Deliverable: D.T2.1.1: Draft of common LEC action plan elaborated

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1. Introduction

The project "*LEC - CIVIC ENERGY FUTURE: SUSTAINABLE LOCAL ENERGY COMMUNITIES*", financed in the framework of the Interreg IPA CBC Italy - Albania - Montenegro Programme 2014 – 2020 has the overall objective to contribute to the improvement of the energy efficiency and renewable energy usage through the development of "*local community of active energy consumers*" (LEC) which cooperates with municipalities (public-private partnerships), by encouraging the sustainable Municipalities models through local actions in accordance with the change in the citizens behavior. To this end, 4 LECs will be created aimed at committing themselves to implement a shared common action plan finalized to energy efficiency in a sustainable and ethics way related to the territory's needs. The common action plan will become a political commitment of the municipalities and LECs through the signing of an Agreement. The application of the common action plan will be shown through the implementation of n. 4 pilot projects in identified public buildings/areas that includes the active involvement of 4 LECs.

The LEC total budget is Euro 717.904,35 and the project is co-funded by the Interreg IPA CBC Italy - Albania - Montenegro Programme for a total budget of Euro 107.685,66 (85% of the total).

The Lead Partner of LEC is the Municipality of Tuzi coming from Montenegro.

The Partners are:

- PP2 - Confindustria Bari e Barletta-Andria-Trani - Association of industrial firms located in the Provinces of Bari and Barletta-Andria-Trani (Italy)
- PP3 - Municipality of Mirabello (Italy)
- PP4 - Municipality of Tirana (Albania)

The project is composed by several technical work packages in order to reach the planned goals and to implement the activities:

1) WP MANAGEMENT;
2) WP T1 - Creation of sustainable local energy communities (LEC);
3) WP T2 - Crossborder sustainable energy action plan based on LEC model;
4) WP T3 - LEC Pilot projects "Energy efficiency in a sustainable and ethics way";

5) WP COMMUNICATION.

The present “Draft of common LEC action plan elaborated”, developed in collaboration with the involved municipalities and experts from the sector, has been built to drawn up a common sustainable energy action plan aimed at promoting investments in the field of renewable sources, energy efficiency of public buildings, at the behavioural dissemination and education, single and collective eco-sustainable and even within industrial and commercial areas. The deliverable will be based in a common session which will establish a common goal, a strategic framework, energy policies, territorial contests and actions at the crossborder level and a session dedicated to single municipalities with some specific action plans at the local level.

It is important to underline that this contribute has been elaborated following the LEC model and the European guideline "How to develop a Sustainable Energy Action Plan (SEAP)" adopted by the EU-Convenant of Mayors, taking into account the founding and constituent elements of the SEAP but, the information provided, will be also referred and developed considering the updates present in the new guidebook "How to develop a Sustainable Energy and Climate Action Plan (SECAP)", published by the Joint Research Centre (JRC) of the European Commission in the 2018.

2. The Sustainable Energy Action Plan

2.1 The LEC project and its connections with the Local Energy Communities

The LEC project foresees the creation of a "Common Action Plan" will also include indications for the drafting of local action sheets. Starting from the analysis of good practices at national and international level about how smaller cities and municipalities are committed to promote sustainable energy, in order to reduce the CO2 emissions, by increasing the level of energy efficiency and the production of energy from renewable sources, the project partnership elaborated a benchmarking analysis report and organized 4 living labs, one for each target area, for developing and sharing a local energy communities model. The results of the living labs have been shared at cross-border level to arrive at the definition of a "common model" of sustainable municipality based on the active participation of citizens/users. This common LEC model will be used for the creation of the 4 LECs and it will represent also an important background for the involvement of the public bodies and private organizations which will sign the agreements for the establishment of the local energy communities in the different target areas in the framework of the WP T1 - Creation of sustainable local energy communities (LEC).

The political commitment of local governments is the best guarantee of durability of the project results. A commitment that will translate into the availability of human and financial resources. The territorial interpretation of the action plan at the demonstration level is represented by the 4 pilot projects that the partners will implement within the WP T3 LEC Pilot projects “Energy efficiency in a sustainable and ethics way”;

Three pilot projects will concern interventions in public buildings owned by the municipalities (Tuzi, Mirabello and Tirana) that guarantee the subsequent ordinary and extraordinary maintenance of the buildings with their own finances. The fourth pilot intervention is based on the activation of a support service for owners and managers of public infrastructure in the geographical area of the Metropolitan City of Bari.

All these 4 interventions are connected to the creation of 4 local sustainable energy communities (LEC) with the goal to favour the development and implementation of models of sustainable municipalities that intend to contribute to the European 20-20-20 climate target, namely the reducing greenhouse gas emissions by 20% compared to 1990 levels, increasing the share of renewable energy use to 20%, and improving energy efficiency by 20 %. A goal that is hard to be reached by public authorities, due to the constant reduction of public spending[1].

The local energy communities could, within a few years, revolutionize the energy market, leading to an energy model that is no longer centralized, on the contrary, distributed throughout the territory, where users are both producers and distributors of energy.

According to the report "*The Potential for Energy Citizens in the European Union*[2]", prepared by the environmental research institute CE Delft on behalf of Greenpeace, European Renewable Energies Federation (EREF), by 2050 half of the citizens (prosumers and/or European energy citizens) could produce, but also manage, their own energy produced essentially from renewable sources. The report estimates that energy communities could cover 45% of total EU demand by 2050.
Models may change:

- on the basis of the forms of aggregation (companies, associations, foundations, cooperatives);
- the nature of the members (private, public-private, with internal or external participation of the municipality/association, etc.);
- of the support policies (crowdfunding, subsidized loans, awareness campaigns on economic and environmental benefits, economic incentives for the inhabitants of the areas concerned, obligation for energy producers to make local communities participate in the ownership of the plants);
- for the technological choices with respect to local needs and territorial limits and for the social purposes related to the promotion and involvement of other stakeholders who can contribute to a model of sustainable municipality.

Therefore, the model, while based on some common principles, may adopt different characteristics depending on the socio-economic characteristics (size of the city, prevalence of industrial areas, commercial centers, public buildings, etc. environmental related to territories and cities). All these different elements will be considered and valorized within the 4 LEC to-be created during the activities of the LEC

[1] According to the The EEA report 'Trends and Projections in Europe 2021', the EU achieved its three 2020 climate and energy targets. However, only 21 Member States reached their national target in 2020, based on preliminary data. This means that Bulgaria, Cyprus, Finland, Germany, Ireland and Malta would need to use flexibilities, such as buying emission quotas from other EU countries, to comply with their legal objectives.

[2] The potential of energy citizens in the European Union, Delft, CE Delft, September 2016

project, as well as in this common action plan that will be elaborated following the LEC model and the European guideline "How to develop a Sustainable Energy Action Plan (SEAP)" adopted by the EU-Convenant of Mayors and the subsequent guide "How to develop a Sustainable Energy and Climate Action Plan (SECAP)".

2.2 What is a SEAP?

The Sustainable Energy Action Plan (SEAP) is a key document that outlines how Covenant signatories will meet their 2020 targets. Taking into account data from the Baseline Emissions Inventory, the document identifies the most appropriate areas of action and opportunities to achieve the CO2 reduction target. It defines concrete reduction measures, along with timelines and responsibilities, in order to translate the long-term strategy into action. Signatories commit to deliver their SEAP within one year of joining. The SEAP should not be viewed as a rigid, binding document. As circumstances change and as interventions provide results and you have more experience, you may find it useful or even necessary to revise your plan. It is important to keep in mind that each new development project approved by the local authority represents an opportunity to reduce emissions levels. Missing these opportunities, it can have a significant impact over time. Therefore, it is important to evaluate energy efficiency and emissions reductions for all new projects, even if the SEAP has not yet been finalized or approved.

2.3 The differences between SEAP and SECAP

Following the adoption of the European Union's Climate and Energy Package in 2008, the European Commission launched the Covenant of Mayors, to endorse and support the efforts deployed by local authorities in the implementation of sustainable energy policies. addressing climate mitigation by means of a reduction in fossil fuels consumption.

In October 2015, following a consultation process on the future of the Covenant of Mayors, the European Commission launched the new integrated Covenant of Mayors for Climate and Energy, which goes beyond the objectives set for 2020. The signatories of the new Covenant commit to reduce their CO2 emissions (and possibly other GHG) and to adopt a joint approach to tackling mitigation and adaptation to climate change.

Signatories of the Covenant of Mayors for Climate and Energy have committed to prepare and implement a Sustainable Energy and Climate Action Plan (SECAP) before 2030[3].

[3] www.eumayors.eu

Picture 1. Evolution of the Covenant of Mayors Initiative

Adaptation to climate change is required. The task is to anticipate the adverse effects of climate change and to take appropriate action to prevent or minimise the damage it can cause, it has been shown that well planned, early adaptation action saves money and lives later.

As SEAP did, SECAP includes an assessment of the geographical, demographical and energy local context, a Baseline CO2 Emission Inventory (BEI) referring to a specific base year, a clear identification of the emissions reduction target, and the actions planned together with time frames, assigned responsibilities and estimated impacts and costs. Thus the SECAP retains the same outline procedure used for SEAPs but differs in:

- **Target**: a SECAP is aimed at defining mitigation actions that allow cutting down at least 40% of CO2 emissions;
- **Timeframe**: a SECAP is expected to achieve the objective of 40% reduction by the year 2030;
- **Development time**: a SECAP has to be submitted within two years of joining the Covenant.

In addition to the differences listed above, the Covenant of Mayors for Climate and Energy requires members to develop a risk and vulnerability assessment of the effects of climate change, in order to highlight strengths and weaknesses of a territory. This is to determine the nature and extent of risk by analysing potential hazards and assessing vulnerability that could pose a potential threat or harm to people, property, livelihoods and to the environment on which they depend. This will allow the definition of appropriate adaptation strategies, which will translate into the SECAP's actions and contribute to improve the resilience of the territory[4].

2.4 Scope of the SECAP and its process

Starting from the awareness that nowadays the SEAP has been "upgraded" with the SECAP, this instrument represents an opportunity for the cities and the municipalities, because it allows to plan and implement

[4] http://www.simpla-project.eu/en/guidelines/introduction-and-problem-setting/definitions/what-is-a-secap/

specific actions on energy and environmental issues in favour of the community and is able to stimulate the local green economy.

2.4.1 Purpose and phases of the SECAP

The Covenant of Mayors focuses on actions at the local level within the competence of the local authority. The actual SECAP, as well as the former SEAP, should focus on actions aimed at reducing CO2 emissions and final energy consumption by end users. The commitment of the signatories covers the whole geographical area of competence of the local authority (country, city, region). SECAP interventions, therefore, should cover both the public and private sectors. However, the local authority should set a good example by taking prominent measures for its buildings, facilities, car fleet, etc. The local authority can choose whether to define the overall CO2 reduction target as "absolute reduction" or "per capita reduction". The main targets concern buildings, equipment, facilities and public transport.

The SECAP also includes interventions related to local electricity production (photovoltaic, wind, cogeneration, improvement of local energy production), local heating/cooling generation. The SECAP should cover those areas where local authorities can influence long-term energy consumption (such as spatial planning). In addition, it should encourage the consumption of energy efficient products and services (public procurement) and stimulate a change in consumption patterns (working with citizens and stakeholders). On the contrary, industry is not one of the key target sectors of the Covenant of Mayors, so the local authority can choose whether or not to include interventions in this sector. In any case, installations covered by the ETS (European Emission Trading Scheme) must be excluded, unless they have been included by the local authority in previous plans

The oldest SEAP and the newest SECAP process are detailed by key steps for a successful result. As shown in the graph, the SECAP process is not a linear one, and some steps may overlap with others. Besides, it is possible that some actions will have started before the adhesion to the Covenant[5].

[5] 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 Bertoldi, P. (editor), 2018.

Picture 2. Structure of SECAP process

PHASE	STEP
Initiation	Political commitment and signing of the Covenant
	Mobilize all municipal departments involved
	Build support from stakeholders
Planning phase	Assessment of the current framework: Where are we?
	Establishment of the vision: Where do we want to go?
	Elaboration of the plan: How do we get there?
	Plan approval and submission
Implementation phase	Implementation
Monitoring and reporting phase	Monitoring
	Reporting and submission of the implementation report Review

Picture 3. Structure of SECAP phases

2.4.2 Benefits of the SECAP

The local (political) authorities can obtain the following benefits in supporting SECAP implementation[6]:

[6] ANNEX II of The European guideline "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 – pag.65

- Contribute to the global fight against Climate Change - the global decrease of greenhouse gases will also protect the city against Climate Change
- Demonstrate commitment to environmental protection and efficient management of resources
- Participation of civil society, improvement of local democracy
- Improve the city's image
- Political visibility during the process
- Revive the sense of community around a common project
- Economic and employment benefits (retrofitting of buildings…)
- Better energy efficiency and savings on the energy bill
- Obtain a clear, honest and comprehensive picture of budgetary outflows connected
- with energy use and an identification of weak points
- Develop a clear, holistic and realistic strategy for improvement in the situation
- Access to National/European funding
- Improve citizens well-being (reducing energy poverty)
- Local health and quality of life (reduced traffic congestion, improved air quality …)
- Secure future financial resources through energy savings and local energy production
- Improve long-term energetic independence of the city
- Eventual synergies with existing commitments and policies and systemic approach to
- energy and climate policies
- Preparedness for better use of available financial resources (local, EU grants and
- financial schemes)
- Better position for implementation of national and/or EU policies and legislation
- Benefits from networking with other Covenant of Mayors signatories with a view to funding opportunities
- Reduction of potential impacts of Climate Change and related losses and damages
- Climate-proof buildings and resilient productive systems
- Improved health, housing, sanitation indicators, among others, for vulnerable social groups
- Proactive and long-term planning based on long-term risk reduction and cross-cutting benefits

3. Elaborating emissions inventories

3.1 Baseline Emission Inventory (BEI)

The previous SEAP and the current SECAP should be developed on the basis of reliable information regarding energy consumption and GHG emissions in the territory of autonomous local governments. For this reason, a comprehensive assessment of the current (basic) situation and facilities should be made in the initial phase. The assessment begins with the determination of the level of energy consumption in the respective sectors of the city's economy and the development of the baseline emission inventory (BEI), the determination of the volume of carbon dioxide (CO2) emissions related to energy consumption in the reference year.

The BEI and the additional CO2 emissions inventory (if available) are the main tool for local authorities to determine the priority measures and the efficiency of the measures they implement, aimed at reducing greenhouse gas emissions.

The development of the BEI is a mandatory step in the preparation of the SECAP and the key aspect in the implementation of the commitments under the Covenant. The inventory should be included in the full version of the SECAP officially approved by local authorities.

The main features of the BEI are provided below:

- The BEI should reflect the local situation, i.e. it should be based on local data on energy consumption/production and other information needed to prepare the inventory. Assessments and estimates based on national or regional means will not reflect the actual situation at the local level (in the city), since in most cases they are characteristic of a specific spatial location. In addition, the inventory estimated on the basis of such data will not be an important reference point for the assessment of the efficiency of efforts made by local authorities to achieve their goals in the field of CO2 emission reduction.
- The methodological approaches and data sources used in the estimates are not expected to change for several years. This means that the methodology used for the development of the BEI should also be used for additional inventory measures to be taken on a regular basis for monitoring progress in emission reduction (Emission Inventory Monitoring).
- The BEI should include at least those sectors in which local authorities intend to take measures to achieve their emission reduction targets, i.e. sectors that are important sources of CO2 emissions.
- The BEI should contain reliable information or at least a common sense view of reality (i.e., if possible, more objectively reflect the current situation).
- The process of collecting the input data, the sources of the data, and the calculation methodology for the BEI should be properly documented (this can also be done within the SECAP, or, at the very least, the necessary data should be kept in the local authority documents).

It is strongly recommended that signatories from the Eastern Partnership countries include energy cost monitoring in the BEI and other inventory activities.

3.2 Risk and Vulnerability Assessment (RVA)

Sometimes contradictory policies and procedures coexist in the same municipality. First, existing municipal, regional, and national policies, plans, procedures, and regulations that affect energy and climate issues in the local authority should be identified. Identifying and analyzing existing plans and policies is a good starting point for improving integration of various policies. The aims and objectives of the documents identified should then be studied, checked and compared with those to be pursued in order to implement a sustainable energy policy. This operation is aimed at discovering whether these aims and objectives are consistent or contradictory. Finally, the local authority should invite all stakeholders and interested parties to discuss the identified inconsistencies. Agreement should be reached on changes needed to update policies and plans, clearly stating by whom and when they will be implemented. Necessary actions will be

planned (if possible) and a list of those actions will be included in the SECAP. It may take time for changes to have a positive effect. Nevertheless, they will need to be supported by political leadership.

A risk and vulnerability assessment (RVA) determines the nature and extent of a risk by analyzing potential hazards and assessing the vulnerability that could pose a potential threat or harm to the people, property, livelihoods, and environment on which they depend. This may take the form of a single assessment or several assessments undertaken by sector, for example. It can also be different types of assessments, such as institutional risk assessments, a hazard assessment, a retrospective assessment of vulnerabilities to extreme weather events, such as a Local Climate Impacts Profile.

4. The common aspects in the LEC Action Plan

4.1 Cross-border objective

The result of the project "*LEC - CIVIC ENERGY FUTURE: SUSTAINABLE LOCAL ENERGY COMMUNITIES*", will be the adoption of a joint action plan for energy efficiency and sustainable energy production in 4 target areas of the municipalities of Tuzi, Tirana, Mirabello and Bari, based on the model of the "local community of active energy consumers" (LEC). The joint action plan will be defined and adopted through the creation of 4 Local Energy Communities (LEC), public-private partnerships (municipality, citizens and SMEs), which will contribute to the creation and implementation of 4 coordinated pilot projects consisting of energy efficiency interventions in public buildings and industrial parks, identified in the target areas.

The final goal is to create LECs that contribute to the development of sustainable municipal energy models through a change in daily consumer behavior and an active role in promoting and managing energy efficiency in cities. In fact, considering the continuous reduction in public spending, it is difficult to promote energy savings and increase the consumption of renewable sources without implementing locally models that provide for the active participation of users, organized in LECs that work with municipalities by establishing public-private partnerships.

The "cross-border models" of sustainable municipalities based on the LEC has been defined through an analysis of best practices at the international level and living laboratories involving local actors. The definition of this model is the building block of the 4 LECs, a "formed user group" between citizens, public/private organizations, including the municipality that led the LEC processes, at the local level, Tuzi (MN), Tirana (AL) and Mirabello (IT).

This "Draft of common LEC action plan elaborated", exploiting not only a common session for all the interested actors, but especially presenting for each project's partner a specific section, valorizing the best practices and the proposals for investment in renewable energy, energy efficiency of public buildings/industrial parks, dissemination and education of individual and collective green behaviors. The planned actions will be addressed to both the public and private sectors (citizens and industries), in the belief that everyone should feel responsible for achieving common goals.

The final definition of the "Common LEC Action Plan" at the cross-border level will be done through a participatory approach starting from the contributions of the 4 LECs at the local level and organized with these following actions:

- ✓ each partner will support the LECs in the organization of 4 meetings at the local level to consider integrations/changes from the stakeholders to insert in this draft of Common Action Plan;
- ✓ following these 4 local meetings, a cross border meeting in Mirabello (Molise) will be organized to share and approve the final version of this LEC sustainable "Action Plan";
- ✓ The "Action Plan" will be formally adopted through the signing of a Crossborder Pact/agremeent on “sustaibanility municipality” that will be signed by the LEC, the mayors and the industrial organizations.

4.2 Strategic Framework

The main challenge of the program area (Italy with the Puglia and Molise Regions, the entire territory of Albania and Montenegro), at the international level, is to reduce carbon emissions and improve energy efficiency in the public sector through innovative practices and tools, according to the Europe 20-20-20 objectives, established in the 2020 climate & energy package, a set of laws passed to ensure the EU meets its climate and energy targets for the year 2020[7]. A vision also shared by municipalities through the "Covenant of Mayors"[8]. Objectives that will be difficult to achieve unless processes of participation from below are promoted and implemented based on citizen mobilization. In fact, as already stated, considering the reduction of public spending, the role of users, from public administration to municipalities and private individuals, citizens and businesses, becomes fundamental for the achievement of the objectives.

The LEC project, in line with the Energy Efficiency Directive (EU) 2018/844 of May 30, will contribute to improve energy efficiency and the use of renewable energy through the development of "local communities of active energy consumers (LECs) that cooperate with municipalities (public-private partnership), encouraging models of sustainable municipalities through local actions in accordance with the directive[9].

