests, which are, especially in the electricity sector, colliding with new developments, such as the implementation of energy communities, which are perceived as a threat to their position in the energy business. The reason for this is the fact, that in general most of these grid operating companies, although organisationally separated, at the end are still rowing the same boat as the related regional electricity suppliers (in a former monopolistic position).

Public corporation level

The *Austrian Federal Economic Chamber* (Wirtschaftskammer Österreich = WKO) functions as the federal parent organization for the nine State Chambers and 110 trade associations for different industries within Austria's system of economy. WKO has local offices to provide services in close proximity to members. Compulsory membership by Austrian federal law is automatic with obtaining the operating licence of the company and thus includes all Austrian companies in operation. The main tasks are:

- Representation of membership interests at all levels of government: by law governments are obliged to consult with Chambers on legislative projects and important regulation.

- Information and advisory service to members: Typical issues include taxation, labour law, vocational training, industry-specific legislation, industry-wide advertising and market research.

The *Chambers of Agriculture* (LK) are the legal representation of farmers and foresters in Austria. Since, according to the Austrian Federal Constitution, the responsibility for the Chambers of Agriculture falls within the competence of the individual Federal Provinces, there are independent Chambers of Agriculture in the individual Federal Provinces, which are structured differently in each province. Membership is compulsory, similar to other chambers. As a rule, members of the Chambers of Agriculture are: The owners of land used for agriculture and forestry, operators of agricultural and forestry enterprises and their family members, (if they work on these farms as their main occupation), agricultural and forestry cooperatives and their executive employees

Both, WKO and LK are umbrella organisations, important for the allocation and mobilization of resources and commodities existing on the socio-economic-cultural level.

Socio-economic-cultural level

The socio-cultural level can be seen as the most heterogenous level and is characterized by private initiatives of residents, various associations, single enterprises, political parties etc. Despite the fact, that the influence of the actors on this level on the policy and governance processes in the system can be very low, they are a highly important factor for the implementation of the energy transition. For mobilizing this enormous and important potential, catalizing measures like information campaigns, competitions, school cooperation programs etc. are to be applied.

Image 2 is giving an overview on the EEL ecosystem at a macro level

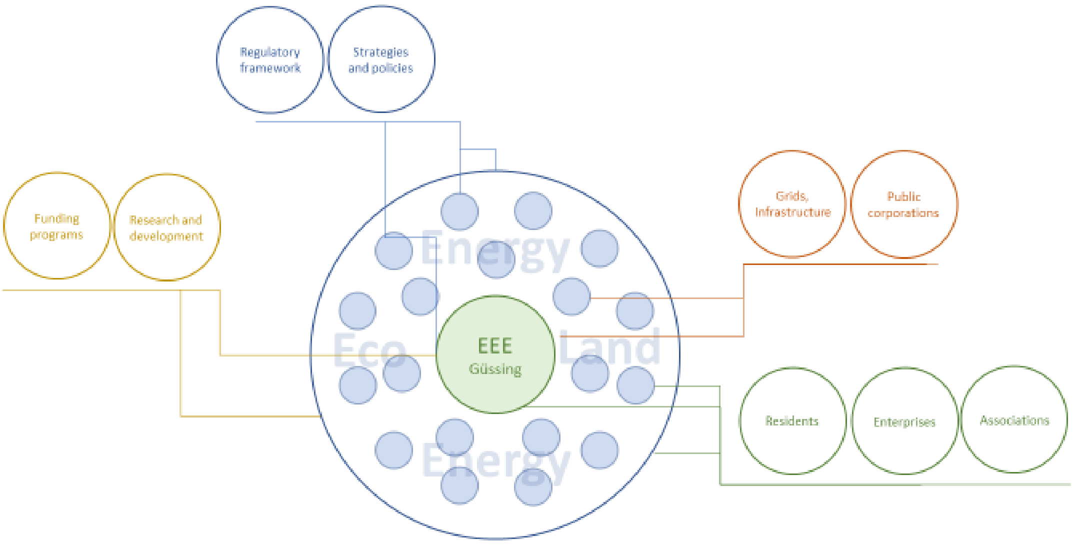


Image 2: Macro level overview on the EEL Ecosystem

4.2 Spatial focusses

The common criterion for the respective assignment wether a region is urban or rural, is the population density per square kilometre, as a degree of urbanization. Roughly, a rural area is characterized by less than 300 inhabitants per km², according to EUROSTAT criteria. In this context, the EEL is clearly a rural area.

Basically, all measures within the priorities of the EEL´s REAP are applicable both in urban as well as rural areas, whereby measures regarding energy efficiency and mobility are showing better results (higher impact with less effort) in dense settlement areas and measures regarding efficient generation of renewable (primary) energy is creating less effort in rural areas.

A clear rural focus is the extension of the existing district heat grids, which are using local biomass for operation, brought in on short transport routes

4.3 Specific measures for the transition

In order to achieve a high impact of the transition process, some measures need also a fine tuning to the region´s specific conditions.

The main difference between the EEL as a disperse rural area and a single settlement with a comparable number of inhabitants is the way of coordinating activities on the authority and administration level. This regards mainly responsibilities, because measures like settlement densification, for example, require decisions in each affected municipality individually in order to bring about the desirable results and thus, are requiring much more effort than in a single urban unit. The increased number of involved equal stakeholders can lead to different velocities within the association, slowing down or inhibiting the transition impact.

Specific measure: Establishment of an EEL-agent in each member municipality for addressing the residents in place. In this way, activities can be coordinated better already on municipal level and then bundled on the regional level. This gives the municipalities also the possibility to be initiator or part of local renewable energy projects at an already high starting-information level.

The increase of volatile electricity production feeding into distribution grids in the past years results increasingly also in an instability of frequency and voltage deviations, threatening grid stability in certain areas, where many small PV units are connected. DSOs react in this case with a power curtailment of PV facilities in these stressed grid sections. This technical shortcomings are counterproductive to the increase in renewable energy supply and also to the viability of future renewable energy communities, both core elements of the energy transition.

Specific measure: Intense testing of grid integrated large storage battery systems for grid services as a first step, and as a second step implementation of grid bound storages for higher grid stability on one hand and for better viability of energy communities on the other hand.

4.4 Enabling and restraining factors

4.4.1 Enabling factors

Enabling factors on authority, administrative and organisational level

- Regulatory framework and strategies in place
- Well elaborated incentivation framework
- Regional stakeholders on the policy level are familiar with various renewable energy projects
- Most municipalities have been already involved in renewable energy and energy efficiency projects. There is already a series of good practice in place
- EEE as the regional energy agency is well experienced in the development of projects and business models as well as stakeholder involvement.
- Well established network on national, European and international level.

Enabling factors on public corporation level

- In the strategic position of representing the interests of their members, both, WKO and LK are actively supporting their members in business affairs by counselling and promoting activities in the field of energy efficiency and renewable energy
- LK has good competences regarding the utilization of forestal and agricultural biomass for energy purposes.

Enabling factors on infrastructure level

- Existing heat grids are all based on biomass.
- Experience with pilot projects on smart control and smart operation of district heat grids
- Experience in a series of electricity related pilot projects in cooperation with the local DSO
- Major part of electricity grid connections already equipped with smart meters

Enabling factors on socio-economic-cultural level

- Good acceptance of renewable energy issues, especially PV and biomass utilization, in the region
- Residents as well as SMEs are interested in participating in RE projects. A series of citizen-participation projects have been successfully implemented.
- Major industrial SMEs are implementing facilities for energy self-supply and activities for energy efficiency
- Increasing number of enterprises with good competence in the field of renewable energy

4.4.2 Restraining factors

Restraining factors on authority, administrative and organisational level

- Financial situation of small municipalities do not allow bigger investments in demonstration sites, providing benchmarks for the population or for other municipalities
- Shortage of adequate staffing in the municipalities as well as in the EEE
- Population drain, loss of jobs and low income are still factors with high impact on policy priorities, overshadowing other issues.

Restraining factors on public corporation level

- Energy and energy transition issues are not core competences of public corporations. Counselling requests on the issue are often forwarded to region-extern stakeholders instead of promoting a region-internal network, where a good coordination of proceedings is necessary for achieving good results.

Restraining factors on infrastructure level

- Still no full roll-out of smart meters
- Only one municipality connected to the gas grid
- Electricity grid needs partly improvement

Restraining factors on socio-economic-cultural level

- Residents as well as SMEs are sceptical about innovative measures as long as there is no critical mass of benchmarks with positive reporting
- Regional GDP is still only ~64% of the national average value
- Currently low interest of industry in investing in efficiency measures which do not carry immediate or short term economic advantage.

4.5 Challenges, estimation of efforts and impact

Energy transition and its planning is a multi-level challenge. There is no benchmark model which can be followed. It is involving all levels of society and taking place in a living system, bound to new technologies and business models. Partly, some experience could be adopted from the change-management models applied in the business sector

The main challenge, thus, is an effective multi-level change management.

Authority, administrative and organisational level

The challenge on this level is, that the EEL, as a contractual entity has no power to set regulatory framework or to provide or manage funds. The only possibility to influence the development directly is the competence of the individual municipalities in spatial planning (regarding settlement development) and their role as the local building police. But also in that context the scope for design is limited and requires approvement by the overarching authorities.

On the other hand, this fact of being a contractual entity offers the possibility of bundling tasks and efforts very efficiently. The challenge in this case is to establish and to keep a culture of commitment, communication and information exchange on an equal footing, which is able to unleash the full potential of synergies.

The installation of an EEL agent in each municipality, coordinated by the regional management, is the approach to take up this challenge. In this way, needs can be detected better and made a subject of discussion and action, but also up-to-date information on particularities in regulatory and policy issues, as well as on funding programs etc. can be communicated faster and more efficiently to the relevant target groups, including residents .

Public corporation level

Public corporations, as service organisations, are the main information and service contact point for their client base regarding regulations and financing issues. This is also the case in the EEL. The challenge for these organisations is to provide competent counselling on sustainability issues (e.g. upcoming carbon-taxes), their impact on the respective production- or service-lines and the optimization of the relevant businesses. Furthermore they need to play a key-role in overcoming limited industry thinking in favour of interlinked and complementary business-ecosystems, which are a prerequesite for sector coupling and circular economy. The promotion of a corporate regional brand referring to energy efficiency and carbon neutrality is an approach to take up this challenge.

Infrastructure level

As providers of infrastructure, DSOs, district heat- and gas-grid operators as well as the providers of IT infrastructure, are carrying the biggest load of responsibility for the energy transition. Their main challenge is to connect with each other on the information flow level in order to detect potentials for flexibility and dispatching on distribution grid level, also with regard to the introduction of energy communities and electromobility. There are still no mainstream solutions for complex demand-response systems, for managing decentralized, volatile generation and consumption, on the market. To be able to face the challenge accordingly, EEE is participating in pilot projects concerning digitalization, decentralized generation, storage and sector coupling. Stakeholders in the region are providing test sites.

Socio-economic-cultural level

Since this level is the level of everyday life in the region, it is the central stratum adressed by the energy transition. The main challenges, here, are acceptance of measures as well as mobilisation of potentials regarding energy efficiency and the replacement of fossil energy carriers. All efforts on the other levels culminate on this basic level, with the goal to motivate the population to become active drivers of the transition process.

