REGI1ST

Planning Framework

Guiding Document

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1 Introduction

What is regional energy planning?

Regional energy planning is a collaborative, systematic process that focuses on developing and implementing energy strategies at a regional level. By taking into account the specific needs, resources, and opportunities of a region, it aims to optimise the energy system, reduce greenhouse gas emissions, and enhance overall sustainability. Regional energy planning enables the integration of energy efficiency measures, renewable energy sources, and innovative technologies into the local context, ensuring a more effective and targeted approach to meeting energy and climate objectives.

What is the Energy Efficiency First Principle and how does it relate to regional energy planning?

The Energy Efficiency First (EE1st) principle[1] is a guiding policy concept that prioritises the implementation of energy efficiency measures before investing in new energy supply infrastructure or capacity. By emphasising energy efficiency, this principle helps to reduce overall energy demand, decrease the need for new infrastructure investments, lower greenhouse gas emissions, improve energy security, and save consumers money. In the context of regional energy planning, the EE1st principle directs policymakers and planners to first consider demand-side measures. Such measures include: improving the energy efficiency of buildings, promoting efficient appliances and lighting, and encouraging behavioural changes that lead to energy conservation, before exploring options for increasing energy supply. Incorporating the EE1st principle into regional energy planning ensures a more sustainable, cost-effective, and resilient energy future for communities.

The REGIO1st project

REGIO1st, a project co-funded by the EU LIFE programme, aims to raise awareness about the Energy Efficiency First Principle (EE1ST) among regional authorities and their

[1] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-first-principle_en

agencies, as well as support them to incorporate this in decisions related to energy planning. It does so through the provision of appropriate guidance to regional authorities to embed the EE1st principle in their decisions and in the implementation of their energy plans. It starts from six participant regions and expands its reach to over 100 regions in the EU. Within the framework of the project a community of practice for EE1st is also being established, in cooperation with the Covenant of Mayors.

The specific objectives of the REGIO1st project are to:

- Provide support to regional authorities to apply the EE1st principle in their energy-related planning practices.
- Establish a community of practice for EE1st to ensure political commitment and societal acceptance through the co-development of energy related scenarios.
- Support the incorporation of the EE1st principle in the revision of National Energy and Climate Plans (NECP), Regional Operational Programs and foster the enforcement of Multilevel Climate and Energy Dialogue.

Objective of the REGIO1st Planning Framework

The REGIO1st Planning Framework aims to provide a comprehensive, structured approach for regional energy planners in Europe to develop and implement sustainable, cost-effective energy strategies while prioritising energy efficiency under the EE1st principle. The framework is designed to facilitate collaboration among stakeholders, align with broader national and EU goals, and address the unique challenges and opportunities of each region. By following the REGIO1st Planning Framework, planners can systematically address the complex challenges of energy planning, develop strategies that maximise the benefits of energy efficiency and renewable energy, and create a sustainable, resilient, and economically viable energy future for their communities.

How to use the framework

The REGIO1st Planning Framework is organised into eight stages, each containing specific steps that are key to the process. Planners are encouraged to follow the framework in a sequential manner, moving through each stage from preparation to implementation, monitoring, and review. Throughout the process, planners should engage with stakeholders and prioritise energy efficiency measures in accordance with the EE1st principle.

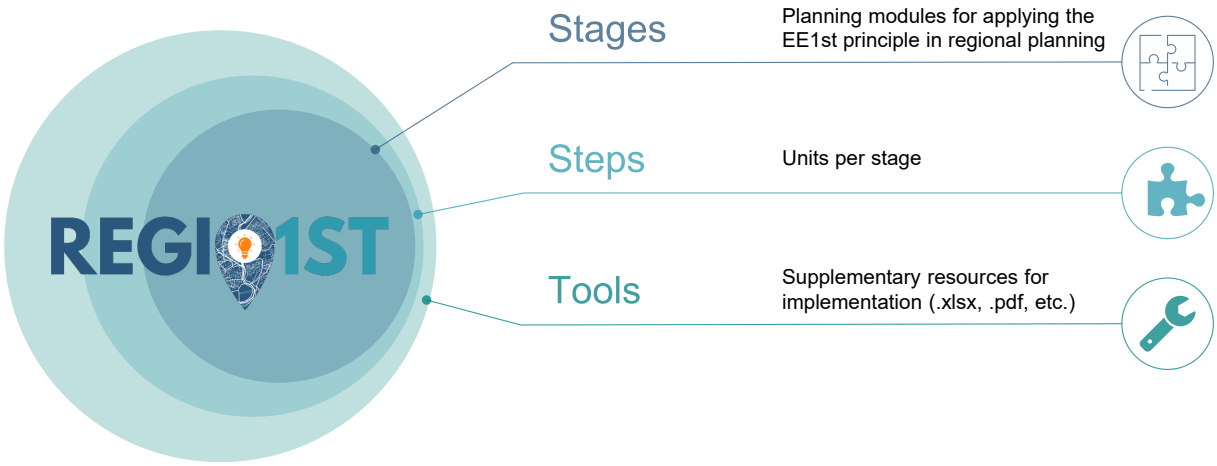
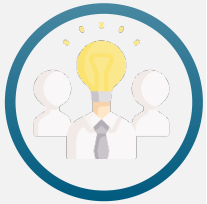


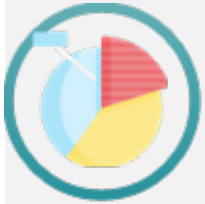
Figure 1 Stages, steps, and tools in the REGIO1st Planning Framework

The framework also includes a suite of readily available tools and templates (Excel, PDF, etc.) designed to assist planners through different stages of the process. These tools aid in data collection, analysis, scenario modelling, multi-criteria decision analysis, and other essential tasks while emphasising the importance of energy efficiency. By leveraging these tools, planners can streamline the planning process, ensure a thorough and accurate analysis, and make informed decisions that align with the EE1st principle.

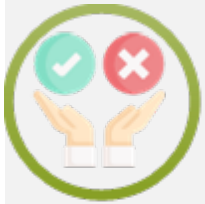
In summary, the REGIO1st Planning Framework provides a comprehensive roadmap for regional energy planners to develop and implement sustainable, cost-effective, and energy-efficient strategies and plans that align with the Energy Efficiency First principle and contribute to a low-carbon, environmentally sustainable, and economically prosperous energy system in Europe.

Outline of the framework

	Stages	Steps	Description	Tools
	Stage 1 | Preparation	Step 1.1 Determine the geographical area and scope of planning	Define the spatial boundaries and key aspects of the energy system for the planning process.	• Roles and Responsibilities Matrix (Excel)
		Step 1.2 Determine roles and responsibilities	Assign tasks and responsibilities to planning team members and stakeholders that will have a leading role in the planning process.	
		Step 1.3 Identify and review existing regional energy plans	Review and assess previous and ongoing energy planning efforts in the region, as well as other relevant planning documents.	
		Step 1.4 Set up the framework for developing a regional energy plan	Establish the planning process, timeline, budget, and resources for developing the plan.	
	Stage 2 | Engaging stakeholders and building partnerships	Step 2.1 Identify key stakeholders	Determine the relevant stakeholder groups and understand their interest, strengths, limitations, influence, and potential impact.	• Stakeholder Identification and Analysis Template (Excel) • Stakeholder Engagement Plan Template (PDF)
		Step 2.2 Develop a stakeholder engagement plan	Design a strategy for effectively involving stakeholders in the planning process, ensuring open communication and collaboration.	

	Stages	Steps	Description	Tools
	**Stage 3 | Reviewing energy objectives and targets**	Step 3.1 Review national visions and targets	Examine national energy policies, targets, and strategies to align regional planning with broader goals.	• National and Regional Targets Comparison Template (Excel) • Participatory Priorities Ranking (PPR) Tool (Excel)
		Step 3.2 Review regional visions and targets	Assess existing regional energy objectives and targets, as well as other relevant regional objectives and targets, to ensure these are aligned.	
		Step 3.3 Set and define new regional objectives and targets	Develop new or updated targets that align with national goals and respond to local priorities.	
		Step 3.4 Discuss visions and targets with stakeholders	Engage stakeholders in the process of refining and validating the region's energy goals and targets.	
	**Stage 4 | Exploring the current regional energy system**	Step 4.1 Collate data to understand the current energy system	Gather data on energy production and consumption for a comprehensive baseline assessment.	• Energy Inventory Data Collection Template (Excel)
		Step 4.2 Analyse energy consumption patterns by sector	Examine energy use across various sectors to identify trends, challenges, and opportunities.	
		Step 4.3 Evaluate existing energy infrastructure	Assess the current state and capacity of energy production, distribution, and storage facilities.	
		Step 4.4 Review the current system with stakeholders	Discuss the baseline assessment and potential areas for intervention with stakeholders to build consensus.	

	Stages	Steps	Description	Tools
	**Stage 5 | Cost-benefit analysis**	Step 5.1 Assess the potential of energy efficiency solutions	Investigate opportunities for energy conservation and for implementing energy efficiency interventions across various sectors.	• Technology Catalogue Tool (Excel) • Cost-Benefit Analysis Tool (Excel)
		Step 5.2 Assess the potential of renewable energy resources	Evaluate the availability and potential of renewable energy sources within the region.	
		Step 5.3 Agree on modelling approaches and scenarios with stakeholders	Establish a shared understanding of the methodology and assumptions for modelling future energy scenarios.	
		Step 5.4 Model future techno-economic options	Develop and compare energy system scenarios based on the identified renewable resources and energy efficiency solutions.	
		Step 5.5 Monetise benefits and wider impacts	Estimate and monetise the economic, social, and environmental impacts of the different energy options.	
		Step 5.6 Identify optimal combinations of solutions	Undertake a cost-benefit analysis to determine the least cost – greatest net benefits mix of renewable resources and energy efficiency measures to meet regional objectives.	
		Step 5.7 Assess the sensitivity of the analysis	Evaluate the robustness of proposed solutions against possible changes in key assumptions or external factors.	

	Stages	Steps	Description	Tools
	**Stage 6 | Assessing the practical feasibility of least-cost energy solutions**	Step 6.1 Assess distributional impacts	Examine the potential effects of proposed solutions on different stakeholder groups and communities.	• Multi-Criteria Decision Analysis (MCDA) Tool (Excel)
		Step 6.2 Evaluate the readiness of supply chains for proposed technologies and solutions	Assess the availability, capacity and maturity of supply chains to support the implementation of selected options.	
		Step 6.3 Assess the workforce capacity for the implementation of proposed options	Determine the workforce requirements and skill development needs for the successful deployment of selected solutions.	
		Step 6.4 Organise stakeholder consultations to gather feedback and review options	Engage key stakeholders in reviewing and refining the proposed energy options, ensuring transparency and community support.	
	**Stage 7 | Defining actions and developing the regional energy plan**	Step 7.1 Prioritise energy interventions and develop the regional plan	Rank proposed initiatives according to established criteria to focus on high-impact, feasible solutions.	• Monitoring Template (Excel)
		Step 7.2 Establish a monitoring and evaluation system	Design a system to track the progress of energy actions, measure their effectiveness, and inform future decision-making.	
		Step 7.3 Pursue public acceptance and finalise the regional energy plan	Obtain public support for the plan through communication, transparency, and engagement, and finalise the plan based on feedback.	

	Stages	Steps	Description	Tools
	**Stage 8 | Implementation, monitoring and review**	Step 8.1 Develop detailed implementation plans	Create comprehensive plans for each energy action, outlining resources, timelines, and responsibilities.	
		Step 8.2 Establish partnerships to support actions implementation	Engage businesses, utilities, and organizations to collaboratively execute energy projects and programs.	
		Step 8.3 Implement actions and communicate successes to stakeholders and the public	Identify and pursue funding opportunities and resources to support the implementation of prioritised projects and programs.	
		Step 8.4 Review and update the regional energy plan	Periodically revisit the energy plan, incorporating new data, lessons learned, and evolving priorities to ensure ongoing relevance and effectiveness.	

2 Planning workflow (stages & steps)

This chapter introduces the workflow of the REGIO1st Planning Framework, delineating its stages and steps to guide users through the implementation process. Users will gain comprehensive insights into each step of the framework, facilitating effective execution and utilization.

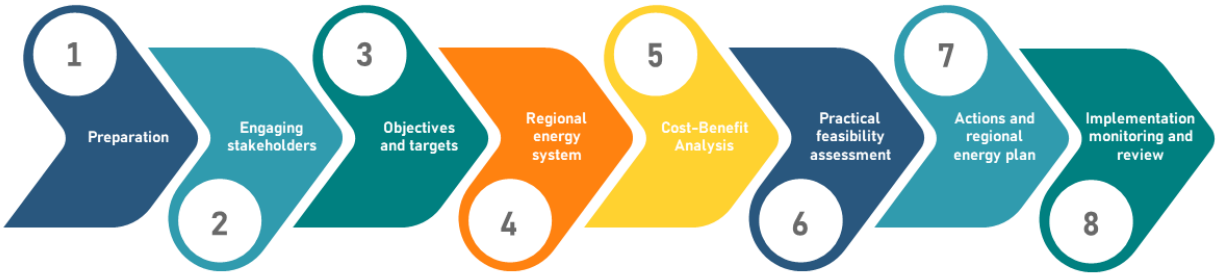


Figure 1. REGIO1st Planning Framework workflow.

Stage 1 Preparation

Stage 1 focuses on laying the groundwork for developing an effective regional energy plan. It involves determining the geographical area and scope of the planning, defining roles and responsibilities, identifying existing regional energy plans, and starting the process for developing the plan.

Steps

Step 1.1 Determine the geographical area and scope of planning

The first step is identifying the geographical area that the regional energy plan intends to cover. This may include, for instance, a specific area of interest (e.g. covering a group of municipalities) or the entire region.

Subsequently, the scope of the plan needs to be defined, for instance the plan may encompass selected sectors and specific energy sources (electricity, gas, heat etc.), or all key sectors and energy sources. Key sectors to consider in energy planning include:

- Buildings, equipment & facilities: Residential, commercial and municipal/institutional buildings and facilities. Manufacturing and construction industries can be considered as well.
- Transport: Transportation within the regional/local authority boundary disaggregated by mode (road, rail, waterborne navigation and off-road) and by fleet type (municipal, public, private and commercial transport).

- Energy Supply: Facilities for the generation of energy (e.g. electricity, CHP and heat/cold production plants) within the regional/local authority boundaries.
- Other non - energy related: Agriculture/forestry/fisheries, waste management, wastewater management and other non-energy related sectors.

A clear definition of the geographical area and scope of planning will help ensure the plan's relevance and effectiveness.

Step 1.2 Determine roles and responsibilities

The effective coordination and collaboration of the planning team is essential for an effective process. In this step, planners should identify key departments within the region, as well as key stakeholders (e.g., regional energy agencies), that will actively contribute throughout the regional planning process and define their roles and responsibilities in the planning process.

Establishing appropriate structures that support the planning process is also good practice, such as a steering committee or working group with a defined mandate to undertake specific tasks and activities.

Step 1.3 Identify and review existing regional energy plans

Before embarking on the creation of a new regional energy plan, existing plans and strategies in the region should be considered. This should include strategies and plans that focus on sustainable energy, infrastructure development, transport, waste, and other relevant urban and rural activities.

This review will help identify potential synergies, overlaps, and gaps in the current planning landscape and inform the development of a new regional energy plan (or enable the more effective revision of an existing one). The successes and challenges of previous planning efforts should also be considered, as these can provide valuable insights and lessons learned for the development of the new plan.

Step 1.4 Set up the framework for developing a regional energy plan

Once the groundwork has been laid, the framework for developing the regional energy plan needs to be set up. In particular, the planning process needs to be established, taking into consideration the planning and decision-making processes of the regional authority. The timeline, budget, and resources for developing the plan need to be determined.

Moreover, the technical capacity of the region needs to be assessed along with whether there is a need to commission part of the work to an external party (consultancy, regional energy agency etc.). In this case, the regional authority's relevant procurement process needs to be followed (which also defines what is being sub-contracted and why) and approvals need to be obtained from the relevant competent structure (often the

regional council). The necessary resources also need to be allocated and ensured, such as funds, staff, and access to technical expertise and data.

Related Tools

Roles and Responsibilities Matrix

This Excel tool can assist planners in determining and assigning roles and responsibilities, ensuring that all necessary tasks are covered and that the process is well-coordinated and efficient. The tool can also help define the role and responsibilities of stakeholders actively involved in the planning process, as well as produce a visual matrix that facilitates communication and collaboration among the planning team members.

Stage 2 Engaging stakeholders and building partnerships

A successful planning process requires effective coordination and collaboration among various stakeholders, including regional authorities, local governments, utilities, businesses, and community organizations. This stage outlines the stakeholder engagement process, including identifying key stakeholders and developing a stakeholder engagement plan.

Steps

Step 2.1 Identify key stakeholders

In this step, planners should identify key stakeholders to be involved in the regional energy planning process. Stakeholders can include, amongst other, energy agencies, utilities, businesses, industry, local authorities, community organizations, environmental groups, energy experts, and citizens.

Identifying stakeholders and understanding their priorities, interests, strengths, limitations, influence, and potential impact is essential for ensuring that the regional energy plan addresses local and regional needs and empowers all relevant parties to actively contribute to the region's just energy transition.

To achieve this, planners can conduct stakeholder mapping exercises/analysis, hold informal meetings, or organize workshops or focus group discussions.

This will help develop a comprehensive understanding of the diverse perspectives, needs and expectations of the stakeholders involved in the planning process, whilst at the same time enable the establishment of a participatory energy planning process.

Step 2.2 Develop a stakeholder engagement plan

Once key stakeholders have been identified and their relevance, influence and impact are understood, planners should develop a stakeholder engagement plan. This plan should outline how stakeholders will be involved throughout the planning process, as well as the tools that will be used and the timing and frequency of engagement activities. In particular, the stakeholder engagement plan should be designed to:

- Ensure the transparent, inclusive, and meaningful participation of all relevant stakeholders, including marginalized and underrepresented groups
- Facilitate an open and constructive dialogue among stakeholders, fostering trust and cooperation

- Provide opportunities for stakeholders to influence decision-making and shape the regional energy plan
- Communicate the progress and outcomes of the planning process to stakeholders, maintaining their interest and support throughout the planning but also the implementation phase.

Some possible engagement methods include workshops, focus groups, public consultations, surveys, online platforms, and social media. The choice of method will depend on the specific context, objectives, and resources available for the planning process.

Related Tools

Stakeholder Identification and Analysis Tool

This Excel tool can help planners systematically identify and analyse key stakeholders within the regional energy planning process. The tool can be used to collate stakeholder names, roles, interests, relevance, influence, and potential impact in the energy transition. This tool can support planners in better understanding and engaging stakeholders.

Stakeholder Engagement Plan Template

This template can guide planners in developing a comprehensive stakeholder engagement plan that outlines the objectives, methods, timelines, and resources required for engaging stakeholders throughout the planning process. The template can incorporate stakeholder analysis, and the development of communication strategies, engagement activities, and evaluation measures, ensuring that stakeholder engagement efforts are well-planned and effective. The outcomes that result from the use of the Stakeholder Identification and Analysis Tool (step 2.1) can feed in this template as well.

Stage 3 Reviewing energy objectives and targets

This stage focuses on reviewing and establishing energy objectives and targets that align with national, regional, and local visions, as well as engaging stakeholders to ensure a shared and well-informed approach.

Steps

Step 3.1 Review national visions and targets

In this step, planners should review relevant national energy policies, strategies, and targets. Such plans may include objectives related to greenhouse gas emissions reductions, renewable energy deployment, energy efficiency improvements, transport infrastructure development and energy security, among others.

Understanding the national context and national priorities will help ensure that the regional energy plan aligns with broader policy frameworks.

Step 3.2 Review regional and local visions and targets

In addition to national targets, planners should examine existing regional and local visions, strategies, and targets for energy, as well as for other relevant policy areas. For instance, planners could review, amongst other, regional development plans, energy master plans, urban mobility plans, regional spatial/territorial plans, waste management plans and other relevant strategic documents that affect energy policy.

Evaluating existing regional and local targets, strategies and plans will help identify synergies, gaps, and potential conflicts at a regional level as well as between different levels of governance. This will ensure that the regional energy plan is consistent with and builds upon existing planning efforts.

Step 3.3 Set and define new regional objectives and targets

In this step, the new/revised regional objectives, priorities and targets need to be defined, considering existing national regional and local targets and strategies. These should also consider economic development, long-term energy independence, environmental protection, improvement of quality of life and of health. In addition, appropriate indicators need to be identified to better define set objectives.