Indeed, the energy challenge is an "international affair" that can only be won purely on the basis of a cooperation at all levels, both of users (citizens and businesses) and of municipalities and nations. The advantage in cooperation, in the specific case of the LEC project, consists in the expertises and experiences integration (public sector/municipality with the private industrial sector):

- ✓ Municipalities that have an energy action plan to be upgraded, such as those of Mirabello, Bari and Tirana and which have also joined, although during different periods to the Covenant of Mayors for the sustainable municipality;
- ✓ The partner Confindustria bari (Italy) is a leader organization in Bioeconomy;
- ✓ The sharing of experiences and expertises will be used to promote a process of improvement and updating of the Action Plans both in the methods in which citizens are involved, by promoting aggregation processes that can more efficiently involve wider groups of the local communities and

[7] https://ec.europa.eu/clima/eu-action/climate-strategies-targets/2020-climate-energy-package_en
[8] www.eumayors.eu
[9] DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

in the available technologies through the involvement of non-profit industrial associations that can better guide the choices on the basis of environmental, social and economic sustainability criteria, as they don't have individual speculative impacts.

4.3 Energy policies at European Level

The EU has considerably further developed over the past years the frame for energy efficiency policies. The most important initiatives relevant for energy efficiency include:

1. The Energy Performance of Buildings Directive (2002/ 91/EC), which establishes the following obligations for Member States[10]:
   - establish a method for calculating/measuring the energy performance of buildings;
   - set minimum energy performance standards for new/renovated buildings; and
   - establish a certification system that informs potential buyers/tenants of buildings (residential, commercial etc.) about the energy performance of the building in question;
   - display an energy performance certificate in all "public" buildings;
   - establish an inspection scheme for cooling and heating systems above a certain size.

This regulation was supposed to enter into force in all member states as of January 2006 (with some possible delay until January 2009 for some chapters), but many member states have been slow to adopt the necessary measures and laws;

2. Communication COM (2009) 490 "Action Plan on Urban Mobility" which aims to establish actions to be implemented through programs and tools.
3. Directive 93/116/EC of 17 December 1993 adapting to technical progress Council Directive 80/1268/EEC relating to the fuel consumption of motor vehicles.
4. Directive 2009/28/EC on the promotion of the use of energy from renewable sources.
5. Directive 2003/30/EC on the promotion of the use of biofuels for other renewable fuels for transport.
6. Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.

4.4 Territorial Contests and common actions aimed at promoting investiments in the field of renewables sources

According to Directive (EU) 2018/2001, renewable energy refers to energy from renewable non-fossil sources, namely wind, solar (both solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas. It is important to note that renewable and non-greenhouse gas (GHG) emitting energy sources are not synonyms according to this definition. For example, nuclear power plants do not pollute the air or emit GHG when producing electricity, but the material most often used to generate nuclear energy, uranium, is generally a non-renewable resource and, as a consequence, nuclear energy is not considered renewable.

[10] DIRECTIVE 2002/91/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2002 on the energy performance of buildings

Several reasons justify the interest of the EU in the promotion of RES. Among them, there is the goal to achieve a more environmentally sustainable energy system, seen how RES contribute to the reduction of GHG emissions and local pollutants and, as a consequence, to climate change mitigation and improvement of air quality.

Furthermore, the penetration of RES in the energy mix can also help with other traditional goals of the EU energy policy, such as the competitiveness of energy prices and reducing imported fossil fuel reliance. Besides, the promotion of renewable energy can create new opportunities for local employment, help ensure the leadership of EU manufacturers in green technologies and contribute to overall economic growth. In this context, it is important to underline the relevance of the "Renewables self-consumers" concept, especially regarding the connection with the LEC objectives[11].

EU commitment to renewable energy has been long established and is attested by art. 194 of the Treaty on the Functioning of the European Union[12], which states that the Union policy on energy shall promote the development of new and renewable forms of energy, in a spirit of solidarity between the Member States. However, the same article specifies that the promotion of RES shall be without prejudice to the right of Member States to determine the conditions for exploiting their energy resources, their choices between different energy sources and the general structure of their energy supply.

The promotion of RES is a long term strategy of the EU, and several legislative initiatives have been taken over the years to foster it. Among them, the establishment of an Emission Trading Scheme (ETS), the adoption of targets to limit the GHG emissions from the sectors not covered by the ETS, the introduction of an electricity market design that better reflects the specificities of RES-based generation, the deployment of measures supporting energy efficiency, and the definition of long term Energy and Climate Plans at the national level.

On top of these policies, the EU has adopted a series of specific measures and targets for the penetration of RES in the energy mix. These measures and targets, which reflect the conditions in the various countries and end-use sectors, have evolved over time and aim to provide clear signals to the Member States, investors, firms and energy consumers.[13]

4.5 Energy efficiency of public buildings

[11] Directive (EU) 2018/2001. According to art. 21 „Renewables self-consumers", Member States shall ensure that consumers are entitled to become renewables self-consumers, subject to this Article.

[12] TFEU, Article 194 — ENERGY, comma 1 "In the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment, Union policy on energy shall aim, in a spirit of solidarity between Member States, to:
(a) ensure the functioning of the energy market;
(b) ensure security of energy supply in the Union;
(c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; and
(d) promote the interconnection of energy networks.

[13] https://fsr.eui.eu/renewable-energy-in-the-european-union/

In the framework of the LEC project, the public buildings have a crucial role as the implementation of the 4 pilot projects will be realized in identified public buildings and, of course, the active involvement of the 4 LEC foresees the Public Institutions (Municipalities) as the main actors.

Nowadays, the buildings are responsible for 40 % of total EU energy consumption and are often the largest energy consumer and CO2 emitter in urban areas. Therefore, it is crucial to devise efficient polices to reduce energy consumption and CO2 emissions in this sector. The policies and measures allowing to promote energy efficiency and renewable energies in buildings depend on the type of buildings, their usage, age, location, ownership (private/public…), and if the building is in a project-phase or is an existing one. For example, historic buildings may be protected by law so that the number of options to reduce energy consumption is quite restricted. The main energy usages in buildings are: maintaining an adequate indoor climate (heating, cooling, ventilation and humidity control), lighting, production of sanitary hot water, cooking, electrical appliances, elevators.

Key factors that affect energy consumption in buildings are the following:

- performance of the building envelope (thermal insulation, building tightness, surface and orientation of the glazed surfaces…);
- behaviour (how we use the buildings and its equipment in our day-to-day life);
- efficiency of the technical installations;
- quality of the regulation and maintenance of the technical installations (are the technical installations managed and maintained in such a way as to maximise their efficiency and minimise their overall usage?);
- ability to benefit from heat gains in the winter and limit them in the summer (appropriate summer comfort strategy);
- ability to benefit from natural lighting;
- efficiency of electrical appliances and lighting.

Recourse to renewable energy sources will not result in a reduction of energy consumption, but will ensure that the energy used in the building has a lower impact on the environment. The Energy Performance of Buildings Directive – EPBD (2002/91/ EC) is a key regulatory instrument which is meant to boost the energy performance of the building sector and had several updated:

- ✓ The EPBD was enacted in its first instance on 2002/91/EC and came into force in January 2003;
- ✓ It was amended in 2010 and entered into force on 18 June 2010. This version of the EPBD (Directive 2010/31/EU) broadened its focus on Nearly Zero-energy buildings, cost optimal levels of minimum energy performance requirements as well as improved policies. According to the recast, the directive requires the application of a methodological framework for calculating energy performance of buildings (Art. 3) in Energy Efficiency Policies in the European Union. EPBD requires further that all new buildings to be nearly zero-energy buildings by the end of 2020, and all new buildings occupied and owned by public authorities are nearly zero-energy buildings by end 2018. National plans to reach that target are required and need to include the definition of nearly zero-energy buildings according to local conditions and by giving a numerical value that indicates the primary energy use as well as intermediate targets for the energy use of new buildings to be set for 2015; and information on political and financial measures to achieve the target. Member states

shall ensure that all accessible parts of the heating and airconditioning systems are regularly inspected and that heating installations older than 15 years are assessed with respect to their energy performance. In addition, independent control systems for energy performance certificates and for inspection reports of heating and air-conditioning systems shall be established[14];

- ✓ Proposal for a revised directive on the EPBD (COM/2016/0765). On 30 November 2016, the European Commission published the "Clean Energy For All Europeans", a package of measures boosting the clean energy transition in line with its commitment to cut CO2 emissions by at least 40% by 2030, modernise the economy and create conditions for sustainable jobs and growth.[5] The package included a whole set of legislative proposals;
- ✓ On 11 October 2017, the European Parliament's Committee on Industry, Research and Energy voted positively on a draft report on the revised EPBD. The Committee *"approved rules to channel the focus towards energy-efficiency and cost-effectiveness of building renovations in the EU, updating the EPBD as part of the "Clean Energy for All Europeans" package"*[15].

4.5.1 Suggestions of policies that can be implemented at the local level in order to boost energy efficiency and renewables in buildings

The Guidebook "*How to develop a Sustainable Energy Action Plan*[16]", published by the European Union in 2010 presents some really useful suggestions of policies that can be implemented at the local level in order to boost energy efficiency and renewables in buildings which are summarized as follows:

1. **Regulations for new/renovated buildings**
   - Adopt stricter global energy performance standards than those applicable at national/regional level, especially if such standards are not particularly demanding.
   - Adopt specific standards for building components (thermal transmittance of the envelope, of windows, efficiency of the heating system, etc.).
   - Impose the inclusion of some components that will help to improve the energy efficiency (shading devices, presence of meters that record the energy consumption, heat recovery devices for mechanical ventilation…).
   - Impose a certain quantity of renewable energy production/usage, in particular in public buildings.
   - Adopt energy performance standards for renovation works which are not considered as 'major renovation' by national/regional law, and for which no energy performance standards apply.

2. **Enforcement of regulations**
   - Ensure that the energy performance standards are respected in practice and apply penalties if necessary. It is recommended to adopt both 'on paper' and 'on site' verifications.

3. **Financial incentives and loans**

[14] https://www.odyssee-mure.eu/publications/archives/MURE-Overall-Policy-Brochure.pdf
[15] https://en.wikipedia.org/wiki/Directive_on_the_energy_performance_of_buildings
[16] European Commission How to develop a Sustainable Energy Action Plan (SEAP) – Guidebook Luxembourg: Publications Office of the European Union 2010.

- The local authority could complement the financial support mechanisms existing at national or regional level, with extra financial incentives for energy efficiency or renewable energy sources. Such a scheme could focus on the global energy performance of buildings.
- In addition, the local authority could provide financial support for the purchase of energy efficient equipment that allow to reduce energy consumption of buildings (efficient lamp bulbs, efficient appliances, …).
- Although financial incentives do reduce the cost of investment related to energy-efficiency, investors (either citizens, private companies, etc) still have to face up-front payments. To facilitate the access to capital, the local authority may liaise with local banks and financial institutions, so that low-interest loans are available for energy efficiency or RES.

4. Information and training

- Make the relevant stakeholders (architects, building developers, construction companies, citizens…) aware of the new energy performance requirements for buildings, and provide them some motivating arguments (the savings on the energy bills can be highlighted, as well as the benefits in terms of comfort, environmental protection, etc. …).
- Inform the general public and key stakeholders about the importance and benefits of behaviour favouring the reduction of energy consumption and CO2 emissions.
- Involve local companies: they may have an economic interest in the energy efficiency and renewable energy business.
- Inform the stakeholders about the resources available.
- Organise specific info and training sessions for the architects, workers and construction companies.
- Make sure the tenants, owners and managers of new and renovated buildings are informed about the building's features

5. Promote successes

- Encourage people to build efficient buildings by offering them recognition.

6. Demonstration buildings

- Demonstrate that it is feasible to build energy-efficient buildings or to make renovation with high-energy performance standards. Show how it can be done.

7. Promote energy audits

- Energy audits are an important component of energyefficiency policy, as they enable identifying, for each audited building, the best measures allowing to reduce energy consumption.

8. Urban planning

- Urban planning is a key instrument to boost and plan refurbishments.

9. Increase the rate of refurbishment

- By accelerating the rate of buildings undergoing energy efficient refurbishments, the impact of the above measures on the energy and CO2 balance will increase. Some of the above measures,

and in particular urban planning, financial incentives, loans or information campaigns about the benefits of energy efficient renovations are likely to have such an effect.

10. **Energy taxes**
    - Higher energy prices generally increase awareness and motivation towards energy savings. If the local authority has the legal power to do so, it may decide to levy taxes on energy.

11. **Coordinate policies with other levels of authority**
    - A number of policies, instruments, tools in the field of energy efficiency of buildings and RES exist at regional, national and European level. The local authority should have a good view of these, in order to avoid duplication, and to take the maximum advantage of what already exists.

12. **Some recommendations for public buildings**
    - Management of public buildings: a local authority has often control over a large number of buildings. Therefore, a systematic approach is recommended in order to ensure a coherent and efficient energy policy covering the entire building stock over which the local authority exercises control[17].

4.6 Dissemination and behavioural education

The reduction of energy consumption and the increase of energy production from renewable sources are the common challenges for the 4 LECs to-be created within the framework of the project "*LEC - CIVIC ENERGY FUTURE: SUSTAINABLE LOCAL ENERGY COMMUNITIES*". The European Union target of Europe 20-20-20 is a difficult target for the public authorities, not only due to the constant reduction in public spending but also for the needed involvement of the citizens. An active engagement of citizens obliged by the (EU) Energy Efficiency Directive 2018/844 of May 30 for the electricity market, which confirms that all citizens have the right to consume, store, sell self-produced energy and that even when they do not produce it, they have the right to participate in energy markets, becoming active consumers if they want to: more than just consumers.

The Covenant of Mayors is a global movement, launched and supported by the European Union, through which small cities and municipalities commit to sustainable energy, in order to reduce CO2 emissions, increasing the level of energy efficiency and the production of energy from renewable sources. The signatory cities are actively committed to the new objective to reduce greenhouse gas emissions by 40% by 2030.

The choice of the *LEC* project to win the "energy challenge" based on contributing to the development of sustainable municipalities is supported by the active and organized involvement of

[17] European Commission How to develop a Sustainable Energy Action Plan (SEAP) – Guidebook Luxembourg: Publications Office of the European Union 2010, from pag. 27 to pag. 29.

citizens/consumers/SMEs (prosumers[18]). In fact, the starting point is the establishment of some local communities of active energy consumers" (LEC) that collaborate with municipalities (public-private partnership), promoting the creation of models of sustainable municipalities with local actions inspired by changing the daily behavior of citizens. LECs are defined as a "group formed by users" to promote and manage renewable energy according to the needs of the local community and seeking to reduce costs and fuel efficiency. This user group could consist of citizens who live in private buildings and use public buildings, employees who work in public buildings or by manufacturing companies located in industrial parks.

Therefore, in order to reach this goal, the *LEC* project ensures a participatory approach at all levels, both at the city level and between the three involved municipalities and among municipalities and the private sector (Confindustria Bari Bat), ensuring a bottom-up and multiactor approach in solving the energy problem in both urban and industrial areas, including concrete actions based on an active role of citizens/users and not only established and implemented by local authorities.

The 4-pilot project are the tool to demonstrate the methods of implementation of the actions planned in this "common action plan" according to the LEC model, or through active involvement of citizens/users, allowing concrete action in public buildings (Tuzi, Tirana and Mirabello) and the creation of a "technological service" to promote the process of energy efficiency for thepublic, including public infrastructures operating in the geographical area of the Metropolitan City of Bari. Moreover, the pilot projects, thanks to this active role of the users, will promote the diffusion and education of individual and collective eco-sustainable behaviors at the local community level. Infact, each pilot intervention will be subject to monitoring and follow up activities thanks also to the installation of useful technologies to monitor energy consumption and saving in order to evaluate the results of the pilot projects.

Several activities are foreseen in the LEC project for ensuring the strong involvement of the local stakeholders and the educative function of the project:

- ✓ Organization of n. 4 Living Lab opened to citizens/consumers, one for each target area. There is no standard definition of the concept of living lab. It could be defined as a methodology, an organization, a system, an arena, an environment, and/or a systemic innovation approach. In general, living labs deal with user-centered, open innovation ecosystem, often operating in a territorial or regional context (e.g. city, agglomeration, region), integrating concurrent research and innovation processes within a citizen-public-private partnership, also characterized as Public-Private- People Partnerships (PPPP) for user-driven open innovation, involving quadruple helix stakeholders (companies, researchers, public organizations and users). However, during the organization of the 4 Living Labs, each partner has took into account the 4 main activities characterising a Living Lab: a) Co-Creation: co-design by users and producers; b) Exploration: discovering emerging usages, behaviours and market opportunities; c) Experimentation; d) Evaluation;

[18] Prosumers are generally defined as electricity consumers that produce part of their electricity needs from their own power plant and use the distribution network to inject excess production and to withdraw electricity when self-production is not sufficient to meet own needs.

- ✓ Organization of n. 2 local workshops for each LEC/target area. Each partner will organize 2 workshops at local level to inform, transfer the knowledge, raise awareness and promote the LEC model for a sustainable municipality to the target area users.
- ✓ Organization of n. 4 Local meeting to discuss the Action plan. Each partner will support the LECs in the organization of 4 meetings at the local level to consider integrations/changes from the stakeholders and insert them into the Action Plan. In addition, the local actions will be defined;
- ✓ Elaboration and dissemination of project's posters, leaflets and communication materials;
- ✓ Set up and updating of the LEC website and social media and recording of a video with the final results.
- ✓ Organization of local launch events to present the 4 local energy conversion plans, local press conferences;
- ✓ Organization of the International final conference in Tuzi Municipality to show the final results of the n. 4 pilot projects.

4.7 Individual and eco-sustainable collective

Energy Communities (EC), as new aggregation models of energy end user, can combine the electricity distributed generation and the optimization of the energy-use, enhancing the share of energy among users. In a context where Renewable Energy Sources (RES) are growing, it is crucial to guarantee flexibility to the energy system. In fact, legislative frameworks at different level have recently developed a series of contractual instruments, allowing this link to be regulated, adapting physical and regulatory infrastructures, observing energy market requirements, ensuring energy equity and the security of energy supply[19].

The *LEC* project strategy will be based on the active involvement of citizens in the process of energy efficiency in public buildings/industrial parks identified as pilot projects, creating their own Local Energy Communities in which citizens, small-medium enterprises (SME) and local authorities, cooperate in the generation, consumption, distribution, storage, supply of energy, or in providing energy efficiency and service management. The LECs have the main objective to provide economic, environmental, and social benefits at a territorial scale, rather than economic profits.

5. Local Actions in Municipality of Tuzi (MN)

5.1 Analysis of relevant regulations:

5.1.1 National Level[20]

The Ministry of Economy is responsible for Montenegro's energy policy, which is based on the principles underpinning EU energy policy and transposition of the EU acquis communautaire as set out in the Energy Community Treaty. Montenegro's energy policy also takes account of its status as a contracting party to the UNFCCC and the Kyoto Protocol and as a signatory of the Paris Agreement. The Energy Policy of

[19] International Journal of Sustainable Development and Planning Vol. 16, No. 1, February, 2021, pp. 1-11 Journal homepage: http://iieta.org/journals/ijsdp

[20] Source: https://www.energycharter.org/fileadmin/DocumentsMedia/IDEER/IDEER-MontenegroEN_2018.pdf

Montenegro until 2030 (adopted in March 2011) sets out 20 key strategic objectives based on three priority areas: security in the energy supply; development of the competitive energy market; and sustainable energy development.

The Energy Development Strategy of Montenegro until 2030 (adopted in July 2014) sets out the approach and measures to achieve the objectives of the energy policy. Montenegro has concrete obligations to transpose key EU laws and regulations relating to energy efficiency into the national legal framework, including:

- Directive 2012/27/EC on Energy Efficiency;

- Directive 2010/31/EC on the Energy Performance of Buildings;

- Directive 2010/30/EU on Energy Labelling of Energy Related Products and accompanying regulations.

In addition to the obligations above, Montenegro also transposes Directive 2009/125/ EC, establishing a framework for the setting of ecodesign requirements for energy-related products and accompanying regulations. 20 In-Depth Review of the Energy Efficiency Policy of Montenegro | 2018 The Directorate for Energy Efficiency, under the Ministry of Economy, is responsible for energy efficiency policy through three departments that separately deal with development of the energy efficiency legal framework and implementation of energy efficiency measures.

To transpose the aforementioned EU laws, Montenegro has adopted two main national laws regulating energy efficiency:

- Law on Energy (adopted in January 2016) – focused on efficiency in energy supply;

- Law on Efficient Use of Energy (adopted in December 2014) – focused on final consumption.