This requires on one hand awareness building measures as process catalizers and on the other hand an intense campaign of information on funding and financing possibilities and, as a core aspect, assistance in the application of the programs.

5. ACTION DEFINITION

After setting the key energy priorities and the definition of corresponding measures as well as the investigation of available instruments, a target-oriented SWOT was conducted to determine the region´s readiness for the planned steps on the transition pathway. By weighing the SWOT factors, an impact-effort estimation for the measures bundled within the priorities, was conducted. Based on these estimations, actions were defined under the viewpoint of selecting and using suitable instruments to promote enabling factors and counteract restraining factors.

Image 3 is giving an overview on the estimation of expected impacts and efforts regarding the selected priorities:

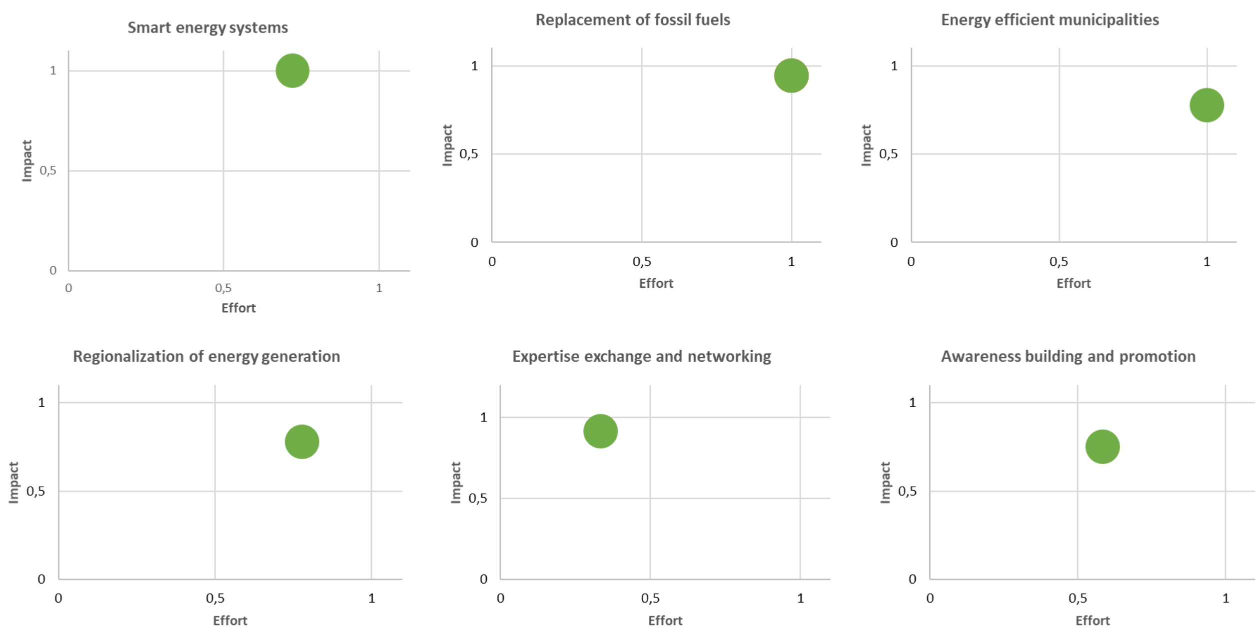


Image 3: Impact effort estimation diagrams of selected priorities

In the following paragraphs, measures are presented detached from the priorities and sorted by the main aspects for the energy transition, in a tabellary form.

The tables contain measure description, targets, responsibilities and a description of the set of instruments to use, as the proper action description.

5.1 Energy efficiency

Measure	• **Establishing a consulting service for construction and refurbishment projects.** • **Promotion of energy refurbishment of the building stock**
Priority	Replacement of fossil fuels
Description	Creating a regional hub (EEE and municipal agents) offering counselling and support in funding issues as well as specific financing and contracting models
Affected sector	Residential, service, production, public, agriculture
Spatial focus	Urban and rural
Specific target groups	Residents, enterprises, building owners
Involved stakeholders	EEE, municipal administrations, banks, companies in the building sector
Implementation responsibility	Model region management, municipal offices
Instruments	
planning	Investigation and evaluation of potentials
policy	Promotion of service on local level
financial	Creation of financing models as a combination of optimized funding coupling and loans as well as energy contracting ; implementation of existing regional and national programs
organisational	Networking of stakeholders with temporary meetings
business	Collection of benchmarks of similar models
communication	EEL related websites, push messages on municipal apps.
technical	-

Measure	• **Initiation and implementation of further efficiency projects in the public sector.** • **Benchmarking, piloting and establishing best practices on municipal level**
Priority	Energy efficient municipalities
Description	Providing municipal objects in remote settlement areas with an appropriate and energy efficient equipment; joint technology pilots in one municipality, evaluation and communication of results; application of technology on suitable sites in all municipalities
Affected sector	Public
Spatial focus	Rural
Specific target groups	Municipalities
Involved stakeholders	Mayors, municipal councils, model region management, EEE
Implementation responsibility	Municipalities, EEE
Instruments	
planning	Investigation and evaluation of potentials
policy	Implementation of specific regional and national programs
financial	Exploitation of relevant national funding schemes
organisational	documentation
business	Aggregated offer collection
communication	Internal channels
technical	Respective test site or pilot implementation

Measure	● **Implementation of pilot projects for building (automation), electricity generation, storage, mobility and grid interaction for high efficient distribution grids. Application of achieved results in the region**
Priority	Smart energy systems
Description	Creation of points of reference for the digitalisation of the energy system and for sector coupling. Elaboration of models how producers, consumers and storage facilities can be connected via a platform and which role the integration of e-mobility can play in this construct. Real life application of results in the context of energy community development
Affected sector	All
Spatial focus	Urban and rural
Specific target groups	Building owners, prosumers, grid operators, local authorities, companies in the energy and building sector. Energy communities
Involved stakeholders	EEE, building owners, housing companies, DSOs, IT and electrotechnic enterprises
Implementation responsibility	EEE, site providers
Instruments	
planning	Investigation and selection of suitable sites
policy	Implementation of specific regional and national programs. Cooperation with DSOs with
financial	Exploitation of relevant national funding schemes
organisational	Formation of energy communities
business	Benchmarking, development of business models
communication	EEL related websites
technical	Respective test site or pilot implementation. Real life implementation

Table 3: Measures for energy efficiency

5.2 Renewable energy supply

Measure	• **Replacement of oil fired boilers**
Description	Current overarching regulatory framework privides for an end of oil heatings in the building stock until 2030. Both, on national and regional level there are already incentivation programs for the replacement in place. In the role of being the local building police, the municipality can already ban the installation of oil fired boilers in the building stock before the 2030 deadline and thus accelerate the development
Priority	Replacement of fossil fuels
Affected sector	Residential, service, public
Spatial focus	Urban and rural
Specific target groups	Owners of buildings
Involved stakeholders	Municipal and regional administration, national program carriers, EEE, building owners, heating installers, district heat operators.
Implementation responsibility	EEE, municipalities
Instruments	
planning	Investigation of oil heatings
policy	Pronouncing the ban by the municipal councils, promoting the national and regional incentivation programs by free counselling services
financial	Development of financing models for low income households
organisational	Creation of a contact point at EEE as the local energy agency
business	Creating a network of heating installers and district heat operators
communication	Local media, EEL related websites, push messages on municipal apps
technical	Support of local district heat operators regarding capacity

Measure	• **Development and dissemination of promising energy solutions:** • **in connection with photovoltaics, electricity storage and e-mobility,** • **in combination with solution approaches for services for regional electricity network operators/ suppliers** • **Consulting services for construction projects regarding the use of renewable energy sources**
Priority	Regionalization of RES, smart energy systems
Description	The measure is based on the results of a LEADER project „Domestic power plant“. It promotes the establishment of predomonantely energy-autonomous buildings under the aspects of electricity, heat and e-mobility. The service offers consulting on variants for demand covering, feasibility and viability on predomionantely PV based solutions
Affected sector	Building owners, SMEs, municipalities, energy communities
Spatial focus	Urban and rural
Specific target groups	Building owners and participants in energy communities
Involved stakeholders	EEE, building owners, housing companies, SMEs, DSOs
Implementation responsibility	EEE, model region management
Instruments	
planning	-
policy	Free consulting offer for EEL residents
financial	Model of currently available fundings combination with classical loan financing
organisational	EEE as the contact point
business	Cooperation with specific electrotecnical enterprises
communication	Local media, EEL related websites, push messages on municipal apps
technical	-

Measure	• **Continuation and expansion of PV based electricity generation and tapping of wind potential**
Priority	Regionalization of RES
Description	Promotion of the annual increase of PV facilities in order to cover the expected increasing electricity demand in the course of the other transition measures. Wind
Affected sector	All
Spatial focus	Urban and rural
Specific target groups	Building owners, SMEs, farmers, energy communities
Involved stakeholders	Municipalities, Public corporations, enterprises, farmers, DSOs
Implementation responsibility	EEE, municipalities
Instruments	
planning	Updating the data on potential
policy	Implementation of all available promotional and funding programs available at the respective timestep
financial	Creation of financing models as a combination of optimized funding coupling and loans as well as contracting-models ; implementation of existing regional and national programs
organisational	Energy community establishment, individual case counselling
business	Purchasing syndicates, public participation models
communication	Regional media, relevant websites, push messages
technical	Facility installation

Measure	● **Focus on the use of biogas as a multifunctional energy carrier for electricity, heat and fuel production**
Priority	Regionalization of RES
Description	The measure is built on the results of an exploration-, technical and feasibility planning-, and stakeholder pooling project. The aim of the measure is to ensure the continued existence of the biogas plants in place and to realise novel models for sector coupling for the production of electricity, heat and fuel for mobility purposes, in cooperation with a gas grid operator, being a pioneer in this field of sector coupling.
Affected sector	Agriculture, transport, industry, electricity supply
Spatial focus	Rural
Specific target groups	Transport enterprises, district heat grid operators, industry
Involved stakeholders	EEE, Biogas plant operators, gas grid operator, R&D institutions, enterprises, public administrations
Implementation responsibility	EEE, biogas plant operators, gas grid operator
Instruments	
planning	-
policy	Pioneering in the promotion of the Renewable Energy Development Act
financial	Exploitation of funding possibilities enabled by the RED-Act and R&D funding programs, investments by grid operator and biogas plant operators
organisational	Establishment of a cooperative planning and development platform
business	Joint venture
communication	Regional media, EEL related websites internal channels
technical	Implementation of required infrastructure