Step 3.4 Discuss visions and targets with stakeholders

Once national, regional, and local visions, targets, strategies, and plans have been reviewed, planners should engage with stakeholders to discuss these and their implication on the regional energy plan. The dialogue should aim to:

- Identify potential barriers and opportunities for achieving established goals in order to consider them further in the regional plan
- Ensure that regional needs and stakeholder concerns are adequately reflected in the regional plan and sufficiently considered in new/revised objectives and targets
- Build consensus on the regional energy vision, objectives, and targets
- Rank the importance of objectives to build consensus on priorities

Stakeholder engagement may take the form of workshops, meetings, or online consultations, depending on the resources available and the preferences of the stakeholders involved.

Related Tools

National and Regional Targets Comparison Template

This Excel template can help planners systematically compare their regional energy targets with EU, national and other objectives, such as the European Union's energy and climate goals. The template includes columns for each target type (e.g., energy efficiency, and renewable energy) and rows for filling in national, regional, and other targets, enabling planners to identify deviations and areas for review.

Participatory Priorities Ranking (PPR) Tool

This tool can facilitate planners rank priorities using a collaborative process. It provides a systematic approach for gathering inputs and perspectives from a diverse group of stakeholders, such as community members, experts, or decision-makers, and collectively determining the relative importance/urgency of different options/ measures. By actively involving stakeholders, a more inclusive and representative prioritization process is ensured, ultimately leading to more effective and sustainable outcomes.

Stage 4 Exploring the current regional energy system

This stage involves gathering and analysing data on the existing energy system, including energy consumption patterns, infrastructure, and other key aspects.

Steps

Step 4.1 Collate data to understand the current energy system

In this step, planners should gather data to understand the current regional energy system. This includes quantitative information on regional energy production, renewable energy production, energy consumption per sector and energy source. Data sources may include regional and national statistical institutes/offices, utilities, industry reports, technical reports and academic publications.

Accurate and comprehensive data are essential for developing a baseline energy inventory, understanding the current regional energy system and setting realistic targets in the regional energy plan.

Step 4.2 Analyse energy consumption patterns by sector

Once the necessary data has been collected, planners should analyse the energy consumption data by sector, in order to derive consumption patterns in different sectors, especially the residential, commercial, and transport sector. The analysis should consider factors such as energy demand, energy intensity, and the types of energy sources used in each sector.

Understanding sector-specific energy consumption patterns will help planners identify opportunities to improve energy efficiency, switch fuels, and implement other demand-side interventions.

Step 4.3 Evaluate existing energy infrastructure

In addition to analysing energy consumption, planners should evaluate the existing energy infrastructure in the region. This should consider the age, condition, capacity, and efficiency of energy production, distribution, and storage facilities, as well as the availability and accessibility of renewable energy resources.

This assessment will help planners identify infrastructure-related constraints and opportunities to include in the regional energy plan, such as the development of new renewable energy projects.

Step 4.4 Review the current system with stakeholders

Once a thorough understanding of the current regional energy system has been established, planners should discuss the findings with stakeholders. This may involve organizing workshops, meetings, or other engagement activities to present the data and analysis, as well as to gather feedback and insight from stakeholders.

This step is important for validating the information, ensuring that all relevant aspects have been considered, and building consensus on the key challenges and opportunities of the regional energy system.

Related Tools

Energy Inventory Data Collection Template

This Excel template can help planners systematically collect and organize relevant energy data, such as energy production and consumption, as well as key infrastructure information (e.g. existing renewable energy production capacity). It can also act as a checklist that helps planners identify key sectors and energy sources to collect data for. Finally, it can help planners subsequently develop a Greenhouse Gas inventory for the region.

Stage 5 Cost-benefit analysis

This stage involves assessing the potential of various energy options and identifying the least cost – greatest net benefits combinations of solutions, while considering wider impacts and uncertainties.

Steps

Step 5.1 Assess the potential of energy efficiency solutions

In this step, planners should evaluate the potential uptake and impact of energy efficiency solutions. This should include identifying opportunities for energy conservation and energy efficiency improvements in various sectors, such as buildings, transportation, and industry. Planners should consider factors such as cost-effectiveness, technical feasibility, and potential for energy savings and greenhouse gas emissions reductions.

This step is key in properly incorporating the energy efficiency first principle in energy planning, by ensuring that the maximum possible uptake of such solutions is planned.

Step 5.2 Assess the potential of renewable energy resources

In addition to energy efficiency solutions, planners should also evaluate the potential of renewable energy resources in the region. This may include solar, wind, biomass, hydro, and geothermal resources, among others. Planners should consider factors such as technical feasibility, environmental impact and potential for regional economic development. This assessment will help identify the most promising renewable energy options to incorporate in the regional energy plan.

Step 5.3 Agree on modelling approaches and scenarios with stakeholders

Before conducting the cost-benefit analysis, planners should consult with stakeholders to agree on the modelling approaches and scenarios to be used. This may involve discussing appropriate analytical tools, determining key assumptions, and defining various future scenarios, such as business-as-usual, and energy efficiency-focused scenarios.

As such, this is an opportunity to communicate the benefits of incorporating the energy efficiency first principle in future scenarios and ensuring stakeholders buy-in.

Furthermore, stakeholders should be given the opportunity at this stage to provide data and evidence to support the cost-benefit analysis. Engaging stakeholders in this step will help ensure the transparency and credibility of the analysis.

Step 5.4 Model future techno-economic options

With the modelling approaches and scenarios agreed upon, planners should conduct a cost-effectiveness analysis. This should involve modelling the future energy system under different scenarios, taking into account the potential of renewable energy resources, energy efficiency solutions, and other relevant factors. The analysis should also consider both direct costs, such as capital and operating costs of the solutions, and indirect costs, in order to identify the most cost-effective mix of solutions.

Step 5.5 Monetise benefits and wider impacts

In addition to direct and indirect costs, the cost-benefit analysis should also account for benefits and wider impacts, such as employment generation, local economic development, environmental benefits (e.g. improvements in air quality), public health benefits, and opportunity costs. Monetising benefits and wider impacts will help planners capture the full value of different energy options and inform decision-making.

Step 5.6 Identify optimal combinations of solutions

By undertaking a cost-benefit analysis and comparing the costs and benefits of different options, planners should identify the least cost – greatest net benefits combinations of renewable energy resources and energy efficiency solutions that can achieve the region's energy objectives and targets.

Step 5.7 Assess the sensitivity of the analysis

Finally, planners should assess the sensitivity of the cost-benefit analysis to uncertainties, such as changes in technology costs, energy prices, and policy frameworks. This will help planners understand the robustness of the analysis and identify potential risks and opportunities associated with different energy options.

Related Tools

Technology Catalogue Tool

The Technology Catalogue Tool can help planners assess the potential of various supply-side and demand-side solutions in their region, by providing indicative information on renewable energy sources, regional energy generation solutions, as well as end-use energy efficiency solutions for different sectors. More specifically, the tool can help planners understand the cost-effectiveness of various energy technologies and solutions, including average costs (capital, operational and maintenance costs, etc.), efficiencies and emission intensities for the supply side, as well as potential energy and cost savings for energy efficiency solutions. As such, the tool allows planners to select

and compare different energy technologies and solutions based on the region's specific needs and objectives.

Cost-Benefit Analysis Tool

The Cost-Benefit Analysis Tool can help planners assess the costs, effectiveness and to an extent the benefits (e.g., energy cost savings) of different energy solutions for their region. This tool can enable planners compare various energy options and identify those that provide the greatest net benefits for the region. More specifically:

- The user inputs key variables, such as technology costs and energy prices.
- The tool produces outputs, including the costs, energy savings and energy cost savings of different energy solutions.

The tool can also help planners assess the sensitivity of the analysis, to uncertainties, by changing key inputs variables. This can help planners identify the most robust and resilient energy solutions under different circumstances.

Stage 6 Assessing the practical feasibility of least-cost energy solutions

This stage involves examining the distributional impacts, supply chain availability, workforce capacity, and public acceptability of the identified optimal energy solutions.

Steps

Step 6.1 Assess distributional impacts

Planners should evaluate the distributional impacts of the energy solutions on different groups within the region, such as residents, businesses, and vulnerable populations. This assessment should consider factors such as energy access, affordability, and potential job creation or displacement. Identifying and addressing potential inequalities will help ensure that the regional energy plan promotes social equity and enjoys broad support from the community.

Step 6.2 Evaluate the readiness of supply chains for the proposed technologies and solutions

Planners should assess the availability and maturity of supply chains for the proposed energy technologies and solutions. This includes evaluating the local and regional availability of necessary equipment, materials, and services, as well as the degree of technological maturity and market readiness. An understanding of the supply chain landscape will help planners identify potential bottlenecks, risks, and opportunities, and inform the selection and prioritization of energy options.

Step 6.3 Assess the workforce capacity for the implementation of proposed options

In addition to supply chain considerations, planners should assess the workforce capacity to implement the proposed energy solutions. This involves evaluating the availability of skilled labour, the need for training and capacity-building programs, and the potential for job creation.

Ensuring that the regional workforce has the necessary skills and expertise to support the selected energy solutions will be crucial for the successful implementation of the regional energy plan.

Step 6.4 Organise stakeholder consultations to gather feedback and review options

Finally, planners should organize stakeholder consultations to gather feedback and review the different energy solutions. These consultations should engage a diverse range of stakeholders, for instance businesses, local authorities, and other interested parties (including the public if deemed appropriate). Stakeholder consultations can take various forms, such as workshops, focus groups, online surveys and meetings. The objectives of the stakeholder consultations should be to:

- Present the findings of the cost-benefit analysis and practical feasibility assessment
- Solicit feedback on the proposed energy options, their distributional impacts, and potential implementation challenges
- Address concerns and answer questions from stakeholders
- Build stakeholder support and buy-in for the regional energy plan

Related Tools

Multi-Criteria Decision Analysis (MCDA) Tool

This Excel tool serves as a valuable aid for energy planners by facilitating the prioritization of various energy options and ultimately supporting the decision-making process. The tool enables planners and stakeholders to derive aggregated scores and rankings, thus identifying the most feasible energy options for the region. In particular, it allows the selection of criteria and the assignment of weights to these criteria, encompassing factors such as environmental sustainability, social equity and economic feasibility. Stakeholders and/or planners can then assign scores to the selected criteria for each solution, aiding in a qualitative assessment, whilst the tool also assists decision-makers in quantifying qualitative impacts when evaluating solutions. Subsequently, it calculates scores to provide a quantitative assessment of impacts, enabling a more informed decision-making process.

Stage 7 Defining actions and developing the regional energy plan

This stage focuses on selecting specific actions and formulating a robust regional energy plan, based on the potential impact, cost-effectiveness, net benefits, distributional impacts, and alignment with stakeholder priorities of the optimal energy solutions.

Steps

Step 7.1 Prioritise energy interventions and develop the regional plan

In this step, planners should prioritize and select the energy solutions/interventions, considering their potential impact, cost-effectiveness, and alignment with the priorities of the various stakeholders. The prioritization process should be aligned with the energy efficiency first principle. Subsequently, a sound plan should be developed with specific actions/interventions and outlining for each, scope, responsibilities, timelines, estimated implementation costs, expected impact and likely funding sources/mechanisms. Demonstration projects should also be identified, i.e. projects that address specific challenges or opportunities in the region that can showcase the feasibility and benefits of innovative energy technologies or approaches and provide valuable learning experiences to the local community. These can help build public support, attract investments and stimulate local markets for new energy solutions.

Step 7.2 Establish a monitoring and evaluation system

Planners should establish robust monitoring and evaluation systems to track progress in implementing the regional energy plan and assess its performance against established objectives and targets. These systems should involve regular data collection, analysis, and reporting on key performance indicators, such as energy consumption, greenhouse gas emissions, renewable energy generation, and energy efficiency improvements. The monitoring and evaluation process should also involve periodic reviews and assessments of specific projects and actions to identify challenges, successes, and lessons learned.

Step 7.3 Pursue public acceptance and finalise the regional energy plan

The regional energy plan should be put out to public consultation to gather feedback from stakeholders and citizens, in order to ensure the public's acceptance and buy-in. After thoroughly considering the results of the public consultation, the plan should be finalised and published.

Related Tools

Multi-Criteria Decision Analysis (MCDA) Tool

This Excel tool serves as a valuable aid for energy planners by facilitating the prioritization of various energy options and ultimately supporting the decision-making process. The tool enables planners and stakeholders to derive aggregated scores and rankings, thus identifying the most feasible energy options for the region. In particular, it allows the selection of criteria and the assignment of weights to these criteria, encompassing factors such as environmental sustainability, social equity and economic feasibility. Stakeholders and/or planners can then assign scores to the selected criteria for each solution, aiding in a qualitative assessment, whilst the tool also assists decision-makers in quantifying qualitative impacts when evaluating solutions. Subsequently, it calculates scores to provide a quantitative assessment of impacts, enabling a more informed decision-making process.

Monitoring Template

This template can assist planners in monitoring the implementation of the actions/interventions incorporated in the regional energy plan. It can enable planners report on progress and on the impact of actions/interventions and evaluate their effectiveness.

Stage 8 Implementation, monitoring and review

This stage focuses on implementing the regional energy plan, tracking progress, and periodically reviewing and updating it.

Steps

Step 8.1 Develop detailed implementation plans

For each action/solution incorporated in the plan, a detailed implementation plan should be developed that outlines specific steps, allocates resources, roles and responsibilities of various stakeholders, as well as defines in detail activities, timelines and key milestones. Securing funding is also crucial for the implementation of actions and projects. Planners should therefore explore various funding sources, such as public funds, private investments, grants, and loans, and identify the most suitable options for each action and project. The implementation plans should also address potential risks and consider mitigation measures to ensure the successful execution of the actions.

Step 8.2 Establish partnerships to support actions implementation

To successfully implement sustainable energy actions and projects, planners should establish partnerships with key stakeholders. These may include utilities, businesses, research institutions, non-profit organizations, and other relevant entities. Partnerships can help leverage resources, expertise, and networks to support project implementation, as well as facilitate knowledge exchange and collaboration among stakeholders. Additionally, partnerships can enable in-kind contributions, such as land, expertise, or equipment from stakeholders to support project implementation.

Step 8.3 Implement actions and communicate successes to stakeholders and the public

Throughout the implementation phase, planners should communicate successes to stakeholders and the public to maintain support and engagement. Regular updates on progress in implementing sustainable energy actions and projects, as well as their impacts and benefits, can help build stakeholders' and public trust and enthusiasm for the regional energy plan. Communication efforts may include press releases, newsletters, social media updates, and public events, among other.

Step 8.4 Review and update the regional energy plan

Finally, the regional energy plan should be periodically reviewed and updated to ensure that it remains relevant and responsive to evolving regional needs and circumstances.

The revision process should carefully consider the outcomes of the comprehensive assessment of the plan's progress towards meeting its objectives and targets, the effectiveness of specific actions/projects and lessons learnt from these, as well as an evaluation of the changing energy landscape, technological advancements, and stakeholder priorities. Based on this review, planners should identify areas for improvement and revise the plan accordingly, including revising sustainable energy actions and projects, adjusting targets and objectives, and refining tailored implementation plans.

3 REGIO1st Tools

This chapter serves as a guide to the tools developed under the REGIO1st planning framework. It includes detailed descriptions of tools, step-by-step instructions for their use, and examples for each tool, empowering users to implement the framework's suggested Stages and Steps smoothly and effectively.

Roles and Responsibilities Matrix

Relevant to Stage:1

Introduction

This Excel tool can assist planners in determining and assigning roles and responsibilities, ensuring that all necessary tasks are covered and that the process is well-coordinated and efficient. The tool can also help define the role and responsibilities of stakeholders actively involved in the planning process, as well as produce a visual matrix that facilitates communication and collaboration among the planning team members.

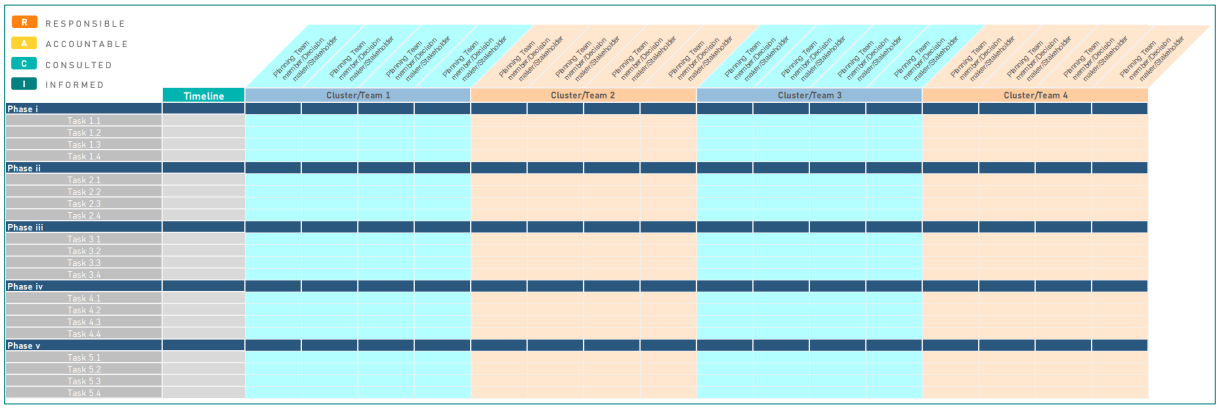
User instructions

Objective

The purpose of this tool is to assist users in clarifying roles and responsibilities within a team. Its' objective is to clearly define who is Responsible, Accountable, Consulted, and Informed (RACI) for each task or activity during the energy planning process or the implementation of a project.

Description

The RACI method utilizes a matrix to identify the individuals or groups of people accountable for implementing a project and assigns specific roles to each throughout its' duration. The acronym RACI is derived by the various responsibility types: Responsible, Accountable, Consulted, and Informed.



How should a planner use this tool?

RACI matrix tab	
Phase /Task	Insert the title of the respective Phase/Task
Timeline	Insert the date that each respective phase/task is expected to be finalised
Planning Team member/Decision maker/Stakeholder	Insert the name of the respective planning team department/decision maker/stakeholder
Cluster	Insert the name of the respective cluster/team. It is recommended to cluster teams/team members/decision makers/stakeholders with similar characteristics.
RACI matrix roles	Use the drop down menu within the matrix cells to indicate the role of each team/team member in the respective task.
Responsible	The responsible person/team undertakes the task/activity and ensures that timescales/deadlines are met, so that ultimately the task/activity is completed on time. The accountable team consists of the task's "doers," who work diligently to ensure the completion of each task.
Accountable	The accountable person/team for the task delegates work and reviews the task outcomes/deliverables. On some tasks/activities, the Responsible party may also serve as the Accountable one. It is important to only have one Accountable person/team assigned to each task/activity.
Consulted	A consulted person/team provides input and feedback based on either how the task/activity impacts their work or based on their expertise. Sometimes this person is also involved in the decision-making process.
Informed	Parts who require up-to-date information about the project are considered informed parties. They don't necessarily have to be consulted or involved in decision-making processes, but it is important to keep them informed.
Example tab	An example of using this tool is provided based on a mockup regional planning process.

Potential teams/cluster members

Planning team members	Regional planning teams, team members, and consultants
Decision makers	Regional/local authority representatives/elected members or offices
Stakeholders	Local authorities, other regional authorities, regulatory bodies, grid system operators (TSOs/DSOs), citizen groups, consumers, businesses, associations

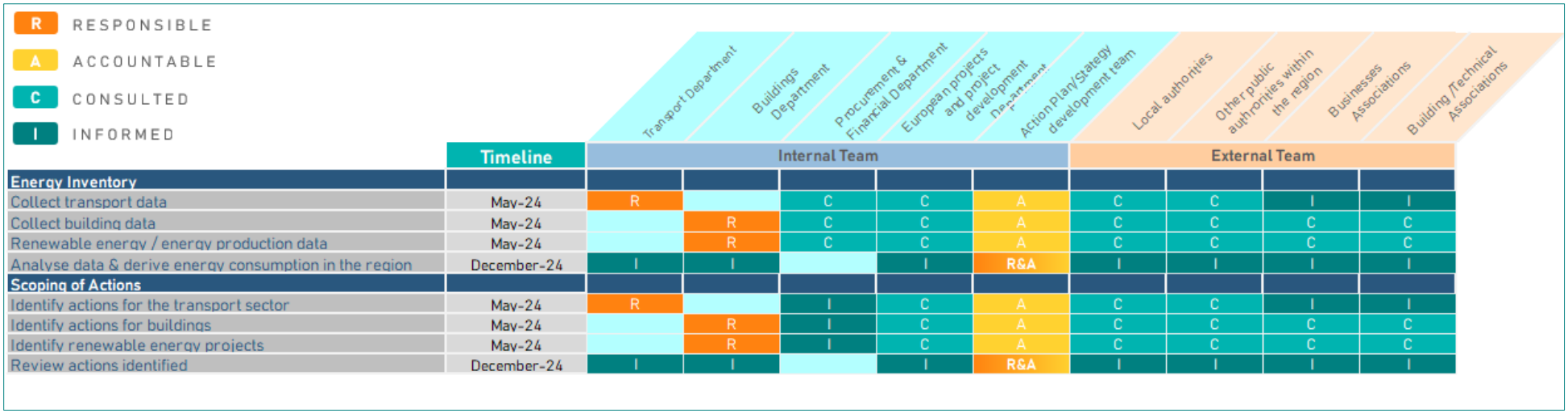
Step by step

To effectively utilize the Roles and Responsibilities matrix, start by listing all the tasks or activities relevant to the project or process along the left-hand column. Then, across the top row, list all team departments/team members/decision makers/stakeholders involved.