The Energy Development Strategy until 2030 defines long-term targets for the utilisation of renewable energy, but not for energy efficiency improvements. Instead, there exists only a short-term indicative energy saving target until 2018, representing 9% savings of the final energy consumption compared with the final average energy consumption from 2002–2006. Adoption of Energy Efficiency Action Plans (EEAPs) is one of the requirements of Directive 2012/27/EU, and Montenegro is now implementing its third Energy Efficiency Action Plan for 2016–2018, adopted in June 2016, which covers all end-use sectors, energy entities and horizontal measures. Renewable Energy Policy Development of renewable energy is one of the key priorities of the Energy Development Policy and the Energy Development Strategy of Montenegro until 2030. The Law on Energy complies with EU Directive 2009/28/EC and recognises obligations to adopt a National Renewable Energy Action Plan (NREAP) and the determination of the national RES targets. For Montenegro, the national RES target was determined at a level of a 33% share of energy produced from RES in the gross final energy consumption by 2020 by the Decision of the Ministerial Council of the Energy Community. The NREAP, adopted in 2014, provides detailed forecasts with the aim of reaching the RES target. According to the Government of Montenegro, the country achieved a 31.7% of share of RES in final energy consumption in 2016. However, the Eurostat data indicates that Montenegro already surpassed the 33% target and reached the level of 41.5% in 2016.

The identified difference is related to different methodologies applied to the calculation of the contribution of biomass to the RES target. The legislative framework envisages the following support schemes for RES:
- Guaranteed purchase of electricity using 'feed-in-tariffs (FIT)' from privileged producers for a period of 12 years;

- Priority in delivery of electricity generated into transmission or distribution systems;

- Exemption from any payment related to imbalances, network charges and electricity losses for SHPPs connected to the distribution system.

Twelve small HPPs, with total installed capacity of 24.1 MW, and the Krnovo windfarm, with installed capacity of 72 MW, were put into operation during 2014–2018. Apart from completed projects, there are also a number of ongoing projects, including the Možura windfarm, with installed capacity of 46 MW and a solar power plant in the Briska Gora Locality, with installed capacity of 250 MW. As for the latter, the project is being implemented without any support from the Government of Montenegro in the form of the FITs. Despite the progress in promoting solar power plants, the use of solar thermal systems is not well developed, as there exist no state incentives for the utilisation of these systems in Montenegro.

5.1.2 Covenant of Mayors for Energy and Climate

The Covenant of Mayors is an EU initiative launched in 2008. The signatories of the Covenant of Mayors share the vision to make cities decarbonised and resilient, committing themselves to contribute to the goals of the Sustainable Energy Development Strategy and the implementation of the action plan for improving energy efficiency measures of the European Union through the development and implementation of the Local Sustainable Energy Action Plan (SEAP). The initiative was previously aimed at achieving the goals set by the EU by 2020 in a package of measures in the field of energy and action to combat climate change, by reducing greenhouse gas emissions by at least 20% by implementing local Energy Action Plans and increasing use and production renewable so-called "Clean" energy. According to the estimates of the Secretariat of the initiative, the total reduction of greenhouse gas emissions of all signatories to the Covenant by the end of 2020 was 27%.

The Covenant of Mayors continued after 2020 with the ambition to gather local authorities that voluntarily want to achieve and exceed the EU's energy and climate goals. The Covenant of Mayors for Energy and Climate is now the largest global initiative for local energy and climate action, bringing together more than 9,000 local and regional governments in 60 countries around the world, which are voluntarily committed to implementing EU energy and climate goals. The signatory cities are committed to achieving at the local level the EU goal of reducing greenhouse gas emissions by 40% by 2030 and to adopt a common approach in the fight against climate change mitigation and adaptation. The EU Joint Research Center (JRC) has developed precise guidelines with instructions for developing an Action Plan. In accordance with the guidelines, the plan should, inter alia, contain a local inventory of greenhouse gas emissions (BEI), a vital part of the plan, which serves to monitor mitigation measures, as well as climate risk and vulnerability assessment (RVA), while the local strategy Climate change adaptation can be an integral part of the Action Plan or drafted as a separate planning document. The guidelines provide detailed instructions to local partners for the development of the Action Plan, in particular:

- defining the key elements of the initiative;

- calculation of local inventory of greenhouse gas emissions (BEI);
- analysis of climate risk and vulnerability assessments (RVA);
- formulation of measures and scenarios;
- support for implementation and monitoring

5.1.3 Municipality of Tuzi and Covenant of Mayors

The municipality of Tuzi, on December 29, 2020, joined the Covenant of Mayors. By signing the Covenant, the town administration has committed itself to implementing a number of energy efficiency measures and renewable energy sources, which will ultimately reduce CO2 emissions by more than 40% by 2030. Thanks to the support of the *Adria Alliance project*, which brings together 19 municipalities from three countries (Italy, Albania and Montenegro), the municipality of Tuzi in May 2021 began drafting the Sustainable Energy and Climate Action Plan, with the goal of low-carbon economic and energy development with an increase in the share of energy produced from renewable sources, further reduction of CO2 emissions by at least 40% by 2030, achieving environmental and energy sustainability and adaptation to climate change in the municipality. It is important to emphasize that this is a purely voluntary initiative and that the municipality will not bear any consequences for possible failure to meet the planned goals.

5.2 Energy Consumption and CO_2 Emissions in the base year[21]

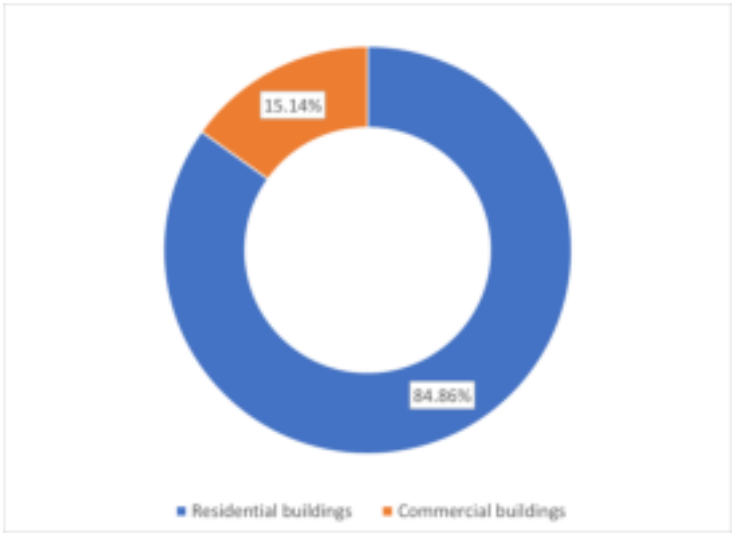
5.2.1 Analysis of energy consumption in the building sector

Information on buildings for monitoring and managing energy consumption is very demanding to collect in Montenegro and in more IT-equipped services, but basic data (on the area, number and purpose of buildings) are mostly available from the real estate cadastre. The remaining data of importance, primarily the energy characteristics of buildings are collected by a survey or through dedicated software that generates the estimated energy characteristics of buildings based on the typification of buildings and the recommended algorithm. In this regard, data on the number and purpose of buildings on the territory of the Municipality of Tuzi were available (Table 3.1, Figure 3.1), but not on their usable area and number of storeys.

Table.1 Structure of facilities by purpose in the Municipality of Tuzi

	No.	Surface [m^2]
Residential buildings	1572	333.857,9
Business facilities	95	59.559,5
Total	1667	393.417,4

[21] Source: Sustainable energy and climate action plan (SECAP) for Municipality Tuzi



Slika.1 Structure of the total area of buildings according to purpose

It can be noticed that the total area of buildings is dominated by residential buildings with approximately 85% share. It is clear that this has a direct impact on the share in total energy consumption.

Data on public buildings are somewhat more accessible, especially when it comes to buildings managed by the municipality.

5.2.2 Town-owned buildings

In addition to the building of the Municipality, the buildings of all public institutions on the territory of the Municipality are also included here, and these are also primary and secondary schools, a health center and a house of culture. An overview of their characteristics is given below (Table 3.2).

Table 3.2 Overview of basic characteristics and energy consumption of public buildings on the territory of the Municipality of Tuzi in 2019

	Number of facilities	Surface [m^2]	Electricity consumption [kWh/year]	Fuel oil consumption [l / year]
Municipality building	1	1423	115.308	0
Health centre	1	737	100.022	0
Community Cultural Center	2	1179	22.174	3.000
Elementary schools	10	6177	607.861	24.000
High Schools	2	3120	448.014	0

The total energy consumption in public buildings in 2019 amounted to 1,549.61 MWh (Table 3.3), and within that consumption, the dominant share belongs to facilities in the field of education (primary and secondary schools) with 75% share in total energy consumption (Figure 3.2).

Table 3.3 Energy consumption of public buildings in 2019

	Electricity consumption [MWh / year]	Fuel oil consumption [MWh / year]	Total energy consumption [MWh / year]
Municipality building	115,31	0,00	115,31
Health centre	100,02	0,00	100,02
Community Cultural Center	22,17	28,47	50,64
Elementary schools	607,86	227,76	835,62
High Schools	448,01	0,00	448,01
Total public buildings	1.293,38	256,23	1.549,61

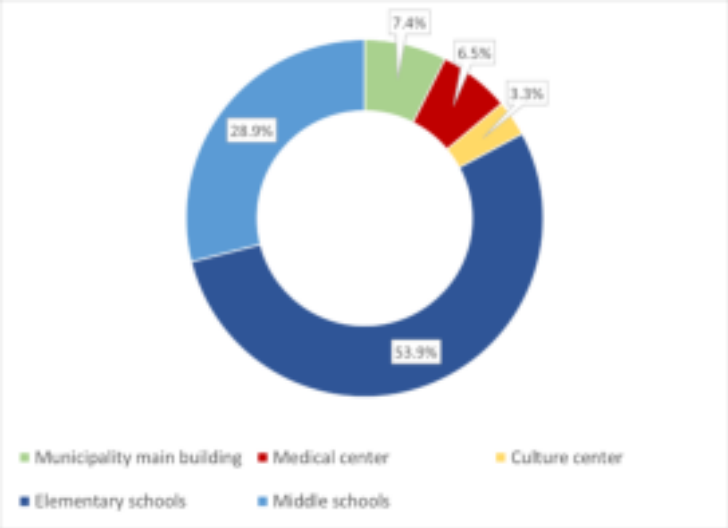


Figure 3.2 Structure of energy consumption in public buildings of the Municipality of Tuzi in 2019

It is necessary to emphasize that the building of the Municipality and the building of the Health Center are significantly represented in the energy balance because they are individual facilities, so in that sense they can be recognized as an address for potential measures to improve energy efficiency. Specific energy annual consumption for the building of the Municipality and the Health Center is 81 kWh / m2 and 136 kWh / m2. A national software for energy classification of buildings is being developed, which will give typical and recommended values of this and other indicators of interest as one of the results, in order to assign an appropriate energy class to each building. If the recommended values from the literature were observed, it could be pointed out that according to the specific energy consumption, the building of the Municipality is not energy intensive, ie has lower specific consumption than is usual for administrative buildings in Montenegro, while the Health Center is slightly above the recommended values for medical facilities. In any case, as the goal is to achieve energy close to a neutral building, it is clear that there is a lot of potential for energy efficiency measures in the public building sector.

5.2.3 Town-owned buildings

The sub-sector of commercial and service sector buildings covers an area of 59,559.5 m2. Area data were obtained from the Real Estate Administration. As it is known, the real estate cadastre for the Municipality of Tuzi is not fully harmonized with all the needs of stakeholders, so it is insufficiently equipped with the necessary data for the needs of analyzing the area and purpose of buildings in the Municipality of Tuzi, in

order to model energy consumption by building sectors. The alternative was to survey all commercial entities in order to gather all the information, and as this is an extremely extensive and time-consuming job, this was not done. It is to be expected that after the development of the national software for energy categorization of buildings, and with some improvements in the information base on buildings currently available from the cadastre, sufficiently reliable monitoring of energy consumption in all subsectors of the building sector.

When it comes to energy consumption in this sector, it is easiest to collect data from the Electricity Supplier, but this requires knowledge of consumer numbers that correspond to all facilities of the commercial sector because the supplier does not monitor electricity consumption by categories recognized by this planning document.

In order to estimate the total energy consumption of the building sector, based on typical values of specific energy consumption for commercial buildings in Montenegro, the total energy consumption can be estimated at 8,934 MWh / year. As it is a commercial sector, electricity is assumed to be the dominant energy source.

5.2.4 Residential buildings

According to the available data from the real estate cadastre, it is estimated that the area of buildings corresponding to residential buildings is 333,857.9 m2. The total number of residential buildings on the territory of the Municipality of Tuzi is 1,572. Individual housing facilities dominate. There is currently no standardized collection of data on energy consumption in the residential sector. EPCG Supply, which is responsible for electricity supply, has the most reliable data on energy consumption. Data on the remaining energy sources used are collected through a survey on a selected sample.

As the preparation of national software for energy certification of buildings is currently in the process, the first phase of data collection for some typical facilities from all climate regions of Montenegro has already been completed. The municipality of Tuzi is associated with the region to which the Capital Podgorica belongs with the coast due to the extremely warmer climate in relation to the central and northern region of the country. For this region, the share of the following energy sources in the residential sector was recognized (Table 3.4): electricity, firewood, liquefied petroleum gas and a small share of coal.

Figure 3.3 Structure of energy consumption in the residential sector in 2019

Residential buildings	Energy consumption [kWh / year]				
	Electricity	Firewood	LPG	Coal	Total
	25.640,21	13.913,42	1.550,07	227,34	41.331,04

It is obvious that electricity consumption dominates in the residential sector (approximately 62%), but firewood also has a significant share (approximately 34%). LPG has a small share and insignificant coal (Table 3.4).

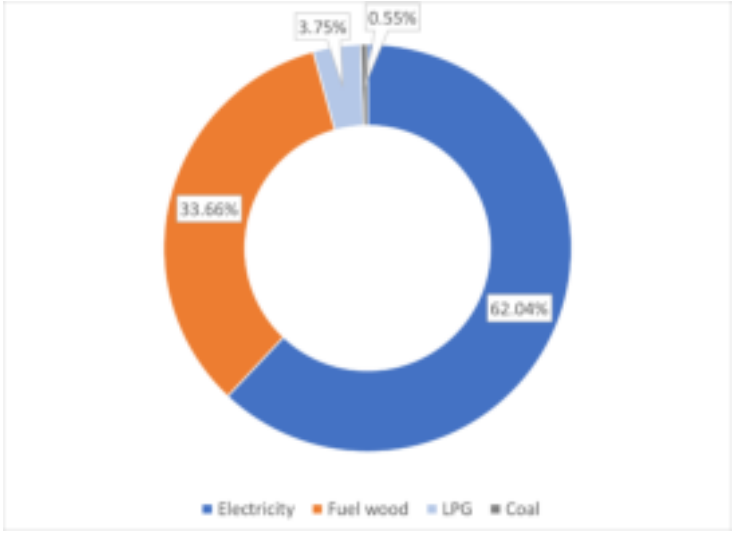


Figure 3.3 Structure of energy consumption in the residential sector

All energy sources except electricity are used predominantly to meet the needs for thermal energy (space heating, hot water preparation and cooking). On the other hand, electricity is also used to meet the needs for thermal energy, especially in the region to which Tuzi and the Capital belong. It is estimated that about 40% of total electricity consumption meets the needs for heat in this region. However, it should be emphasized that it is common for only approximately 30% of the usable area of residential buildings to be heated and that only approximately 5% of buildings have a heating system for the entire usable area (according to statistical analyzes performed to prepare a national building inventory).

5.2.5 Analysis of total consumption in the building sector

Summarizing all subsectors, the energy consumption balance for the building sector was obtained (Table 3.5). The total energy consumption in the base year is 51,814.57 MWh. Typically, the largest share of energy consumption is in the residential sector (approximately 80%), followed by commercial buildings

Table 3.5 Total annual energy consumption in the building sector

Sector	Energy consumption [kWh / year]					
	Electricity	Firewood	LPG	Coal	Fuel oil	Total
Residential buildings	25.640,21	13.913,42	1.550,07	227,34	-	41.331,04
Public buildings	1.293,38	-	-	-	256,23	1.549,61
Commercial buildings	8.933,93	-	-	-	-	8.933,93
Total	35.867,51	13.913,42	1.550,07	227,34	256,23	51.814,57

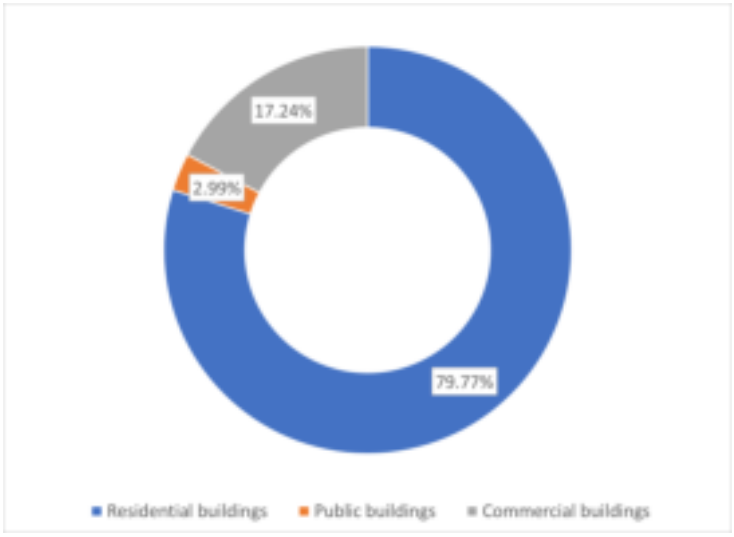


Figure 3.4 Structure of energy consumption by building subsectors

Public buildings have the smallest share in energy consumption, and thus the smallest potential global effect of energy efficiency measures, but due to organizational characteristics, in this subsector of buildings the implementation of energy efficiency measures is most effective, so the measures start using this subsector. Of course, the greatest long-term global effect is achieved by involving citizens in the process of implementing measures on their own facilities.

5.3 Analysis of energy consumption in the public lighting sector

Since the founding of the Municipality of Tuzi, the Town Service "Komunalno Tuzi" has taken over all the responsibility regarding the maintenance and plans for the expansion of public lighting. The fact that the management and operation of public lighting is centralized facilitates the collection of data and monitoring of the quality of public lighting, ie the identification of measures that can improve energy efficiency.

Currently, there is no register of lighting in the form of a geographic information system (GIS), so the introduction of the same in the future would further improve the quality of public lighting.

Public lighting facilities consist of power supply devices, cables (underground or overhead), poles, lampholders, lamps, light sources as well as control and regulation devices. Public lighting facilities are supplied from the distribution network from 10 / 0.4 kV substations. Measuring points are located in separate cabinets or as a field of public lighting in the low-voltage block of the substation itself. The complete topology of the public lighting network depends on the layout and size of the town units as well as the layout of the substations or distribution cabinets from which they are supplied.

The control of public lighting is done by means of astronomical switching clocks for control depending on the sunset and sunrise. Public lighting works on average about 4,360 hours a year.

The number of light bulbs in the territory of the Municipality of Tuzi is 3,500, while the number of measuring points is 62. Different types of lamps have been installed in the territory of the Municipality of Tuzi, more precisely lamps with a light source (70 W, 100 W, 150 W and 250 W), and lamps with LED light source (LED40, LED50 and LED 120). In relation to the total number of lamps in the Territory of the Municipality of Tuzi, 80% are lamps with a sodium light source.

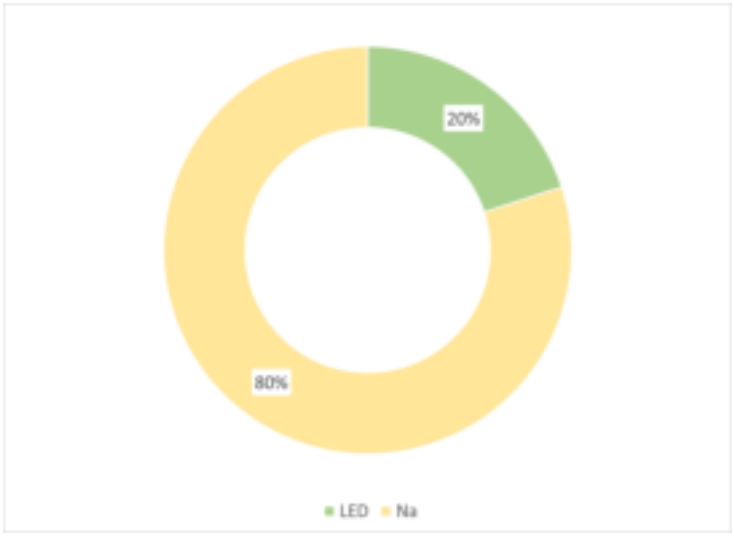


Figure 3.5 Structure of light bulbs used in public lighting according to the type of light source

The total annual electricity consumption for public lighting is about 1,400 MWh. As the Municipality of Tuzi relatively recently received this status, historical data on electricity consumption for public lighting were contained in data collected integrally for the Capital Town of Podgorica. Observing the historical trend of public lighting consumption in that period, one can notice the stagnation of consumption with moderate growth in certain years due to the development of infrastructure. During the period when the Municipality of Tuzi was part of the Capital, the share of electricity consumption for public lighting corresponding to the Municipality of Tuzi in the total electricity consumed for public lighting of the Capital is approximately 10%.