Table 4: Measures fore renewable energy supply

5.3 Sustainable mobility

Measure	• **Clean and silent region**
Description	The goal is to reduce noise emissions & the accompanying reduction of fossil fuel use and CO2 emissions, caused by motorized applications in the region. This will be achieved primarily in municipal operations, which is to be achieved by a large-scale switch to battery-powered devices. In addition, the topic of "Silent Mobility" plays a major role here, which will be achieved through the municipal use of e-mobility.
Priority	Replacement of fossil fuels
Affected sector	Public, residential, service
Spatial focus	Urban and rural
Specific target groups	Municipalities, residents, service enterprises
Involved stakeholders	EEE, municipalities, e-vehicle and e-device retailers
Implementation responsibility	EEE, municipalities
Instruments	
planning	Cost evaluation
policy	Promotion and supply of relevant infrastructure
financial	Implementation of of existing funding programs
organisational	Information events
business	Benchmarking
communication	Local media, EEL related websites, push messages on municipal apps
technical	Infrastructure deployment

Measure	• **Digital rural ecosystem**
Priority	Smart energy systems
Description	Digitalized service platform, connecting renewable energy generation and consumption (energy communities), mobility- and tourism services
Affected sector	Service, mobility, public
Spatial focus	rural
Specific target groups	Residents, tourists, SMEs
Involved stakeholders	EEE, platform technology providers, SMEs residents
Implementation responsibility	EEE, regional tourism association
Instruments	
planning	Defining the digital ecosystems components and properties
policy	Promoting sustainable e-mobility for residents and visitors , promotion of sector coupling
financial	Implementation of funding programs and private investments
organisational	Implementation of a digital service platform
business	Connection of prosumers, energy communities and touristic services
communication	Websites, platform app,
technical	Implementation of technical infrastructure and app

Table 5: Measures for sustainable mobility

5.4 Sustainable infrastructure and spatial development

Measure	• **Digital rural ecosystem**
Description	See description in 5.3

Measure	• **Extension of local district heat system connections**
Priority	Replacement of fossil fuels
Description	All local DH systems are based either on solid regional biomass or a combination of this biomass and biogas based CHP. With the replacement of fossil fuel boilers, the potential of further connections to these grids is increasing considerably, and is to be realised through this measure, increasing the systems´efficiency.
Affected sector	Buildings
Spatial focus	Urban and Rural
Specific target groups	Building owners
Involved stakeholders	EEE, Municipalities, DH operators, households, SMEs
Implementation responsibility	Municipalities, DH system operators
Instruments	
planning	Potential and capacity evaluation
policy	Local building regulations, promotion of relevant funding programs
financial	Relevant funding programs, private investment, loans
organisational	Information and experience exchange of operators
business	Offers to potential connectors
communication	Local media, EEL related websites, push messages on municipal apps
technical	Infrastucture implementation

Measure	• **Settlement densification**
Priority	Energy efficient municipalities
Description	Most municipalities are consisting of scattered settlement units, characterized by uncontrolled settlement expansion in the last decades. This causes high infra-structure costs and increasing energy demand for supply and maintenance. Prioritizing densification instead of expansion is the aim of the measure.
Affected sector	Public
Spatial focus	Rural
Specific target groups	Municipalities, residents, housing companies
Involved stakeholders	Municipal councils, regional government, heat- and electricity grid operators
Implementation responsibility	Municipalities, regional government
Instruments	
planning	Revision of the zoning and land-use plans
policy	Revision of infrastructure cost distribution, preference of short grid bound infrastructure connection obligation
financial	-
organisational	-
business	-
communication	Municipal websites
technical	-

Table 6: Measures for sustainable infrastructure and spatial development

5.5 Catalizing factors: awareness, education, information

Measure	• **Establishment of an EcoEnergyLand agent in each member municipality**
	Energy efficient municipalities
Description	Appointment of an EEL-agent in each member municipality for more precise and efficient implementation of measures as a direct link between the municipality and the model region management as well as the population of the respective municipality. The agent should not only be the contact person, but also have a certain know-how, steering and initiating power in the respective municipality
Affected sector	Public
Spatial focus	Rural
Specific target groups	Residents, enterprises
Involved stakeholders	EEE, mayors, municipal councils, municipal administration
Implementation responsibility	EEE, municipalities
Instruments	
planning	Selection of suitable personnel
policy	Assigning specific competences
financial	Municipal staff
organisational	Introductory education, temporary meetings for information updates
business	-
communication	Municpal websites, push messages on municipal apps, internal channels
technical	-

Measure	• **Development of a "Corporate Identity" and a cooperation brand for partner enterprises in different categories**
Priority	Awareness building and promotion
Description	The establishment of EcoEnergyLand partner companies should on the one hand reflect the idea of increasing regional added value by integrating regional companies into the implementation of energy projects, and on the other hand increase the efficiency of companies, since the implementation of efficiency-enhancing measures will be a basic requirement for an EEL partner company. In addition, it is the aim to develop own EcoEnergyLand products and services. The products or service vouchers will be equipped with information about the model region, which for example can take the form of a small label or a barcode, which will bring up the model region's Homepage with all information, activities and news about the model region.
Affected sector	Production, service
Spatial focus	Urban and rural
Specific target groups	Enterprises incl. farms
Involved stakeholders	EEE, public corporations, enterprises
Implementation responsibility	EEE
Instruments	
planning	Participation requirements, brand creation
policy	Promotion by municipalities
financial	Funding programs for green products, energy efficiency and renewable energy, participation fee
organisational	Establishment of an association
business	Benchmarking of similar regional brands
communication	EEL website
technical	-

Measure	• **Cooperation projects with educational instituitions and schools**
Priority	Awareness building and promotion
Description	In order to be able to pass on information to the children, it will be necessary in a first step to train the teachers accordingly, so that they have the core knowledge about the region, renewable energy and climate issues. Workshops will be held to which all educators in EcoEnergyLand will be invited. In the course of a presentation and subsequent guided tour through the region, they will get an overview of the fields of activity in which the climate and energy model region is active and what projects have already been implemented Once the relevant information has been passed on and awareness has been raised, an evaluation system for "certification" as an "ökoEnergieland school" or "ökoEnergieland kindergarten" will be developed. In this system, prerequisites will be defined on the basis of which the educational institution may bear this title.
Affected sector	Education
Spatial focus	Rural
Specific target groups	Educational personnel, students
Involved stakeholders	EEE, school authority, schools, energy generation facility operators, municipalities
Implementation responsibility	EEE, schools
Instruments	
planning	Preparation of educational material
policy	Implementation of regional energy and climate strategy
financial	Fundings from regional government and Austrian Climate and Energy fund
organisational	Workshop organisation
business	-
communication	EEL related websites
technical	-

Measure	● **Networking with other regions and initiatives**
Priority	Networking
Description	Experience exchange and benchmarking with other regions, initiatives or companies on renewable energy, climate protection and other related issues in order to keep speed in the the transition process
Affected sector	Public
Spatial focus	Urban and rural
Specific target groups	Local energy agents and region managers
Involved stakeholders	Local energy agents and region managers
Implementation responsibility	EEE
Instruments	
planning	-
policy	-
financial	-
organisational	Temporary study travels, face-to-face and online meetings
business	-
communication	EEL website
technical	-

Table 7: Measures for catalizing factors

6. SCENARIOS

6.1 Overview on main actions and measures on the time scale

The scenario for 2030 is built on the information framework and prognoses elaborated by the Austrian Conference on Spatial Planning (ÖROK), an organisation established by the federal government, the Länder and municipalities to coordinate spatial development at the national level. Its tasks include creating basic planning materials for Austria's spatial development policy (e.g. "ÖROK Forecasts"). The outcome of the work of the experts finds also acceptance at the political level.

A series of the used information is also published online in the form of an „atlas", with already visually prepared data. An example is Image 4, containing visualized content regarding the population prognoses for Austrian regions for the time horizon of 2040. In this context, the EEL falls into the category of a population change between 0 and -5%.

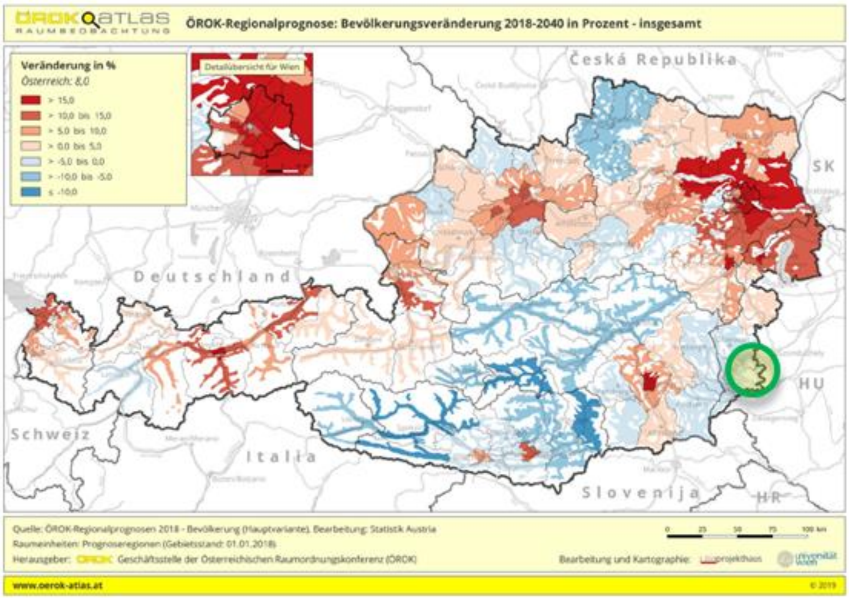


Image 4: ÖROK Population prognosis 2010 to 2040

The REAP in general and the scenario in particular, thus, is elaborated with regard to the framework of analyses, prognoses and recommendations of the ÖROK, including the recommendations on funding strategies for the 2021-2027 period.

For the 2030 scenario full measure implementation is assumed.

Initially, in 2019, it was planned to evolve activities in a sequence of 3-4 year steps, covering the decade until 2030. With the COVID emergency and ist consequences, this schedule changed, due to the fact, that decision makers and stakeholders had to focus on different, more urgent priorities.

As a consequence, short term actions (1 to 3 years timeframe) of the original time schedule have been extended to the mid term (4-6 years), some of the initial measures have been integrated into others and some are on hold.

Roughly it can be said, that actions and measures requiring pilot projects and sites should be implemented until the middle of the decade and the entire plan until the end of it.

Since little data on the production sector could be gathered, the scenario is focussing mainly on the residential, public, service and transport sector. These sectors are responsible for ~60% of the final consumption

Image 5 is giving an overview on the main components of the scenario, arranged in three impact groups: „energy effiency“ and „renewablew supply“ as mixes of policy and technical measures and „catalizers“ as connecting policy measures. Measures in the olive-green boxes are expected to have a considerable impact on the carbon balance.