In each cell, using the drop-down menu, assign one of the four RACI roles: Responsible (the person or role responsible for completing the task), Accountable (the person who has ultimate ownership and decision-making authority), Consulted (those who need to provide input or expertise), and Informed (those who need to be kept up to date on progress but aren't directly involved). A fifth option is given, i.e. "R&A", for people/teams that are both Responsible and Accountable.

Once the matrix is completed, clearly communicate assigned roles among team members. Regularly review and update the matrix as necessary to reflect any changes in roles or responsibilities throughout the project lifecycle.

Example



	Timeline	Internal Team					External Team			
		Transport Department	Buildings Department	Procurement & Financial Department	European projects and project development Department	Action Plan/Stategy development team	Local authorities	Other public authorities within the region	Businesses Associations	Building /Technical Associations
Energy Inventory										
Collect transport data	May-24	R		C	C	A	C	C	I	I
Collect building data	May-24		R	C	C	A	C	C	C	C
Renewable energy / energy production data	May-24		R	C	C	A	C	C	C	C
Analyse data & derive energy consumption in the region	December-24	I	I		I	R&A	I	I	I	I
Scoping of Actions										
Identify actions for the transport sector	May-24	R		I	C	A	C	C	I	I
Identify actions for buildings	May-24		R	I	C	A	C	C	C	C
Identify renewable energy projects	May-24		R	I	C	A	C	C	C	C
Review actions identified	December-24	I	I		I	R&A	I	I	I	I

Stakeholder Identification and Analysis Tool

Relevant to Stage: 2

Introduction

This template can help planners systematically identify and analyse key stakeholders within the regional energy planning process. The template can be used to collate stakeholder names, roles, interests, relevance, influence, and potential impact in the energy transition. This tool can support planners in better understanding and engaging stakeholders.

How does this tool fit into the REGIO1st Planning Framework?

The Stakeholder Identification and Analysis tool is an integral part of Stage 2 in the REGIO1st Planning Framework. It helps ensure that the regional energy strategy accounts for the diverse interests and influences among stakeholders, promoting a balanced and inclusive approach to planning.

User instructions

Objective

The tool provides a structured approach designed to help planners identify and analyze key stakeholders for the regional energy plan. It helps categorize stakeholders by influence and interest, and provides tailored recommendations for engagement.

How should a planner use the tool?

Begin by filling out the Stakeholder Identification table (A_StakeholderIdentification) with details of all potential stakeholders.

Next, use the Stakeholder Analysis table (B_StakeholderAnalysis) to rate their influence and interest.

Based on these inputs, the table will then also provide tailored engagement recommendations. Finally, based on this analysis, three key recommendations are generated (C_Recommendations).

How should a planner interpret the Influence and Interest ratings?

Both Influence and Interest are rated on a scale of 1-5. Influence refers to the stakeholder's ability to affect the project's outcomes, while Interest refers to how concerned the stakeholder is with the project's outcomes. A high rating indicates a high level of influence or interest.

What if the stakeholder's influence or interest changes over time?

The tool is designed to be dynamic. As the project evolves and stakeholders' positions change, the planner can update the Influence and Interest ratings, which will automatically generate updated engagement recommendations.

What should a planner do with the engagement recommendations?

The engagement recommendations are meant to guide planners' approach for each stakeholder. Recommendations aim to help planners identify key stakeholders to focus on, suggest engagement strategies, and propose mitigation measures to manage risks associated with each stakeholder. However, the tool's recommendations should be considered in the context of each unique project circumstances and stakeholder dynamics.

What is the significance of the data currently entered in the example sheet of the tool?

The information in the example sheet is hypothetical/dummy data, intended to show how the tool works and what kind of information should be entered. It is strongly recommended that planners do not use this dummy data and instead use actual, relevant information for their region. This ensures that the analysis and recommendations provided by the tool will be specific and beneficial to each planners' particular context and stakeholder landscape.

Step by step

Stakeholder Identification

To input data into the tool, begin by thoroughly identifying all potential/identified stakeholders. This involves considering individuals, groups, or organizations that may be impacted by the project or hold sway over its results. Utilize the provided fields to document each stakeholder's information systematically. A unique Stakeholder ID is assigned for easy reference, followed by the Stakeholder name, specifying the Type of stakeholder. Include Contact information to facilitate communication and collaboration. Define their Role in the project, delineating responsibilities, and contributions. Additionally, categorize stakeholders by Sector, by choosing one of the drop-down list given by the tool. Utilize the Notes section to capture any pertinent details or insights regarding each stakeholder. This comprehensive approach ensures that all stakeholders are accounted for and effectively engaged throughout the project lifecycle.

A.2. Stakeholder list

Start by identifying all relevant stakeholders for your project. Think about all the individuals, groups, or organizations that could be affected by your project or could influence its outcome. A hypothetical list of stakeholders has been provided as an example.

Stakeholder ID	Stakeholder name	Type of stakeholder	Contact information	Role in project	Sector	Notes
S1						
S2						
S3						
S4						
S5						
S6						
S7						
S8						
S9						
S10						
S11						
S12						

Stakeholder Analysis

In the Columns of "Step 2" of the tool, it is essential to estimate the influence and interest levels of stakeholders and keep relevant notes.

Assign a rating from 1 to 5 for both influence and interest by filling in the respective cell, considering factors such as stakeholders decision-making power and level of engagement in the energy planning process.

Then, in the Columns of "Step 3", the tool generates tailored recommendations based on these assessments. These recommendations include indications on the stakeholder's influence and interest levels. Additionally, the tool provides strategies for engaging with stakeholders, specifying appropriate communication methods and potential risks associated with each stakeholder. Mitigation measures are also outlined to address and minimize these risks effectively, ensuring smooth stakeholder management throughout the project.

B. Stakeholder analysis

REGIO1ST

Step 1: The tool gathers the stakeholders defined in *A_StakeholderIdentification*		**Step 2:** Estimate their influence and interest.			**Step 3:** The tool provides tailored recommendations.			
Stakeholder ID	Stakeholder name	Influence (1-5)	Interest (1-5)	Notes	Engagement strategy	Communication method	Potential risks	Mitigation measures
S1	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S2	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S3	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S4	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S5	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S6	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S7	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S8	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S9	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S10	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S11	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S12	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S13	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S14	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S15	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S16	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S17	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S18	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S19	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y
S20	0				#Δ/Y	#Δ/Y	#Δ/Y	#Δ/Y

Recommendations

Finally, based on this analysis, you can find three key recommendations, generated and presented in (C_Recommendations) sheet. Based on the input of the tool, this output table will then also provide tailored engagement recommendations.

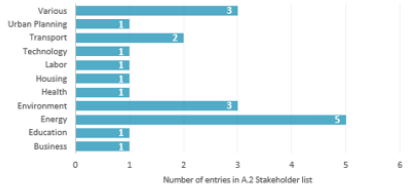
Example

The Stakeholder Identification part (A_StakeholderIdentification)

A. Stakeholder identification

REGIO1ST

A.1. Number of stakeholders by sector



A.2. Stakeholder list

Start by identifying all relevant stakeholders for your project. Think about all the individuals, groups, or organizations that could be affected by your project or could influence its outcome. A hypothetical list of stakeholders has been provided as an example.

Stakeholder ID	Stakeholder name	Type of stakeholder	Contact information	Role in project	Sector	Notes
S1	Regional Energy Board	Government Agency	123 Main St, 555-555-5555	Overseeing regulatory compliance, providing guidelines	Energy	Holds regular public meetings
S2	City of Newville	Local Government	321 Elm St, 555-555-5556	Implementing energy policies, providing local data	Various	Key partner in terms of implementation
S3	Green Future NGO	Non-Governmental Organization	info@greenfuture.org	Advocate for renewables, providing environmental impact analysis	Environment	Well-connected with local communities
S4	Newville University	Research Institution	789 Oak St, 555-555-5557	Conducting related research, student involvement in projects	Various	Potential for academic collaborations
S5	Clear Energy Corp.	Private Company	159 Maple St, 555-555-5558	Providing potential technology solutions, consulting on technical feasibility	Energy	Involved in similar projects previously
S6	United Workers Union	Labor Union	union@workers.org	Representing workers' interests, ensuring fair labor practices	Labor	Strong voice for worker rights
S7	Local Community Council	Local Community	communitycouncil@newville.org	Representing local community interests, feedback on local acceptance	Various	Useful for public engagement activities
S8	Regional Environment Agency	Government Agency	852 Pine St, 555-555-5559	Overseeing environmental impacts, providing environmental data	Environment	-
S9	River Energy Co.	Private Company	riverenergy@company.com	Energy production, consulting on energy generation possibilities	Energy	-

The Stakeholder Analysis part (B_StakeholderAnalysis)

B. Stakeholder analysis

REGI01ST

Step 1: The tool gathers the stakeholders defined in *A_StakeholderIdentification*		**Step 2:** Estimate their influence and interest.					**Step 3:** The tool provides tailored recommendations.			
Stakeholder ID	**Stakeholder name**	**Influence (1-5)**		**Interest (1-5)**		**Notes**	**Engagement strategy**	**Communication method**	**Potential risks**	**Mitigation measures**
S1	Regional Energy Board	5		1		High influence due to regulatory oversight; High interest because of sector relevance	Moderate Engagement	Regular Meetings	Active opposition, potential project delay	Collaborative problem-solving
S2	City of Newville	5		3		High influence as it oversees local policy; Interest varies depending on the project	High Priority Engagement	Frequent Direct Contact	Risk of project termination	Formation of advisory committee
S3	Green Future NGO	3		5		Influence varies; High interest as they advocate for environmental protection	High Priority Engagement	Frequent Direct Contact	Risk of project termination	Formation of advisory committee
S4	Newville University	2		5		Moderate influence with good research backing; High interest for research opportunities	Strong Engagement	Regular Direct Contact	Severe opposition, potential regulatory complications	Joint decision-making
S5	Clear Energy Corp.	4		4		High influence and interest due to their direct involvement in the energy sector	High Priority Engagement	Frequent Direct Contact	Risk of project termination	Formation of advisory committee
S6	United Workers Union	3		2		Moderate influence representing worker rights; Interest depends on labor considerations in projects	Informal Consultation	Occasional Meetings	Potential public protest	Seek regular feedback
S7	Local Community Council	4		3		High influence in local community acceptance; Interest depends on project impact	Strong Engagement	Regular Direct Contact	Severe opposition, potential regulatory complications	Joint decision-making
S8	Regional Environment Agency	4		5		High influence due to environmental oversight; High interest because of sector relevance	Primary Stakeholder	Personalized Communication	High risk of project failure	Stakeholder inclusion in project leadership
S9	River Energy Co.	4		4		High influence and interest due to their direct involvement in the energy sector	High Priority Engagement	Frequent Direct Contact	Risk of project termination	Formation of advisory committee
S10	Global Green Tech	2		3		Moderate influence due to international footprint; High interest in technology advancement	Informal Consultation	Occasional Meetings	Potential public protest	Seek regular feedback
S11	National Transport Authority	5		3		High influence as they oversee transport policy; Interest depends on transport-related considerations	High Priority Engagement	Frequent Direct Contact	Risk of project termination	Formation of advisory committee
S12	Public Health Service	3		2		Moderate influence as public health advisers; Interest depends on health considerations in projects	Informal Consultation	Occasional Meetings	Potential public protest	Seek regular feedback
S13	State Housing Department	4		3		High influence in housing policy; Interest depends on housing-related considerations	Strong Engagement	Regular Direct Contact	Severe opposition, potential regulatory complications	Joint decision-making
S14	Newville Chamber of Commerce	3		3		Moderate influence representing business interests; Interest depends on business impact of the project	Moderate Engagement	Regular Meetings	Active opposition, potential project delay	Collaborative problem-solving
S15	Citizens for Clean Energy	2		5		Moderate influence, but high interest in environmental sustainability	Strong Engagement	Regular Direct Contact	Severe opposition, potential regulatory complications	Joint decision-making
S16	Newville Grid Operator	5		5		High influence and interest as they maintain the local grid	Key Strategic Partner	Individual Briefings and Updates	Project termination, potential legal implications	Stakeholder becomes part of strategic decision-making
S17	Transport for Newville	5		3		High influence as they oversee local transport policy; Interest depends on transport-related considerations	High Priority Engagement	Frequent Direct Contact	Risk of project termination	Formation of advisory committee
S18	National Energy Regulator	5		4		High influence due to regulatory oversight; High interest because of sector relevance	Primary Stakeholder	Personalized Communication	High risk of project failure	Stakeholder inclusion in project leadership
S19	Regional Planning Committee	4		3		High influence in urban planning aspects; Interest depends on how the energy plan integrates with urban development	Strong Engagement	Regular Direct Contact	Severe opposition, potential regulatory complications	Joint decision-making
S20	Local Schools and Universities	2		3		Moderate influence with potential to educate future generations; Interest varies depending on	Informal Consultation	Occasional Meetings	Potential public protest	Seek regular feedback

The recommendations part (C_Recommendations)

C. Key recommendations for stakeholder engagement

- Regularly consult with City of Newville and Green Future NGO, ensuring their high interest and influence are reflected in the project direction.
- Despite their low interest, it is crucial to engage Regional Energy Board and Newville University due to their high influence. Show them how this project aligns with their objectives.
- Though United Workers Union and Global Green Tech may lack influence, their high interest can help garner wider public support for the project.

Stakeholder engagement plan Template

Relevant to Stage:2

Introduction

This template can guide planners in developing a comprehensive stakeholder engagement plan that outlines the objectives, methods, timelines, and resources required for engaging stakeholders throughout the planning process. The template can incorporate stakeholder analysis, and the development of communication strategies, engagement activities, and evaluation measures, ensuring that stakeholder engagement efforts are well-planned and effective. The outcomes from the Stakeholder Identification and Analysis Tool (Step 2.1) can feed into parts of this template as well.

User instructions

Objective

This template outlines the essential parts of a successful stakeholder engagement plan, including the objectives, motivations, and strategies for engaging with key stakeholders. It aims to help regional/local authorities, energy agencies, and individual planners navigate the intricate landscape of stakeholder engagement. It includes all essential steps for effectively engaging stakeholders, such as mapping stakeholders and monitoring progress. The template is designed to be complementary to the Stakeholder Identification and Analysis Tool, provided within the REGIO1st Planning Framework, so the latter can be used to inform parts of this plan.

Content

The proposed stakeholder engagement plan comprises of six key chapters that include all the needed ingredients to provide the essential path and considerations that will enable you to identify, understand, and engage with the diverse groups and individuals who have a vested interest in your project. By following a structured approach, you will be better equipped to build meaningful relationships, manage expectations, and navigate potential challenges that may arise during the course of implementing the EE1st principle in your energy planning:

Introduction

The introduction sets the context and purpose of the plan.

Chapter 1: Objectives of the stakeholder engagement plan

Chapter 1 elaborates on the objectives of the engagement plan, delineating its overarching goals and desired outcomes.

Chapter 2: Stakeholders mapping and analysis

Chapter 2 delves into stakeholder mapping and analysis, identifying key stakeholders and assessing their interests and influence.

Chapter 3: Involvement of each stakeholder

Chapter 3 outlines the potential involvement of each stakeholder, specifying their roles and responsibilities.

Chapter 4: Engagement tools/channels

Chapter 4 defines the engagement tools and channels to be utilized for effectively communicating and interacting with stakeholders.

Chapter 5: Schedule of related events

Chapter 5 presents a schedule of related events, detailing when and how engagement activities will take place.

Chapter 6: Monitoring

Chapter 6 focuses on monitoring, providing mechanisms for tracking and evaluating the success of the engagement plan over time, ensuring its adaptability and responsiveness to changing stakeholder dynamics and needs.

Annex: Templates

- Event agenda
- Events disclaimers
- Event report
- Stakeholder Feedback survey

National and Regional Targets Mapping Template

Relevant to Stage: 3

Introduction

The National and Regional Targets Mapping template serves as a tool aimed at assisting regional authorities in refining their objectives within Energy and Climate regional planning. This is achieved through a comparative analysis that helps align new/existing regional targets with those included in EU, national, and local strategies, directives, and laws.

User instructions

Objective

The purpose of this template is to assist users map EU, national, regional and local energy and climate targets with a particular focus on energy efficiency. Given that local/regional authorities need to define their own targets in their regional/local energy plans, this template adopts a multi-level approach for mapping and comparing energy and climate targets at different levels to facilitate the decision-making process.

Description

The National and Regional Targets Mapping template is a structured tool designed to support regional authorities define their targets in energy and climate planning, ensuring that these are in line with the targets set in EU, national and local strategies/directives/laws.

It offers an analytical template that guides the user to effectively map all the relevant targets set at different governance levels. As a result, it enables the user to identify whether the regional targets deviate from targets set at different governance levels and helps redefine these when needed.

How do planners use this tool?

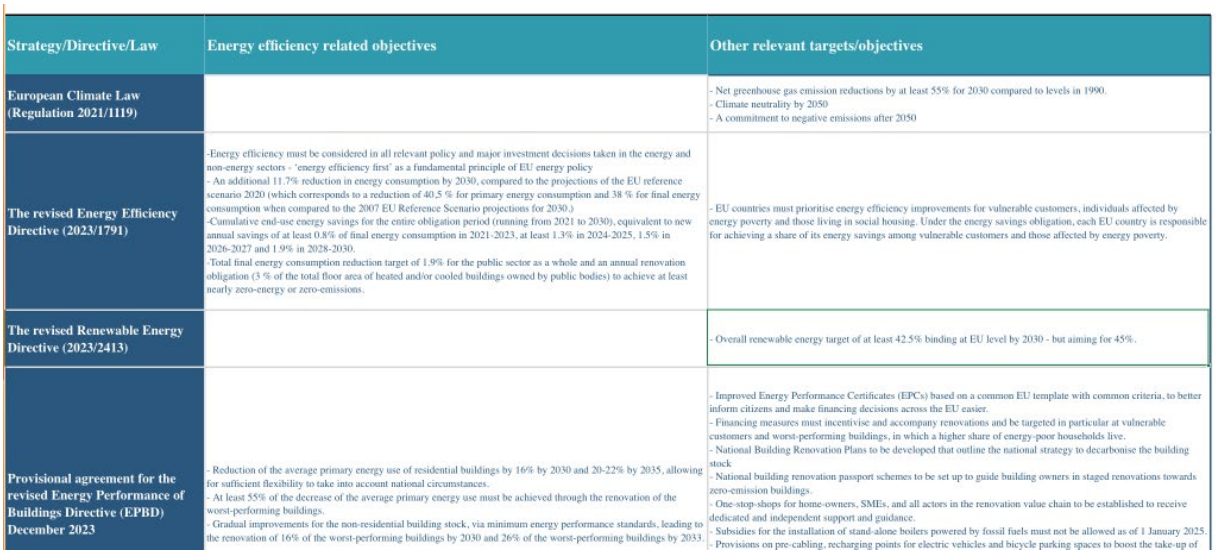
EU targets	This tab includes relevant Strategies/ Directives/Laws that set targets on energy efficiency. Users can update/supplement this tab when deemed appropriate.
Regional and other targets	The user fills in this tab to map relevant plans/strategies at national, regional and local level and outline sustainable energy targets set in each.

Example	This tab presents an example of mapping relevant plans and strategies.

Step by step

EU targets

This tab summarises key elements of EU Strategies, Directives, and Regulations, with particular emphasis on energy efficiency related objectives and targets. By meticulously cataloging these legislative measures and strategic initiatives, stakeholders gain a comprehensive understanding of the relevant regulatory landscape, with the aim to facilitate informed decision-making. Users are not expected to provide any input in this tab, other than updating the EU mapping if needed.