5.4 Analysis of energy consumption in the transport sector

5.4.1 Town administration vehicles

The town administration has 6 passenger cars, of which 3 are under 6 years old, and the oldest 2 were produced in 2008. All vehicles have a volume below 1,900 cm3 and use diesel as fuel. The town administration also has one truck. Total diesel consumption in 2019 and 2020 was 16,511 liters and 11,822 liters, respectively. It is evident that during 2020, there was a significant reduction in fuel consumption.

The energy value of diesel consumption by town government vehicles is 166.52 MWh and 119.22 MWh for 2019 and 2020, respectively.

5.4.2 Public transport

In the area of the town of Tuzi, there are possibilities for public transport to take place by bus, taxi and train. However, only taxi transport has the role of public transport. Bus transport has the role of exclusively intercity passenger transport (to Podgorica) in the form of 2 lines that are permanently maintained during the year, except during school holidays when only one line is in operation. There is 1 bus on each of the mentioned lines.

The Podgorica-Shkodra railway runs along the entire territory of the municipality of Tuzi, with a railway station and a customs office in Tuzi, which is currently used exclusively for freight transport (Figure 3.6). It is planned to start railway passenger transport on the route Tuzi - Shkodra - Tuzi within the IPA projects in cooperation with the Ministry in charge of transport.

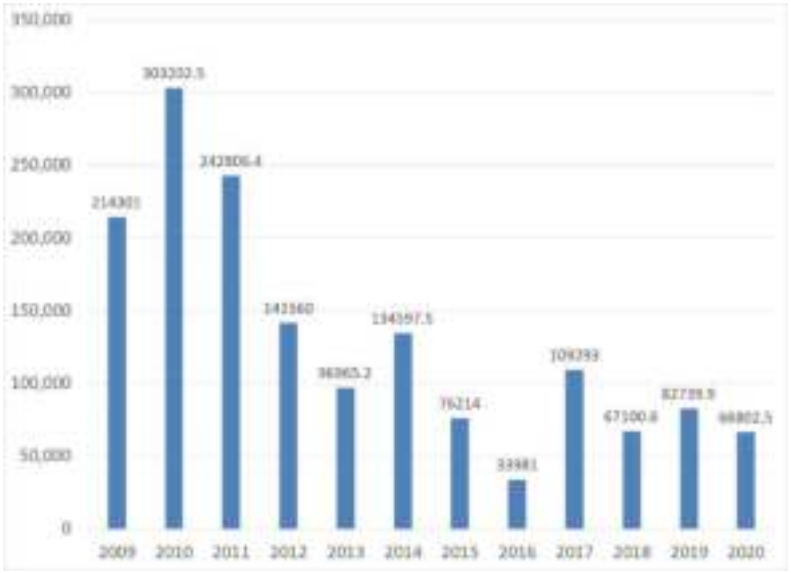


Figure 3.6 Freight transport on the route Podgorica-Tuzi [tone]

The total number of registered buses on the territory of the municipality is 7, of which 4 are registered by transport companies, while the remaining 1 is a school bus, 1 is owned by a religious organization and 1 is privately owned.

The annual fuel consumption for the maintenance of the mentioned intercity bus lines is 66,500 liters of diesel. Since the beginning of the pandemic, only 1 bus has been operating and had a consumption of 40,150 liters of diesel. The corresponding energy values are: 670.66 MWh and 404.92 MWh respectively. The total number of passengers per year is 64,000 (2019) and 52,500 (2020).

Data on organized taxi transport on the territory of the Municipality of Tuzi were not available, as well as the associated fuel consumption.

5.4.3 Town road transport

The total number of registered vehicles in 2020 was 4184 and that is about 2% in relation to the total number of registered vehicles in Montenegro. The structure of the vehicle fleet in the territory of the Municipality of Tuzi is dominated by passenger cars (Table 3.6) with approximately 87.5% share in the total number of vehicles, which is slightly above the share of passenger cars in the total number of vehicles in Montenegro (86.2%). The average age of the vehicle fleet is 16 years.

Table 3.6 Fleet structure by type of vehicle for 2020

Passanger vehicle	Bus	Truck	Van	Motorcycle	Trailer	Agri. tractor	Special vehicles	Total
3661	7	403	1	18	56	10	28	4184

Historical data on the number of registered vehicles for the Municipality of Tuzi were not available due to the relatively recent acquisition of the status of a municipality, so these data were combined within the data for the Capital. However, on the trend of changing the number of vehicles in the previous period, it is possible to draw conclusions from historical data at the level of Montenegro (Figure 3.7).

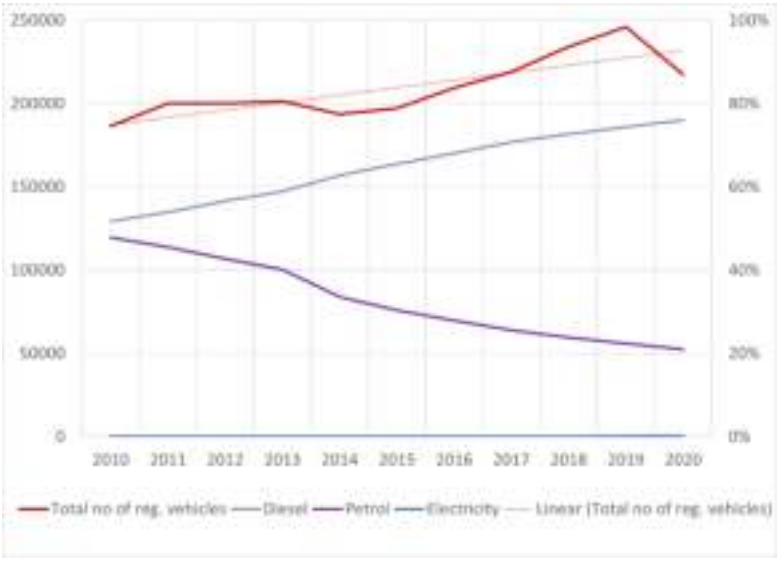


Figure 3.7 Trend of change in the total number of registered vehicles and their share by fuels of interest

So, from 2010 until today, the growing trend in the number of registered vehicles is clearly visible. A slightly more noticeable decline in the number of vehicles is seen in 2020 due to the pandemic, but it is to be expected that the recognized trend will continue. Also, the same figure shows the trend of changing the share of vehicles with selected fuels. The strong growth in the share of vehicles using diesel as a fuel from 2010 to the present is more than obvious. Thus, with the practically equal representation of vehicles with diesel and gasoline as propellants in 2010, in 10 years there has been a drastic substitution of propellants in the fleet of Montenegro, and today vehicles that use diesel have a share of almost 80% in the total vehicles. The main reasons for this are economic in nature (lower fuel price and higher vehicle economy), however this results in an extremely adverse impact on the environment and climate change. The precise structure of the vehicle fleet by motor fuels is given in the figure below (Figure 3.8).

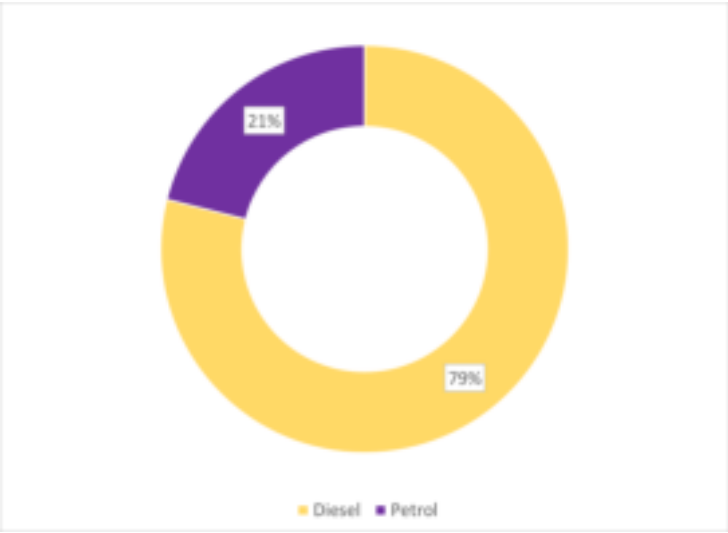


Figure 3.8 Vehicle structure by type of fuel for Montenegro in 2020

The fleet of the Municipality of Tuzi in 2020 can be said to correspond to the same structure when it comes to fuels as for Montenegro.

Private vehicles dominate in the fleet of the Municipality of Tuzi with 87.4% (Figure 3.9), while commercial vehicles (vehicles owned by economic entities) have a share of 12.4%. Vehicles owned by public institutions have a very small share of 0.2%.

Figure 3.9 Structure of the vehicle fleet according to the purpose of the vehicle

Based on the insight into the type and age structure of vehicles registered in the Municipality of Tuzi, as well as statistical data on the associated characteristics of fuel consumption (GFEI, IEA) in the transport sector, the total fuel consumption in the transport sector of Tuzi Municipality was estimated (Figure 3.10).

Table 3.7 Overview of total fuel consumption in the Municipality of Tuzi

Fuel type	Gasoline		Diesel	
	[Liters]	[MWh]	[Liters]	[MWh]
2020	664.698	6.381,1	2.368.856	23.890,18

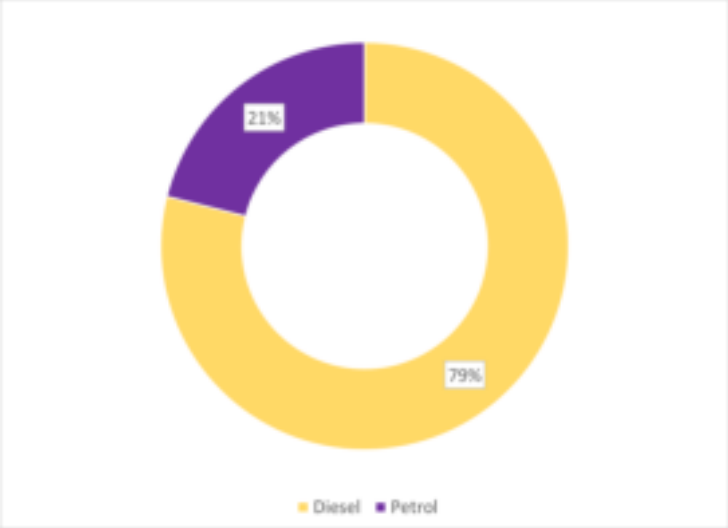


Figure 3.10 Structure of motor fuels according to energy value

The total energy value of annual fuel consumption is 30,271 MWh and similarly to the share of vehicles in the total fleet, diesel fuel dominates with almost 80% share.

Table 3.8 Energy consumption in the transport sector

	Gasoline	Diesel	Total
Town administration vehicles		119,22	119,22
Public transportation		670,66	670,66
Town road transport	6.381,10	23.890,18	30.271,29
Total transport sector	6.381,10	24.680,07	31.061,17

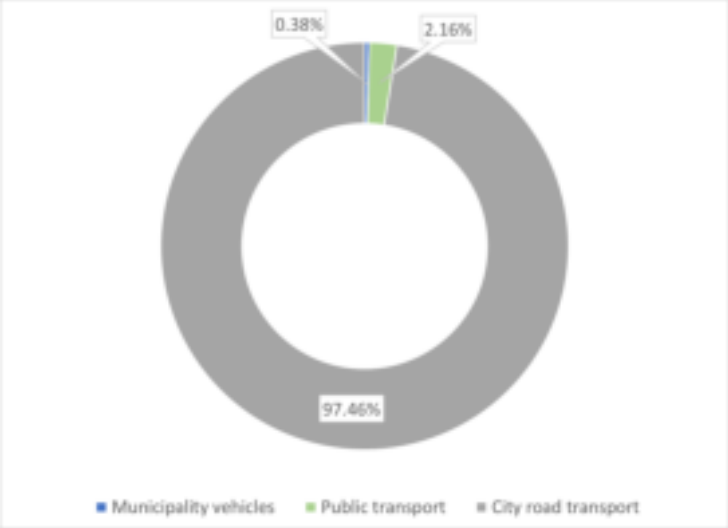


Figure 3.11 Share of subsectors in total energy consumption of transport sector

It is planned to install a charging station for electric vehicles with a simultaneous power of 34 kW in the parking lot of the Municipality building, as well as to build a gas station Eco under construction, which is under construction after the bridge over the river Cijevna at Karabuško polje it is a candidate for the UNDP project) a fast station for charging electric vehicles with a simultaneous power of 50 kW or more.

5.5 Analysis of the total energy consumption of the Municipality of Tuzi

An overview of total energy consumption in sectors and subsectors for the reference year is given in the table below (Table 3.9).

Table 3.9 Total energy consumption by sectors in the reference year

Buildings	Residential buildings	41.331,04	51.814,57
	Public buildings	1.549,61	
	Commercial buildings	8.933,93	
Public lighting		1.400	1.400
Transport	Town administration vehicles	119,22	31.061,17
	Public transportation	670,66	
	Town road transport	30.271,29	

Total	84.275,74

The total annual consumption of the sector of interest for this plan is 84,275.74 MWh. The intensity of energy consumption is highest in the building and transport sectors, which together account for over 98% of total consumption. Among subsectors (Figure 3.12), residential buildings and road transport stand out the most in terms of energy consumption, which together make up approximately 85% of consumption, so it is clear that measures targeted for these subsectors have the greatest effect on total energy consumption.

5.6 Reference Inventory of Emissions

As the Municipality of Tuzi has recently received the status of a municipality, it is a process of personalized collection of statistics and data of interest concerning the municipality itself, still in development, and the establishment of a reliable information base for the preparation of such and related plans is still expected. Collection of historical data was possible only for a part of the necessary information, but as other necessary data for the development of this plan for a further period in the past were contained within the data concerning the Capital, it was not possible to separate them within the deadline for this document. As a result, and taking into account the fact that 2020 cannot be taken as a typical year, 2019 was taken as the reference year for inventory purposes.

According to Monstat data, the estimated number of inhabitants in the middle of 2019 for the municipality of Tuzi was 12,371 inhabitants. According to these data, it can be concluded that there has been a slight increase in the population compared to the 2011 census.

Emission factors for identified energy sources are taken from the IPCC manual, while for electricity the national emission coefficient derived from the production mix of power plants is used, which was used when reporting on CO2 emissions in Montenegro (Table 5.1).

Table 4.1 Emission factors

Type of energy source	Emission factor tCO_2/MWh
Electricity	0,34
Fuel oil	0,276
LPG	0,227
Gesoline	0,249
Diesel	0,267
Firewood	0

5.6.1 Building Sector

Taking into account the presented energy consumption balances and the stated emission factors, it is possible to estimate the total CO2 emissions for the building sector of the Municipality of Tuzi (Table 4.2). It can be noticed that, similarly to energy consumption, the residential sector has a dominant share in CO2 emissions (Figure 4.1).

Table 4.2 Total CO2 emissions by building subsectors (tCO_2)

	Electricity	TNG	Coal	Fuel oil	Total

Residential buildings	8.717,67	351,87	82,87		9.152,40
Public buildings	439,75			70,72	510,47
Commercial buildings	3.037,53				3.037,53
Total	12.194,95	351,87	82,87	70,72	12.700,41

It should be emphasized that all emissions are conditioned by the dominant presence of electricity in the energy balance, so with the expected future improvement of the production mix in Montenegro there will be a spontaneous reduction of CO2 emissions at the state level, and thus the municipality. Then, when it comes to CO2 emissions, those sectors that use other energy sources that are particularly emission-intensive, such as fossil fuels, will come to the fore. Precisely to avoid this, it is necessary to plan the substitution of fossil fuels with cleaner and more affordable alternatives.

Figure 4.1 Structure of CO2 emissions by subsectors of buildings

5.6.2 Public lighting Sector

CO2 emissions from the public lighting sector in the town of Tuzi result from the electricity consumption of the public lighting network. CO2 emissions in the public lighting sector in the reference year were 476 tCO_2.

5.6.3 Transport Sector

Taking into account the emission factors and the previously presented balance of energy consumption, the emissions of the transport sector by subsectors for the reference year were estimated (Table 4.3). Practically all emissions in the transport sector correspond to urban road transport (above 97%). Public transport has a very small share, but this is expected due to its poor development.

Table 4.3 Total CO2 emissions by transport subsectors (tCO_2)

	Gasoline	Diesel	Total
Public administration vehicles		31,83	31,83
Public transportation		179,07	179,07
Town road transport	1.588,89	6.378,68	7.967,57
Total transport sector	1.588,89	6.589,58	8.178,47

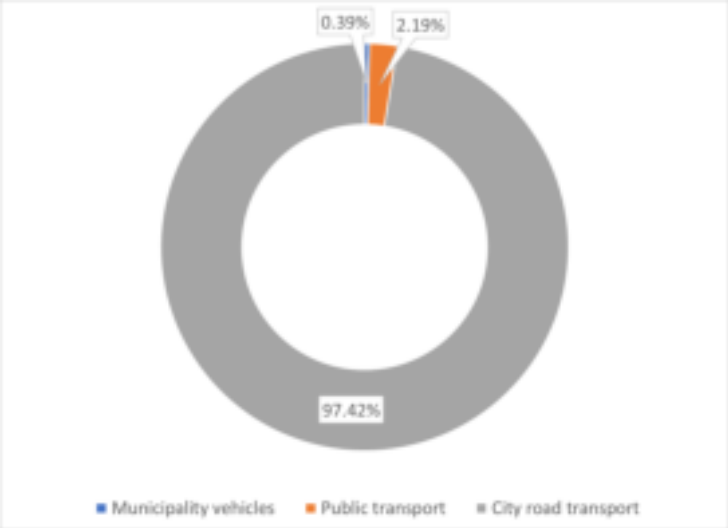


Figure 4.2 Structure of CO_2 emissions by transport subsectors

5.6.4 Total emissions in the reference year by sectors

Summarizing all the results calculated for the sectors, it is possible to obtain an overview of total CO2 emissions (Table 4.4). It can be noticed that similarly to energy consumption, the building sector is dominant (approximately 59%), but it is not as dominant in relation to the transport sector as when it comes to energy consumption. The reason is the significant presence of firewood in the energy balance of buildings, which does not emit CO2. This circumstance should be especially taken into account when defining measures aimed at reducing CO2 emissions in the building sector.

Table 4.4 Total CO_2 emissions by sectors

Sector	Emission [tCO_2]
Buildings	12.700,41
Public lighting	476
Transport	8.178,47
Total	21.354,88

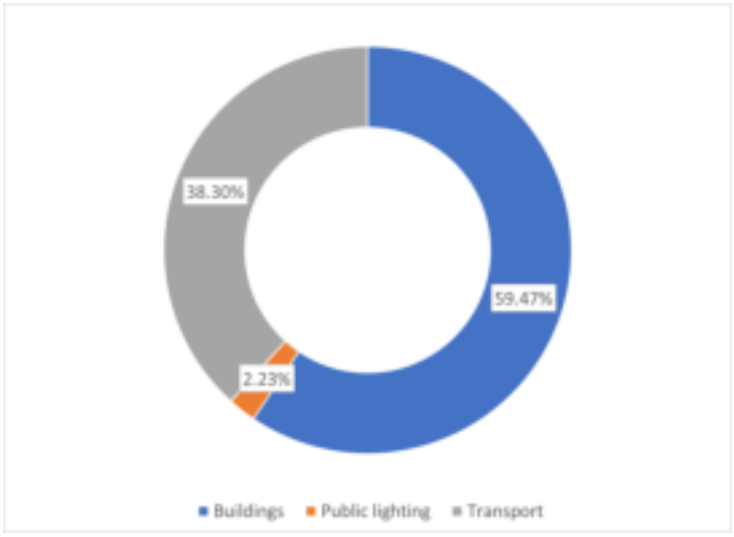


Figure 4.3 Structure of CO2 emissions by sectors of interest for the reference year

Therefore, measures to reduce CO2 emissions are especially important in the building and transport sectors, especially electromobility, but also the activation of railway transport, but it is important to keep in mind the way electricity is produced, ie it is important to influence the energy mix, a higher share of renewable energy sources in order to reduce the national emission factor, which is linked to the electricity system. This would affect all sectors because electricity is the dominant energy source.