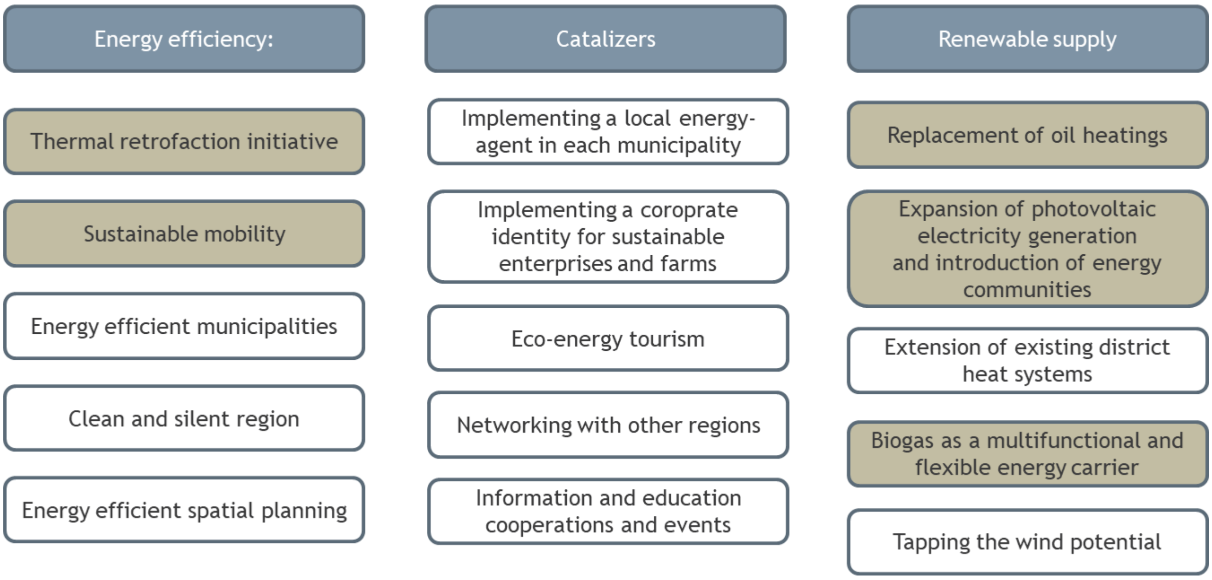


Image 5: Overview on main components of scenario 2030

6.2 Scenario 2030

6.2.1 General description:

The development of the scenario, as stated above, is bound to the data input from the ÖROK publications and the the online ÖROK atlas.Due to these framework data, a best-case scenario is characterized by being able to at least keep current levels of population, workplaces and basic infrastructure. A worst-case scenario is characterized by an absolute drain of population by 5% and, with even higher impact, the loss of working population by up to 10% or even more.

At first glance, the result of a negative development appears contradictorily positive in the context of consumption, green generation and carbon emissions, but at a closer look it turned out that the, nonetheless necessary investments for the energy transition on local level, are becoming less effective and the projects are threatened in their viability because of lack of participants and consumption.

Therefore, the 2030 scenario is a single-point-of-view scenario, focussing on the best case, which is being able to keep the current development level.

In the case of the EEL, available current development trends were extended to the end of the decade and compared to the efforts done up to 2020 and their specific regional impacts. In an iterative process, the trends were discussed under point of view of the planned actions and the experience made in past activities. This led to the estimation of the regional development potential and to the shaping of the scenarios. Impacts of expected disruptive developments, like the deep digitalisation of everyday´s life in general and of the energy system in particular, are hard to estimate. The latter is regarded by an increase of the general electrixity demand as dicussed and estimated in a publication by the „Shift Project“ in 2019.

The scenario values, then, are estimated by means of a calculation tool developed in MS Excel, for the purposes of PROSPECT 2030 scenario building.

The estimation is done on the baseline values regarding consumption and generation. The main components of the consumption side are „shift“ and „change“. „Shift“ is characterised by the switch from fossil to renewable energy sources and „change“ by decrease or increase of general consumption within a sector, regarding heat, electricity or transport fuels. On the generation side, supply by type and technology can be modeled.

All values are superimposed to give an overview as complete as possible regarding final and primary consumption as well as energy generation and carbon emissions by the energy mix at the projection timeline.

6.2.2 State of energy efficiency, renewable energy supply, mobility, infrastructure and spatial development

Energy efficiency

The main components in the energy efficiency complex are the initiatives for thermal retrofaction of the residential building stock as the major, and the stock of buildings in the public and private service sector (incl. municipal buildings and facilities) as the minor (but more awareness building) part

The total building stock in the region is made up o fapp. 8250 buildings, of which app. 7600 buildings are residential ones.

The focus of the measure in the residential sector is laid on the building stock deriving from the period between 1960 and 1990. This group is making up 42% of the total building stock with a total area of ~ 450 000 $m^2$and an average heat consumption of 220 kWh/m^2*a.

The measure aims at an annual refurbishment rate of 1,5% until 2030, reducing the annual heat demand in the sector by app. 24 300 MWh, which equals to 14,5% of the sectoral baseline demand of 168 300 MWh/a.

For the production sector, due to the lack of reliable data, no significant change in consumption is assumed.

Together with the measures in buildings in the services sector this results in a total reduction of the annual regional heat demand by ~ 6%.

Renewable energy supply

In the renewable energy supply complex is expected to have the biggest impact in the transition process. It consists of the replament of oil boilers, the expansion of photovoltaic applications and introduction of energy communities, extension of district heat grids, the implementation of biogas as a multifunctional energy carrier and, as a more promotional factor, the electrification of the motor-driven equipment for green space maintenance in the municipal sector.

Replacement of oil fired boilers:

At the baseline, the energy demand for heat and thermal process is covered to 53% by petroleum products.

In the scenario, by 2030, the following shift from oil and petroleum products to renewable is estimated, considering a temporal lag for boilers installed up to the year 2018 and the hard to estimate replacement potentials in the production sector.

From crude oil and petroleum products to…	Renewable general	Heat pump	Thermal grid	Gas	Electric
Agriculture, forestry and fishing	35,0%	15,0%	5,0%	0,0%	
Industry (without construction), energy, water etc	11,0%	1,0%	3,0%	0,0%	
Construction	0,0%	0,0%	0,0%	0,0%	
Transport	0,0%			0,5%	13,5%
Services	40,0%	10,0%	15,0%	0,0%	
Residential	50,0%	15,0%	15,0%	0,0%	

Table 8: Scenario 2030 - shift rates from oil and petroleum products to renewables

By 2030, the scenario sees a share of 59% of all petroleum based thermal applications replaced by renewables. This equals an amount of 140 000 MWh/a. Furthermore, the measure leads to an increase in the electricity demand by 4% (5200 MWh) annually, caused by the increase in heat pumps.

Expansion of photovoltaic electricity generation and introcuction of energy communities

The strong increase in PV installations to date is rooted in an increased affordability, caused by falling investment costs and a good return of investment, caused by incentivized feed-in tariffs. Another effect for investing in PV, observed in the region in the course of the implementation of citizen-participation PV projects, is the fact, that investing in a project with guaranteed returns for a defined timespan, which are higher than keeping the funds on a bank account, is highly attractive.

The change in national the regulatory framework in 2021, adapting finally the remaining parts of the Union´s Clean Energy Package, is promoting more self consumption as well as cooperative generation and consumption models (energy communities).

On the other hand, in a revised legislation on spatial development, the regional government defined preferential areas for free-standing PV facilities. The assignment of these areas to that specific use option is unlocking the potential of ~ 150 MWpeak within the EEL-boundaries.

Thus, the scenario includes two development strands: a steady increase in low scale PV (<50 kWp), driven by prosumers and energy communities and a quick leap in PV-based renewable electricity supply, driven by (external) investors.

The prosumer driven strand, carried by residents, public institutions, farms, SMEs and municipalities, partly organised in energy communities, results in a capacity of 14,5 MWpeak and together with the investor driven quick leap to a total capacity of 164,5 MW by 2030, generating 190 000 MWh anually.

Extension of district heat systems

The extension of the existing heat systems goes also along with the replacement of oil fired heatings as well as with settlement densification efforts. The measure is focussing on 3 target groups:

- Stock of silent connectors who have an inactive connection, because they had invested into new oil boilers shortly before the DH line was established.
- Other and new Riparians along the DH lines
- New buildings or assigned building areas outside the DH grids, not yet connected but easily to develop

In total, the estimated increase in DH supply is ~30% of the current supply capacity, resulting in a total supply of 57 000 MWh/a in 2030

Biogas as a multifunctional energy carrier

The four existing biogas plants in the region are currently having an output ~1 200 m^3/h, resulting in an annual capacity of ~ 62 000 MWh of primary energy in the form of methane. The current form of utilization is mainly CHP generation, injecting the electricity in the electric grid and the excess heat into the local heat grids. Extending the existing biogas pipeline and connecting the plants by a regional biogas grid with a connection point to the natural gas grid (which is expected to be extended into the region within the next two decades) offers the possibility of flexible generation of electricity, heat and green gas which can also be used for transport purposes in the freight transport sector. This allows a technical flexibility within the regional energy system, compensating the fluctuations in the mainly PV based electricity generation, but also an economic flexibility in a flexible tariff structure with a potential to strenghten the viability of the facilities.

The impact of the measure on the scenario is a reduced central electricity generation (and CHP related heat generation) in the summer months and a shift of this part of gas production to green gas, usable for direct combustion, vehicles or even micro CHP applications. Since a serious distribution key cannot be set at the moment, for the scenario it is set to 1/3 each in electricity, direct use and transport. The amount of produced primary energy is remaining the same as in the baseline.

Mobility

The core aspect of this scenario component is the electrification of the transport sector. The baseline vehicle stock in the EEL amounts to ~13 000 passenger cars and ~ 2 000 lorries. These numbers are regarded as stable for the scenario.

The number of electric passenger cars at the baseline, according to statistics, is 90 vehicles. Furthermore, the annual growth rate of the share of vehicles was estimated with the current annual trend of a 0,32% growth rate. A logistic growth function for these values returns a number of around 1 800 vehicles (13,5% of the stock) for 2030.

In the scenario, this development leads to a reduction of 22 500 MWh/a (~ 14%) in the demand for fossil transport liquids and an increase of the electricity demand by 8 000 MWh/a (~5%).

The main challenge in this context is not the supply of electricity, but the supply of charging infrastructure and related charging power capacity. In the scenario´s case the charging infrastructure for the number of vehicles requires a power capacity of additional 57 MW at peak times, which is the 4-fold power capcity of the EEL´s current energy system and roughly 1/3 of the 2030 power capacity.

Infrastructure and spatial development

This component is future-oriented, but should show first results by the end of the current decade. Based on the results of the project „ZERsiedelt" and the connected online grey-energy-calculator, the annual energy demand for and of infrastructure, in the case of controlled and uncontrolled settlement development, was estimated with the example of the EEL.

Assuming that demolition and construction rates of dwellings remain stable, but denser arrangements of dwellings are promoted, the infratructural energy demand of housing activities is reduced by 23% (450 MWh) from 1 900 MWh/a to 1450 MWh/a. Although the amount is small, it shows, that controlled settlement development can reduce the respective annual energy demand by at least 1/5.

6.2.3 Required investments

Table 9 is giving an overview on the required investments for the realization of the 2030 scenario, based on the average costs per unit (kW, m², kWh, vehicle etc.) in 2020.

Activity	Investment Mill €	Incentives Mill €	Investment per capita €	Incentives per capita €
Energy efficiency	72	8	4 120	460
Renewable energy supply	223	68	12 730	3 890
Mobility	66	11	3 750	660
Infrastructure development	7	3	400	160
Total	**368**	**90**	**21 000**	**5 170**

Table 9: estimation of required investments and incentive contributions for the 2030 scenario

The expected investment until 2030 is 368 million € in total, or, as a per capita value, the amount of 21 000.- €-
In relation to the the current per capita GDP of 27 300.- € this amount equals 77% of an annual unit.