Strategy/Directive/Law	Energy efficiency related objectives	Other relevant targets/objectives
European Climate Law (Regulation 2021/1119)		- Net greenhouse gas emission reductions by at least 55% for 2030 compared to levels in 1990. - Climate neutrality by 2050 - A commitment to negative emissions after 2050
The revised Energy Efficiency Directive (2023/1791)	-Energy efficiency must be considered in all relevant policy and major investment decisions taken in the energy and non-energy sectors - 'energy efficiency first' as a fundamental principle of EU energy policy - An additional 11.7% reduction in energy consumption by 2030, compared to the projections of the EU reference scenario 2020 (which corresponds to a reduction of 40,5 % for primary energy consumption and 38 % for final energy consumption when compared to the 2007 EU Reference Scenario projections for 2030.) -Cumulative end-use energy savings for the entire obligation period (running from 2021 to 2030), equivalent to new annual savings of at least 0.8% of final energy consumption in 2021-2023, at least 1.3% in 2024-2025, 1.5% in 2026-2027 and 1.9% in 2028-2030. -Total final energy consumption reduction target of 1.9% for the public sector as a whole and an annual renovation obligation (3 % of the total floor area of heated and/or cooled buildings owned by public bodies) to achieve at least nearly zero-energy or zero-emissions.	- EU countries must prioritise energy efficiency improvements for vulnerable customers, individuals affected by energy poverty and those living in social housing. Under the energy savings obligation, each EU country is responsible for achieving a share of its energy savings among vulnerable customers and those affected by energy poverty.
The revised Renewable Energy Directive (2023/2413)		- Overall renewable energy target of at least 42.5% binding at EU level by 2030 - but aiming for 45%.
Provisional agreement for the revised Energy Performance of Buildings Directive (EPBD) December 2023	- Reduction of the average primary energy use of residential buildings by 16% by 2030 and 20-22% by 2035, allowing for sufficient flexibility to take into account national circumstances. - At least 55% of the decrease of the average primary energy use must be achieved through the renovation of the worst-performing buildings. - Gradual improvements for the non-residential building stock, via minimum energy performance standards, leading to the renovation of 16% of the worst-performing buildings by 2030 and 26% of the worst-performing buildings by 2033.	- Improved Energy Performance Certificates (EPCs) based on a common EU template with common criteria, to better inform citizens and make financing decisions across the EU easier. - Financing measures must incentivise and accompany renovations and be targeted in particular at vulnerable customers and worst-performing buildings, in which a higher share of energy-poor households live. - National Building Renovation Plans to be developed that outline the national strategy to decarbonise the building stock - National building renovation passport schemes to be set up to guide building owners in staged renovations towards zero-emission buildings. - One-stop-shops for home-owners, SMEs, and all actors in the renovation value chain to be established to receive dedicated and independent support and guidance. - Subsidies for the installation of stand-alone boilers powered by fossil fuels must not be allowed as of 1 January 2025. - Provisions on pre-cabling, recharging points for electric vehicles and bicycle parking spaces to boost the take-up of

Regional and other targets

Regional authorities and planners are tasked with reviewing national, regional and local legislation, plans and strategies, and summarizing key information in this tab. By clicking on the light blue cells a drop-down menu will appear for planners to identify the level of governance for which an obligation arises for each strategy/plan included. Additionally, planners should identify key points and objectives of each strategy/plan and fill in the cells highlighted in orange.

Country		#Choose your country using the drop-down menu
Region		# Name your region

Strategy/plan	Level for which targets are set			Targets/objectives		
	National	Regional	Local	Energy efficiency	Renewable energy	Other
National Energy and Climate Plan (NECP)						
…… Other National/regional/local plans on energy efficiency/climate adaptation/waste management etc. ……						
…… Other ……						

Example

Regional and other targets

Country	Greece	#Choose your country using the drop-down menu
Region	Attica	# Name your region

Strategy/plan	Level for which targets are set			Targets/objectives		
	National	Regional	Local	Energy efficiency	Renewable energy	Other
Law no. 4936/2022/Government Gazette 105 A/27.5.2022: "National Climate Law - Transition to climate neutrality and adaptation to climate change, urgent provisions to address the energy crisis and protect the environment".	Compulsory	Compulsory	Compulsory			-Greenhouse gas emission reductions of 55% by 2030 and 80% by 2040 compared to 1990 levels. - Compulsary Regional Climate Change Adaptation Plans. - Compulsary Municipal Emission Reduction Plans that set emission reduction targets of 10% by 2024 and 30% by 2030, compared to 2019. - Reduction of emissions of 80% by 2030 in relation to the year 2019 in non-interconnected islands. - Reduction of emissions from facilities out of the scope of the European Emissions Trading System (ETS) by 30% at least, until 2030 in relation to 2019
Law no. 4843/Government Gazette 193/A/20.10.2021, regarding the incorporation of Directive (EU) 2018/2002 (Energy Efficiency Directive) on energy efficiency	Compulsory	Compulsory	Compulsory	-Annual renovation of 3% of the total area of central public buildings. - Compulsary Energy Performance Plans for regional and municipal buildings		
Revised National Energy and Climate Plan (NECP) - October 2023	Compulsory	Not applicable	Not applicable	- Final consumption of energy in 2030 at the level of 2021 - Reduction in final consumption in 2030 by about 15 % compared to 2021 in the buildings sector	- 44% Renewable energy as a share of total gross energy consumption for 2030	- Greenhouse gas emission reductions of 54% by 2030 compared to 1990 levels (57% with LULUCF). - Energy poverty reduction of 50% by 2035 and 75% by 2030

Participatory Priorities Ranking Tool

Relevant to Stage: 3

Introduction

This tool can facilitate planners rank priorities using a collaborative process. It provides a systematic approach for gathering inputs and perspectives from a diverse group of stakeholders, such as community members, experts, or decision-makers, and collectively determining the relative importance/urgency of different options/ measures. By actively involving stakeholders, a more inclusive and representative prioritization process is ensured, ultimately leading to more effective and sustainable outcomes.

User instructions

Objective

The purpose of this tool is to assist users in selecting and prioritizing Energy and Climate Priorities at the regional level. Given that involving all relevant parts, including authorities, planners, stakeholders, and society, is vital for creating a meaningful plan, the tool incorporates features that facilitate collaborative decision-making regarding regional priorities.

Description

The Participatory Priorities Ranking (PPR) tool is a structured tool designed to support regional authorities define their priorities in energy and climate policy, through a participatory approach by engaging stakeholders in the decision-making process.

It offers a transparent framework that guides users through the process of selecting, evaluating and ranking priorities. This structured approach encourages open communication, fosters a sense of ownership and buy-in from all stakeholders, and promotes a shared understanding of regional planning.

Through their active involvement, stakeholders can collaboratively weigh the significance of each priority, considering various factors such as EU & National policies, social acceptance and other regional strategies. By enabling the consideration of diverse perspectives and expertise, the tool ensures a robust evaluation and ranking of priorities, leading to informed and well-balanced decisions that address the collective needs and aspirations of stakeholders.

As a result, the final ranking of priorities is not only comprehensive and accurate but also enjoys broad-based support, enhancing the likelihood of successfully implementing the respective actions that emerge. This participatory approach fosters a culture of

collaboration, cooperation, and shared responsibility, which is vital for addressing complex challenges, such as climate change, and achieving long-term positive impacts.

Methodology

The PPR tool follows the methodology outlined below to extract, evaluate and rank regional priorities:

1. Regions and their planners should select up to 7 priorities (relevant to their energy and climate planning).
2. Regions and their planners should define evaluation criteria and their respective importance to assess selected priorities.
3. Regions, planners, stakeholders and society should evaluate each priority, using the selected criteria.
4. The PPR algorithm calculates the final priorities ranking.

Scientific base

To rank the priorities, an algorithm has been used that is based on the Weighted Sum Method (WSM). This decision-making multicriteria method is used when there are multiple alternatives and the most favorable one has to be selected against multiple criteria. WSM was chosen amongst several other similar approaches, such as the Weighted Product Method (WPM), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), and VIKOR, for its simplicity, robustness, user-friendliness and relevance to the objectives of regional energy planning.

How do planners use this tool?

Tool_PPR	The "Tool_PPR" sheet should be used for using the tool. In this sheet, there are 4 consecutive steps that need to be followed in order to rank priorities: Step 1 - Select Priorities Step 2 - Define the Importance of the Evaluation Criteria Step 3 - Evaluate Priorities Step 4 - Rank Priorities Users are expected to provide input in Steps 1,2 and 3, while step 4 presents the results of the ranking algorithm. Users should provide input for orange cells only, using the drop-down menu. Detailed instructions are given in each Step, to guide the user step-by-step throughout the process.

Example	The "Example" sheet presents an example of running the tool for a simulated regional planning process.

Step by step

Step 1 – Select priorities

To begin, the regional authority and planners should select priorities for the regional energy and climate plan. This involves completing Table 1. By clicking on cells 1 to 7 a dropdown menu appears that includes indicative priorities. Users should select one priority per cell from the provided options. Alternatively, users have the flexibility to define their own priorities by typing them at the end of " Table 2. List of indicative priorities" or by deleting one of the current priorities and replacing it with a new one. It is important to note that users should only provide input in the orange cells.

Table 1. Priorities selection

Priorities selection
Energy Efficiency
Climate Adaptation
Regional and Local Development
Just Transition
Smart Cities Transition

**Users should fill in orange cells only*

Table 2. List of indicative priorities

List of indicative priorities
Energy Efficiency
Climate Adaptation
Regional and Local Development
Economic Growth
Energy Independence
Technological Innovation
Protection of Environment, Biodiversity and Land Uses
Changing peoples Energy Habits
Energy Poverty Alleviation
Smart Cities Transition
Renewable Energy production
Just Transition
Deep Renovation of buildings / nZEBs
Decarbonization of Heating

Step 2 – Define the Importance of the Evaluation Criteria

Subsequently, the importance of the evaluation criteria needs to be determined, so that priorities in regional/local energy planning can be ranked. Begin by assigning the importance scores to each preselected criterion in Table 3. The algorithm will calculate the weight of each criterion based on the input provided.

More specifically, to assign a score to each of the four criteria listed, choose the desired score from the drop-down list provided in orange cells. The importance scale ranges from "Very Low" to "Very High" linguistically.

Table 3. Criteria's importance

Criteria to rank Regional Priorities	Select Importance (Very low to very high)	Weight
National and EU policies relevance		<< Please select importance
Regional strategy relevance		<< Please select importance
Stakeholders' satisfaction		<< Please select importance
Social acceptance		<< Please select importance

Very low
Low
Medium
High
Very high

**Users should fill in the orange cells only*

Step 3 - Evaluate Priorities

This step is anticipated to be executed using a participatory approach involving all stakeholders and citizens in the planning process. Each priority selected by the planning team, must be evaluated based on the designated criteria.

- For every priority, the Regional/Local authority and the planning team assesses its alignment with the National & EU policies (1st criterion) and the Regional broader strategy (2nd criterion).
- The stakeholders evaluate each priority's relevance to their respective needs by assigning a score to the "Stakeholders' satisfaction" criterion (3rd criterion).
- The broader society, represented through NGOs, civil groups, and other stakeholders, assigns a score to each priority's relevance to their needs, utilizing the "Social acceptance" criterion (4th criterion).

In order to input a score per criterion, the matrix per criterion should be used, where the number of votes per preference needs to be filled in the orange shaded cells. The evaluation scale is linguistic, and ranges from "Very Low" to "Very High". Each column represents one alternative scenario.

Table 4. Priorities evaluation

Evaluator:	Question	Score	Number of votes for each score per priority						
Regional/local authority & planners	How relevant is each priority to National and EU policies?	Very Low							
		Low							
		Medium	2		2				
		High	2		1				
		Very high	3	7	4				
Regional/local authority & planners	How relevant is each priority to your regional strategy?	Very Low							
		Low	2	1					
		Medium		3					
		High	10						
		Very high	3	11					
Stakeholders	How important do you consider each priority?	Very Low							
		Low							
		Medium							
		High							
		Very high							
Citizens	How important do you consider each priority?	Very Low							
		Low							
		Medium							
		High							
		Very high							

The number of votes per preference per criterion can be collected using a participatory method/tool, to foster engagement and inclusivity. Online survey platforms enable the online collection of votes and opinions, while voting and polling apps facilitate real-time feedback during meetings or events. Crowdsourcing platforms and social media polls on platforms broaden participation by reaching diverse audiences. Additionally, interactive traditional town hall and focus group meetings provide opportunities for face-to-face dialogues and voting, where participants can share insights during facilitated discussions. These methods/tools collectively ensure that stakeholders' opinions and votes are effectively gathered and considered in decision-making.

Note: If a consensus-based scoring is preferable, then the matrix should be completed using only one vote.

The planning team (regional authority/energy office) must be proactive and facilitate the participatory process. More on participatory policy design can be found at the EU Competence Centre on Participatory and Deliberative Democracy.

Step 4 - Rank Priorities

In this tab of the tool, the final Priorities Ranking is presented in a bar chart.

Example

Step 1 – Select priorities

Table 1. Priorities selection

Priorities selection
Energy Efficiency
Climate Adaptation
Regional and Local Development
Just Transition
Smart Cities Transition

**Users should fill in orange cells only*

Table 2. List of indicative priorities

List of indicative priorities
Energy Efficiency
Climate Adaptation
Regional and Local Development
Economic Growth
Energy Independence
Technological Innovation
Protection of Environment, Biodiversity and Land Uses
Changing peoples Energy Habits
Energy Poverty Alleviation
Smart Cities Transition
Renewable Energy production
Just Transition
Deep Renovation of buildings / nZEBs

Step 2 – Define the Importance of the Evaluation Criteria

Table 3. Criteria's importance

Criteria to rank Regional Priorities	Select Importance (Very low to very high)	Weight
National and EU policies relevance	High	22%
Regional strategy relevance	Very high	28%
Stakeholders' satisfaction	High	22%
Social acceptance	Very high	28%

**Users fill in orange cells only*

Step 3 – Evaluate Priorities

Table 4. Priorities evaluation

Evaluator:	Question	Score	No of votes on each score per priority						
			Energy Efficiency	Climate Adaptation	Regional and Local Development	Just Transition	Smart Cities Transition		
Regional authority & planners	How relevant is each priority to National and EU policies?	Very Low	0	0	0	0	0		
		Low	0	0	0	0	0		
		Medium	0	0	0	1	10		
		High	5	5	11	10	4		
		Very high	10	10	4	4	1		
			Energy Efficiency	Climate Adaptation	Regional and Local Development	Just Transition	Smart Cities Transition		
Regional authority & planners	How relevant is each priority to your regional strategy?	Very Low	0	0	0	1	0		
		Low	0	0	0	9	10		
		Medium	1	5	0	5	3		
		High	12	10	0	0	2		
		Very high	2	0	15	0	0		
			Energy Efficiency	Climate Adaptation	Regional and Local Development	Just Transition	Smart Cities Transition		
Stakeholders	How important do you consider each priority?	Very Low	4	5	0	0	0		
		Low	1	9	0	0	0		
		Medium	25	21	10	30	5		
		High	5	10	5	11	35		
		Very high	10	0	30	4	5		
			Energy Efficiency	Climate Adaptation	Regional and Local Development	Just Transition	Smart Cities Transition		
Citizens	How important do you consider each priority?	Very Low	50	20	0	50	190		
		Low	50	80	0	100	600		
		Medium	100	800	100	50	50		
		High	200	100	250	300	250		
		Very high	700	100	750	600	10		

Step 4 – Rank Priorities

Energy Inventory Data Collection Template

Relevant to Stage: 4

Introduction

This Excel template can help planners systematically collect and organize relevant energy data, such as energy production and consumption, as well as key infrastructure information (e.g. existing renewable energy production capacity). It can also act as a checklist that helps planners identify key sectors and energy sources to collect data for.

User instructions

Objective

This tool aims to support users identify the data that are needed in regional energy planning, both from the supply and the demand side, as well as facilitate the implementation of the Efficiency First (EE1st) Principle.

Description

Accurate and comprehensive data are essential for developing a baseline energy inventory, understanding the current regional energy system and setting realistic targets in the regional energy plan. The data collection template helps the user identify and collect the data required to build an energy inventory, both from the supply and demand side, in order to analyse the current situation and plan future actions in line with the Energy Efficiency First (EE1st) principle. Moreover, this template includes an advanced inventory template that can be used to collect other relevant data that can help estimate and support different elements of the energy inventory, as well as a notepad to help users take notes on the data gathering process.

How do planners use this tool?

Energy Demand Inventory	This tab follows the format of the Covenant of Mayors energy inventory, and it is designed to help regional/local authorities gather and report energy data. In particular, the energy consumed in the territory per fuel type and consumption category.
Energy Supply Inventory	This tab is designed to help regional/local authorities gather and report energy data. In particular, the energy produced per fuel type and production technology.

Advanced Inventory	This tab aims to guide regional/local authorities acquire a better understanding of the regional energy system, by collecting and processing different types of relevant data that can be used to estimate and support different elements of the energy inventory both for demand and supply side. Not all data categories apply on demand/supply categories. So, please search for the data indicated with x per category.	
Notepad	In this tab planners can add comments/notes on the data gathering process.	

Where to search for the data?

Data sources may include regional and national statistical institutes/offices, utilities, industry reports, and research institutions. Key data sources at an EU level include amogst others:

- Eurostat: Eurostat provides detailed statistics on energy consumption and production in EU countries, including data on renewable energy sources, energy efficiency, and greenhouse gas emissions. Their databases offer insights into energy balances, energy prices, and indicators that are crucial for developing a sustainable energy action plan.
- European Environment Agency (EEA): The EEA offers extensive data on energy consumption, production, and efficiency, as well as greenhouse gas emissions and climate change data. Their reports and datasets can help in understanding the environmental impacts of energy systems and inform the development of sustainable energy policies at the regional level.
- EU Open Data Portal: The EU Open Data Portal aggregates datasets from various EU institutions, agencies, and bodies, including energy statistics, energy efficiency data, and information on renewable energy sources at the regional level. This resource can provide a wealth of data for comprehensive energy planning.
- International Energy Agency (IEA) – Country and Regional Data: While focusing on a global perspective, the IEA publishes detailed country and regional statistics on energy production, consumption, investment, and efficiency.
- Hotmaps: Hotmaps is a free online software that supports local, regional, and national heating and cooling planning processes. It allows for the mapping of heating and cooling demand, efficiency, and supply in Europe and can be a crucial tool for Covenant of Mayors' signatories.

- European Network of Transmission System Operators for Electricity (ENTSO-E): ENTSO-E offers comprehensive data on electricity transmission and system operations across Europe, including network development plans, electricity market reports, and transparency platform data crucial for understanding regional electricity dynamics.
- European Network of Transmission System Operators for Gas (ENTSOG): ENTSOG provides insights into the European gas market, including network development plans, capacity maps, and operational data. This information is vital for regions considering gas in their energy mix or transition plans.
- Covenant of Mayors – Europe Office: Not just a commitment platform but also a source of guidance, best practices, and data shared by experts and cities across Europe. Exploring the actions and plans of municipalities, especially the ones within the territory of the region, can give information and validated approaches to energy planning.