Taking into account the amount of emissions in the reference year, it is clear that the target for 2030 is thus set to reduce emissions to at least 12,812.93 tCO_2. Appropriate measures in those sectors that are characterized by the most intensive emissions, ie. use of energy sources with a significant impact on emissions: fossil fuels, but also electricity taken from the public energy supply system as long as the energy mix is unfavorable in terms of the participation of renewable energy sources. A fixed emission factor for electricity will be assumed here, although it is clear that various strategies at the national level are aimed at further integration of renewable energy sources and that the national emission factor of the Montenegrin electricity system (depending on the generation mix) will decline over time of the aforementioned goal.

5.7 Examples of Local Actions

5.7.1 Establishment of an energy management system

Establishment of an energy management system	
Sector	Buildings - subsector of public buildings
Description of the measure	Establishment of an energy management system implies defining the boundaries of the managed system, energy policy of that system, energy manager, main and most important users, monitoring of energy consumption, as well as defining measures and priorities for implementing measures to improve energy management and energy consumption. This process of establishing an energy management

	system is clearly defined and described by the international standard MEST EN ISO 50001 Energy management systems - Requirements with instructions for use. The energy management system, as described in the standard can be applied to smaller systems such as one building but also wider. Basic goals: • Adoption of a methodology for collecting relevant energy indicators for the building sector at the municipal level • Collection of relevant energy indicators according to the developed methodology on an annual, monthly and daily basis (depending on the type of indicators), where automatic remote reading systems will be used for collection, as well as readings by employees to further verify their accuracy; • Development of an energy management information system at the municipal level, which will include all collected data and indicators and enable the development of all necessary analyzes; • Preparation of the annual energy balance of the Municipality, ie. total annual energy consumption in buildings, according to Montenegrin regulations.
Responsible body / department	Municipality, energy manager, town urban planning service
Implementation timeframe – start	2021
Implementation timeframe – end	2030
Expected energy savings [MWh]	5,895 MWh year 3030
Expected emission reductions CO_2 [tCO_2]	1.455 tCO2 in 2030
Investment costs (€)	100.000 Euros
Non-investment costs (€)	
Financial resources	Municipality of Tuzi, Government of Montenegro, ECO Fund, European Bank for Reconstruction and Development

5.7.2 Installation of photovoltaic panels on the roofs of public buildings

Installation of photovoltaic panels on the roofs of public buildings	
Sector	Buildings - subsector of public buildings
Description of the measure	Existing legal solutions enable very simple construction of photovoltaic systems on the roofs of buildings in terms of energy exchange at the point of connection. The administration building has significant energy consumption and high approved power. Since the building also has an auxiliary facility, as well as 3 electric meters, there is enough space to build a photovoltaic system with an installed power of 50-100 kW. Such a system could, depending on the method of implementation, cover from 50% to almost the total electricity needs on an annual basis when it comes to the administrative building. A special advantage of the construction of photovoltaic power plants on administrative buildings is the high simultaneity of electricity production with demand, which has a very favorable impact on the electricity distribution network.
Responsible body / department	Municipality, energy manager, town urban planning service
Implementation timeframe - start	2021
Implementation timeframe - end	2024
Expected energy savings [MWh]	60-120 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	20-41 tCO2 in 2030
Investment costs (€)	50.000 - 90.000 Euros
Non-nvestment costs (€)	
Financial resources	Municipality budget ECO Fund European Bank for Reconstruction and Development

5.7.3 Installation of photovoltaic panels on school roofs

Installation of photovoltaic panels on school roofs

Sector	Buildings - subsector of public buildings
Description of the measure	Existing legal solutions enable very simple construction of photovoltaic systems on the roofs of buildings in terms of energy exchange at the point of connection. There are 12 school buildings in the Municipality of Tuzi and each of them (roof) can be a potential location for the construction of small photovoltaic power plants with a capacity of at least 30 kW per building. Where conditions allow, that power can be even higher. Taking into account the number of facilities, the total installed power of photovoltaic power plants would be between 360 kW and 500 kW. A special advantage of the construction of photovoltaic power plants on school buildings is the high simultaneity of electricity production with demand, which has a very favorable impact on the electricity distribution network. Such a system could, depending on the method of implementation, cover from 50% to almost the total electricity needs on an annual basis when it comes to schools.
Responsible body / department	Municipality, relevant ministry
Implementation timeframe - start	2021
Implementation timeframe - end	2025
Expected energy savings [MWh]	432-600 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	147-204 tCO2 in 2030
Investment costs (€)	330.000 - 450.000 Euros
Non-nvestment costs (€)	
Financial resources	ECO fund European Bank for Reconstruction and Development Relevant ministry

5.7.4 Reconstruction of facades and facade carpentry on buildings of the commercial and service sector

Reconstruction of facades and facade carpentry on buildings of the commercial and service sector

Sector	Buildings - subsector of commercial building
Description of the measure	This measure is recognized as a very effective measure for achieving savings in energy consumption, primarily for the needs of air conditioning. Problems that service and commercial sector buildings have due to poor thermal insulation have been identified. Facilities that are candidates for the implementation of this measure must have a prior energy audit in order to give priority to those facilities that have the highest energy losses. The measure would be limited to 4% of facilities per year (observed as a share in the total area of facilities in the commercial and service sectors). This would achieve the result that 30% of buildings in 2030 have improved thermal insulation characteristics by at least 40% compared to the existing condition.
Responsible body / department	Municipality, relevant ministry
Implementation timeframe - start	2021
Implementation timeframe - end	2030
Expected energy savings [MWh]	1340 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	456 tCO2 in 2030
Investment costs (€)	9.000.000 Euros
Non-nvestment costs (€)	
Financial resources	Own funds of building owners ECO fund EU funds and programs Programs of competent ministries European Bank for Reconstruction and Development

5.7.5 Raising citizens' awareness of energy efficiency and renewable energy sources (RES)

Raising citizens' awareness of energy efficiency and renewable energy sources (RES)	
Sector	Buildings - residential building subsector

Description of the measure	The measure includes a number of educational activities that are regularly carried out: • opening of EE info-corners in key town positions • continuous informing consumers about ways to save energy • conducting thematic information campaigns to raise awareness of energy efficiency and RES • organization of meetings and campaigns on the design, construction and use of buildings in a sustainable way for target groups • production of leaflets and promotional materials on energy efficiency and RES • organization of the Town Energy Days at least once a year • support to citizens in projects to increase energy efficiency and the use of RES. It is estimated that the implementation of this measure would achieve savings of at least 15% by 2030 in the residential sector.
Responsible body / department	Municipality, relevant ministry
Implementation timeframe - start	2021
Implementation timeframe - end	2024
Expected energy savings [MWh]	7.032 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	1.570 tCO2 in 2030
Investment costs (€)	40.000 Euros
Non-nvestment costs (€)	
Financial resources	Municipality budget ECO Fund EU funds and programmes Programmes of relvant ministries European Bank for Reconstruction and Development

5.7.6 Installation of photovoltaic panels on the roofs of family houses

Installation of photovoltaic panels on the roofs of family houses	
Sector	Buildings - residential building subsector
Description of the measure	Existing legal solutions enable very simple construction of photovoltaic systems on the roofs of buildings in terms of energy exchange at the point of connection. The procedures are especially simplified for households that intend to install photovoltaic systems up to 10 kW of installed power. Systems with an installed power of 5-6 kW are sufficient to fully meet the needs of the average household for electricity on an annual basis. The total number of residential buildings in the reference year is 1,572. This measure assumes the construction of photovoltaic systems with an installed capacity of 6 kW on 40% of facilities from the reference year until 2030, which makes the total installed capacity of distributed photovoltaic power plants of close to 3.8 MW in 2030.
Responsible body / department	Municipality, energy manager, town urban planning service
Implementation timeframe - start	2021
Implementation timeframe - end	2030
Expected energy savings [MWh]	4.527 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	1,539 tCO2 in 2030
Investment costs (€)	4.000.000 E
Non-investment costs (€)	
Financial resources	Own funds of building owners Municipal budget ECO fund European Bank for Reconstruction and Development

5.7.7 Renovation of thermal insulation and heating system of family houses

Renovation of thermal insulation and heating system of family houses	
Sector	Buildings - residential building subsector
Description of the measure	The measure includes the reconstruction of the thermal insulation of the outer shell of the building and the repair of the roof and carpentry, as well as the replacement of the heating system of family houses in the administrative area of the town. This measure primarily refers to buildings that have large energy losses caused by poor thermal insulation and inefficient heating systems. Assuming that 4% of the buildings in the housing sector will be renovated annually (participation in the total useful area of this sector is observed), which means that approximately 630 family houses will be included in the reconstruction by 2030. It is estimated that with this measure it is possible to achieve energy savings of about 60 kWh / m^2 with investment costs of 200 EUR/m^2.
Responsible body / department	Municipality, energy manager, town urban planning service
Implementation timeframe - start	2021
Implementation timeframe - end	2030
Expected energy savings [MWh]	8.013 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	1.789 tCO2 in 2030
Investment costs (€)	26.700.000 Euros
Non-nvestment costs (€)	
Financial resources	Homeowners' own funds Municipal budget ECO fund European Bank for Reconstruction and Development

5.7.8 Replacing worn-out Na lamps with LED lamps

Replacing worn-out Na lamps with LED lamps

Sector	Public lighting
Description of the measure	This measure plans to completely replace the world's public lighting of traditional production with LED public lighting. Part of public lighting (20%) already makes LED lighting. The first phase of the replacement includes 1,000 global and planned liabilities by 2025, and the remaining 1,800 global liabilities by 2027. Currently, public lighting is dominated by lamps with a sodium light source (power 70 V, 100 V, 150 V and 250 V). In addition to savings in energy consumption and CO2 emissions, this measure achieves and reduces maintenance costs, increases average lighting and improves the quality of life of the local population.
Responsible body / department	Municipality, energy manager, town urban planning service
Implementation timeframe - start	2021
Implementation timeframe - end	2030
Expected energy savings [MWh]	900 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	306 tCO2 in 2030
Investment costs (€)	700.000 Euros
Non-nvestment costs (€)	
Financial resources	Municipal budget ECO fund European Bank for Reconstruction and Development

5.7.9 Development of infrastructure for alternative fuel vehicles

Development of infrastructure for alternative fuel vehicles	
Sector	Transport
Description of the measure	The aim of this measure is to facilitate the acceptance of alternative fuels by users / consumers by strengthening the infrastructure for the

	distribution of alternative fuels. First of all, these are stations for electric vehicles. There are about ten stations in Montenegro, and so many more are in the process of being designed. There are several programs that subsidize the construction of charging stations for electric vehicles. There are 2 types of stations: fast (above 22 kW) and slow (up to 22 kW). In the initial phase of infrastructure development for electric vehicles, slow charging stations are in the foreground. According to studies that project an increase in the number of vehicles, by 2030 the share of electric vehicles in the total number of vehicles is expected to be 5%, which is 183 vehicles for the Municipality of Tuzi compared to the reference year. If subsidies for the purchase of electric vehicles are taken into account, it is possible to reach projections of an optimistic scenario corresponding to a share of 10% of vehicles. According to the EU Directive 2014/94 / EU on the establishment of infrastructure for alternative fuels, at least one charging station should be installed on 10 electric cars. Among them, 4 fast and 32 slow should be chosen.
Responsible body / department	Municipality, energy manager, town urban planning service
Implementation timeframe - start	2021
Implementation timeframe - end	2030
Expected energy savings [MWh]	1.955 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	470 tCO2 in 2030
Investment costs (€)	3.230.000 Euros
Non-nvestment costs (€)	
Financial resources	Municipal budget ECO fund European Bank for Reconstruction and Development

5.7.10 Electrification of the railway Podgorica - Tuzi - Border with Albania

Electrification of the railway Podgorica - Tuzi - Border with Albania	
Sector	Transport
Description of the measure	The Strategic Plan of the Municipality of Tuzi defines as one of the strategic goals Strategic Goal 2: *Improved communal infrastructure,*

	transport and environmental protection, which has Priority 2.4 Construction and Reconstruction of Road and Railway Infrastructure. The construction of the railway infrastructure, ie its electrification, would have the effect of substituting bus transport, but also alleviating the need for new passenger vehicles and freight transport. As the new mode of transport of passengers and goods has a direct consequence of the substitution of currently predominantly used diesel fuel, it is clear that this will have a very favorable impact on the level of emissions, after the completion of this project. It is envisaged that the project has 3 phases: of which the most significant activities include: • Phase II - EUR 2,100,000 • Phase III - EUR 35,100,000. Taking into account the volume of public passenger transport in the reference year, but also the existing number of passenger vehicles and typical conditions of use, it is possible to make an estimate of the energy savings that can be expected. It should be emphasized that the studies that follow the development of the project will offer additional data for the evaluation of the expected effects of this project in terms of the impact on the energy balance of the municipality, ie the level of reduction of CO2 emissions. For the purposes of this plan, a complete substitution of bus transport (64,000 passengers per year) is assumed, as well as a reduction of 5% in the number of vehicles in the horizon of the plan year.
Responsible body / department	Municipality, energy manager, town urban planning service
Implementation timeframe - start	2021
Implementation timeframe - end	2029
Expected energy savings [MWh]	1.925 MWh in 2030
Expected emission reductions CO_2 [tCO_2]	521 tCO2 in 2030
Investment costs (€)	37.200.000 Euros
Non-nvestment costs (€)	
Financial resources	Municipal budget

	ECO fund European Bank for Reconstruction and Development

5.7.11 Feasibility study of construction and construction of photovoltaic and wind power plants on the territory of the Municipality

Feasibility study of construction and construction of photovoltaic and wind power plants on the territory of the Municipality	
Sector	Development measure
Description of the measure	The municipality of Tuzi has significant potential for local use of solar and wind energy. In that sense, research was previously conducted and 3 locations were identified: 1) LSL Tuzi 1 solar power plant (KO HOTI - Drume) of 159,652 m^2, 2) LSL Tuzi 2 solar power plant (KO HOTI - Drume) of 413,726 m^2 3) LSL Stijepovo - Budza (KO ZATRIJEBAČ - Budza) - wind farm on the territory of 3,709,763 m^2 Preliminary analyzes indicate the potential for the construction of 2 photovoltaic power plants with an installed capacity of 20 and 50 MW, or wind power plants between 20 and 50 MW. However, it is necessary to prepare a detailed feasibility study in order to take into account all aspects of interest, such as guaranteed energy placement, connectivity and construction dynamics that are in line with the spatial planning documentation. The construction of these renewable energy sources would fully meet the needs for electricity in the Municipality of Tuzi. Of course, this can only be pointed out in terms of total annual production and electricity consumption. However, due to the unequal production from these sources and the needs of consumers in the municipality, it is clear that a significant part of the needs will be taken over from the public electricity supplier. In this regard, it is not possible to count on a complete substitution of electricity taken from the public network with that produced from the mentioned renewable energy sources, but only a partial substitution in a conservatively estimated amount of 15% of total annual production will be counted here.
Responsible body / department	Municipality, energy manager, town urban planning service
Implementation timeframe - start	2021

Implementation timeframe - end	2026
Expected energy savings [MWh]	144,000 MWh (construction of 70 MW photovoltaic power plants and 20 MW wind farms is assumed)
Expected emission reductions CO_2 [tCO_2]	7.344 tCO_2
Investment costs (€)	40,000 Euros (feasibility study) + 90,000,000 Euros (construction)
Non-nvestment costs (€)	
Financial resources	Municipal budget ECO fund European Bank for Reconstruction and Development

5.7.12 Increasing the energy efficiency of buildings

Increasing the energy efficiency of buildings	
Sector	Buildings
Description of the measure	Application of light colors of facades and reflective coating on the facades of existing and future buildings, including thermal insulation and waterproofing protection. This would increase the efficiency of buildings because it would reduce their heating in summer (due to the reflection of solar radiation) and form a more favorable microclimate of the urban zone; it would reduce energy consumption and increase the resistance to wetting of walls during intense rainfall followed by storms.
Responsible body / department	Apartment owners, town urban planning service
Implementation timeframe - start	2021
Implementation timeframe - end	2030
Action affects mitigation	Yes
Risk and / or vulnerabilities	Heat and cold waves, heavy rains
Achieved results	Better microclimate in the urban zone, reduced energy consumption, reduction of atmospheric moisture from rain or snow, prevention of water penetration into foundations and basements.
Implementation status	-
Investment costs (€)	400.000 Euros

Non-investment costs (€)	
Financial resources	Municipality of Tuzi, Government of Montenegro, PPP (get involved in the work of the Public-Private Partnership Network in Southeast Europe) European Bank for Reconstruction and Development

6. Local Actions in province of Bari and Barletta-Andria-Trani (IT)

6.1 Preamble: Framing the activities of Confindustria Bari and BAT within the new energy efficiency objectives 2021-2030 and sectoral targets

In accordance with articles 3 and 4 of the EU Regulation / 2018/1999 on the EU Governance of the Energy, the European 2030 objectives of reducing emissions by 40% - at the same time as a target of 2.5% reduction in final energy consumption and 32% production of energy from renewable sources (binding at EU level) - must be adopted through a National Plan consistent with the 5 dimensions, identified by the Commission, of energy and environmental policy:

1) the level of decarbonisation and renewable sources targets;

2) the level of energy efficiency;

3) the level of national energy security and synergies with European energy systems;

4) the size of the internal energy market in order to ensure the completion of the single market and greater competitiveness to the benefit of end users;

5) the level of research and innovation, in order to guarantee conditions for technological leadership and concrete opportunities for economic development.

Consistent with the objectives of the "INTERREG IPA CBC ITALY-ALBANIA-MONTENEGRO" Programme, within the Project Code MIS 413 - "CIVIC ENERGY FUTURE: SUSTAINABLE LOCAL ENERGY COMMUNITIES-LEC", it was decided to place the Confindustria Pilot Project within point 2), in accordance with the scenarios of the National Plan, regarding the European decarbonisation objectives set as part of the 20-20-20 Package and close to the 2030 targets.

6.2. Territorial and socio-economic context

The Italian Government has set the national target of CO2 emissions reduction through a RES (production of Energy from Renewable Source) on gross final consumption of at least 17% in 2020, assigning specific targets for the use of RES to each Region. As with the national overall target, each regional target consists

of an indicator obtained from the ratio of gross final energy consumption from RES and total gross final energy consumption.