Based on the incentivation programs offered by the federal, but also the regional government, in 2021, the share of funding by public authorities is ~ 25%. In the case of the EEL, this amount is 90 million € in total.

6.2.4 Renewable energy in supply and consumption

The measures to be implemented and the investments to be done until 2030, are expected to increase the share of renewables in consumption as well as in supply considerably.

Image 6 is giving an overview on the share of renewable energy in final consumption, according to the scenario. This share is expected to rise from currently 38% to 68% in 2030.

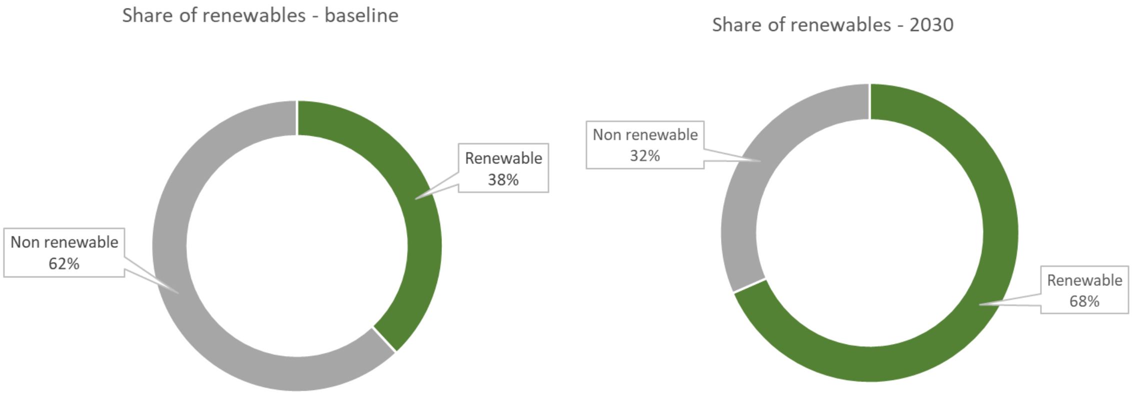


Image 6: Share of renewable energy – baseline and scenario 2030

While the increase of renewables in the heat sector is leading also to an increase of imports of biomass, since the internal resources potential is not sufficient, the required amount of electricity can be covered (in the balance) completely by internal generation. From the balance point of view, the share of region-internal supply is increasing from currently 27% to 47% in the 2030 scenario, as shown in image 7.

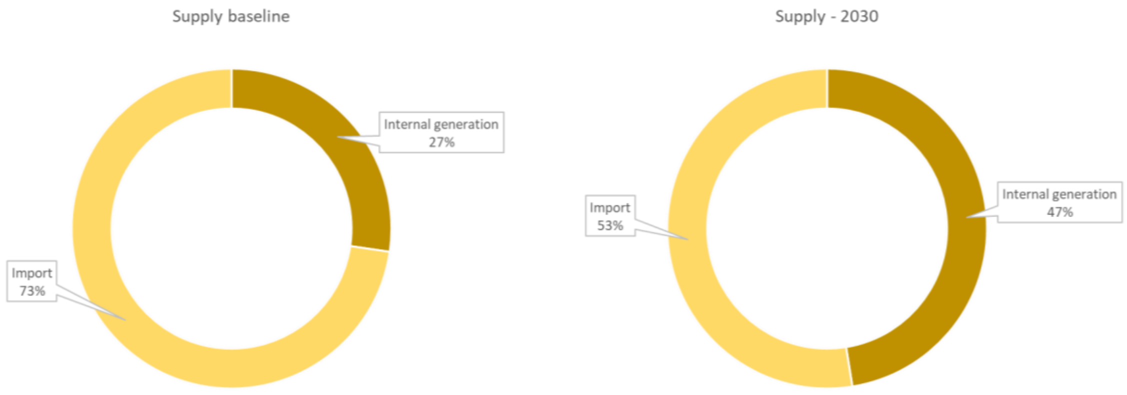


Image 7: Share of region internal generation in final consumption - baseline and scenario 2030

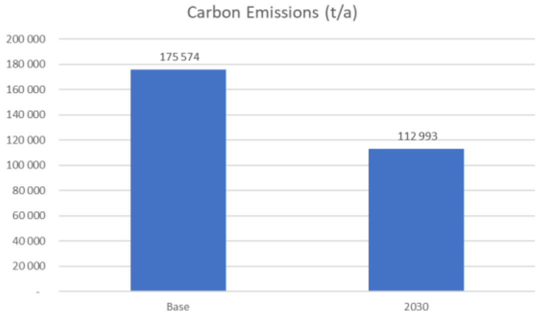
6.2.5 Primary energy in supply and consumption

Shifting from fossil to renewable energy leads to a decrease of 10% in primary energy consumption in total.
On the region-internal supply side, the primary input in electricity generation is reduced by 37% and in heat generation by 14%.

6.2.6 Final energy consumption and GHG emissions

The scenario assumes a reduction of heat demand by 11,8% and a reduction in the transport sector by 12,3%. On the other hand, the ongoing electrification of final applications, the increase of heat pumps and the proceeding digitalisation leads to an increase of the the electricity demand by 7,6%. In the balance, final consumption is expected to be reduced by 5,7%.

The main impact of the measures to implement is expected to be found on the side of GHG emissions, which are expected to decrease by 62 580 t/a (35,6%) with regard to the baseline, mainly caused by the replacement of heating oil and the massive increase of renewable electricity generation on PV base.



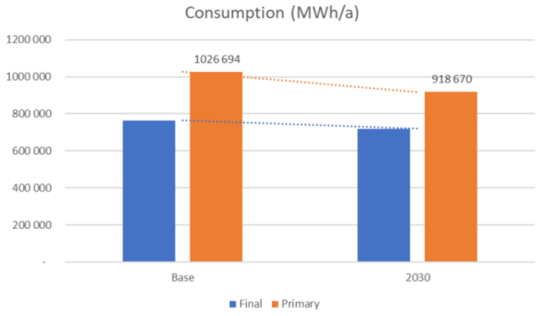


Image 8: Carbon emissions, final and primary consumption – baseline and scenario 2030

The reduction of GHG emissions can be monetized by using the average auction price for carbon certificates, traded at the European Energy Exchange (EEX) in September 2021.This average price is, at reporting date, 61,78.- € per ton.
Based on this value, the carbon reduction effect equals to an annual amount of 3,87 million €, resulting in a payback period of 95,3 years.

6.2.7 Sankey diagrams scenario 2030

In the following, the sankey diagrams of the baseline and the scenario 2030 values are presented.

Image 9 and 10 are comparing the final consumption structures of the baseline and the 2030 scenario:

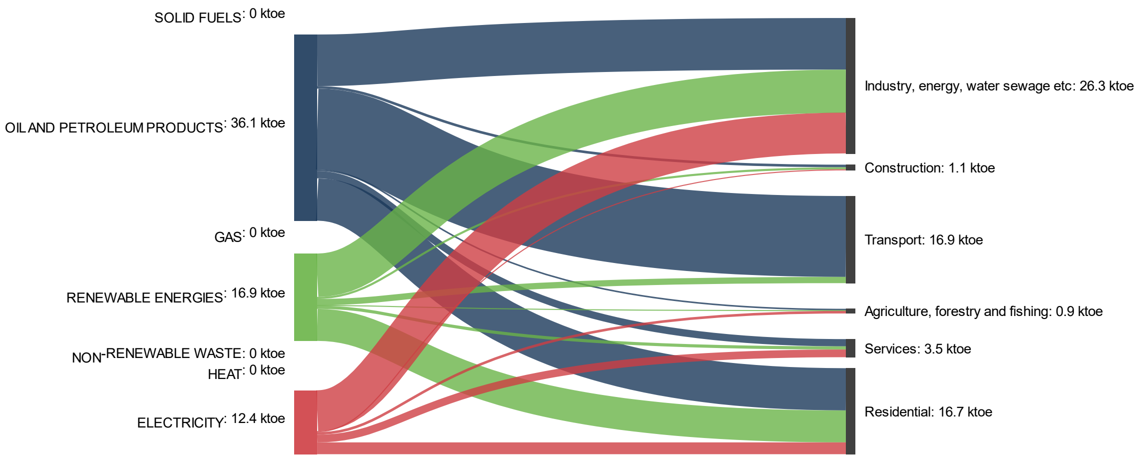


Image 9: Sankey diagram final consumption baseline

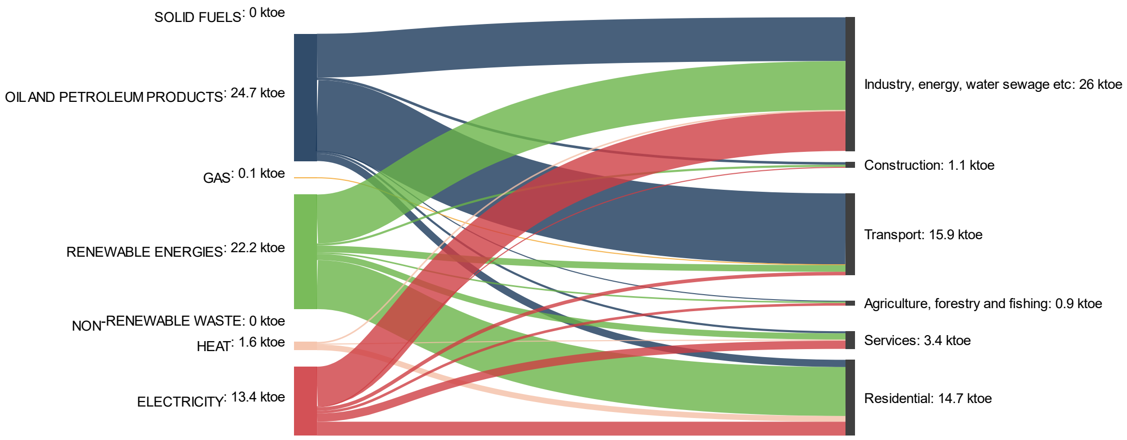


Image 10: Sankey diagram final consumption scenario 2030

Image 11 visualizes the effect of the shift from fossil to renewable energies. Since in the EEL only oil and petroleum based pruducts are accounting for fossil consumption, the fractions of solid and gaseous fossils are neglected. The baseline values are to the left, the scenario 2030 values to the right