Step by step

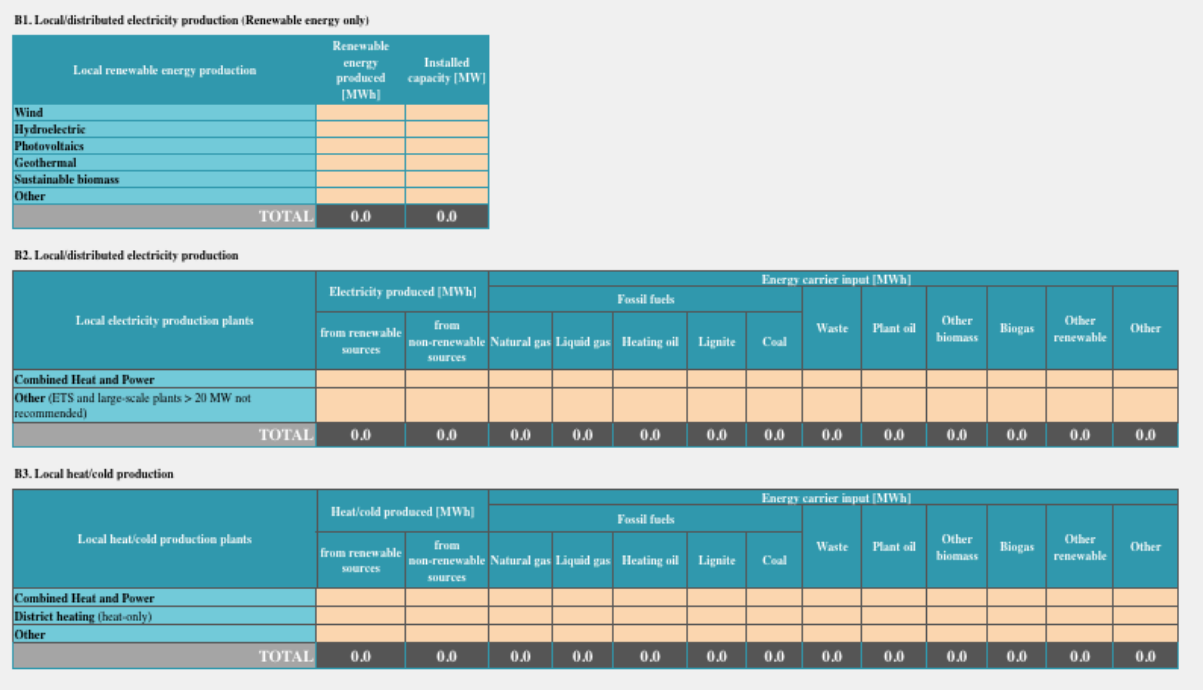
Energy Consumption Inventory

When using this tool, planners should fill in final energy consumption data for the territory in the Energy Consumption Inventory tab. The information should be entered per sector and fuel type, in MWh.

Sector		FINAL ENERGY CONSUMPTION [MWh]												
				Fossil fuels						Renewable energy				
		Electricity	District heating and cooling	Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Other fossil fuels	Biogas	Biofuel	Other biomass	Solar thermal	Geothermal
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES														
Regional/Municipal buildings, equipment/facilities		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Regional/Municipal buildings, equipment/facilities													
	Public lighting													
	Other													
Tertiary buildings, equipment/facilities		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Commercial buildings													
	Other													
Residential buildings		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Private dwellings													
Industry		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Non-ETS													
	ETS (not recommended)													
Subtotal		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRANSPORT														
Regional/ Municipal fleet		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Road													
	Other													
Public transport		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Road													
	Rail													
	Local and domestic waterways													
	Other													
Private and commercial transport		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Road													
	Rail													
	Local and domestic waterways													
	Other													
Subtotal		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER														
Agriculture, Forestry, Fisheries														
Other not allocated														
Subtotal		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Energy Supply Inventory

The **Energy Supply Inventory** tab pertains to energy production categorized by fuel type and production technology. This instruction aligns with the and is aligned to the CoM format. Planners can input data on energy production per fuel type and technology used. This comprehensive approach facilitates the effective analysis of the current situation and informs policies and strategies regarding energy production.



B1. Local/distributed electricity production (Renewable energy only)

Local renewable energy production	Renewable energy produced [MWh]	Installed capacity [MW]
Wind		
Hydroelectric		
Photovoltaics		
Geothermal		
Sustainable biomass		
Other		
TOTAL	0.0	0.0

B2. Local/distributed electricity production

Local electricity production plants	Electricity produced [MWh]		Energy carrier input [MWh]										
			Fossil fuels					Waste	Plant oil	Other biomass	Biogas	Other renewable	Other
	from renewable sources	from non-renewable sources	Natural gas	Liquid gas	Heating oil	Lignite	Coal						
Combined Heat and Power													
Other (ETS and large-scale plants > 20 MW not recommended)													
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

B3. Local heat/cold production

Local heat/cold production plants	Heat/cold produced [MWh]		Energy carrier input [MWh]										
			Fossil fuels					Waste	Plant oil	Other biomass	Biogas	Other renewable	Other
	from renewable sources	from non-renewable sources	Natural gas	Liquid gas	Heating oil	Lignite	Coal						
Combined Heat and Power													
District heating (heat-only)													
Other													
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Advanced Inventory

The **Advanced Inventory** tab serves as a guide for regional or local authorities to gain a deeper understanding of their regional energy system. Utilizing the matrices provided, planners are able to identify different types of data to search for that can help them better understand the current situation and develop an energy inventory using alternative type of data.

Useful type of data to search for per sector are indicated with an "X"

A. Buildings data

BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES		Total Number	Total Floor area	Renovation status	Type of heating system	Use of renewable energy systems	Building type	Construction/ installation date	Energy class/rating
Public buildings, equipment/facilities									
	Public lighting	x		x				x	
	Public buildings	x	x	x	x	x	x	x	x
	Public facilities	x	(x)	x	(x)	x	x	(x)	x
Tertiary buildings, equipment/facilities									
	Commercial buildings	x	x	x	x	x	x	x	x
	Other	x	x	x	x	x	x	x	x
Residential buildings		x	x	x	x	x	x	x	x
Industry	Non-ETS	x				x			x

B. Transport data

TRANSPORT		Number, type, class of vehicles	Number of vehicles per vehicle type	Number of vehicles per fuel type	Number of passengers per journey type	Mileage per vehicle type	Length of lines/roads/ routes
Regional/Municipal fleet							
	Road	x	x	x		x	x
	Other	x		x			
Public transport							
	Road	x	x	x	x	x	x
	Rail	x			x	x	x
	Other	(x)	(x)	(x)	(x)	(x)	(x)
Private and commercial transport							
	Road	x	x	x	x	x	x
	Rail	x			x	x	x
	Bikelanes	x			x	x	x
	Other	x				x	x
Transport not allocated							

C. Other data

OTHER	Number, type, class of machinery	Number of machinery per fuel type	Machinery consumption per hectares of land	Other
Agriculture, Forestry, Fisheries	x	x	x	x
Other not allocated	(x)	(x)	(x)	(x)

Relevant data related to energy production

Local renewable energy installations	Number of plants	Installed capacity	Energy generated	Age of plants
Wind	x	x	x	x
Hydroelectric	x	x	x	x
Photovoltaics	x	x	x	x
Geothermal	x	x	x	x
Sustainable Biomass	x	x	x	x
Other	x	x	x	x

Local electricity production plants	Number of plants	Installed capacity	Energy generated	Age classes
Combined Heat and Power	x	x	x	x
Other (ETS and large-scale plants > 20 MW not recommended)	(x)	(x)	(x)	(x)

Local heat/cold production plants	Number of plants	Installed capacity	Energy generated	Age classes
Combined Heat and Power	x	x	x	x
District heating (heat-only)	x	x	x	x
Other	(x)	(x)	(x)	(x)

Power/electricity networks	Network length	Network distribution hubs (eg. electricity transformers)	Number of consumers connected	Age classes
Electricity	x	x	x	x
Natural Gas	x	x	x	x

Energy Storage facilities	Type	Number	Capacity	Age classes
Electricity	x	x	x	x
Natural Gas	x	x	x	x
Other	x	x	x	x

Notepad

Finally, the **Notepad** is provided so that planners can note down your comments/notes on the data gathering process and quality, and most importantly reference the data sources used for transparency

Data to get collected		Sources of data	Calculation notes	Data collection difficulties	Other notes
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES					
Regional/Municipal buildings, equipment/facilities					
	Regional/Municipal buildings, equipment/facilities				
	Public lighting				
	Other				
Private buildings, equipment/facilities					
	Commercial buildings				
	Residential buildings				
	Other				
Industry	Non-ETS				
Buildings, equipment/facilities and industries not allocated					
TRANSPORT					
Regional/Municipal fleet					
	Road				
	Other				
Public transport					
	Road				
	Rail				
	Other				
Private and commercial transport					
	Road				
	Rail				
	Bikelanes				
	Other				
Transport not allocated					
OTHER					
Agriculture, Forestry, Fisheries					
Other not allocated					
POWER/ELECTRICITY NETWORKS					
Electricity					
Natural Gas					

Technology Catalogue Tool

Relevant to Stage: 5

Introduction

The Technology Catalogue Tool can help planners assess the potential of various supply-side and demand-side solutions in their region, by providing indicative information on renewable energy sources, regional energy generation solutions, as well as end-use energy efficiency solutions for different sectors.

User instructions

Objective

The tool **Technology Catalogue** aims to provide a list of efficiency measures or technologies on both demand and supply sides, together with available sources about their impacts and costs, to support regional planners to develop regional energy transition plans in line with their climate and energy objectives, and the EE1st principle.

Description

The catalogue can help planners understand the cost-effectiveness of various energy technologies and solutions, including average costs (capital, operational and maintenance costs, etc.), efficiencies and emission intensities for the supply side, as well as potential energy and cost savings for energy efficiency solutions. As such, the tool allows planners to select and compare different energy technologies and solutions based on the region's specific needs and objectives.

From the perspective of regional planners, this tool considers the measures and technologies related to the two main situations when the EE1st principle is relevant for system planning and investment decision-making:

First, for **heating transition planning**, the possible actions of regional planners include,

- on the supply side, invest in the district heating (DH) system:
  - construct a new DH system,
  - expand the capacity of an existing DH system,
  - replace the boilers/heat pumps in the existing DH system.
- on the demand side, provide incentives for (1) building owners to reduce their heating demand through building renovations, and (2) industrial companies to adopt higher-efficiency technologies.

Second, for power system planning (incl. power generation or transmission/distribution network planning), the possible actions of regional planners include,

- on the supply side, invest in the power generation technologies or the network,
- on the demand side, provide incentives for end-users to (1) replace their existing appliances with higher-efficiency products, and (2) invest in the technologies that can improve the demand-side flexibility.

Following the spirit of the EE1st principle, this tool aims to provide useful resources about measures/technology options on both the demand and supply sides, to support the planning under the two main situations.

How do planners use this tool?

Supply-side Technologies (Appendix 01)

For the supply-side technologies, the Danish Technology Catalogue provides detailed and comprehensive list and data of options. The Danish Technology Catalogue is published by the Danish Energy Agency and provides information about technology, economy and environment for a number of energy installations.

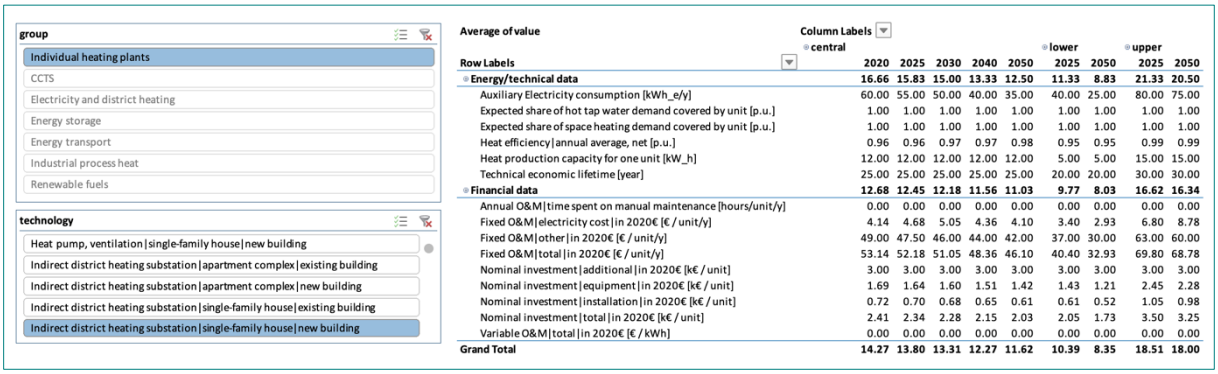
The following technology categories are covered:

1) Generation of electricity and district heating
2) Individual heating plants
3) Renewable fuels
4) Carbon capture, transport, and storage
5) Energy storage
6) Industrial process heat
7) Transport of energy
8) Commercial freight and passenger transport

For each technology, data of multiple aspects are provided, including energy/technical parameters, financial parameters, environmental parameters, etc. The projection of the parameters, as well as their uncertainty, are also provided for years 2020, 2030, and 2050. The Table below is an example table of the "indirect district heating substation for new single-family house" in the catalogue.

Technology	Indirect district heating substation - single-family house - new building										
year	2020	2025	2030	2040	2050	2025	2025	2050	2050	Note	Ref
est	ctrl	ctrl	ctrl	ctrl	ctrl	lower	upper	lower	upper	-	-
cat par											
Energy/technical data											
Heat production capacity for one unit [kW_h]	12	12	12	12	12	5	15	5	15	H	
Expected share of space heating demand covered by unit [p.u.]	1	1	1	1	1	1	1	1	1		
Expected share of hot tap water demand covered by unit [p.u.]	1	1	1	1	1	1	1	1	1		
Heat efficiency (annual average, net) [p.u.]	0.96	0.96	0.97	0.97	0.98	0.95	0.99	0.95	0.99	B, I	9
Auxiliary Electricity consumption [kWh_e/y]	60	55	50	40	35	40	80	25	75	G	
Technical economic lifetime [years]	25	25	25	25	25	20	30	20	30		8
Electric regulation ability											
Primary regulation (per 30 seconds) [p.u.]											
Secondary regulation (per minute) [p.u.]											
Minimum load (of full load) [p.u.]											
Warm start-up time [hours]											
Cold start-up time [hours]											
Environment											
SO_2 [g/GJ_i]											
PM2.5 [g/GJ_i]											
NO_x [g/GJ_i]											
CH4 [g/GJ_i]											
N2O [g/GJ_i]											
Financial data											
Nominal investment (*total) [k€/unit, 2020]	2.41	2.34	2.28	2.15	2.03	2.05	3.50	1.73	3.25	F	10
Nominal investment (equipment) [k€/unit, 2020]	1.69	1.64	1.60	1.51	1.42	1.43	2.45	1.21	2.28		
Nominal investment (installation) [k€/unit, 2020]	0.72	0.70	0.68	0.65	0.61	0.61	1.05	0.52	0.98		
Nominal investment (additional) [k€/unit, 2020]	3	3	3	3	3	3	3	3	3	C, E	
Variable O&M (*total) [€/kWh, 2020]	0	0	0	0	0	0.0	0.0	0.0	0.0		
Fixed O&M (*total) [€/unit/y, 2020]	53	52	51	48	46	40	70	33	69	D, F	8
Fixed O&M (electricity cost) [€/unit/y, 2020]	4.1	4.7	5.1	4.4	4.1	3.4	6.8	2.9	8.8		
Fixed O&M (other) [€/unit/y, 2020]	49.0	47.5	46.0	44.0	42.0	37.0	63.0	30.0	60.0		
Annual O&M (time spent on manual maintenance) [hours/unit/y]	0	0	0	0	0	0	0	0	0		
Technology specific data											

For ease of use of data, this tool has compiled (downloaded in April 2023) for all technologies in all eight categories (Appendix 1), so users can easily explore the whole dataset. Below, an example of "indirect district heating substation for new single-family house" in Appendix 1 is presented.



Average of value	Column Labels	central					lower		upper	
Row Labels		2020	2025	2030	2040	2050	2025	2050	2025	2050
Energy/technical data		**16.66**	**15.83**	**15.00**	**13.33**	**12.50**	**11.33**	**8.83**	**21.33**	**20.50**
Auxiliary Electricity consumption [kWh_e/y]		60.00	55.00	50.00	40.00	35.00	40.00	25.00	80.00	75.00
Expected share of hot tap water demand covered by unit [p.u.]		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Expected share of space heating demand covered by unit [p.u.]		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heat efficiency|annual average, net [p.u.]		0.96	0.96	0.97	0.97	0.98	0.95	0.95	0.99	0.99
Heat production capacity for one unit [kW_h]		12.00	12.00	12.00	12.00	12.00	5.00	5.00	15.00	15.00
Technical economic lifetime [year]		25.00	25.00	25.00	25.00	25.00	20.00	20.00	30.00	30.00
Financial data		**12.68**	**12.45**	**12.18**	**11.56**	**11.03**	**9.77**	**8.03**	**16.62**	**16.34**
Annual O&M|time spent on manual maintenance [hours/unit/y]		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fixed O&M|electricity cost|in 2020€ [€ / unit/y]		4.14	4.68	5.05	4.36	4.10	3.40	2.93	6.80	8.78
Fixed O&M|other|in 2020€ [€ / unit/y]		49.00	47.50	46.00	44.00	42.00	37.00	30.00	63.00	60.00
Fixed O&M|total|in 2020€ [€ / unit/y]		53.14	52.18	51.05	48.36	46.10	40.40	32.93	69.80	68.78
Nominal investment|additional|in 2020€ [k€ / unit]		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Nominal investment|equipment|in 2020€ [k€ / unit]		1.69	1.64	1.60	1.51	1.42	1.43	1.21	2.45	2.28
Nominal investment|installation|in 2020€ [k€ / unit]		0.72	0.70	0.68	0.65	0.61	0.61	0.52	1.05	0.98
Nominal investment|total|in 2020€ [k€ / unit]		2.41	2.34	2.28	2.15	2.03	2.05	1.73	3.50	3.25
Variable O&M|total|in 2020€ [€ / kWh]		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grand Total		**14.27**	**13.80**	**13.31**	**12.27**	**11.62**	**10.39**	**8.35**	**18.51**	**18.00**

However, when focusing on a few specific technologies, it is recommended that the online catalogue is used (accessible on the website) as this is frequently being updated.

Demand-side Efficiency Measures (Appendix 02)

For the demand-side efficiency measures, the sources below are recommended.

EU Reference Scenario 2020 technology assumptions

For the demand-side efficiency measures, there are technology assumptions used in the EU Reference Scenario 2020, provided by E3 Modelling[2] as parameters in the energy system model PRIMES. The data is provided as Appendix 2[3].

In this dataset, the efficiency measures are categorized into three sheets:

- Appliances: the investment cost and efficiency index of the end-uses in the residential and tertiary sectors.
- Building Renovation: energy saving effect and investment cost of building renovation measures in different depths and regions in Europe.
- Industry: the investment cost and efficiency index of the end-uses in the industrial sectors.

As the input data of the large energy system model PRIMES, the technology parameters are estimated at a relatively aggregate level. Although, this is a limitation for regional energy planning, planners can compare the relative cost and benefit between different technologies. Taking the industrial end-use "Motors large scale" as an example, the investment cost and efficiency index is estimated for different efficiency levels: in the year of 2030, the most efficient option would cost 245 EUR/kW but with an efficiency index 1.13.

© E3-Modelling														
	Investment cost EUR/kW - the figures include learning by doing - kW measures plant's capacity in energy terms for the ordinary technology - the ratio kW per ton of output product (not shown in the table) differs by sector and by process type							Energy Efficiency Index (equal to 1 in 2015) - includes learning by doing - measured as useful output per energy input - the useful output is measured in physical units or a physical production proxy - an increase implies higher efficiency						
	Current	2030			Ultimate			Current	2030			Ultimate		
Technology		From		To	From		To		From		To	From		To
Horizontal processes														
Motors large scale	91	82	105	245	73	80	191	1.00	1.01	1.07	1.13	1.01	1.15	1.22
Motors midsize	114	102	232	588	91	179	330	1.00	1.02	1.06	1.13	1.03	1.15	1.21
Motors small	143	129	362	988	114	235	375	1.00	1.03	1.07	1.11	1.05	1.15	1.20
Cooling refrigeration	155	139	320	510	124	294	445	1.00	1.05	1.13	1.15	1.09	1.27	1.34
Lighting	220	201	454	545	120	128	145	1.00	1.16	1.30	1.34	1.26	1.39	1.49
Air ventilation	215	193	254	350	172	198	279	1.00	1.09	1.26	1.35	1.15	1.44	1.66
Heating (low temperature)	135	121	278	578	118	194	440	1.00	1.07	1.18	1.30	1.15	1.29	1.43

[2] E3-Modelling is a consulting company, established in Greece, providing consulting services based on the large-scale empirical modelling of the economy-energy-environment nexus: PRIMES, GEM-E3 and Prometheus.

[3] In Appendix 2, only the part related to "demand-side efficiency measures" are selected from the PRIMES technology assumptions. The full dataset is available on the website by clicking the "technology assumptions" under the section "Main outputs".

De-risking Energy Efficiency Platform (DEEP)

DEEP (https://deep.ec.europa.eu/) is an open-source database for energy efficiency investments performance monitoring and benchmarking, which provides anonymized historical data of investment cases in the building and industry sectors. All the data points are structured along major project characteristics (geography, energy efficiency measures, verification status, industry / type of building, multiple benefits, etc.).

As shown in Figure 2 and Figure 3, the data points of efficiency investment cases in the building sector are plotted by "measure types", showing the variation of the payback time[4] and avoidance cost[5].