Below are the monitoring tables that highlight how the Puglia Region is following a virtuous approach with a progressive reduction in energy consumption and an increasing consumption from renewable sources. In particolare:

♣ Table 2 compares the CFLs from FER (gross final consumption from renewable sources) and the expected CFLs from FER;

♣ Table 3 compares the overall CFLs (Gross final consumption, including the FER component and the NO FER component) recorded and the overall CFLs

♣ Table 4 compares the indicators;

♣ in table 5 the energy consumption forecasts from FER to 2020 for the electricity (FER-E) and thermal (FER-C) sectors are compared with the data actually collected in 2017;

♣ Graph 5 and Graph 6 compare respectively the CFLs from FER detected and the overall CFLs;

Tab. 2 - Consumi finali lordi di energia da fonti rinnovabili (escluso il settore trasporti) - ktep

	Dato rilevato						Previsioni D.M. 15/3/2012 "burden sharing"		
	2012	2013	2014	2015	2016	2017	2016	2018	2020
Piemonte	1.653	1.846	1.825	1.888	1.943	1.941	1.395	1.527	1.723
Valle d'Aosta	307	321	320	327	330	331	278	280	287
Lombardia	2.826	3.113	3.102	3.210	3.290	3.340	2.188	2.486	2.905
Liguria	195	220	188	201	210	218	276	333	412
Prov. Trento	539	564	566	575	572	582	442	460	490
Prov. Bolzano	759	786	822	819	830	827	452	463	482
Veneto	1.772	1.905	1.878	2.017	2.029	2.056	914	1.066	1.274
Friuli V.G.	564	591	594	641	647	662	332	379	442
Emilia R.	1.231	1.360	1.367	1.406	1.390	1.444	835	1.004	1.229
Toscana	1.229	1.262	1.222	1.332	1.330	1.378	1.156	1.327	1.555
Umbria	446	461	443	505	504	536	273	308	355
Marche	443	456	437	451	452	469	354	434	540
Lazio	953	971	902	959	890	975	843	991	1.193
Abruzzo	625	619	614	635	603	662	373	439	528
Molise	196	191	188	199	195	209	159	186	220
Campania	1.047	1.068	996	1.098	1.058	1.160	767	915	1.111
Puglia	1.046	1.137	1.125	1.211	1.192	1.273	947	1.132	1.357
Basilicata	301	313	312	350	366	418	263	312	372
Calabria	846	942	917	917	898	1.029	483	563	666
Sicilia	637	684	726	699	706	752	808	983	1.202
Sardegna	635	676	639	682	606	676	465	556	667
ITALIA *(esclusi i trasporti)*	**18.252**	**19.486**	**19.182**	**20.122**	**20.042**	**20.940**	**14.004**	**16.144**	**19.010**

Tab. 3 - Consumi finali lordi di energia (ktep)

	Dato rilevato						Previsioni D.M. 15/3/2012 "burden sharing"		
	2012	2013	2014	2015	2016	2017	2016	2018	2020
Piemonte	10.303	10.709	10.191	10.605	10.763	10.478	11.400	11.418	11.436
Valle d'Aosta	491	423	429	408	376	404	549	549	550
Lombardia	25.318	25.051	23.725	24.387	24.300	24.196	25.701	25.756	25.810
Liguria	2.321	2.661	2.559	2.661	2.845	2.751	2.915	2.921	2.927
Prov. Trento	1.333	1.338	1.361	1.329	1.304	1.304	1.375	1.377	1.379
Prov. Bolzano	1.281	1.291	1.340	1.292	1.268	1.286	1.319	1.321	1.323
Veneto	11.824	11.371	11.135	11.661	11.566	11.662	12.300	12.325	12.349
Friuli V.G.	3.375	3.406	3.149	3.269	3.298	3.357	3.467	3.477	3.487
Emilia R.	13.993	13.811	12.756	12.856	13.142	12.968	13.818	13.830	13.841
Toscana	8.554	8.199	7.665	7.778	7.833	7.744	9.378	9.392	9.405
Umbria	2.266	2.220	2.104	2.222	2.151	2.126	2.585	2.589	2.593
Marche	2.781	2.792	2.622	2.682	2.659	2.580	3.504	3.509	3.513
Lazio	11.445	10.402	10.174	10.545	10.522	10.437	9.955	9.974	9.992
Abruzzo	2.782	2.697	2.510	2.509	2.425	2.443	2.752	2.757	2.762
Molise	581	572	537	545	509	519	625	626	628
Campania	6.857	6.742	6.445	6.708	6.578	6.978	6.602	6.618	6.634
Puglia	8.584	7.554	7.705	7.560	7.709	7.252	9.509	9.520	9.531
Basilicata	963	953	890	1.039	925	931	1.120	1.123	1.126
Calabria	2.563	2.461	2.415	2.436	2.308	2.420	2.447	2.452	2.458
Sicilia	6.639	6.529	6.253	6.255	6.063	6.033	7.509	7.530	7.551
Sardegna	2.798	2.675	2.556	2.709	2.508	2.568	3.717	3.732	3.746
ITALIA	**127.052**	**123.856**	**118.521**	**121.457**	**121.052**	**120.435**	**132.546**	**132.794**	**133.042**

Grafico 5 - Consumi finali lordi di energia da fonti rinnovabili (escluso il settore trasporti) - ktep

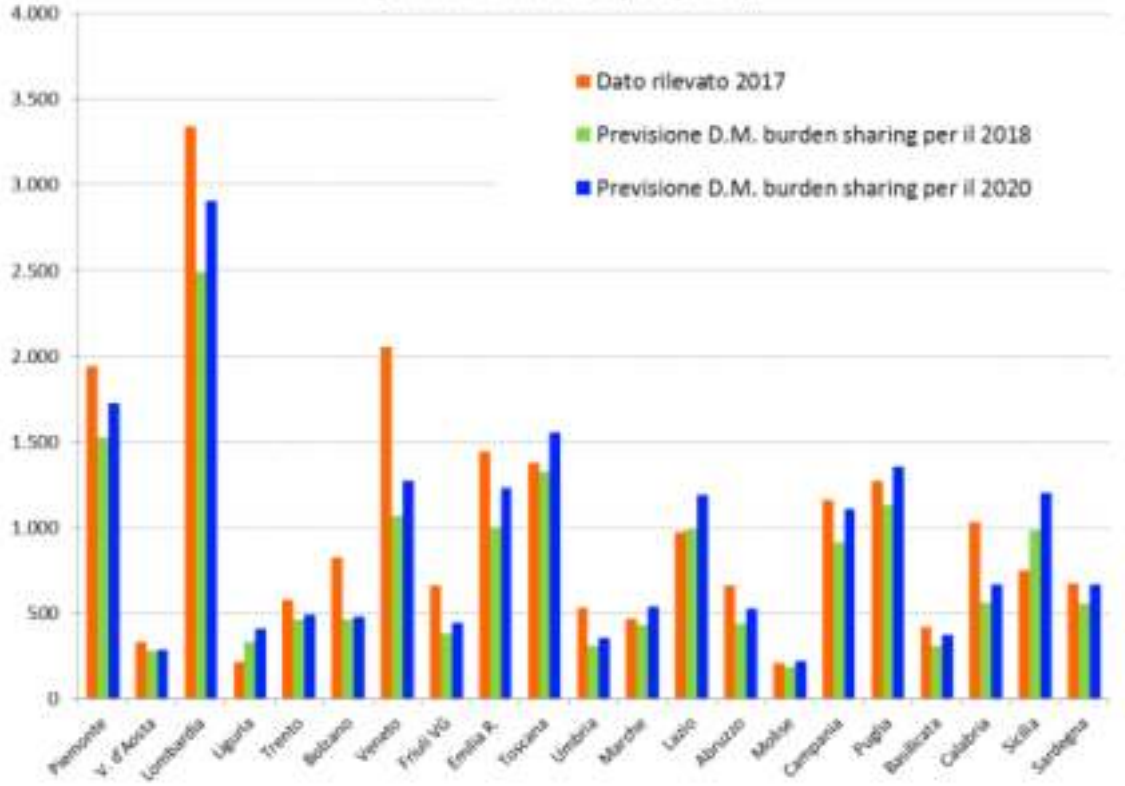
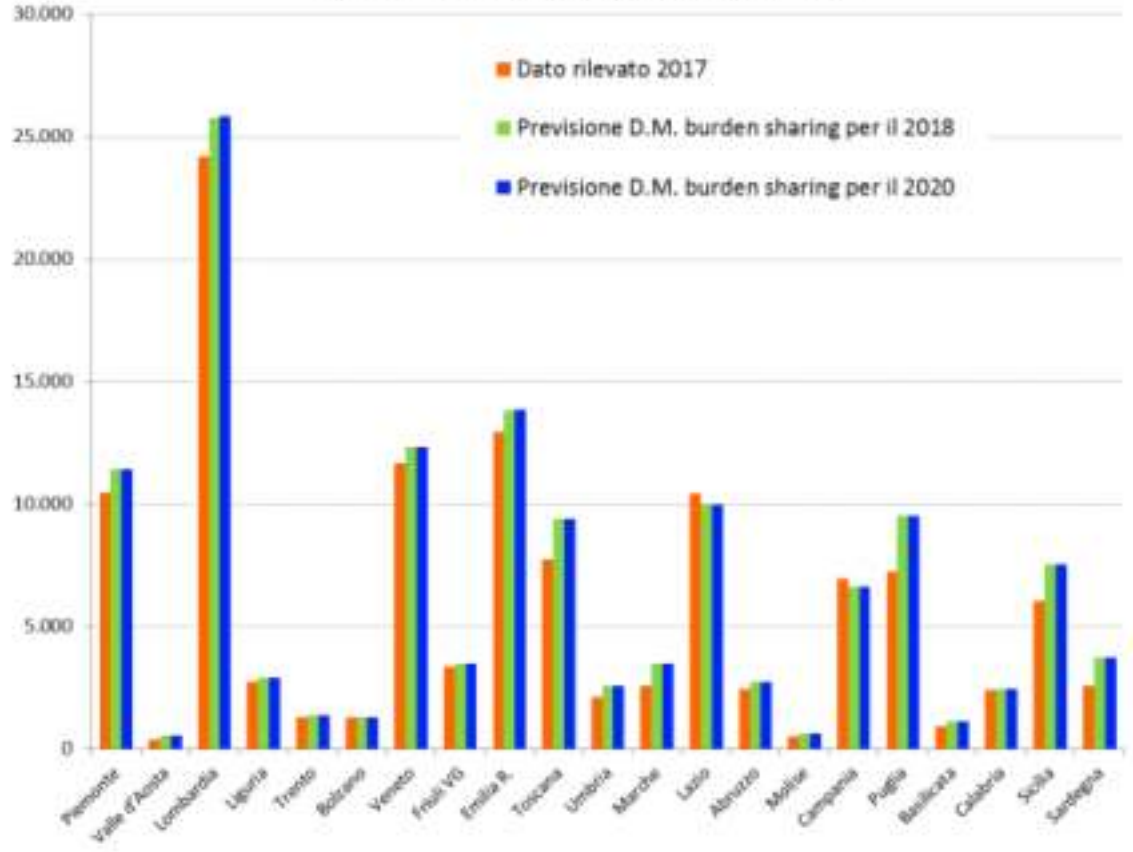


Grafico 6 - Consumi finali lordi di energia - ktep



Tab. 5 - Consumi di energia da fonti rinnovabili nei settori elettrico e termico (ktep)

	CFL da FER nel settore Elettrico			CFL da FER nel settore Termico		
	Dato rilevato 2017 (A)	Previsione DM 15/3/2012 per il 2020 (B)	A / B	Dato rilevato 2017 (C)	Previsione DM 15/3/2012 per il 2020 (D)	C / D
Piemonte	925	732	1,3	1.017	991	1,0
Valle d'Aosta	282	240	1,2	49	47	1,0
Lombardia	1.508	1.090	1,4	1.832	1.815	1,0
Liguria	49	58	0,8	170	354	0,5
Provincia di Trento	389	356	1,1	193	134	1,4
Provincia di Bolzano	522	401	1,3	305	81	3,8
Veneto	664	463	1,4	1.392	811	1,7
Friuli Venezia Giulia	260	213	1,2	402	229	1,8
Emilia Romagna	529	400	1,3	915	828	1,1
Toscana	740	769	1,0	639	786	0,8
Umbria	200	183	1,1	336	172	2,0
Marche	181	134	1,3	289	406	0,7
Lazio	309	317	1,0	666	876	0,8
Abruzzo	264	183	1,4	398	346	1,2
Molise	112	127	0,9	97	92	1,0
Campania	435	412	1,1	725	699	1,0
Puglia	895	845	1,1	379	513	0,7
Basilicata	240	234	1,0	179	138	1,3
Calabria	458	344	1,3	571	322	1,8
Sicilia	454	584	0,8	298	619	0,5
Sardegna	314	419	0,8	362	249	1,5
ITALIA	**9.729**	**8.504**	**1,1**	**11.211**	**10.506**	**1,1**

Tab. 4 - Quota dei Consumi finali lordi di energia coperta da FER (escluso il settore dei trasporti) (%)

	Dato rilevato						Previsioni D.M. 15/3/2012 "burden sharing"		
	2012	2013	2014	2015	2016	2017	2016	2018	2020
Piemonte	16,0%	17,2%	17,9%	17,8%	18,1%	18,5%	12,2%	13,4%	15,1%
Valle d'Aosta	62,5%	75,9%	74,6%	80,2%	87,8%	82,1%	50,7%	51,0%	52,1%
Lombardia	11,2%	12,4%	13,1%	13,2%	13,5%	13,8%	8,5%	9,7%	11,3%
Liguria	8,4%	8,3%	7,4%	7,6%	7,4%	7,9%	9,5%	11,4%	14,1%
Prov. Trento	40,5%	42,1%	41,6%	43,2%	43,9%	44,6%	32,1%	33,4%	35,5%
Prov. Bolzano	59,3%	60,9%	61,4%	63,4%	65,5%	64,3%	34,3%	35,0%	36,5%
Veneto	15,0%	16,8%	16,9%	17,3%	17,5%	17,6%	7,4%	8,7%	10,3%
Friuli V.G.	16,7%	17,3%	18,9%	19,6%	19,6%	19,7%	9,6%	10,9%	12,7%
Emilia R.	8,8%	9,8%	10,7%	10,9%	10,6%	11,1%	6,0%	7,3%	8,9%
Toscana	14,4%	15,4%	15,9%	17,1%	17,0%	17,8%	12,3%	14,1%	16,5%
Umbria	19,7%	20,8%	21,0%	22,7%	23,4%	25,2%	10,6%	11,9%	13,7%
Marche	15,9%	16,3%	16,7%	16,8%	17,0%	18,2%	10,1%	12,4%	15,4%
Lazio	8,3%	9,3%	8,9%	9,1%	8,5%	9,3%	8,5%	9,9%	11,9%
Abruzzo	22,5%	23,0%	24,5%	25,3%	24,9%	27,1%	13,6%	15,9%	19,1%
Molise	33,6%	33,3%	34,9%	36,6%	38,2%	40,3%	25,5%	29,7%	35,0%
Campania	15,3%	15,8%	15,5%	16,4%	16,1%	16,6%	11,6%	13,8%	16,7%
Puglia	12,2%	15,0%	14,6%	16,0%	15,5%	17,6%	10,0%	11,9%	14,2%
Basilicata	31,3%	32,8%	35,0%	33,7%	39,6%	45,0%	23,4%	27,8%	33,1%
Calabria	33,0%	38,3%	38,0%	37,6%	38,9%	42,5%	19,7%	22,9%	27,1%
Sicilia	9,6%	10,5%	11,6%	11,2%	11,6%	12,5%	10,8%	13,1%	15,9%
Sardegna	22,7%	25,3%	25,0%	25,2%	24,2%	26,3%	12,5%	14,9%	17,8%
ITALIA *(esclusi i trasporti)*	**14,4%**	**15,7%**	**16,2%**	**16,6%**	**16,6%**	**17,4%**	**10,6%**	**12,2%**	**14,3%**

6.3 The area of the industrial development consortium of BARI is the driving force behind the Metropolitan city of Bari.

The establishment of public and private activities in the areas of the Consortium for Industrial Development of Bari (Consorzio ASI) represents the largest concentration of factories and employees in the province of Bari, as well as the industrial area among the largest in the South Italy and the Adriatic.

The area of the ASI Consortium has more than 350 production sites in operation between public companies for the supply of services to the Metropolitan City of Bari, industrial plants, craft companies, logistic

companies and construction companies, with about 12,000 direct employees and in the related industries. To these numbers must be added numerous large and small trade centers.

Taking into consideration only the manufacturing, energy and municipal-owned companies, in the area of the ASI Consortium factories have been established over the years. They are owned by about thirty large national and foreign groups. By way of example, Bridgestone, Bosch, Merck-Serono, SKF, Isotta Fraschini-Fincantieri, Getrag, Magneti Marelli, Dana-Heintzmann, etc.

This area covers about 2,000 hectares and its most significant production specializations in the industrial sector are:

- mechanics, the first ever in terms of numbers of employees thanks to the presence of large automotive industries with their subcontractors, and then to the production of pumps, valves and systems for energy, railway equipment, engines, technologies and materials for construction, air conditioning equipment, iron and steel works, semi-trailers, ecological vehicles, tanks, oil machines, electrical panels, lifting equipment, etc .;
- chemistry, in a wide range of subsectors such as tires, pharmaceuticals, hollow glass, paints, adhesives, household and industrial hygiene goods, lamps and molding for plastics;
- publishing industry;
- agri-food;
- energy, with the presence of a turbo gas power plant; call center;
- municipal services (municipal waste management company, public transport company and network management and gas supply company);
- wood-furniture for the construction of kitchen furniture, sofas and other furnishings;
- ecological services;
- business services for planning, accounting, professional training and advertising.

The need to make energy consumption more efficient in industrial companies in the ASI Consortium area arises from the high level of energy consumption and the related environmental impact. In fact, the enormous productive strength of the companies located in the ASI Consortium requires high energy consumption to produce significant production volumes of finished goods, services and utilities which, in turn, feed conspicuous handling by road, rail and, increasingly, even by sea.

To highlight the extent of energy consumption absorbed, it should be noted that the activities in the area generate a total turnover of approximately 3.5 billion euros, and by way of example, a table is provided with the data regarding the turnover of some of the most significant companies located in the area:

Azienda	settore		fatturato
Merck	farmaceutica		917,0
Magna (ex Getrag)	automotive		568,2
TD Bosch	automotive		266,4
Gruppo Turi	mobilio		125,3
Ladisa Ristorazione	ristorazione		115,4
Bridgestone	pneumatici		112,7
AMIU Puglia	raccolta rifiuti		99,5
Alfrus	alimentare		86,1
Soft Line	mobilio		57,0
Centro Acciai. Inox	acciai speciali		56,4
Amgas	distribuzione gas		49,5
Debar	costruzioni		46,5
Amtab	trasporto urbano		43,3
Chimica D'Agostino	chimica		43,1
Specialmangimi Galtieri	mangimistica		41,8
Masmec	meccatronica		36,1
La Lucente	servizi ecologici		31,0
Indeco	meccanica		30,6
CVIT Bosch	meccatronica		29,8
Isotta Fraschini Motori	meccanica		27,8
Tecnoacciai	meccanica		26,8
Gemanco	fertilizzanti		25,4
Amenduni Nicola	meccanica		20,4
Recuperi Pugliesi	servizi ecologici		18,2
Officine Tecniche De Pasquale	impiantistica		17,7
Centro Acciai speciali	meccanica		16,6
Frezza Legnami	legno		15,3
Faver	meccanica		13,4
Alfonso Lorenzo Deriv. Vergella	meccanica		12,3
Tersan Puglia	concimi		11,5
Primiceri	quadri elettrici		10,6
Omnitech	meccanica		8,8
Sedit	industria editoriale		8,7
Sud Montaggi	impiantistica		7,3
Tennis Tecnica	impianti sportivi		7,0

Fonte: Centrale bilanci Cerved e Mediobanca, *Le principali società italiane (2019)*

• Dall'elenco sono escluse le società di distribuzione, case di cura, aziende turistiche

6.4 Examples of Local Actions

6.4.1 Energy Upgrade of a building

Particular interest for public administrations but also for companies is the energy upgrading of a building. It means take action on everything that produces and consumes energy (lighting, heating, cooling) and on the envelopes (walls, floors, floors and roofs, external doors and windows).

Energy upgrading can mean: intervening on the insulation of the envelope, with the insulation of walls and roofs, the replacement of fixtures, the installation of solar shading.

The interventions can range from maintenance - ordinary or extraordinary - with plant implementation up to the structural change in buildings aimed at increasing energy performance.

The Central Public Administrations, however, can also be addressed and accompanied to the PREPAC, Energy Renovation Program for the P.A. From this program, indirectly - although not applicable to peripheral Public Administrations and companies - it is also possible to draw virtuous ideas.

The aim is to contribute to raising awareness about the energy requalification of at least 3% per year of the air-conditioned useful covered area of the public building stock. Even the buildings of companies, as they statistically represent the main "energy consumers", are certainly interested.

6.4.2 Object of the main targets of energy upgrading

Energy upgrading can mean replacing old thermal energy production plants with more efficient systems or systems powered by renewable sources:

- condensing boilers,
- heat pumps,
- biomass power plants,
- solar thermal systems,
- solar thermal systems, combined with solar cooling technology also for the production of cold and therefore upgrade the winter / summer air conditioning system.

6.4.3 Interventions with a mix on the basis of an energy diagnosis in order to choose the main energy requalification objectives

Energy requalification **can mean reducing electricity consumption by replacing the lighting bodies, improving the quality of lighting, also through relamping interventions with the replacement of light bulbs or installing entire more efficient lighting bodies, and also rethinking their setting for ergonomic purposes and improving it with building automation technologies.**

The optimal solution to achieve good efficiency results is to intervene with a mix of these interventions on the basis of an energy diagnosis.

Intervening on a building with this approach can make it possible to transform it into a nearly zero energy building (nZEB), with smaller consumption, and production of the energy it consumes from renewable sources.

This can be an opportunity to renovate a building beyond the energy dimension, creating spaces suitable for the most recent evolutions in ergonomics and home automation and constituting an important step in improving the quality of life and sustainability.

6.4.4 Indications and information on how to cover the rest of the costs of an energy upgrading project

Energy requalification can mean **addressing efficiency through the use of know-how with regard to the "information" sector, with specific knowledge of protocols and architectures in the energy sector, and to the "hardware" sector, i.e. electronics (HW and FW), with electronic and environmental measures This broader and more integrated approach allows to generate the potential to deal with energy-related aspects in an innovative way, optimizing the energy flows also of renewable energies.**

In the global context of IoT, distributed and decentralized IT architectures and 5G, "edge computing" is the new emerging approach, enabling professional IoT solutions and services suitable for many application areas such as Digital Energy, Home, Building and Asset Management, Smart City, Factory and Agriculture and so on. In all these application fields, Edge Computers allow you to run applications on local computational systems that process data directly in the field, reducing the strict dependence on remote data centers, so reducing congestion and cloud latency.