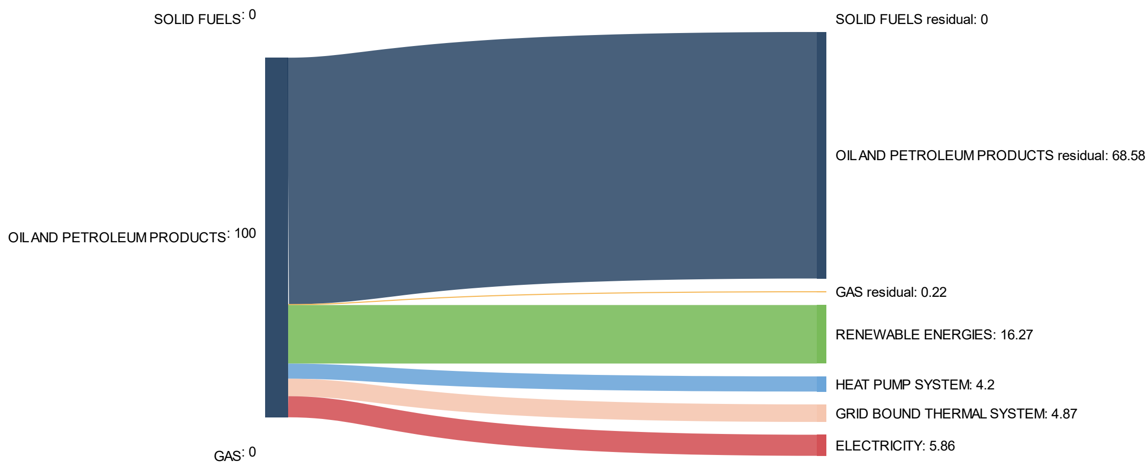


Image 11: Shift from fossil to renewable energy sources in the 2030 scenario

Images 12 and 13 are giving a comparison of carbon emissions between the baseline and the 2030 scenario-

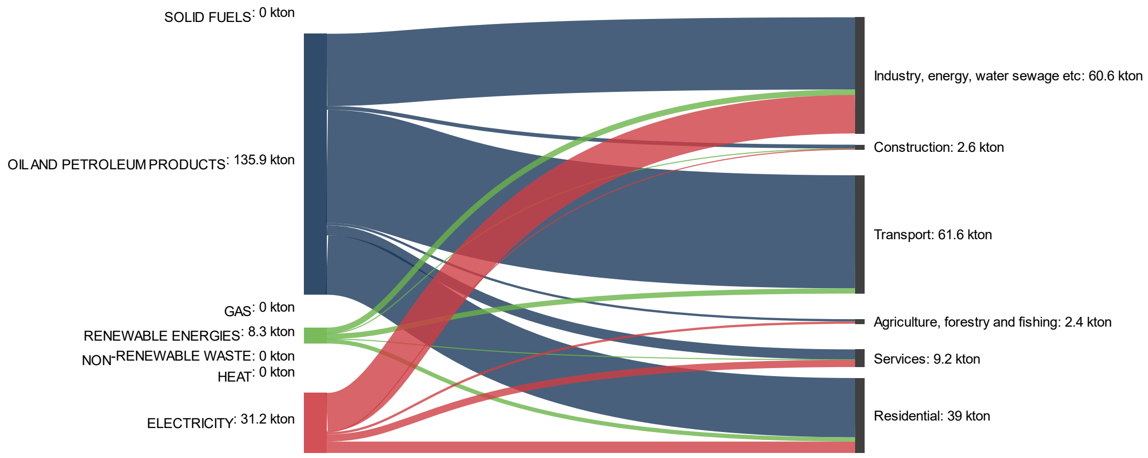


Image 12: Carbon emissions baseline

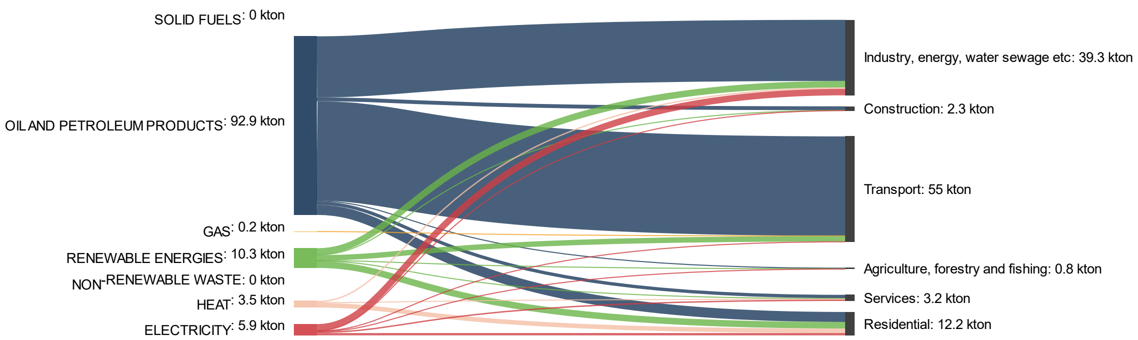


Image 13: Carbon emissions scenario 2030

6.3 Scenario 2040

6.3.1 General description: Actions and measures in the scenario

The scenario 2040 assumes the continuation of the effects achieved by the implementation of measures until 2030, without introducing further disruptive technologies, like, for example, the wide use of hydrogen.

The main components of the scenario are the complete elimination of fossil liquid fuels from the residential sector and the reduction of the same in the other sectors, leading to a remaining share of 15% compared to the baseline demand. In the case of industry, fossil liquids are replaced by gas, assuming the gas grid is extended into the main settlements in the region, where also industry is present. The biogas, produced in the region, is partly converted into electricity and district heat and partly refined and fed into the grid, usable for heat and as transport fuel. Thus the energy system achieves more flexibility on the generation side.

Due to better building standards in new buildings and a continued 1,5% thermal retrofaction rate of the building stock as well as more efficiency in building technology, spatial planning and infrastructure, the energy demand for heat and thermal applications is expected to drop to a value of 50% compared to the baseline. The extension of the existing district heating systems is already completed, additional heat demand in new buildings is covered by heat pumps.

After a steep increase in the 2020ies, the increment of PV generated electricity slows down and the following decade sees a growth of app. 5% additionally to the capacity in 2030. In each municipality at least one renewable energy community is established.

In the mobility sector, a share of 66% of electric passenger cars is achieved and one third of freight transport is carried out by (green-) gas driven lorries. The respective infrastructure is in place.

6.3.2 Required investments

Like in the 2030 scenario, also in the 2040 scenario, investments and incentives are calculated according to the average investment costs on a 2020 price base. The required investments for the additional measures of 2040 scenario are slightly higher (~8%) than in the one for 2030. The largest share of investment is occupied by mobility.
Table is showing the relevant figures for the additional measures of the scenario:

Activity	Investment Mill €	Incentives Mill €	Investment per capita €	Incentives per capita €
Energy efficiency	72	8	4 120	460
Renewable energy supply	8	1	470	80
Mobility	255	50	14 580	2 830
Infrastructure and spatial development	63	9	3 600	490
Total	**399**	**68**	**22 770**	**3 860**

Table 10: estimation of required additional investments and incentive contributions for the 2040 scenario

The total investment costs for achieving the full scenario impact (2030 plus 2040) are presented in table..,

Activity	Investment Mill €	Incentives Mill €	Investment per capita €	Incentives per capita €
Energy efficiency	144	16	8 240	920
Renewable energy supply	231	69	13 200	3 970
Mobility	321	61	18 330	3 490
Infrastructure and spatial development	70	12	4 000	650
Total	**767**	**158**	**43 771**	**9 030**

Table 11: estimation of total required investments and incentive contributions for the 2040 scenario

Based on the average investment costs in 2020, a total investment of 767 million € is required to put all measures into place until 2040.

6.3.4 Renewable energy in supply and consumption

The measures to be implemented and the investments to be done until 2030, are expected to increase the share of renewables in consumption up to a rate of 78% and in supply up to a rate of 62%

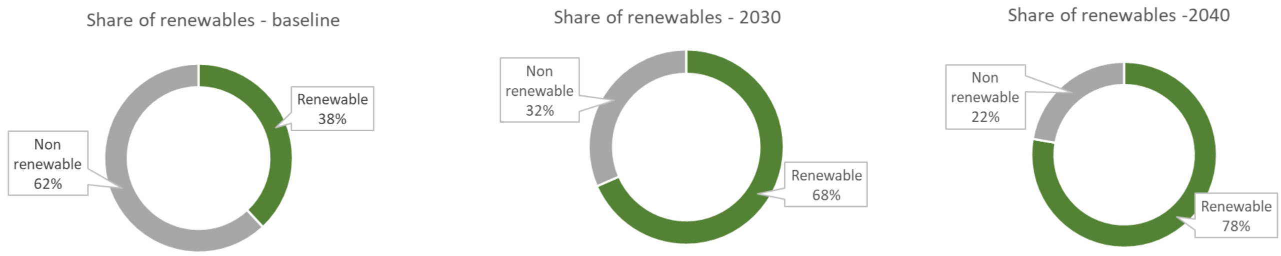


Image 14: share of renewables in final consumption – baseline, scenario 2030 and scenario 2040

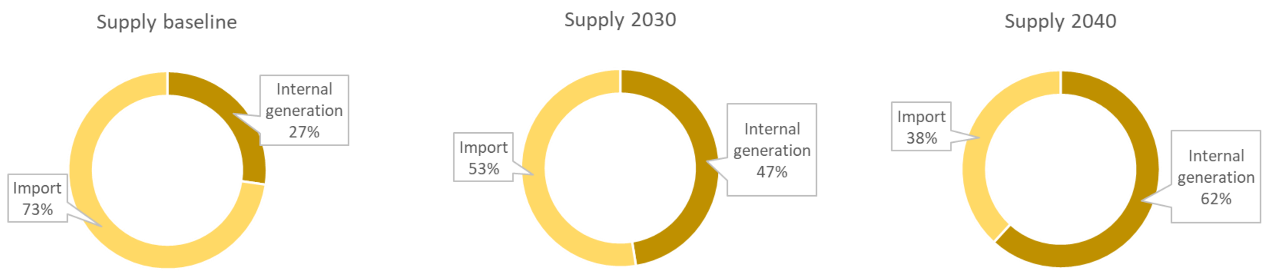


Image 15: share of regional internal generation in final consumption – baseline, scenario 2030 and scenario 2040

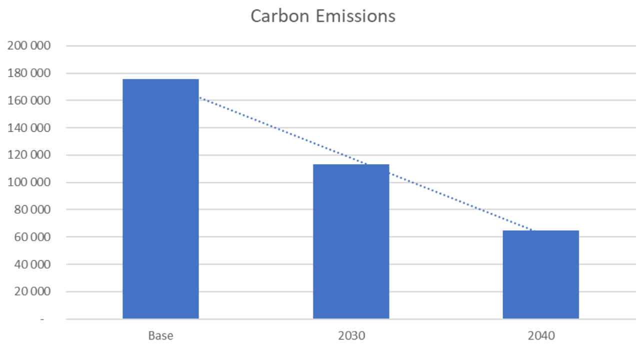
6.3.5 Primary energy in supply and consumption

The measures are expected to reduce the primary energy consumption by 26% in comparison to the baseline value.
On the region-internal supply side, the primary input in electricity generation is reduced by 38% and in heat generation by 16%.

6.3.6 Final energy consumption and GHG emissions

The scenario assumes a reduction of heat demand by 49% and a reduction of liquid fuel consumption in the transport sector by 29%. On the other hand, the electrification of the transport sector leads to an increase of the the electricity demand by 30%. In the balance, total final consumption is expected to be reduced by 18%.

The main impact of the measures to implement is, again, expected to be found on the side of GHG emissions, which are expected to decrease by 110 660 t/a (63%) compared to the baseline, mainly caused by the electrification of the transport sector .