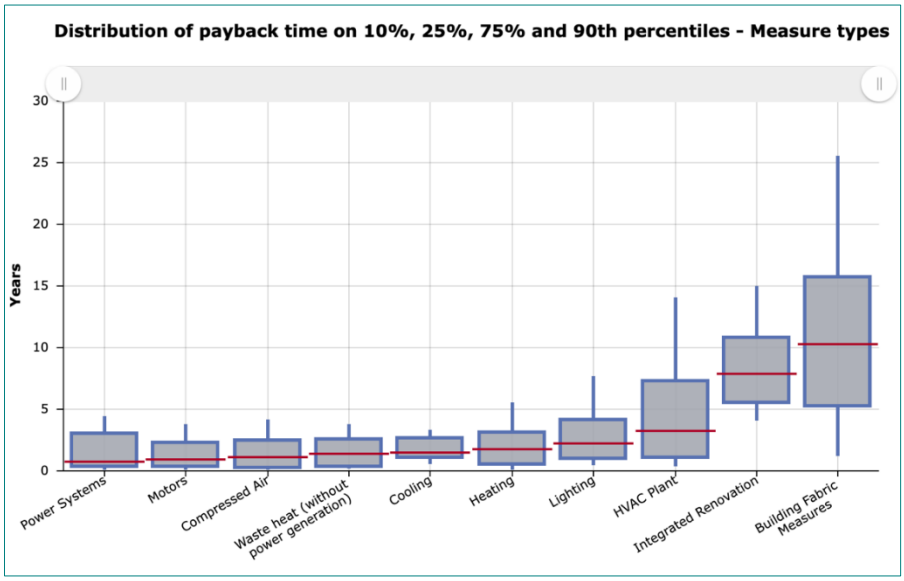


Figure 2 Payback time of investment cases in the building sector in DEEP

[4] In DEEP, the payback time is defined as the average (median) payback time (years required for the saving to pay for the investment without any interest costs).
[5] In DEEP the avoidance cost is defined as the average cost in Eurocent for each kWh energy saved over the lifetime of the measure.

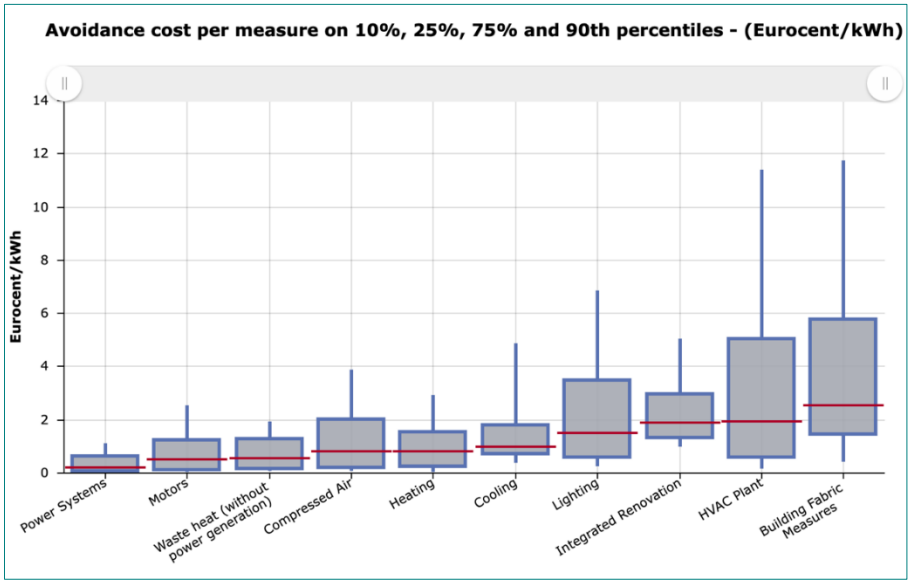


Figure 3 Avoidance cost of investment cases in the building sector in DEEP

Apart from the distribution as shown in Figure 2 and Figure 3, there are other functions, e.g., analysis toolbox, benchmark, etc. Users can find a set of guiding slides following this link.

The advantage of the DEEP database is that all the data points are from real investments with their payback time and avoidance cost calculated. However, for privacy reasons, the data is anonymized in two steps: (1) the data provider uploads individual data records with selected information; (2) the database aggregates projects, so users cannot identify the projects from the graphical and tabular presentation of data within the platform.

As a result, taking the "HVAC Plant" measure as example, the variation of payback time and avoidance can be still large, as shown in Figure 2 and Figure 3. Although this will limit the usefulness of such a tool for a specific investment case, for gaining an overview for regional energy planning, the DEEP database can still provide valuable information from real world cases.

EPREL – European Product Registry for Energy Labelling

EPREL is the database where the suppliers (manufacturers, importers or authorised representatives established in the EU) are obliged to register their products, as of 1 January 2019. In May 2022, the EPREL database was launched for public access and consultation. Consumers can find the database following this link.

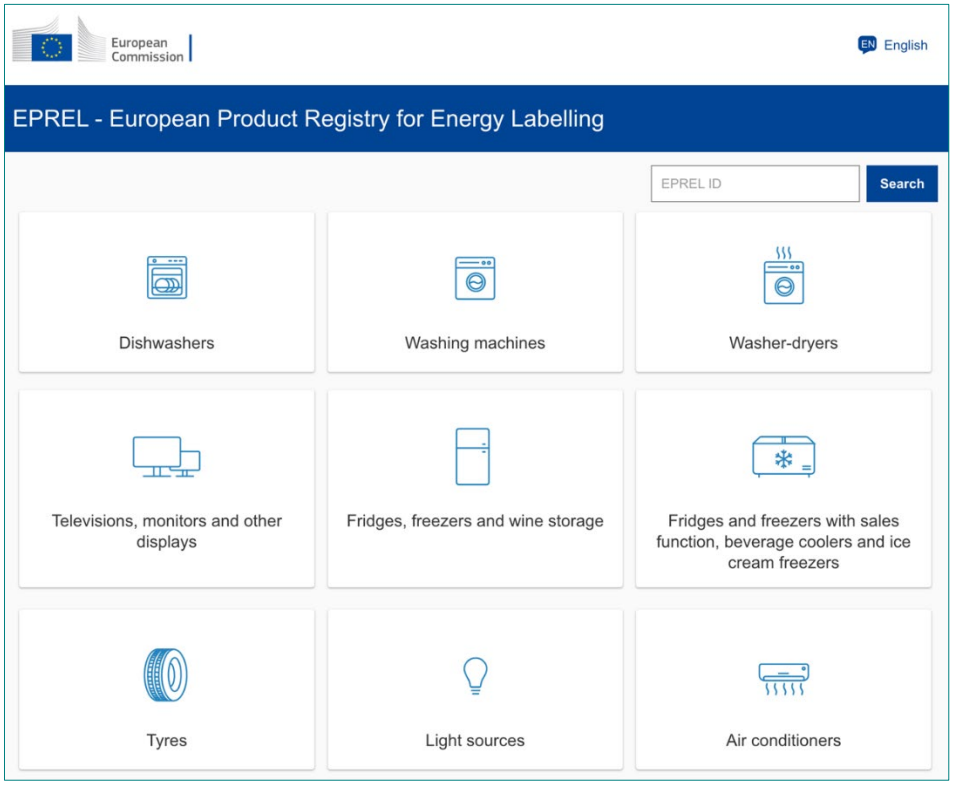


Figure 4 Home page of EPREL database

As shown in Figure 4, the EPREL database provides the registry information of products in different categories, 28 in total. In each category, consumers can find detailed product-specific information, e.g., possible water consumption, noise emission, extension of the warranty, availability of spare parts, etc. (see).

Washing machines

REGULATION (EU) 2019/2014 with regard to energy labelling of household washing machines and household washer-dryers

OFCASA

XPB30-1208A

General information

B (A ↑ G)

10 Kg

Overall dimensions	**462 (Height) x 448 (Width) x 550 (Depth)**	cm
Energy efficiency Index (EEI)	**46,5**	
Washing efficiency index	**1,12**	
Rinsing effectiveness	**5,0**	g/kg
Energy consumption [per cycle, eco 40-60 programme]	**0,026**	kWh
Weighted energy consumption [per 100 cycles, eco 40-60 programme]	**3**	kWh
Water consumption [per cycle, eco 40-60 programme]	**19**	litres
Maximum temperature inside the treated textile (Rated capacity)	**30**	°C
Maximum temperature inside the treated textile (Half)	**25**	°C
Maximum temperature inside the treated textile (Quarter)	**28**	°C
Weighted remaining moisture content	**58**	%
Spin speed (Rated capacity)	**333**	rpm
Spin speed (Half)	**301**	rpm
Spin speed (Quarter)	**312**	rpm
Spin-drying efficiency class	**B**	(A - G)
Programme duration (Rated capacity)	**0:05**	(h:min)
Programme duration (Half)	**0:05**	(h:min)
Programme duration (Quarter)	**0:05**	(h:min)
Type	**Free-standing**	
Airborne acoustical noise emissions (spinning phase)	**62**	dB(A) re 1 pW
Airborne acoustical noise emission class (spinning phase)	**B**	(A - G)
Off-mode	**0,00**	W
Standby mode	**0,40**	W
Delay start	**0,40**	W
Networked standby	**0,00**	W
Releases silver ions	**No**	
Minimum duration of the guarantee offered by the supplier	**12**	months
Additional information	**-**	

Weblink to the supplier's website

no

Download the label for printing

Download the label in high resolution formats

Only the PDF version is suitable for printing with the correct colour codes

Figure 5 Example of EPREL database: information of a washing machine (XPB30-1208A)

For regional energy system planners, especially when planning the investment in power generation or transmission/distribution network, it is important to consider the decline of electricity demand due to efficiency improvements. EPREL can provide detailed information supporting such energy demand forecasts if a survey regarding technology adoption by end-users is done in the region.

Cost-Benefit Analysis Tool

Relevant to Stage: 5

Introduction

The Cost-Benefit Analysis Tool facilitates planners in evaluating the costs, effectiveness, and, to some extent, the benefits of different energy solutions for their region, allowing the comparison and identification of options with the highest net benefits. By inputting key variables, the tool generates outputs enabling planners to assess and identify robust energy solutions for various scenarios.

User Instructions

Objective

Following the spirit of the Energy Efficiency First (EE1st) principle, this tool aims to shed light on the demand-side measures (i.e., building renovation) in regional heating planning by comparing

- Cost: the cost of building renovation for saving heating energy [EUR/kWh];
- Benefit: the saving of heat supply cost [EUR/kWh].

Based on this comparison, the tool aims to support the users to identify, for representative buildings, the extent of renovation and the heating technology to adopt. The tool also provides a "district heating system planning" page, based on which the users can calculate the cost of centralized heat supply given a specified mix of technologies.

Description

The Cost-Benefit Analysis Tool can help planners assess the costs, effectiveness and to an extent the benefits (e.g., energy cost savings) of different energy solutions for their region. This tool can enable planners compare various energy options and identify those that provide the greatest net benefits for the region. More specifically:

- The user inputs key variables, such as technology costs and energy prices.
- The tool produces outputs, including the costs, energy savings and energy cost savings of different energy solutions.

The tool can also help planners assess the sensitivity of the analysis, to uncertainties, by changing key inputs variables. This can help planners identify the most robust and resilient energy solutions under different circumstances.

What can this tool do?

- Calculate the renovation cost for representative buildings that are predefined based on the TABULA project.
- Calculate heat supply cost for four technologies.
- Explore the impact of different scenario assumptions on energy carrier and CO_2 emission prices.

What can this tool not do?

- Freely define a building and calculate its heating demand and renovation cost, for which we suggest the "tabula-calculator" tool provided by the TABULA project for advanced users.

Methodology

This tool uses a standard techno-economics method to calculate and compare the cost of demand-side efficiency measures (renovation) and heat supply for representative buildings from the TABULA database.

Tool 1_IndividualBuilding	This tab includes the calculations for individual representative buildings. It includes three parts: (1) Demand-side calculation (2) Supply-side calculation: heating technologies (3) Comparing demand- and supply-side options

(1) Demand-side calculation: building renovation packages

For the demand-side, three scenarios (two renovation packages) are considered:

- Base: No thermal retrofits are applied, representing a reference case where the EE1st principle is not deliberately considered.
- Usual (renovation package): Light retrofit packages are applied to roofs, windows, walls, and floors, resulting in effective energy savings and reduced need for heat supply.
- Advanced (renovation package): Deep retrofit packages, reflecting the best available options, are implemented to significantly improve building energy performance.

For each of the two renovation packages, the following are considered:

- The energy-saving impact [kWh/yr], which is calculated based on the data from the TABULA database.

- Total cost [EUR/yr], which is calculated at the level of roof, window, walls, and floors (Mandel et al, 2023). Adjustments to reflect the different investment and labour costs across countries are included.

Finally, the two above paramaters are divided to calculate the "levelized cost of energy saving [EUR/kWh]" for each building renovation package.

(2) Supply-side calculation: heating technologies

For the supply-side, four heating technologies are considered:

- Gas boiler
- Biomass boiler
- Air-source heat pump
- Ground-source heat pump

For each technology, the total cost [EUR/yr] is calculated considering the costs of initial investment, maintenance, energy consumption, and CO_2 emission.

To improve the calculations, the following is considered for each representative building:

- First, according to its annual heating demand and floor area, the buildings are mapped to the results of newTRENDs project, in which the heating demand of buildings are calculated at the hourly resolution by the INVERT/EE-Lab and FLEX model as described in Yu et al. (2022). Based on the mapping and modeling, the "heating system size" and "coefficient of performance (COP) of heat pumps" is defined.
- Second, the technology data are taken from the ePANACEA project [7], including the efficiency and the costs of maintenance, initial investment, and labor. Different criteria are implemented according to the size of the heating system. Adjustments to reflect the different investment and labor costs across countries are included.

Finally, the "levelized cost of heat supply [EUR/kWh]" is calculated for the four technologies, by dividing the total annualized cost [EUR/yr] with the annual heating demand of a representative building at the "Base" status [kWh/yr].

(3) Comparing demand- and supply-side options

To reveal the cost and benefit of renovation packages, a representative building is considered at "Base" status, which can be renovated to "Usual" or "Advanced" status. By comparing:

- the "levelized cost of energy saving [EUR/kWh]" of the two renovation packages
- the "levelized cost of heat supply [EUR/kWh]" of the heating technologies that are feasible for the building under consideration

the users can first identify the cheapest heating technology in the given scenario (assumptions of energy carriers and CO_2 emission prices), and then to which extent it is economically reasonable to renovate the building.

The tool also provides some financial indicators (payback time & internal rate of return) for the demand-side investment, given the configuration of heat supply.

Finally, this tool takes a societal perspective in the calculation, meaning that (1) taxes are not considered, including the tax on the investment of renovation packages and the heating technologies, as well as on the consumption of different energy carriers; (2) external costs are included, specifically, the cost of CO_2 emissions, including the emissions from electricity consumption, which is calculated based on the energy mix in the power systems in different countries.

Tool 2_DistrictHeating	In this tab, the tool calculates the supply cost of a district heating system, based on the assumptions on: - coverage of the district heating system in the building stock - percentages and parameters of different supply technologies in the mix - generic profiles of space heating and hot water demand (based on the Hotmaps project)

The second tool calculates the supply cost of a district heating system, based on the assumptions on:

- coverage of the district heating system in the building stock
- percentages and parameters of different supply technologies in the mix
- generic profiles of space heating and hot water demand (based on the Hotmaps project)

Finally, this tool also takes a societal perspective. By applying the standard techno-economics method, it calculates the levelized cost of centralized heat supply.

Step by step

Tool 1_IndividualBuilding

Step 1.1. In the tab "Input_RepresentativeBuildings", select the country of interest, in order to consider all the representative buildings that are available in the TABULA database.

Step 1.2. Copy one row from the table, incl. all the parameters of one representative building, and paste this in the table on top of the tab "Tool 1_BuildingCalculation".

Step 1.3. Fill in the parameters for calculating renovation costs.
Step 1.4. Read the results from the building renovation calculations.
Step 1.5. Fill in the parameters for calculating heating technology investment costs. The scenario assumptions on energy carrier and CO_2 emission costs can be adjusted in the tabs of "Data_EnergyPrice" and "Data_EmissionPrice".
Step 1.6. Obtain the results of heating technology investment.
Step 1.7. Select the demand- and supply-side configurations to calculate the financial indicators.
Step 1.8. Obtain the results of the financial indicators of the demand-side investment.

In this tool, there are mainly three color codes:

- The orange cells or tables, in which the user needs to fill in the parameters for the calculation;
- The blue cells or tables that are automatically filled in and contain intermediate results;
- The yellow tables that are the core results of the tool, i.e., the levelized costs of energy saving through building renovation and heat supply. The results are also visualized in two figures.

Tool 2_DistrictHeating

Step 2.1. On page "Input_RepresentativeBuildings", after selecting the country, define the building stock by assigning the number of representative buildings by renovation status.
Step 2.2. Define the coverage of the district heating system by renovation status
Step 2.3. Define the size of the district heating system and the parameters of the technology mix.
Step 2.4. Obtain the results on district heating system investment.

Multiple-Criteria Decision Analysis (MCDA) tool

Relevant to Stages: 6 and 7

Introduction

This tool serves as a valuable aid for energy planners by facilitating the prioritization of various energy options and ultimately supporting the decision-making process. The tool enables planners and stakeholders to derive aggregated scores and rankings, thus identifying the most feasible energy options for the region.

User instructions

Objective

The purpose of this tool is to enhance the decision-making process of regional and local energy and climate planning, by bringing together diverse perspectives and ensuring that decisions are based on a broad set of criteria/indicators. Given that involving all relevant parties, including public authorities, planners, stakeholders, and society, is vital for creating a meaningful plan, this tool incorporates features that facilitate collaborative decision-making.

Description

This tool (Multi-Criteria Decision Analysis Tool) is a structured tool designed to streamline the complex process of regional energy and climate planning. Given that involving all relevant parts, including authorities, planners, stakeholders, and society, is vital for creating a meaningful plan, the tool incorporates features that considers the results of the collaborative decision-making regarding regional priorities. In particular, it allows the selection of criteria and the assignment of weights to these criteria, encompassing dimensions such as environmental, social and economic sustainability. Stakeholders and/or planners can then assign evaluation scores to the selected criteria for each solution, whilst the tool also assists decision-makers in quantifying qualitative impacts when evaluating solutions. Subsequently, it calculates scores to provide a quantitative assessment of impacts, enabling more informed decision-making.

The tool empowers regions and their planners to make informed decisions by following a 5-step methodology. It provides a structured and efficient approach for regions and planners to extract, evaluate, and rank regional actions/investments, facilitating a data-driven, and impactful energy and climate planning process. This 5-step methodology enables the incorporation of views and priorities identified in the previous stages of the REGIO1ST Planning Framework by planners and stakeholders.

Methodology

The Regio1st MCDA tool considers the following methodology:

In order to extract, evaluate and rank regional activities, regions and their planners need to:

- Select up to 4 alternatives (investment options, scenarios of actions, stand-alone actions for energy and climate).
- Define the criteria to evaluate the selected alternatives, along with their respective importance and type of impact. There are four categories of criteria to consider: economic, environmental, societal and practical feasibility.
- Evaluate the practical feasibility of the alternative energy solutions.
- Assess the alternatives using the remaining criteria.
- Select the importance of each criteria category.

↳ **Final results:** The ranking is calculated by the MCDA algorithm and the results are presented.

How do planners use this tool?

Step 1 – Alternatives	In this tab, the user selects up to 4 alternatives to consider in their regional energy and climate plan. Users fill their input only in orange cells, using the drop-down menu.
Step 2 – Evaluation Criteria	The user selects up to 5 criteria per category (economy, environment, society, practical feasibility) for the evaluation of each alternative,as well as their importance and type of impact. Users fill their input only in orange cells, using the drop-down menu.
Step 3 – Practical feasibility assessment	The user evaluates the practical feasibility of each selected alternative. Users fill their input only in orange cells, using the drop-down menu. This part of the tool can be filled with the results of the Stage 6 activities.
Step 4 – Impacts quantification	In this tab, the user assesses the alternatives using the remaining criteria to enable the decision making algorithm run the calculations. Users fill their input only in orange cells. In case there are no quantifiable data for a criterion, the user can use the linguistic scale provided within the tab.
Step 5- MCDA	The user evaluates the significance of the four planning dimensions (economy, environment, society, practical feasibility) considered by the MCDA tool, using the drop-down menu.
Results	This tab presents the results of the ranking algorithm.