6.4.5 Energy efficiency, renewable energies and management of the energy bill

To make their energy consumption more sustainable, Public Administrations and Companies can make use of energy efficiency, renewable energy sources which are on their territory, or make use of particularly efficient energy production plants, such as high efficiency cogeneration plants, very suitable, for example, for large structures.

Renewable energy plants tend to have high installation costs, but low usage charges, as they do not involve fuel procurement costs.

a - Renewable energies

Entities interested in developing the use of renewable sources for their own needs or in their reference area can resort to the available incentives that help to recover the investment costs incurred for the plants.

For example, renewable sources are encouraged through competitive auctions regulated by the Ministerial Decree of 23 June 2016, which defines the incentives for the production of electricity.

Public Administrations that already own renewable energy plants can optimize their bills through self-consumption and, in a "community" logic, help reduce costs through a "shared" use of renewable energy.

b - High efficiency cogeneration

Interested entities could also make use of cogeneration units, which simultaneously generate electrical (or mechanical) and thermal energy, and increase the efficiency of fossil fuel use up to over 80% and can replace traditional thermal power plants.

Cogeneration is the combined production, in a single process, of electrical - or mechanical - energy and heat.

When a cogeneration unit achieves a primary energy saving (PES) greater than the threshold value established by the standard, it is said to be operating in High Efficiency Cogeneration (CAR).

In the case of final recognition of the CAR operation, for the cogeneration units that require it, income from non-negligible bonuses during operation could also be added (White Certificates, proportional to the energy savings achieved during the year).

c - Energy efficiency monitoring

In order to provide a broader consultancy activity and better suited to the project objectives, it is proposed to provide two services aimed at contextualizing and better emphasizing the need to use appropriate tools and methodologies to allow constant monitoring of energy efficiency and the consequent benefits in economic terms and in respect of the environment.

To this end, a training session will be organized for the main users who have shown themselves to be interested in the project (Public Administrations, Companies, Managers) aimed at creating the so-called "awareness" in the effectiveness and need to implement behaviors aimed at energy saving.

d - Involvement and awareness of energy efficiency

By further implementing the awareness and involvement of users, it is assumed that the free Beeta Game app by Tera will be granted. Thanks to the app, users will receive tips & tricks, their own energy class (Beeta Class, calculated with a specific algorithm), suggestions on how to reduce energy costs, opinions on smart appliances available on the market and information on available energy offers.

The gaming effect will contribute to increasing user engagement also thanks to the "social" effect obtained when users view rankings and compare themselves with other users (with users from the same city, or with users with similar homes, and so on).

Si può prevedere, al fine di interagire con gli utenti, il lancio di specifici “contest” (anche al fine di mettersi “alla prova” sulla pregnanza delle soluzioni da essi individuate) nell’ambito della app Beeta Game, la cui efficacia, per altro, è stata già testata per attività simili effettuate negli scorsi anni in diversificate realtà.

In order to interact with users, specific "contests" should be launched (also in order to prove themseves on the significance of the solutions they have identified) within the Beeta Game app, the effectiveness of which it has already been tested for similar activities carried out in the past few years in different realities.

e - Transports

The Local Public Transport sector ensures the movement in Puglia of about 500,000 daily passengers, involving, in its management, more than 150 companies. In urban areas, the collective public transport service is carried out mainly by bus, while the other types of transport are present only in some of the main cities of the Region.

With the same number of passengers transported, the energy consumption of public transport is much lower than that of private mobility. With the same service offered, however, there are possible margins for further reductions. In fact, if the Public Administrations were able to improve the energy efficiency of their transport, both urban and extra-urban, they could obtain considerable savings that would favor the whole community.

There are many measures potentially applicable by Public Administrations.

To achieve energy efficiency, in addition to spreading its culture, for example by monitoring consumption, it is possible to optimize routes, promote car sharing and the choice of zero-emission vehicles equipped with electric traction.

6.5 Others

6.5.1 Preamble: environmental and economic benefits from investments in energy efficiency

The interventions in energy efficiency provide operational opportunities for improvement that have also been measured in terms of not only environmental but also economic return.

According to research conducted by Centrica Business Solutions, organizations investing in local energy solutions (also known as distributed energy) are already seeing the benefits. 41% benefited from "significantly reduced energy costs", while one- third (35%) report benefiting from greater control and visibility of their energy consumption. This information about energy can then be applied to further reduce energy costs as part of a systematic cycle of continuous improvement. Additionally, a quarter (24%) of businesses say investing in distributed energy solutions has improved their reputation. Similar numbers indicate better compliance with regulations and laws and the achievement of environmental objectives.

Improved energy management standards have also helped around a quarter of organizations achieve key digital transformation goals. They report that advanced energy solutions have helped to enable new flexible ways of working.

Thanks to their foresight in energy management, these organizations are gaining greater control over energy consumption, strengthening their brands and, in some cases, gaining a new revenue stream.

Regarding investment options, most organizations tend to start their own efficiency path by introducing measures that help improve the energy efficiency of buildings, such as optimized HVAC systems and low energy consumption lighting systems. About half (52%) of all users surveyed are implementing energy efficiency measures.

40% of users are investing in information about energy, providing end-to-end visibility of energy consumption. This information can then be applied to create new efficiencies and help businesses save more and more.

For users who have already implemented such efficiency measures, there are other opportunities to consider. Combined heat and power systems are cost-effective for users with high thermal loads (for example, hot water, steam, chilled water or hot air) and for high electricity costs. Through energy recovery and recycling, these combined heat and power systems are a way to reduce utility bills and the environmental impact of operations.

Regardless of the industry, energy also presents the potential for new income streams. Some solutions, such as energy storage units and dynamic demand response pricing, can be effective tools for monetizing energy. Almost all of the users interviewed are aware that they can be paid to sell energy to the power grid during peak demand periods, and there are incentives for flexible energy management based on grid demand. More than 50% are already doing this or are considering the idea of reselling excess capacity to the power grid, participating in incentives linked to supply or demand.

Another opportunity is provided by the installation of plants for the production of energy from renewable sources on site. Physical considerations and the availability of incentives are key factors and, in some cases, collaboration can make renewables an attractive option. Nearly three quarters of the users surveyed believe that partnerships that share energy, infrastructure and production facilities have significant potential value.

With regard to the sources for financing investments in energy efficiency, currently, traditional financing options are the ones that prevail the most. Two-fifths (40%) of the companies have financed initiatives and one-third made use of government programs (36%) and bank loans (34%). About one-third of all users surveyed have funded energy projects using loans directly from their solution provider.

Other funding methods are starting to gain popularity, such as sharing risk models that reduce exposure. Financing of capital reintegration, for example, is a model in which investments are financed by a third party, typically a supplier, and paid for by means of current energy savings or increased revenue, reducing the capital expenditures of the company.

Conclusions

Balancing energy sources with distributed energy solutions must be a strategic priority. Investments in local solutions will not only produce significant environmental benefits, but will save short and long term costs, and will be essential in gaining the flexibility to meet future energy challenges.

As early adopters' experiences have shown, distributed energy solutions have the potential to eliminate the risk of energy supply, increase sustainability and create new income streams.

6.6 Followed path to define the pilot project

Confindustria Bari and BAT, following a series of meetings with representatives of public bodies, came to the conclusion that the best way to implement interventions for energy efficiency in the medium and long term was the activation of a technical assistance desk in support of project ideas and the realization of a cycle of technical seminars (demo labs) for the dissemination of an in-depth culture on energy saving systems and the relative advantages.

As part of the LEC project, we therefore organized meetings (living labs) and carried out a survey through a questionnaire to identify the details of the initiative. From the meetings and the responses of the stakeholders involved, it emerged that it was appropriate to focus the activities in the areas of the Consortium for Industrial Development of Bari as site of both buildings / public areas and of small, medium and large private users with high energy consumption. potentially aggregable for common activities.

6.7 Implementation of a pilot action

Confindustria Bari and BAT, in agreement with the Consortium for Industrial Development of Bari, defined that the best way to improve the energy efficiency of the territory in the medium and long term was the activation of a technical service desk to support project ideas and the creation of a cycle of technical seminars (demo labs) for the dissemination of an in-depth culture on energy saving systems and the relative advantages.

The innovative aspect of this pilot project is the absolute independence of the consultants who will be engaged by suppliers of energy products and services as well as the integration between consultants and technical training to make public and private users fully aware of the advantages and various opportunities of energy efficiency. Finally, to complete the assistance activity, a site was created to facilitate user / consultant dialogue and where operators can consult specific documentation on energy efficiency. The **technical service** is provided through two main activities:

- **Energy Efficiency DESK** aimed at "innovation knowledge transfer" and to facilitate the transition to more effective and more environmentally friendly energy processes by public administrations and companies. The **Energy Efficiency DESK** has been implementing through virtual and physical contacts:
  - A website (https://www.confindustriababt.it/) for information and take first contact
  - Online and servuy on site with pilot project consultants for thecnical service

- high specialization information on innovative solutions with **6 DEMO-LABS** organized for public authorities and companies to show innovative solutions.

6.7.1 Description of the Energy Efficiency DESK

6.7.1a Website for documents and to take first contact

A **website** (https://www.confindustriababt.it/) has been structured with experts (energy managers), which contains content on the most current knowledge and technological solutions on the following areas, established by the Europe Energy Intelligence programs and within H2020:

- encourage energy efficiency and the rational use of energy resources (**SAVE**)
- promote new and renewable alternative sources of energy and encourage energy diversification (**ALTER**)

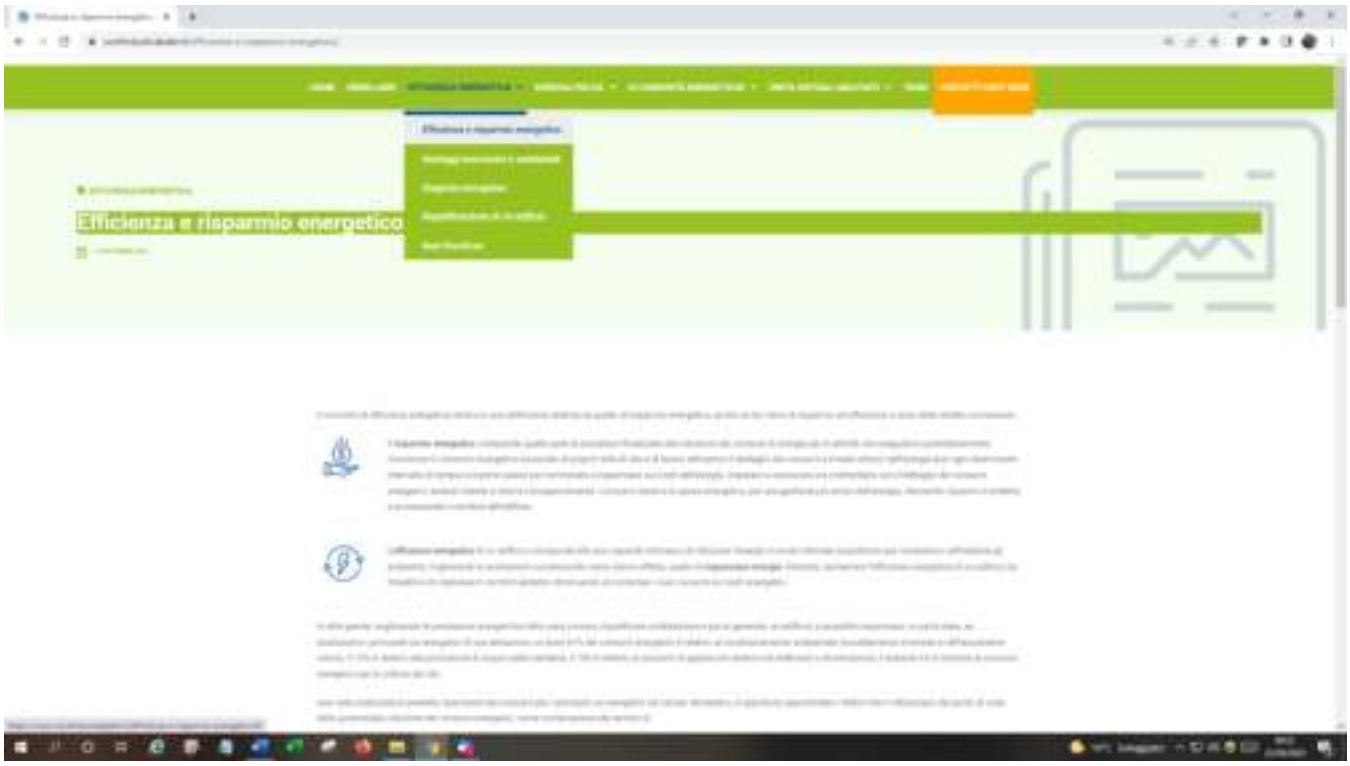
- promote energy efficiency and the use of new and renewable energy sources in transport (**STEER**)

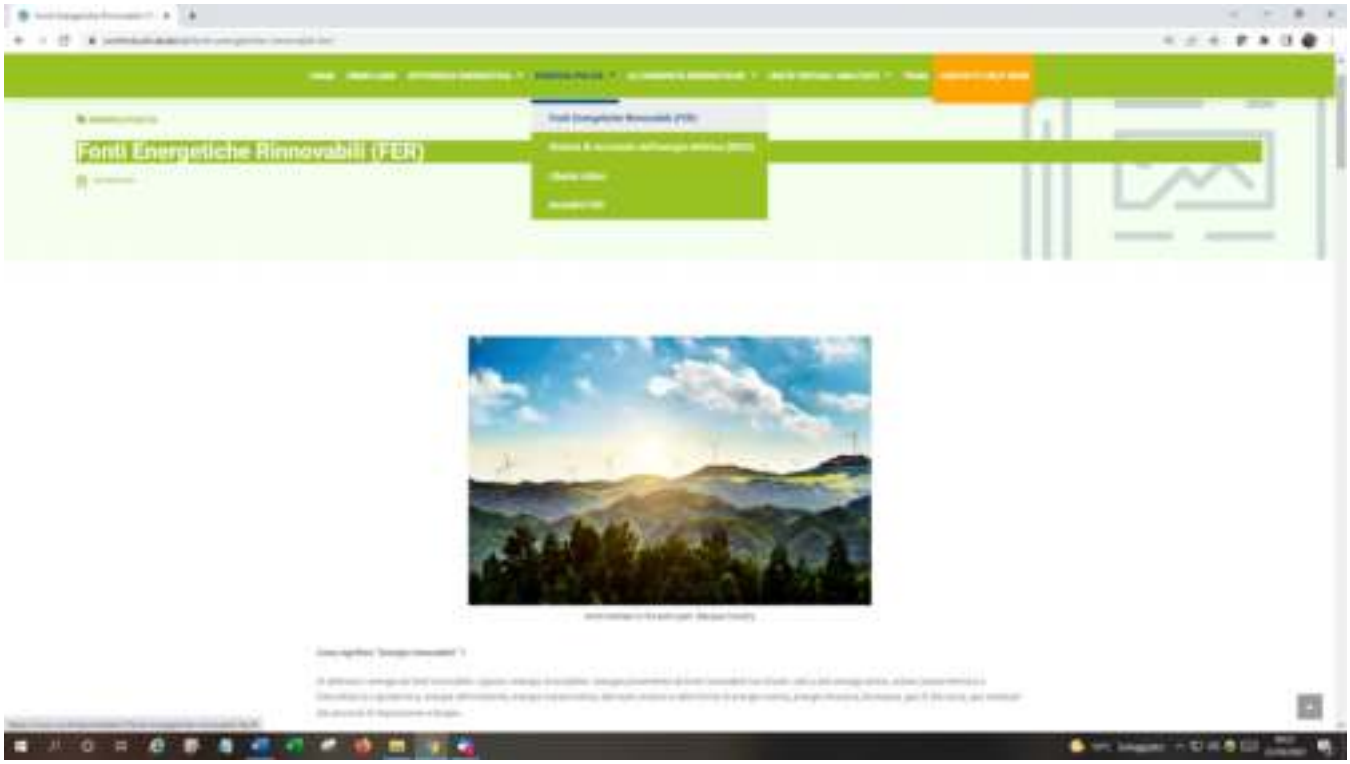
ACCESS TO THE "ENERGY EFFICIENCY" APPLICATION:

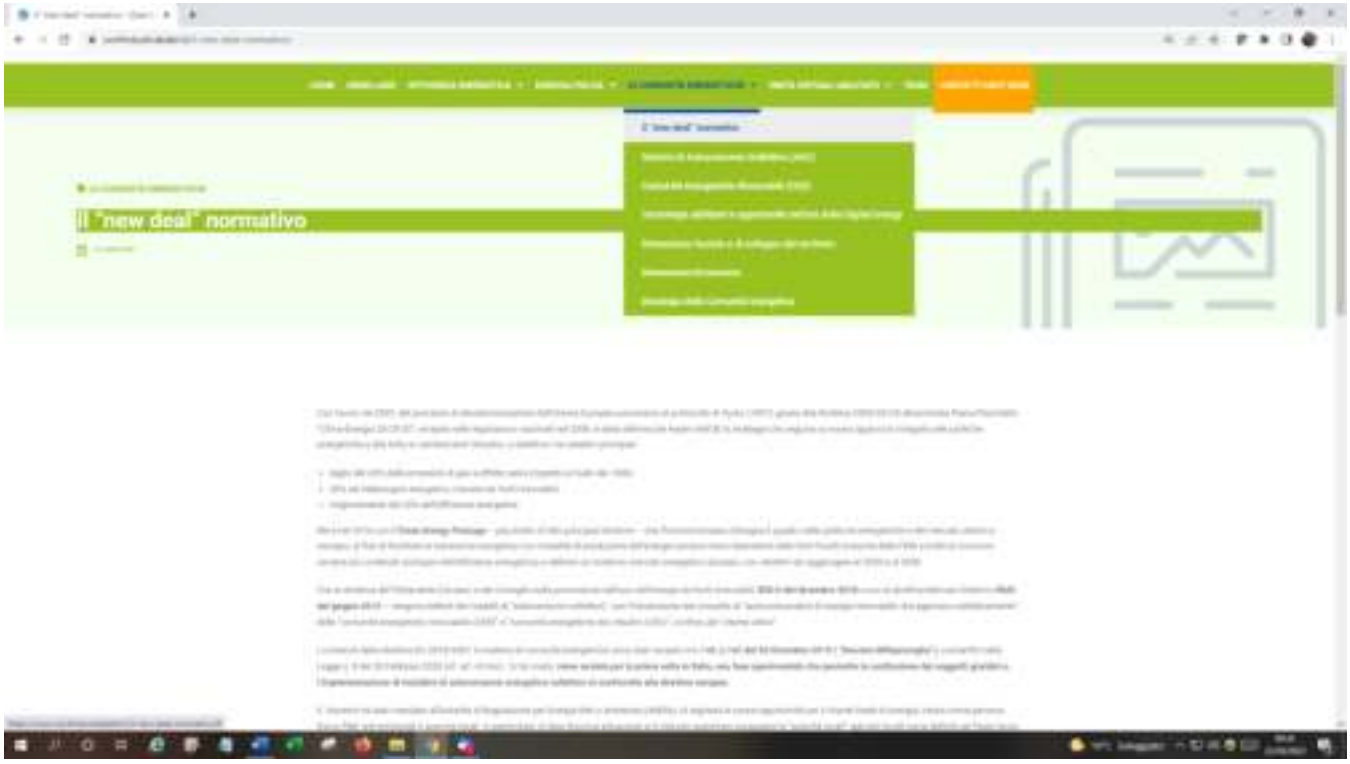
- To access the E.E. DESK website, it will be necessary to have previously registered in the Users Area of the Portal and to have signed up for the DESK application.
- The correct insertion of all the information requested by the Customer Area during the first entry phase, will guarantee the correct management of the "personal" data within the ENERGY EFFICIENCY application (eg legal representative data, addresses, sites where to carry out the interventions, ... etc.).
- Once the registration process has been completed, the website will allow access to generalist information, and will subsequently send the necessary credentials to access at the HELP DESK EE for more specific services that may be requested.