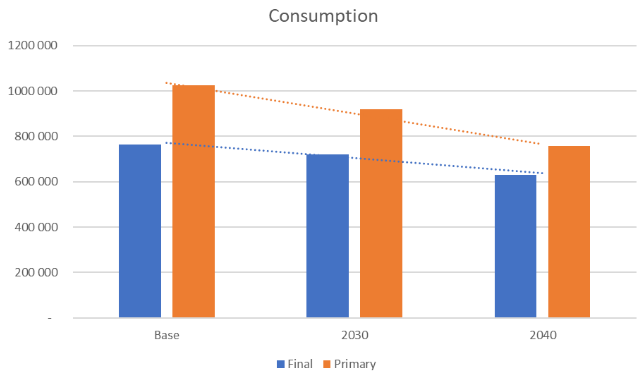


Image 16: carbon emissions, primary and final consumption – baseline, scenario 2030 and scenario 2040

Monetized on the average carbon price in September 2021, the emission reduction equals to an annual amount of 6,8 million €, resulting in a payback period of 112,8 years.

6.3.7 Sankey diagrams scenario 2040

In the following, the sankey diagrams of the baseline and the scenario 2040 values are presented.

Image 17 and 18 are comparing the final consumption structures of the baseline and the 2040 scenario.

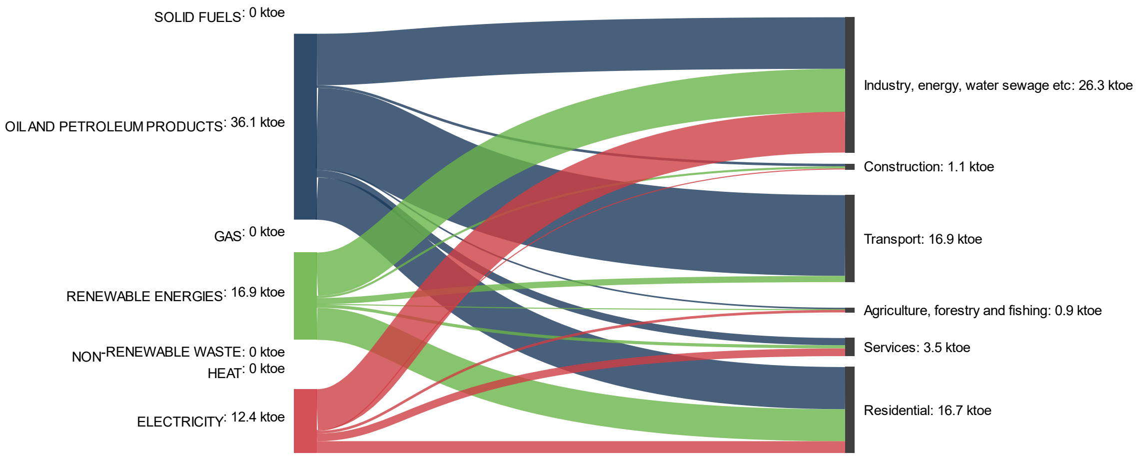


Image 17: Sankey diagram final consumption baseline

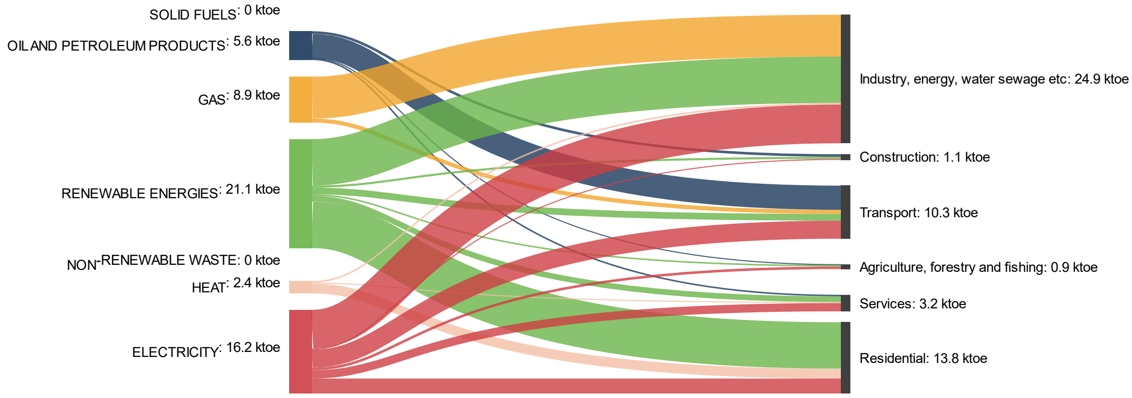


Image 18: Sankey diagram final consumption scenario 2040

Image 19 visualizes the effect of the shift from fossil to renewable energies. Since in the EEL only oil and petroleum based pruducts are accounting for fossil consumption, the fractions of solid and gaseous fossils are neglected. The baseline values are to the left, the scenario 2040 values to the right

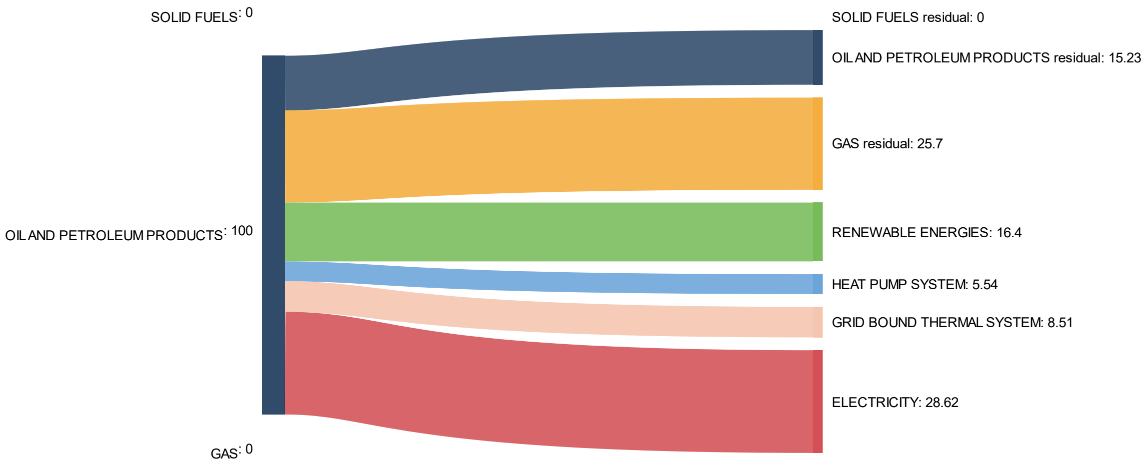


Image 19: Shift from fossil to renewable energy sources in the 2040 scenario

Images 12 and 13 are giving a comparison of carbon emissions between the baseline and the 2030 scenario

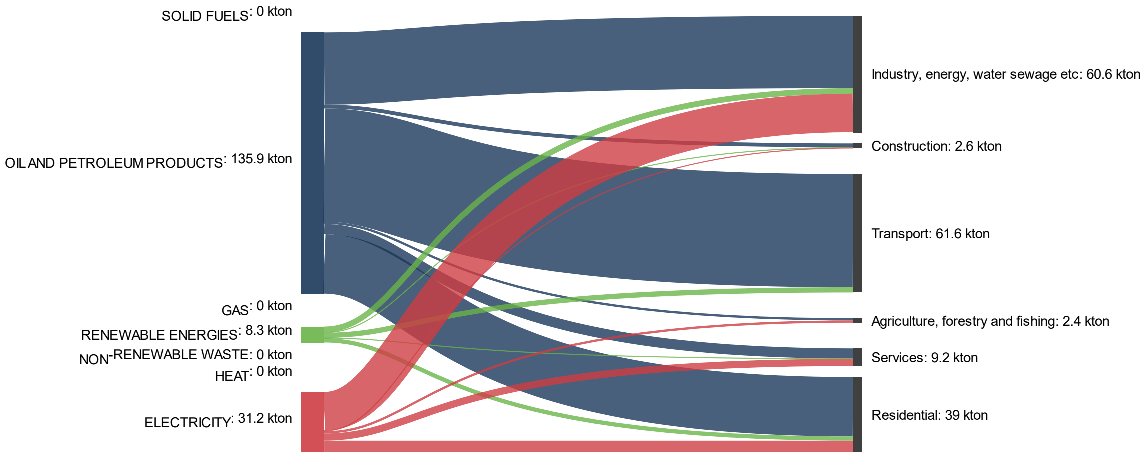


Image 20: Carbon emissions baseline

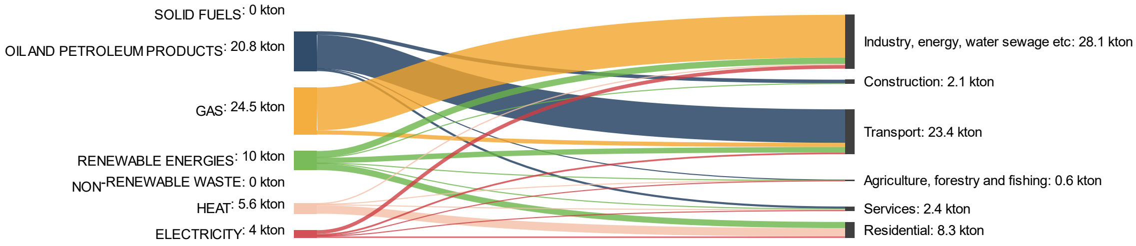


Image 21: Carbnon emissions scenario 2040

7. IMPLEMENTATION MONITORING AND KPIs

7.1 Evaluating body and evaluation periods

Since EEE is the energy agency of the 19 municipalities of the EcoEnergyLand, it will also be the monitoring and evaluating body for the implementation of the action plan on the first level. The evaluation period on this level is one year.

Due to the fact that the EEL is also a Climate- and Energy Model Region in the program of the Austrian Climate- and Energy Fund of the Federal Government, each 3 years an external audit of the activities is carried out as a form of second level evaluation.

In this context, progress monitoring is carried out in annual timesteps and a deeper progress evaluation in triennial periods.

The main evaluation with regard to the target values of the 2030 scenario will be carried out in 2031.

7.2 KPIs for impact monitoring

The KPIs are defined as shares, as differences or as per capita values. Main KPIs for impact monitoring are the following:

- Renewables in general consumption (primary and final)
- Renewables in electricity supply
- Renewables in final electricity consumption
- Renewables in final thermal consumption
- Final energy consumption broken down per sectors and energy carriers
- Electricity in transport
- Alternative fuels in transport
- Final energy consumptions per GDP
- Carbon emissions and Emission reductions
- Carbon emissions per final energy consumption unit
- Carbon emissions per capita
- Carbon emissions per electricity generation
- Regional generation, import, export
- Number of Energy Communities and self consumed generation
- Investments in energy decarbonisation
- Emission costs per capita

8 ASSESSMENT OF SUITING BUSINESS MODELS AND FUNDING SCHEMES

The 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. The way energy and energy services are generated, delivered and traded is expected to change completely in the coming years. Main components of this change are digitalisation and decentralization. This requires not only profound changes in technology and infrastructure, but requires also adaptions and even changes in the business sector.