Scientific base

To rank the alternatives, the algorithm used is based on the TOPSIS method (Technique for Order of Preference by Similarity to Ideal Solution), one of the most used methods when dealing with complex decision making problems in the energy sector. TOPSIS is typically used when there are multiple alternatives and the most favorable one has to be chosen against multiple criteria. This method was chosen among other similar ones, such as the Weighted Product Method (WPM) and VIKOR, as it can handle the complexity of multi-criteria decision-making, and provide a systematic and quantitative approach to evaluate and rank alternative solutions.

Step by step

Step 1 - Alternatives

Regional authorities and planners are provided with the option to select up to four alternatives from a list of proposed solutions. In Table 1.1, planners can click on cells 1 to 4, and a drop-down menu containing suggested alternatives is available to assist the selection. If none of the listed alternatives are suitable, planners can define their own by typing at the end of "Table 1.2 List of proposed alternatives", or by replacing one of the existing alternatives with a new one. This approach ensures flexibility and customization, so that the tool is tailored to the unique needs and circumstances of each region.

Table 1.1 Alternative solution selection

	Alternatives
1	
2	
3	
4	

**Users should fill in the orange cells only*

Select alternative(s)

Table 1.2 Alternatives

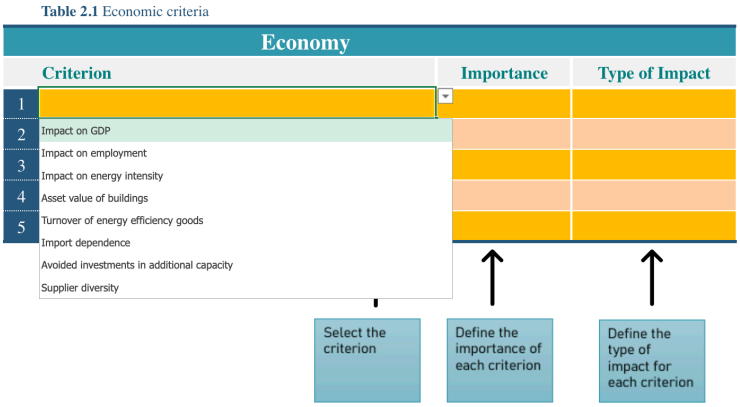
List of Alternatives
Renovations of residential buildings
New natural gas network
Air heat pumps in buildings
Biomass district heating
Transport (modal shift)
Transport (public transportation)
here you can add an alternative not included above
here you can add an alternative not included above

Step 2 - Evaluation Criteria

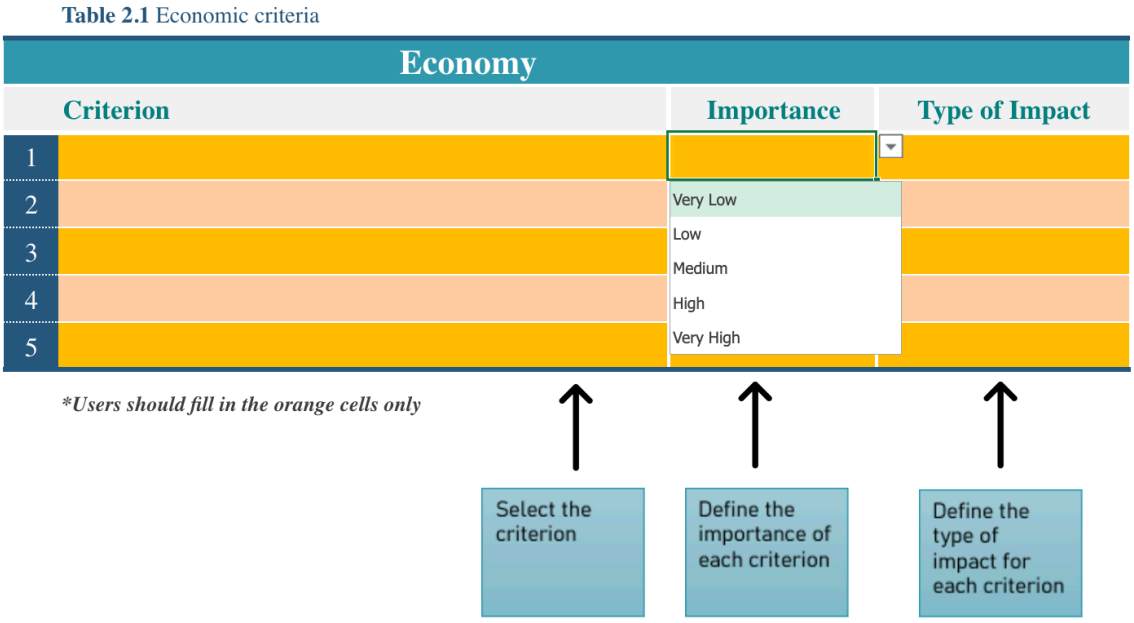
Regional authorities and planners are instructed to select up to five criteria per category (Economy, Environment, Society) and up to four criteria in the practical feasibility section for evaluating each alternative. They are provided with a list of indicators to aid the selection, ensuring that criteria are relevant, measurable, and independent while avoiding vagueness, subjectivity, or overlaps.

Therefore, users can click on cells 1 to 5, in tables 2.1, 2.2, 2.3 and cells 1 to 4 in table 2.4. A drop-drow menu appears with proposed indicators. Users can choose one

indicator per cell. Alternatively, users can define their own indicators by typing them in Lists 1, 2, 3 and 4.



Next, the importance of each criterion needs to be entered under the column "Importance".



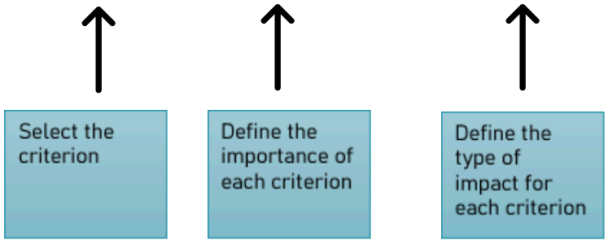
Finally, the type of impact for each criterion needs to be defined. i.e. The type of impact for the criterion Levelized Cost Of Energy (LCOE) is "The lower the better", so a lower LCOE is better than a higher LCOE.

Table 2.1 Economic criteria

Economy			
	Criterion	Importance	Type of Impact
1			
2			
3			
4			
5			

The higher, the better
The lower, the better

**Users should fill in the orange cells only*



The above 3 steps (select indicator, importance and type of impact) need to be done for each one of the four (4) categories: Economy (Table 2.1), Environment (Table 2.2), Society (Table 2.3) and Practical Feasibility (Table 2.4).

Step 3 - Practical feasibility assessment

Regional authorities and planners are now tasked with evaluating the practical feasibility of each alternative selected in Step 1. To accomplish this, they are provided with a matrix where they can assess the performance of each alternative according to predefined criteria using a linguistic scale.

Planners need to click on the orange cells within the matrix, where a drop-down menu is available for their assessment. This method ensures a systematic evaluation process, allowing decision-makers to make informed choices based on the feasibility of implementing each alternative within their region's supply chain context.

Table 3. Assessment of practical feasibility

	Alternatives			
Criteria				
1				
2				
3				
4				

Very Low
Low
Medium
High
Very High

Step 4 – Impacts quantification

In this tab, users are required to provide valuable input concerning the quantification of each criterion per alternative in Table 4.2. need to fill in their input exclusively in the orange cells provided. It is crucial to ensure that all necessary information is accurately provided to ensure the effectiveness of the decision-making process.

Table 4.2 Quantification Matrix

		Criterion	Unit	Alternatives			
Economic	1						
	2						
	3						
	4						
	5						
Environmental	6						
	7						
	8						
	9						
	10						
Societal	11						
	12						
	13						
	14						
	15						
Feasibility	16						
	17						
	18						
	19						

Quantify the indicator(s) for each one of the alternatives. If you cannot quantify this in absolute numbers you can use the linguistic scale proposed above

No action is needed - table filled in in Step 3

If it is not possible to quantify a criterion, users can rate it using a linguistic scale, as described in the tab below (Table 4.1).

In case you have chosen criteria that cannot be quantified in numerical terms, you can use a linguistic scale. In particular, assess the respective criterion using the linguistic scale presented in the table below and fill in the quantification matrix using its numerical equivalent. For instance, "5" should be used for an alternative that performs "very high" under a criterion. Please note intermediate values (e.g. 2.5) can also be used.

Table 4.1 Numerical representation of the linguistic scale

Indicators estimated performance (Linguistic)	Very Low	Low	Medium	High	Very High
Numerical representation	1	2	3	4	5

Step 5- Multiple Criteria Decision Analysis (MCDA)

To effectively utilize the MCDA (Multi-Criteria Decision Analysis) tool, users must understand the significance of the four planning categories: Economy, Environment, Society, and Practical Feasibility, in the decision-making process. These categories represent key aspects to consider when evaluating alternatives. When using the tool, users should focus on filling their input exclusively in the designated orange cells. Input should be provided using the drop-down menu, ensuring consistency and accuracy in the assessment process. This approach streamlines decision-making and promotes a comprehensive evaluation of alternatives across all relevant categories.

Table 5.1 Dimensions' importance

Dimensions	Importance (Very low to very high)
Economy	
Environment	
Society	
Practical feasibility	

After filling in the categories' importance, the decision matrix is finalised and presented in Table 5.2. Users are not requested to input any data in this table.

Table 5.2 Aggregated decision matrix

			Alternatives			
	Dimensions	Weights				
Economy		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
Environment		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
Society		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
Practical feasibility		#DIV/0!				
		#DIV/0!				
		#DIV/0!				
		#DIV/0!				

Results

This tab displays the outcomes of the ranking. It presents the results in Table 6, allowing users to easily interpret and analyze the rankings.

Furthermore, a visual representation of the results is given by a bar diagram, which presents the alternative's scores as calculated by the REGIO1st MCDA algorithm.

Example

Step 1 – Alternatives (investments/scenarios/actions)

Table 1.1 Alternative solution selection

	Alternatives
1	*Example 1- Residential Buildings Renovations*
2	*Example 2- New natural gas network*
3	*Example 3- Air Heat pumps in all buildings*
4	*Example 4- Biomass district heating*

Step 2 – Evaluation Criteria

Table 2.1 Economic criteria selection

Economy			
	Criterion	Importance	Type of Impact
1	*Employment effects*	*Very High*	*The higher, the better*
2	*Asset value of buildings*	*Medium*	*The higher, the better*
3	*Supplier diversity*	*Medium*	*The higher, the better*
4			
5			

Table 2.2 Environment criteria selection

Environment			
	Criterion	Importance	Type of Impact
1	*Fuel savings*	*Very High*	*The higher, the better*
2	*Reduction in air pollution*	*Low*	*The higher, the better*
3	*Reduction of additional capacities in grid*	*Very Low*	*The higher, the better*
4			
5			

Table 2.3 Societal criteria selection

Society			
	Criterion	Importance	Type of Impact
1	*Alleviation of energy poverty*	*High*	*The higher, the better*
2	*Avoided lost working days due to air pollution*	*Medium*	*The lower, the better*
3			
4			
5			

Table 2.4 Practical feasibility (supply chain readiness) criteria selection

Practical feasibility			
	Criterion	**Importance**	**Type of Impact**
1	*Availability of necessary equipment, materials, and services*	*Very High*	*The higher, the better*
2	*Degree of technological maturity and market readiness*	*Medium*	*The higher, the better*
3	*Workforce capacity*	*High*	*The higher, the better*
4	*Availability of skilled labour*	*Very High*	*The higher, the better*

Step 3 - Practical feasibility assessment

Table 3. Assessment of the practical feasibility criteria

		Alternatives			
	Criteria	Example 1- Residential Buildings Renovations	Example 2- New natural gas network	Example 3- Air Heat pumps in all buildings	Example 4- Biomass district heating
1	*Availability of necessary equipment, materials, and services*	*Very High*	*Very High*	*Very High*	*Medium*
2	*Degree of technological maturity and market readiness*	*Very High*	*Very High*	*Very High*	*Low*
3	*Workforce capacity*	*High*	*High*	*High*	*Low*
4	*Availability of skilled labour*	*High*	*Medium*	*High*	*Medium*

Step 4 - Impacts' quantification

Table 4.2 Quantification Matrix

				Alternatives			
		Criterion	**Unit**	Example 1- Residential Buildings Renovations	Example 2- New natural gas network	Example 3- Air Heat pumps in all buildings	Example 4- Biomass district heating
Economic	1	*Employment effects*	*Number of fulltime jobs*	*1,500.00*	*400.00*	*200.00*	*500.00*
	2	*Asset value of buildings*	*% increase*	*25.00*	*5.00*	*10.00*	*20.00*
	3	*Supplier diversity*	*Linguistic*	*5.00*	*1.00*	*5.00*	*1.00*
	4						
	5						
Environmental	6	*Fuel savings*	*MWh*	*1,500.00*	*200.00*	*1,000.00*	*100.00*
	7	*Reduction in air pollution*	*tn CO2*	*1,000.00*	*150.00*	*250.00*	*70.00*
	8	*Reduction of additional capacities in grid*	*Linguistic*	*4.00*	*3.00*	*1.00*	*4.00*
	9						
	10						
Societal	11	*Alleviation of energy poverty*	*Linguistic*	*5.00*	*1.00*	*3.00*	*3.00*
	12	*Avoided lost working days due to air pollution*	*Number of days*	*300.00*	*270.00*	*250.00*	*280.00*
	13						
	14						
	15						
Supply chain	16	*Availability of necessary equipment, materials, and services*	*Linguistic*	*5*	*5*	*5*	*3*
	17	*Degree of technological maturity and market readiness*	*Linguistic*	*5*	*5*	*5*	*2*
	18	*Workforce capacity*	*Linguistic*	*4*	*4*	*4*	*2*
	19	*Availability of skilled labour*	*Linguistic*	*4*	*3*	*4*	*3*

Step 5 – MCDA's priorities selection

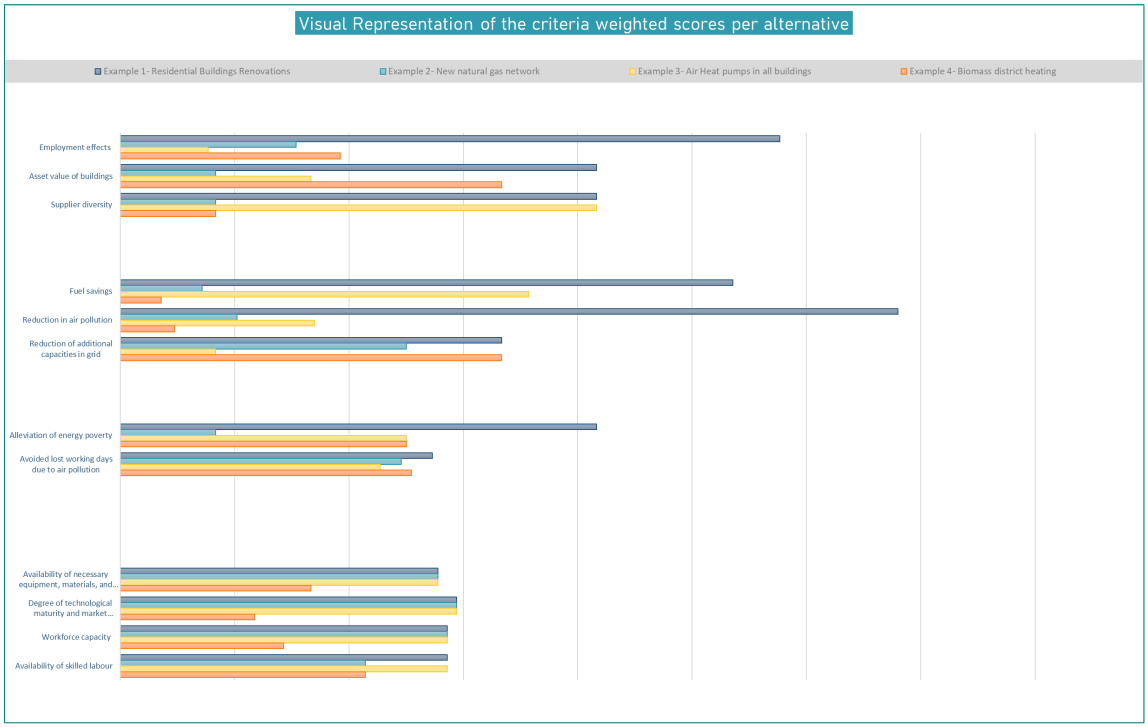
Table 5.1 Dimensions' importance

Dimensions	Importance (Very low to very high)
Economy	Very High
Environment	High
Society	Top priority
Practical feasibility	High

"Users fill their input only in orange cells

Table 5.2 Aggregated decision matrix

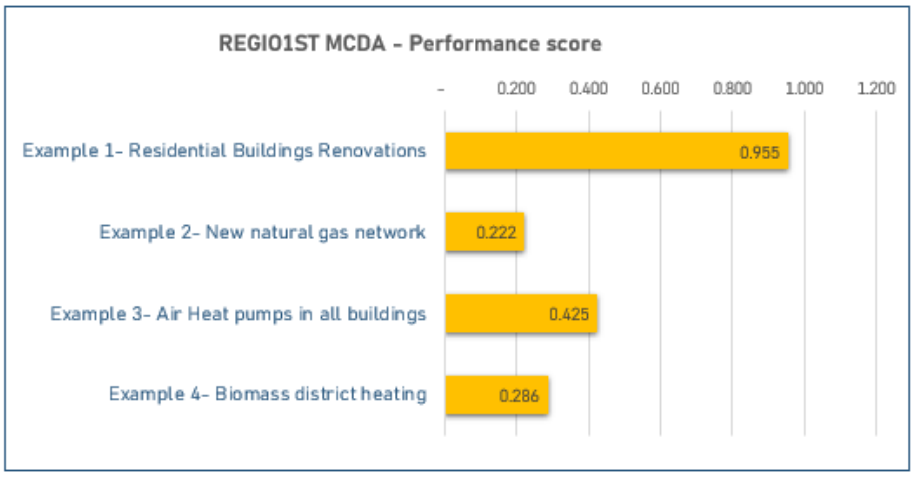
			Alternatives			
	Dimensions	Weights	Example 1- Residential Buildings Renovations	Example 2- New natural gas network	Example 3- Air Heat pumps in all buildings	Example 4- Biomass district heating
Economy	Employment effects	0.13	0.58	0.15	0.08	0.19
	Asset value of buildings	0.08	0.42	0.08	0.17	0.33
	Supplier diversity	0.08	0.42	0.08	0.42	0.08
Environment	Fuel savings	0.10	0.54	0.07	0.36	0.04
	Reduction in air pollution	0.04	0.68	0.10	0.17	0.05
	Reduction of additional capacities in grid	0.02	0.33	0.25	0.08	0.33
Society	Alleviation of energy poverty	0.12	0.42	0.08	0.25	0.25
	Avoided lost working days due to air pollution	0.09	0.27	0.25	0.23	0.25
Practical feasibility	Availability of necessary equipment, materials, and services	0.10	0.28	0.28	0.28	0.17
	Degree of technological maturity and market readiness	0.06	0.29	0.29	0.29	0.12
	Workforce capacity	0.08	0.29	0.29	0.29	0.14
	Availability of skilled labour	0.10	0.29	0.21	0.29	0.21



Final Ranking

Table 6. Final Priorities' Ranking

Regional energy planning **Priorities**	Performance score	Rank	Rank
Example 1– Residential Buildings Renovations	0.955	1	Most Prevalent Alternative
Example 2– New natural gas network	0.222	4	
Example 3– Air Heat pumps in all buildings	0.425	2	
Example 4– Biomass district heating	0.286	3	



Monitoring Template

Relevant to Stages: 7 and 8

Introduction

This template aids users in monitoring the implementation of actions incorporated in a regional energy plan, reporting on progress, and evaluating the actions' effectiveness.

User instructions

Objective

The purpose of this template is to assist users in monitoring the implementation of the actions/interventions incorporated in their regional energy plan. It can enable planners report on progress and on the impact of actions/interventions and evaluate their effectiveness.

Description

The Monitoring template is a structured tool designed to support regional authorities in monitoring their progress regarding the implementation of each action in an efficient and comprehensive way. The tool provides tables, graphics and indicators to assist the procedure.

How do I use this tool?