8.1 Existing business models with regional relevance for low carbon energy supply and development potentials

The current business models applied for energy efficiency and renewable energy supply are mainly located within the framework of private investments in combination with bank loans and public funds in the form of subsidised loans or non-refundable grants.

By type, most of them can be categorized as linear downstream and some as cooperative.

Demand triggered sectoral downstream business models: These business models, traditionally, are focussing on customer demands for more efficiency and cost effectiveness, like efficient electrical appliances, efficient lighting, efficient biomass boilers, low-temperature room-heating systems, leasing and energy contracting services etc. Investments and purchases are carried out on a market- and negotiation-based principle, as soon as goods or services have become mainstream in the respective sector. Typically there are no direct interventions by policy measures even if initially probably being triggered by policy actions, as in the case of corporative renewable energy supply and supply infrastructure.

Policy triggered sectoral downstream business models: These business models are a combination of triggering private investment by public incentivation policy (often as a complement to a regulatory framework) in order to implement or accelerate desired developments. Up to now, this business model is the preferred way in national and regional policy to generate or promote the markets needed for the energy transition.

For enterprises acting in relevant sectors, subsidies are a fixed component for carrying out their business and for developing product- or service-offers. An important factor for these business models is a comprehensive consulting service as well as assistance with the compilation of documents and the submission of funding applications. In the EEL this service is carried out by EEE for free for residents, enterprises and municipalities within the EEL.

Cooperative business models: In the fields of renewable energy, these business models are basically driven by demand, but often triggered by policy

With the establishment of the first local biomass-based heat grids in the early 1990ies, the organisational form of cooperatives was introduced to the regional energy sector. While the construction and extension can be regarded as policy-triggered, the operation of the heat grids is demand-triggered and following the rules of the market and ist fluctuations. Members of the cooperatives can be consumers only, but also feedstock suppliers.

Another cooperative form of business in the region are citizen-participation models for PV facilities. The increased use of photovoltaic systems helps municipalities to place their energy supply on a more independent basis by financing the expansion of PV systems with the help of citizen participation. They make suitable roof surfaces of their buildings available and organise models in which private individuals can participate financially. The investment is matched by a regular return from electricity production and the resulting income from the fixed feed-in tariff over a defined timespan.

While the heat cooperations are focussing on the cooperative supply of a commodity, the citizen participation models are rather an example of a green investment.

All three types of business models are used in the region and contributing to the transition process. There is still a development potential in the service sector, namely planning and consulting, but also in the financing sector for a better exploitation of policy triggered measures regarding individual measures and solutions.

8.2 Alternative business models and regional applicability

The growing installation of distributed electricity generation and storage technologies, along with the widespread availability of "smart" devices, has created room for new business models to emerge in the power sector. The increase in digitalisation and smart metering has enabled the collection and analysis of large datasets that in turn enable automation. All of this provides the basis for the development of new energy-related services.

Platform based local peer to peer (P2P) trading business models: P2P trading platforms enable better management of decentralised generators by matching local electricity demand and supply at all times. Along with the higher local consumption of variable renewable energy, P2P electricity trading can help reduce investments related to the generation capacity and transmission infrastructure needed to meet peak demand. The business model has been explored in the region at a pilot stage in the course of the SHAR-Q project (H2020) and contributes to preparing the ground for renewable energy communities

Community based distributed ownwership and management: In contrary to the cooperation model, other stakeholders – such as conventional energy companies (utilities, retailers, etc.), non-profit organisations and authorities – can participate as individual members of the community on different levels of influence or involvement/participation, as in the case of a citizen energy community. Furthermore, this business model allows to act in a wider context, as for example as a complementor on regional digital ecosystem platforms or, due to little spatial limitation, as a virtual powerplant or flexibility service.

Pay-as-you-go business models: These models are mainly targetting the sector of electromobility. The payments are usually made via mobile credit, by sending e.g. a text message or logging into a digital ecosystem. In turn, the customer receives a code for service activation. The systems, thus, can feature a remote monitoring system that can be activated via mobile network connection.

The regional applicability for these business models is depending on a well developed digital infrastructure. In case of the EEL, these business models are expected to emerge step by step, additionally to the traditional forms of doing business.

8.3 Usable funding schemes: applicability and possible gaps to be filled

The main criterion for a usable funding scheme is, wether it provides planning security or not. This means, that on one hand they should be stable in amount or rate regarding investment or operation (e.g. tariffs) and on the other hand covering a reasonable time span (10 to 15 years). In the case of PV, the long term funding strategy based on guaranteed feed-in tariffs for 13 years, led to a wide spread application of the technology, stimulating demand on the technology market and lowering investment costs considerably. Follow-up funding schemes are now more market related and aiming at promoting local consumption or self consumption at average costs, equal to retail prices.

For a long term planning also expectable disruptive developments need to be taken into account in order to exploit the done investment as long as possible for the best benefit of the region. With regard to decentralisation, this would mean capping funding amounts for certain technologies according to the infrastructural capacities of the sites/regions. This gap in energy planning became visible, when huge investments were subsidised in biomass based centralized energy generation, like solid biomass or biogas powerplants. With the emergence of the biobased-products industry, a heavy competition for feedstock started, leading to the threat of a shutdown of a whole technology and to dead investments and wasted subsidies, which originally had been expected to last for at least 25 years..

9 CONCLUSIONS

9.1 Summary of findings

The document coimprises the planned steps for the region´s energy transition and decarbonisation pathway until 2030 and beyond.

The 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.

The key energy priorities have been selected on the basis of the regional experience in renewable heat supply, renewable electricity generation and in digital energy management and grid service projects.

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

Electricity demand will increase considerably. Main drivers of the demand will be an increased number of heat pumps and the growing share of electric vehicles.

The extension of the current PV capacities, according to the currently planned projects, will lead to an excess of renewable electricity generation in the regional balance. Decarbonized electricity generation reduces the electricity-related carbon emissions by 80% in 2030.

A shift from heating oil applications to renewable heat supply in the residential and the service sector alone, can reduce the total regional carbon emissions by 23%, compared to the baseline, in 2030. Together with renewable electricity generation and a (moderate) shift towards electromobility, the total regional carbon emissions can be reduced by 35%, compared to the baseline, until 2030.

9.2 Challenges for the regional authorities and stakeholders

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.

Energy transition will require moving large amounts of investment into clean technologies and related infrastructures. The better the already existing infrastructure is, the easier it becomes to involve the population into transition projects, but also to attract more investors from outside. From this point of view, cities are in a much better position, than rural areas.

The EEL is a rural micro-region, and, although greatly improved in the economic structures since Austria's entry into the EU, still threatened by depopulation and job losses. Under this perspective, promoting and managing the energy transition is an additional challenge for the regional authorities to cope with.

Activities of the EEL´s action-plan are carried out on the lowest possible authority level, which is the municipal one. This means, that they have to rely on programs and strategies provided by overarching authorities

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. On a sectoral level, these platforms are often already existing (commerce, agriculture, thematic associations etc.), but not connected for achieving an optimum of synergies and promoting bottom up initiatives adequately.

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 as the pillar of (planning-) security: Defining framework, providing strategies and programs on development and funding, removing barriers, monitoring and supervising overall development

Subsidiarity as the pillar of efficiency: Every aspect of governance, that can be carried out on a subordinated level should also be managed/executed there. Subsidiary bodies can be appointed agencies or existing bodies of public administration (one-stop-shops)

Autonomy as the pillar of acceptance: Members of the organisational unit (e.g. initiatives like energy communities etc.) are having the possibility to choose their individual pathway for target achievement (limited by overall framework) and are also fully responsible for the appropriate execution of their decisions.

9.3 Expected impact on regional economy

In 1990, the Güssing municipal council passed an important resolution: a 100% phase-out of fossil fuels. The Güssing biomass district heating plant (the largest in Europe when it was founded), a biodiesel plant, the globally unique Güssing biomass power plant, etc. were created. The organisation of suitable wood logistics was created, as well as wood drying plants, which are very important for the year-round utilisation of the district heating network. With a special business settlement programme, it has been possible to settle numerous new businesses and jobs in recent years. The idea was spreading also to the surrounding municipalities, leading to further renewable energy projects. The development had also an impact on tourism, attracting visitors to see and study the possibilities of economic development based on renewable energy.

This development phase ended with the shift in European and national policy away from biomass utilization for energy supply and putting the new focus on solar, wind and geothermal.

Nevertheless it has shown, that investments in renewable energy are able to create positive developments within the local and regional economy.

But it is also necessary to keep in mind, that the past development was based, like almost all projects in the fields of renewable energy, on an incremental model, aiming at introducing renewable energy to the most possible extent into each suitable process, if possible and viable.

The coming decades will be characterized by transition, which is more than just greening production, service, mobility and living. Transition means a deep electrification in the end use as well as the intense use of digital data on the technical side and a change of working conditions and lifestyle on the socio-economic side.

The impact of the energy transition on the regional economy is hard to estimate since it is completely different to incremental process there are no precedents. The argumentation in the OECD policy brief „Linking Renewable Energy to Rural Development“ can be extended to the impact of of the energy transition on local and regional economy:

„While CO2 emissions and electricity generation can be calculated with relative precision, it is challenging to assess the impact of renewable energy deployment on economic development. One of the reasons is the lack of data for calculating the net impact in terms of jobs at the regional level. The indirect jobs generated by renewable energy spin-offs such as manufacturing are rarely taken into account in national and regional statistics on renewable energy and jobs. Likewise, datasets concerning economic activities are still missing an environmental, or "green", dimension. This lack of information means that public authorities still consider economic development as an automatic or implied benefit of renewable energy deployment, without having the evidence to confirm this is happening or the policy frameworks to make sure it does. Lack of information also limits the ability to evaluate (and then adjust) policies while they are implemented. In the same vein, very high expectations in terms of jobs created by renewable energy can bias the evaluation of the policy. Good results may seem disappointing if expectations had been too high to start with“

9.4 Gaps to fill for proper implementation (technical, regulatory, financial)

It took three decades to increase the share of renewables in the EEL´s energy system from ~ 23% to currently ~38% in total final consumption. This equals an increase in the use of renewables by 65%.

For achieving the values of the 2030 scenario, which is a share of 68% in total final consumption, an increase in the use of renewables by 80% compared to the baseline is to be realized. This requires a more than three-fold speeding up in the development and implementation of technology, know-how, basic skills and doing business.

By investigating the regional gaps to fill for a proper implementation of the REAP, it turned out that the problems at local level are equal to the ones on national or even European level.

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

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 for data collection and processing, which are not yet beyond the status of pilot projects

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. In the EEL, for example, the overall per capita costs are estimated to € 21 000 .- to achieve the values of the 2030 scenario, which equals to 77% of the current annual per capita GDP. Although the average incentive contribution is ~ 25%, there is a need for additional financing models like carbon taxation or green bonds, to keep the decarbonisation on the planned track.

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.

Technical skills gap: The 10-year forecast of EuropeOn, the Electrical Contractors Association, provides a glimpse of the magnitude of the challenge that lies ahead: 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, perceived as a barrier to investments and as the most serious issue respectively by 75% and 25% of businesses in the sector,

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