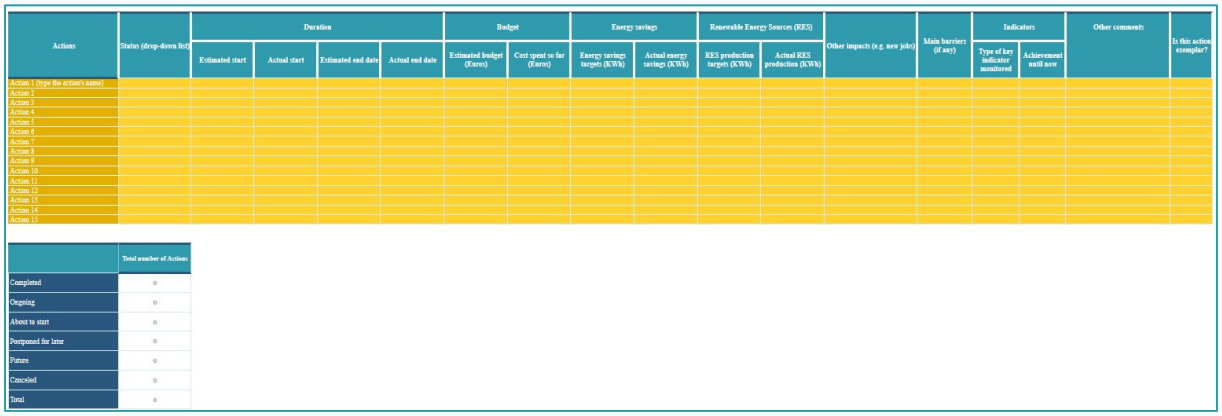
(1) Actions Monitoring	This tab prompts the user to collect key data in order to effectively monitor selected actions of the regional plan. It helps define the current status of each action and quantify the indicators that will be used to monitor progress. Key performance indicators are already defined in the tab and the user can also add other indicators.
(2) Graphic Results	Once the first tab is filled with data, the tab "Graphic Results" presents the results graphically. More specifically there are 3 different figures that present the results in a more user-friendly way.
(3) Indicators	This tab provides an indicative list of indicators that can be used to monitor progress in implementing sustainable energy actions. The user should choose the most suitable indicators (or add new ones) to use in the ""Actions Monitoring"" tab.

(4) Example	An example of monitored actions is presented, along with a graphical representation of the results.

Step by step

Actions Monitoring

To effectively utilize the monitoring tool, regional authorities and planners need to fill in the table with actions that are being /will be implemented, including relevant information in each category (such as status and duration). To do so, users can utilize the dropdown list in the first column to choose the status, and manually fill in the rest of the cells. To fill in the last two columns pertaining to indicators, refer to the list in the "Indicators" tab and add additional columns as necessary for extra indicators. It's recommended to include at least one type of indicator. Additionally, the second table summarises the status of actions.



Actions	Status (drop-down list)	Duration				Budget		Energy savings		Renewable Energy Sources (RES)		Other impacts (e.g. new jobs)	Main barriers (if any)	Indicators		Other comments	Is this action exemplar?
		Estimated start	Actual start	Estimated end date	Actual end date	Estimated budget (Euros)	Cost spent so far (Euros)	Energy savings targets (KWh)	Actual energy savings (KWh)	RES production targets (KWh)	Actual RES production (KWh)			Type of key indicator monitored	Achievement until now		
Action 1 (type the action's name)																	
Action 2																	
Action 3																	
Action 4																	
Action 5																	
Action 6																	
Action 7																	
Action 8																	
Action 9																	
Action 10																	
Action 11																	
Action 12																	
Action 13																	
Action 14																	
Action 15																	

	Total number of Actions
Completed	0
Ongoing	0
About to start	0
Postponed for later	0
Future	0
Canceled	0
Total	0

Graphic Results

In this tab, the figures provide a graphical representation of the data from the tab "Actions Monitoring".

Indicators

A list of indicative indicators for monitoring actions is provided in this tab. The user may select indicators (or add new ones) and reform them according to actions' needs. The indicators are used in the tab "Actions Monitoring".

Sector	Indicators	Measurement Unit
Buildings	Lamps replaced with LEDs (per building/total)	Number of lamps replaced
	Area covered with automations in lighting	m2
	Upgrades in cooling & heating systems	Number of new heating & cooling systems
	Insulation	m2 of insulation
	Double glazing	m2 of windows
	Use of highly energy efficient equipment bought	Equipment number
	Area covered with sensors and timers	m2
	Area with shadings installed	m2
	Installation of digital thermostats	Number of thermostats
	Average temperature in buildings	oC
	Solar water heaters installed	Number of solar water heaters
	A/Cs replaced with new more efficienct ones	Number of A/Cs
	Surface with cool colors applied	m2
	Buildings using cool colors	Number of buildings
	Buildings fully/partially refurbished	Number of buildings
Other public infrastructure	Street lighting lamps replaced with LEDs (per area/total)	Number of lamps
	Length of new lighting network	km
Energy supply	Length of new gas pipelines	km
	District heating plants	Number of plants
	Installed renewable energy capacity	KW
Other	Awareness raising campaigns/activities/events for students/residents	Number of campaigns/activities/events
	Students/residents reached by campaigns/activities/events	Number of students/residents attending each event
	Training seminars implemented	Number of seminars
	Municipal/regional employees trained	Number of employees
	Printed informational material	Number of material distributed
	Participation in funding programs	Number of programs

Example

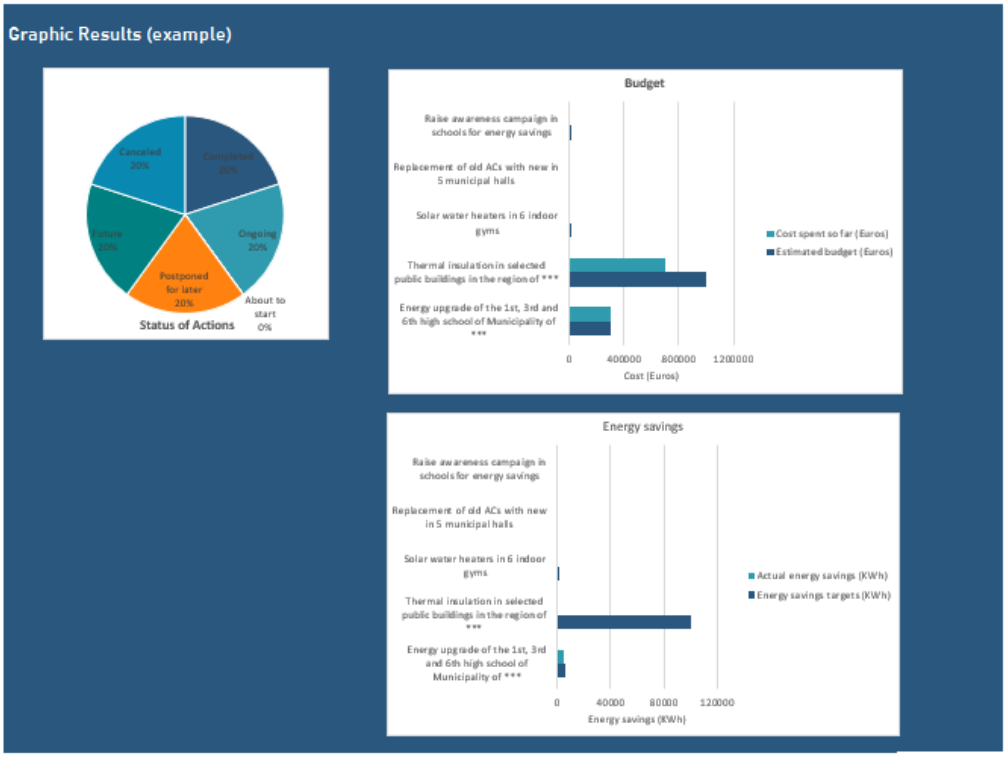
Actions Monitoring

Actions	Status (drop-down list)	Duration				Budget	
		Estimated start	Actual start	Estimated end date	Actual end date	Estimated budget (Euros)	Cost spent so far (Euros)
Energy upgrade of the 1st, 3rd and 6th high school of Municipality of ***	Completed	February 2020	18 February 2020	August 2020	01 October 2020	300,000	300,000
Thermal insulation in selected public buildings in the region of ***	Ongoing	June 2022	01 July 2020	December 2023	Ongoing	1,000,000	700,000
Solar water heaters in 6 indoor gyms	Future	March 2024		June 2024		5,000	
Replacement of old ACs with new in 5 municipal halls	Canceled	March 2024					
Awareness raising campaign in schools for energy savings	Postponed for later	September 2023 New estimation: January 2024		June 2024 New estimation: December 2024		10,000	

Energy savings		Renewable Energy Sources (RES)		Other impacts e.g. jobs created	Main barriers (if any)	Indicators					
Energy savings targets (KWh)	Actual energy savings (KWh)	RES production targets (KWh)	Actual RES production (KWh)			Type of key indicator monitored	Achievement until now	Type of key indicator monitored	Achievement until now	Type of key indicator monitored	Achievement until now
6,000	5,500				Delays due to bureaucracy	Number of new heating systems (natural gas)	3	Double glazing	150 m^2	Number of lamps replaced with LEDs	52
100,000				-Employees noted an improvement in thermal comfort -Estimated that three municipal halls reduced the use of their heating system		Number of buildings with new insulation	23/35				
1,500		1,500				Number of solar water heaters					
					Canceled due to the lack of funding						
No direct energy savings		1,500			Postponed due to the lack of human resources	Number of students informed		Number of schools where campaigns took place			

	Total number of Actions
Completed	1
Ongoing	1
About to start	0
Postponed for later	1
Future	1
Canceled	1
Total	5

Graphic Results



4 Additional material

The REGIO1st planning framework includes supplementary resources alongside best practices and success stories. The table below summarizes where within the framework's stages and steps one can locate this additional material. These resources serve to enrich the planning process, offering insights, examples, and lessons learned that can enhance the effectiveness and success of regional planning. Whether at the initial stages of assessment or during the implementation phase, the supplementary material is designed to support planners in making informed decisions and achieving sustainable outcomes in regional energy planning.

	Additional resources	Best practices/ Success stories
Stage 1 | Preparation	CoM Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 1: The SECAP process, step-by-step towards low-carbon and climate-resilient cities by 2030	-
Step 1.1 Determine the geographical area and scope of planning	-	-
Step 1.2 Determine roles and responsibilities	What is a RACI matrix?	-
Step 1.3 Identify and review existing regional energy plans	-	-
Step 1.4 Set up the framework for developing a regional energy plan	-	-
Stage 2 | Engaging stakeholders and building partnerships	CoM Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 1: The SECAP process, step-by-step towards low-carbon and climate-resilient cities by 2030	
Step 2.1 Identify key stakeholders	EU Visual toolbox for system innovation URBACT Stakeholders Ecosystem Map EXACT External Wiki Stakeholder analysis NET ZERO CITIES - COMPANION GUIDE FOR CIVIC ENGAGEMENT MAPPING	-
Step 2.2 Develop a stakeholder engagement plan	URBACT Engaging Stakeholders COMPILE Toolkit: Stakeholder Engagement Guide UNEP's Stakeholder Engagement Handbook REScoop Guide to engage and manage stakeholders Guide for consultations to shape the future Interreg - Toolkit	Rouen: A scientific approach to citizen engagement Tackling local needs: the development of an adaptation strategy using a citizen survey Cesena's Energy Savings Sprint: using the campaign to engage citizens in climate action OECD Stakeholder engagement across the European Union

	Additional resources	Best practices/ Success stories
Stage 3 | Reviewing energy objectives and targets	CoM Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 1: The SECAP process, step-by-step towards low-carbon and climate-resilient cities by 2030	-
Step 3.1 Review national visions and targets	-	-
Step 3.2 Review regional and local visions and targets	-	-
Step 3.3 Set and define new regional objectives and targets/priorities	CLEI guide for cities: science-based targets	-
Step 3.4 Discuss visions and targets/priorities with stakeholders	Co-creation for policy: Participatory methodologies to structure multi-stakeholder policymaking processes Urb Cultural Planning Participatory design guide URBACT Engaging Stakeholders	ICAEN: Cycle of sessions focused on how citizens will participate in the new energy model of Catalonia Crete Regional Development Fund: Insular multi-level governance for clean energy transition
Stage 4 | Exploring the current regional energy system	CoM Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 2: Baseline Emission Inventory (BEI) and Risk and Vulnerability Assessment (RVA) The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) C40 city Inventory Reporting and Information System (CIRIS) tool	-
Step 4.1 Collate data to understand the current energy system	Eurostat Energy statistics International Energy Agency energy statistics Energy Consumption and Energy Efficiency trends in the EU, 2000-2020	-

	Additional resources	Best practices/ Success stories
Step 4.2 Analyse energy consumption patterns by sector	-	-
Step 4.3 Evaluate existing energy infrastructure	-	-
Step 4.4 Review the current system with stakeholders	Co-creation for policy: Participatory methodologies to structure multi-stakeholder policymaking processes EU Visual toolbox for system innovation	-
Stage 5 | Cost-benefit analysis	-	-
Step 5.1 Assess the potential of energy efficiency solutions	Repository of short-term energy saving actions by local authorities in Europe Toolkit on emergency energy saving measures Top Energy Saving Inventions and Innovations World energy perspective: Energy efficiency technologies IEA Energy Efficiency 2023 Energy Efficiency in Transport Clean and energy efficient vehicles Energy efficiency in buildings: greater focus on cost-effectiveness still needed SETIS - SET Plan information system	RenoBooster, triggering a building renovation wave in Vienna FEBUS, a success story of fuel cell buses deployment District heating as key enabler for climate neutrality in Gothenburg Mur|Mur : Retrofitting private buildings to reduce energy consumption Energy efficiency interventions for public buildings and lighting systems Thermal Refurbishment of a Municipal Polyclinic and a Pediatrics department in the Town of Voznesensk Modernization of the street lighting system in Polack

	Additional resources	Best practices/ Success stories
Step 5.2 Assess the potential of renewable energy resources	EC Renewable energy statistics European Environment Agency (EEA) Renewable energy repository IRENA Renewable potential assessment	Win-win Renewables: Success stories for nature and citizens in Europe Renewable Energy Success Stories from Europe Pilot Roof PV Installations and Energy Storage Systems in 3 Social Buildings for Energy Poverty Mitigation in the City of Plovdiv Plantation of Willow for Biomass Production and Modernization of the Street Lighting System in Festelita Solar energy in Artik and Aparan
Step 5.3 Agree on modelling approaches and scenarios with stakeholders	-	-
Step 5.4 Model future techno-economic options	EU Guide to Cost-benefit Analysis of Investment Projects Towards a decarbonised and climate-resilient EU energy infrastructure: recommendations on an energy system-wide cost-benefit analysis World Bank guide for Cost-effectiveness Analysis	-
Step 5.5 Monetise benefits and wider impacts	ENEFIRST Energy Efficiency First and Multiple Impacts: integrating two concepts for decision-making in the EU energy system MICAT – Multiple Impacts Calculation Tool – project	-
Step 5.6 Identify optimal combinations of solutions	-	-
Step 5.7 Assess the sensitivity of the analysis	-	-

	Additional resources	Best practices/ Success stories
Stage 6 | Assessing the practical feasibility of least-cost energy solutions	-	-
Step 6.1 Assess distributional impacts	Distributional Impact Assessment	-
Step 6.2 Evaluate the readiness of supply chains for the proposed technologies and solutions	Four keys to resilient supply chains UNICEF Supply Chain Maturity Model Methods for Assessing Technology and Market Readiness for Clean Commercial Transportation	-
Step 6.3 Assess the workforce capacity for the implementation of proposed options	-	Clean heat and energy efficiency workforce assessment
Step 6.4 Organize stakeholder consultations to gather feedback and review options	The Gold Standard Organisation Guide for Stakeholder consultation and engagement requirements Notes on Designing and conducting consultations	-
Stage 7 | Defining actions and developing the regional energy plan	CoM Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)'- Part 3: Policies, key actions, good practices for mitigation and adaptation to climate change and Financing SECAP(s) C-Track 50 Guidebook for achieving carbon neutrality by 2050 ICLEI;s Climate Neutrality Framework The United Nations Human Settlements Programme (UN-Habitat) Guiding Principles for City Climate Action Planning	-
Step 7.1 Prioritize energy interventions and develop the regional plan	-	-

	Additional resources	Best practices/ Success stories
Step 7.2 Establish a monitoring and evaluation system	-	-
Step 7.3 Pursue public acceptance and finalise the regional energy plan	Background Document on Public Consultation What is Public Consultation? Public Consultation Guidelines	Vienna's Climate Team: using an award-winning hybrid engagement approach to tackle climate change Case study: collective urban planning in the London Borough of Newham Case Study: Citizen Proposals in Linz Norwich, CT teams up with local development corporation to develop a community engagement platform
Stage 8 | Implementation, monitoring and review	-	-
Step 8.1 Develop detailed implementation plans	EC Project fiche template OECD Project fiche templates	-
Step 8.2 Establish partnerships to support actions implementation	The SDG Guidebook for building Partnerships The ILO Guide to Multi-Stakeholder Partnerships	-
Step 8.3 Implement actions and communicate successes to stakeholders and the public	-	Rouen: A scientific approach to citizen engagement
Step 8.4 Review and update the regional energy plan	Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' The Global Covenant of Mayors (GCoM) common reporting framework (CRF)	-

5 Frequently Asked Questions

What is the purpose of the REGIO1st framework?

The REGIO1st Planning Framework aims to help regional energy planners across Europe develop sustainable energy and climate strategies and incorporate the Energy Efficiency 1st principle. It's divided into eight stages, each one of which has different steps and tools to support regional energy planning.

Are there any detailed instructions or a user guide available?

The REGIO1st Planning framework is developed in a user-friendly way, so the interaction of the user with the framework should be self-explanatory and self-evident. Despite this, a comprehensive guidance has also been developed and is accessible here.

Is there any cost associated with the use of framework?

No, there are no charges associated with the REGIO1st framework or its accompanying tools; they are accessible free of charge.

Do I have to sign up?

No subscription is required to access the framework or download its tools.

What type of files are the tools? Can I download them and work locally?

The tools are available in PDF or Excel formats, to ensure ease of use. All tools can be downloaded and used offline.

Who is this framework designed for?

The framework is designed to be used by technical staff of regional authorities and regional energy agencies, energy and climate planners, as well as other stakeholders interested in formulating sustainable and cost-effective energy strategies, aligned with the EE1st principle.

Is the framework suitable for both urban and rural energy planning?

Indeed, the framework has the requisite flexibility to be effectively used by different types of EU regions, irrespective of their urban or rural characteristics.

Is the framework tailored to specific geographical areas

While initially designed to meet the REGIO1st participating regions' needs, the framework can be used by different regions from diverse geographical contexts. Consequently, it can be used by regions across and beyond Europe that have varied energy landscapes and requirements.

Are there any case studies or examples demonstrating the application of the framework?

While comprehensive case studies covering all stages of the framework are not presently available, illustrative examples are incorporated within the tools. Additionally, supporting material are provided for each stage, including specific case studies for certain steps.

Can I report a possible issue encountered when using the tools or provide feedback/suggestions?

Certainly, reporting issues faced when using the tools and providing feedback and suggestions is strongly encouraged. You may do so by visiting the designated contact page within the framework or by utilizing the contact details provided within each tool. We highly value user input and continuously strive to enhance our tools based on feedback received.

Can I expect updates for the framework or the tools?

Yes, updates for both the framework and the tools are anticipated in the future. Our team remains dedicated to improving their functionality and addressing any issues encountered. Updates will be deployed accordingly to ensure an improved and more seamless user experience.

Next Steps and Continuous Improvement

The REGIO1st Planning Framework embodies the REGIO1st partners' collective commitment to incorporate the Energy Efficiency First principle within regional energy planning. This guide is designed to serve not only as a roadmap but also as a reference point towards a sustainable, energy-efficient future for EU Regions.

All regional planners and stakeholders are encouraged to follow the stages and steps of this framework and adapt them according to their unique contexts and challenges. The success of this framework lies in its application and the tangible impact it creates in our communities.

The REGIO1st planning framework is a living document. As such, the REGIO1st consortium is committed to its continuous improvement, incorporating new insights, feedback, and evolving best practices. Planners can contribute to this process by sharing their experiences, challenges, and successes. Planners feedback is invaluable and can help ensure that the framework remains relevant, practical, and impactful.

Further Resources and Support

For further resources, tools, and support, please visit the REGIO1st planning framework. A repository of tools, additional materials, best practices, and Frequently Asked Questions is available there.

Stay Engaged

Visit the REGIO1st website at https://fedarene.org/project/regio1st/

Use and follow the project hashtag #REGIO1ST on social media!

REGIO1st Website: https://fedarene.org/project/regio1st/

REGIO1st Planning Framework website: https://regio1st-planning-framework.fedarene.org/

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