Homepage screenshot:

Screeenshots of first page of website dedicated for information about energy efficiency:


Efficienza e risparmio energetico

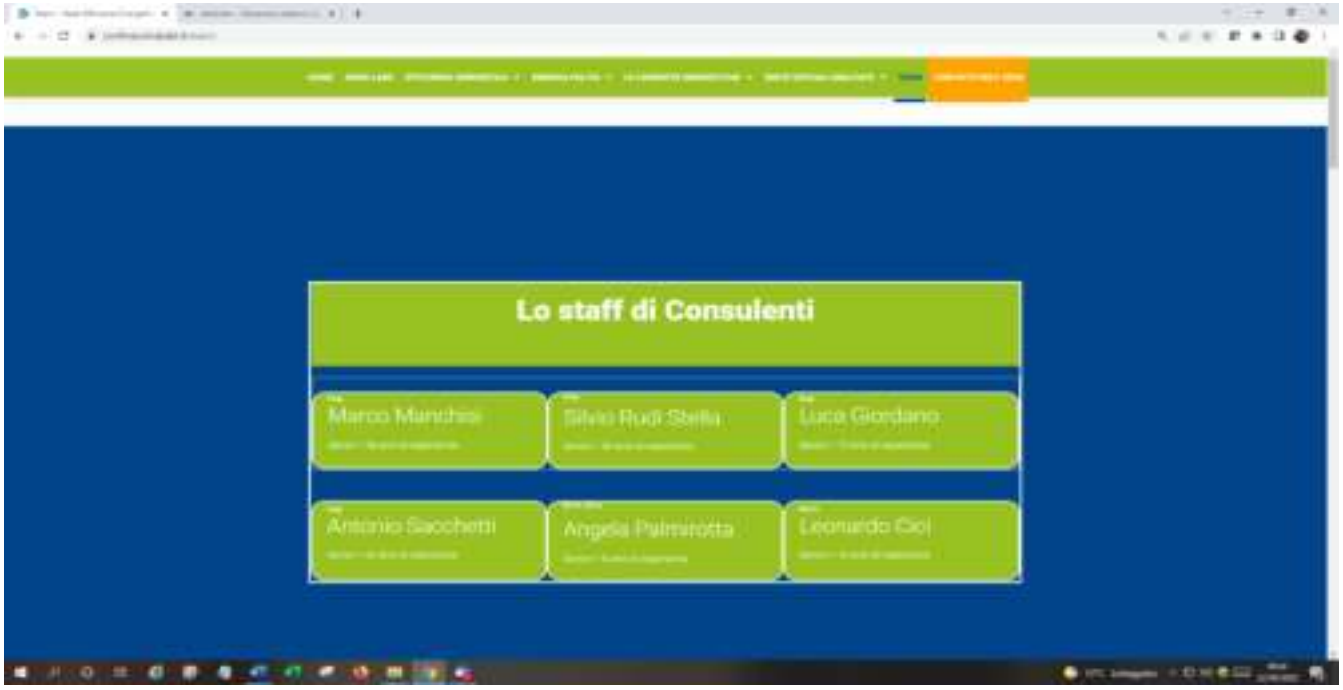

Fonti Energetiche Rinnovabili (FER)


Il "new deal" normativo


Apertura del Mercato Servizi Dispacciamento

Screenshot of webesite menu for taking contact and asking technological service in energyefficency:

Consulting TEAM



6.7.1b DEMO-LABS

- Based on the requests from Users received online at HELP DESK E.E., considering the technological topics / solutions that will have received the greatest interest, **6 DEMO-LABS were organizing**, structured in informative workshops for:

❖ identify opportunities to energetically upgrade one's real estate assets, industrial activities and reduce the consumption of services;

❖ choose the most appropriate technologies for their projects among those of both hard industry and smart devices available on the market and information on available interoperability, digital energy, home, building and asset management, edge computers and related services based on their characteristics;

❖ choose the most appropriate incentive tools for their projects, industrial or otherwise, and assess their compatibility with other financial resources;

❖ reconcile its administrative procedures for the implementation of projects with the methods envisaged for requesting incentives;

❖ identify strategic infrastructures, also at the service of industries, to affect the optimization of network services, lighting and possibly, where required, public transport.

❖ Structuring of the 5 DEMO LABS in a promotional function of assistance to the P.A. and to Companies within the CONFINDUSTRIA PILOT PROJECT

The purpose of these assistance and demonstration services object of the DEMO LABS, for most of the types of interventions that can make a building more energy efficient, or the contribution that the improvement of the performance of a plant makes to the project, the yield is calculated on the basis of the type of intervention, according to the increase in performance. energy that it generates, or - in the case of interventions on the plants - on the basis of the energy that can be produced.

❑ 1. ENERGY REQUALIFICATION OF A BUILDING

Energy efficiency through the redevelopment of buildings can take place by intervening on the insulation of the envelope, with the insulation of walls and roofs, the replacement of fixtures, the installation of solar shading.

The interventions can range from maintenance - ordinary or extraordinary - with plant implementation up to the structural modification of buildings aimed at increasing energy performance.

The Central Public Administrations, however, can also be addressed and accompanied to the PREPAC, Energy Redevelopment Program of the P.A. Central. From this program, indirectly - although not applicable to peripheral Public Administrations and companies - it is also possible to draw virtuous ideas.

The aim is to contribute to raising awareness about the energy requalification of at least 3% per year of the air-conditioned useful covered area of the public building stock. Even the buildings of companies, as they statistically represent the main "energy consumers", are certainly interested.

❑ 2. OBJECT OF THE MAIN TARGETS OF ENERGY REQUALIFICATION

Energy upgrading can mean replacing old thermal energy production plants with more efficient systems or systems powered by renewable sources:

- condensing boilers,
- heat pumps,
- biomass power plants,
- solar thermal systems,
- solar thermal systems, combined with solar cooling technology also for the production of cold and therefore upgrade the winter / summer air conditioning system.

❑ 3. TRANSPORTS

The Local Public Transport sector ensures the movement in Puglia of about 500,000 daily passengers, involving, in its management, more than 150 companies. In urban areas, the collective public transport service is carried out mainly by bus, while the other types of transport are present only in some of the main cities of the Region.

With the same number of passengers transported, the energy consumption of public transport is much lower than that of private mobility. With the same service offered, however, there are possible margins for further reductions. In fact, if the Public Administrations were able to improve the energy efficiency of their transport, both urban and extra-urban, they could obtain considerable savings that would favor the whole community.

There are many measures potentially applicable by Public Administrations.

To achieve energy efficiency, in addition to spreading its culture, for example by monitoring consumption, it is possible to optimize routes, promote car sharing and the choice of zero-emission vehicles equipped with electric traction.

❑ 4. INTERVENTIONS WITH A MIX ON THE BASIS OF AN ENERGY DIAGNOSIS ON THE BASIS OF WHICH TO CHOOSE THE MAIN ENERGY REQUALIFICATION OBJECTIVES

Energy requalification **can mean reducing electricity consumption by replacing the lighting bodies, improving the quality of lighting, also through relamping interventions with the replacement of light bulbs or installing entire more efficient lighting bodies, and also rethinking their setting for ergonomic purposes and improving it with building automation technologies.**

The optimal solution to achieve good efficiency results is to intervene with a mix of these interventions on the basis of an energy diagnosis.

Intervening on a building with this approach can make it possible to transform it into a nearly zero energy building (nZEB), with smaller consumption, and production of the energy it consumes from renewable sources.

This can be an opportunity to renovate a building beyond the energy dimension, creating spaces suitable for the most recent evolutions in ergonomics and home automation and constituting an important step in improving the quality of life and sustainability.

❑ 5. INDICATIONS AND INFORMATION ON HOW TO COVER THE REST OF THE COSTS OF AN ENERGY REQUALIFICATION PROJECT

Energy requalification can mean **addressing efficiency through the use of know-how with regard to the "information" sector, with specific knowledge of protocols and architectures in the energy sector, and to the "hardware" sector, i.e. electronics (HW and FW), with electronic and environmental measures This broader and more integrated approach allows to generate the potential to deal with energy-related aspects in an innovative way, optimizing the energy flows also of renewable energies.**

In the global context of IoT, distributed and decentralized IT architectures and 5G, "edge computing" is the new emerging approach, enabling professional IoT solutions and services suitable for many application areas such as Digital Energy, Home, Building and Asset Management, Smart City, Factory and Agriculture and so on. In all these application fields, Edge Computers allow you to run applications on local computational systems that process data directly in the field, reducing the strict dependence on remote data centers, so reducing congestion and cloud latency.

❑ 6. ENERGY EFFICIENCY, RENEWABLES AND MANAGEMENT OF THE ENERGY BILL

To make their energy consumption more sustainable, Public Administrations and Companies can make use of energy efficiency, renewable energy sources which are on their territory, or make use of particularly efficient energy production plants, such as high efficiency cogeneration plants, very suitable, for example, for large structures.

Renewable energy plants tend to have high installation costs, but low usage charges, as they do not involve fuel procurement costs.

5a - Renewable energies

Entities interested in developing the use of renewable sources for their own needs or in their reference area can resort to the available incentives that help to recover the investment costs incurred for the plants.

For example, renewable sources are encouraged through competitive auctions regulated by the Ministerial Decree of 23 June 2016, which defines the incentives for the production of electricity.

Public Administrations that already own renewable energy plants can optimize their bills through self-consumption and, in a "community" logic, help reduce costs through a "shared" use of renewable energy.

5b - High efficiency cogeneration

Interested entities could also make use of cogeneration units, which simultaneously generate electrical (or mechanical) and thermal energy, and increase the efficiency of fossil fuel use up to over 80% and can replace traditional thermal power plants.

Cogeneration is the combined production, in a single process, of electrical - or mechanical - energy and heat.

When a cogeneration unit achieves a primary energy saving (PES) greater than the threshold value established by the standard, it is said to be operating in High Efficiency Cogeneration (CAR).

In the case of final recognition of the CAR operation, for the cogeneration units that require it, income from non-negligible bonuses during operation could also be added (White Certificates, proportional to the energy savings achieved during the year).

5c - Energy efficiency monitoring

In order to provide a broader consultancy activity and better suited to the project objectives, it is proposed to provide two services aimed at contextualizing and better emphasizing the need to use appropriate tools and methodologies to allow constant monitoring of energy efficiency and the consequent benefits in economic terms and in respect of the environment.

To this end, a training session will be organized for the main users who have shown themselves to be interested in the project (Public Administrations, Companies, Managers) aimed at creating the so-called "awareness" in the effectiveness and need to implement behaviors aimed at energy saving.

5d - Involvement and awareness of energy efficiency

By further implementing the awareness and involvement of users, it is assumed that the free Beeta Game app by Tera will be granted. Thanks to the app, users will receive tips & tricks, their own energy class (Beeta Class, calculated with a specific algorithm), suggestions on how to reduce energy costs, opinions on smart appliances available on the market and information on available energy offers.

The gaming effect will contribute to increasing user engagement also thanks to the "social" effect obtained when users view rankings and compare themselves with other users (with users from the same city, or with users with similar homes, and so on).

Si può prevedere, al fine di interagire con gli utenti, il lancio di specifici “contest” (anche al fine di mettersi “alla prova” sulla pregnanza delle soluzioni da essi individuate) nell’ambito della app Beeta Game, la cui efficacia, per altro, è stata già testata per attività simili effettuate negli scorsi anni in diversificate realtà.

- In order to interact with users, specific "contests" should be launched (also in order to prove themseves on the significance of the solutions they have identified) within the Beeta Game app, the effectiveness of which it has already been tested for similar activities carried out in the past few years in different realities.

7. Local Actions in Municipality of Mirabello (IT)

7.1. Analysis of relevant regulations

7. 1.1 Introduction [22]

The objectives indicated in the "20-20-20 Strategy" can be achieved through the application of numerous energy and environmental regulations that the EU has issued in recent years.

These are Directives and Regulations, with which the framework of the commitments required of all member states is progressively finding greater definition and clarity. In this context, the Directives mentioned below represent an essential reference also for the implementation of energy policies of local authorities, increasingly called upon to develop energy efficiency, production and use of renewable energy in their territory. This latter role has been further strengthened by adhesion to the Covenant of Mayors:

- Directive 2002/91/EC (December 16, 2002): Promotion of the energy performance of buildings within the EU;
- Directive 2003/54/EC (June 26, 2003): common rules for the internal electricity market (repealing Directive 1996/92/EC);
- Directive 2003/87/EC (October 16, 2003): establishment of a system for greenhouse gas emission allowance trading (amended by Directives 2004/101/EC, 2008/101/EC, 2009/29/EC and Regulation 219/2009/EC);
- Directive 2005/32/EC (July 6, 2005): eco-design criteria for energy-intensive products;
- Directive 2006/32/EC (April 5, 2006): improvement of energy end-use efficiency and energy services (repealing Directive 1993/76/EC);
- Decision no. 406/2009/EC (April 23, 2009): Indicating Member States' obligations to reduce greenhouse gas emissions in order to meet the Community's greenhouse gas emission reduction commitments by 2020;
- Directive 2009/28/EC (April 23, 2009): Promotion of the use of energy from renewable sources (amending and repealing Directives 2001/77/EC and 2003/30/EC);
- Directive 2009/31/EC (April 23, 2009): geological storage of carbon dioxide (amending Directives 85/337/EEC, 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) no. 1013/2006 of the European Parliament and of the Council).

In addition, it should be emphasized that the EU's intervention in the fight against climate change includes, in addition to regulatory interventions, the implementation of a series of financing or financial engineering instruments that are applied with the necessary support of the European Investment Bank (EIB).

These are E.L.E.N.A. (European Local Energy Assistance), J.A.S.P.E.R. (Joint Assistance to Support Projects in European Regions), J.E.S.S.I.C.A. (Joint European Support for Sustainable Investments in City Areas) and J.E.R.E.M.I.E. (Joint European Resources for Micro to Medium Enterprises),that are instruments aimed at generating virtuous mechanisms of local development, with the involvement of institutions and private entities, within which interventions in the energy field aimed at the implementation of the measures contained in the territorial energy planning can be fully included.

[22] Source: https://mycovenant.eumayors.eu/docs/seap/2497_1366208338.pdf

7.1.2 National Level [23]

On a national level, energy policies were launched in the early 1990s when, following the approval of the National Energy Plan (PEN, 10 August 1988), all Regions were required to adopt Action Plans for the use and promotion of renewable energies in their territory. In this sense, Laws n. 9 and n. 10 of January 9, 1991[24] were fundamental, through which the state legislature has provided to outline a clearer framework of processes and planning tools that would guide the energy policies of local authorities.

Specifically, Law 9 provided for an initial implementation of the PEN, also initiating a partial liberalization of the energy market (for self-consumption or to be fed into the Enel network).

With Law 10, on the other hand, not only have the required contents been defined for the Regional Energy Plans (from the energy balance to the identification of financial resources for new plants, up to the construction of scales of importance of the objectives), but - a central aspect for future local energy policies - a first decentralization of functions towards Regions and Provinces has taken place.

In addition, municipalities with more than 50,000 inhabitants are required to integrate the PRG with a specific plan for the use of Renewable Energy Sources. Among the other regulatory interventions of that period, it is necessary to mention the D.P.R. n. 412 of August 26, 1993[25], implementation of the cited Law n. 10/19991, which provides the "Regulation containing rules for the design, installation, operation and maintenance of thermal systems of buildings".

Subsequently, with the approval of Legislative Decree no. 79/1999 ("Bersani Decree"), Italy took its first real and concrete step towards European energy policies. In fact, with this decree, the content of Directive 96/92/EC is implemented in our system. The contents of the Bersani Decree were subsequently implemented through the MICA/MinAmb Decree of 11/11/99, which established the green certificate system, and the Decree of the Ministry of Productive Activities (20/7/2004), which again identifies the quantitative objectives for increasing energy efficiency in the final use of energy.

This was followed by a series of regulatory and planning measures in line with European policies and directives on the subject, albeit with substantial delays with respect to the implementation of certain important measures.

The following is a brief summary:

- Legislative Decree no. 387 of 29 December 2003 - in implementation of Directive 2001/77/EC - aimed at promoting electricity produced from renewable energy sources in the domestic market; at implementation level, the Decree of the Ministry for Economic Development of 19 February 2007 was issued, which identifies "Criteria and methods for encouraging the production of electricity by means of photovoltaic conversion from solar sources";
- Legislative Decree no. 192 of August 19, 2005 - which implements Directive 2002/91/EC - establishes the minimum energy performance requirements for buildings, affecting the entire building system (insulation, heating, air conditioning, lighting, use of renewable energy sources); coordinated with Legislative Decree no. 311/2006, corrective and supplementary provisions to Legislative Decree 192/2005, it is further taken up with Presidential Decree no. 59 /2009, which introduces the "Regulations for the implementation of article 4, paragraph 1, letters a) and b), of Legislative Decree no. 192 of 19 August 2005, regarding the building implementation regulations";

[23] Source: https://mycovenant.eumayors.eu/docs/seap/2497_1366208338.pdf

[24] Source: https://www.gazzettaufficiale.it/eli/id/1991/01/16/091G0015/sg

[25] Source: https://www.gazzettaufficiale.it/eli/id/1993/10/14/093G0451/sg

- Legislative Decree no. 152 of April 3, 2006 and subsequent amendments and additions. "This is the main legislative text governing environmental matters in its various forms (waste, water resources, EIA, SEA, etc.).
- Legislative Decree of October 1, 2007, converted into Law no. 222/2007 and linked to the 2008 Finance Act, establishes innovations regarding the penetration and spread of renewable energy sources and the improvement of energy efficiency in buildings.
- Legislative Decree no. 115 of May 30, 2008, issued in implementation of Directive 2006/32/EC. This measure introduces measures aimed at improving the efficiency of energy end uses and identifies the indicative targets, incentives and institutional, financial and legal framework necessary to eliminate existing market barriers in order to promote efficient energy end use. With this decree, moreover, the distribution among local authorities of the minimum energy saving targets necessary to achieve the objectives proposed by the EU is carried out.
- D.Lgs. June 26, 2009, n.158 - published in implementation of the provisions of paragraph 9 of art. 6 of Legislative Decree 192/2005 and subsequent amendments, defines the National Guidelines for the energy certification of buildings and the instruments of connection, consultation, cooperation between the State and the Regions.
- Ministerial Decree of March 3, 2011 and Ministerial Decree of May 5, 2011, which introduce: "incentives for the production of energy from solar photovoltaic systems", and which implement Directive 2009/28/EC on the promotion of the use of energy from renewable sources.
- In the energy field, of particular relevance are also the forecasts contained each year in the Financial Laws, through which the State often introduces specific measures and/or provides the appropriate tools to implement energy policies by central and local administrations and private entities.

7.1.3 Regional and provincial level[26]

Within the framework of EU and national policies outlined above, the Molise Region has - since the 90s - put in place its own energy policy that has found concrete expression in specific initiatives, measures and regulatory measures aimed largely at regulating and encouraging energy saving and energy production from renewable sources in line with the above programmatic and regulatory references at national and EU level. Among the legislative measures issued are recalled:

- Regional Law of November 3, 1994, n. 20 - "Completion of the gas distribution program beneficiaries priorities of intervention current criteria";
- Regional Law 12 May 1995, n. 25 - "Contributions for the use of energy sources";
- Regional law 27 September 2006, n. 28. - It introduces the discipline related to "Works related to electrical lines and installations up to 150,000 volts";
- Regional Law 21 May 2008, n. 15. - Introduces the discipline related to "Renewable energies - Wind and photovoltaic plants on the territory of Regione Molise";
- Regional Law 7 August 2009, n. 22. - Introduces the discipline related to "Installations of electric energy from renewable sources";

[26] Source: https://mycovenant.eumayors.eu/docs/seap/2497_1366208338.pdf

- Regional Law no. 23 of 23 December 2010 - with this measure amendments and integrations were made to the regulations concerning the Areas and authorisation regime as well as the introduction of the discipline of "Electricity plants from renewable sources";
- Regional Law no. 7 of April 21, 2011. - "Promotion of the sustainable development of the regional energy system - Preclusion of installation in the regional territory of nuclear plants and deposits of radioactive material";

With this measure, it was intended to promote the sustainable development of the regional energy system while precluding the installation of nuclear plants and deposits of radioactive material;

Lastly, it should be noted that with the Deliberation of the Regional Council of August 4, 2011, no. 621, the "Guidelines for the conduct of the single procedure pursuant to art. 12 of Legislative Decree no. 387/2003 for the authorization to build and operate energy production plants" were approved.
In terms of programming, the Molise Region has also introduced a system of incentives, related to the ERDF Operational Program 2007 - 2013, in which under Axis II Energy, measures for energy saving in the private and public sectors have been included. In particular, the Axis II, has a budget of approximately 26 million euros, of which about 9.5 million euros of Community contribution of the ERDF, is divided into the following activities:
- Activity II.1.1 Rationalization of the use of energy sources;
- Activity II.1.2 Renewable energy sources.

7.1.4. Key European Regulations affecting climate and energy policies at local level [27]

- The Energy Performance of Buildings Directive (2002/91/EC), which establishes the following obligations for Member States: · Setting up a method to calculate/measure the energy performance of buildings:
- Setting minimum energy performance standards for new/ renovated buildings
- Setting up a certification scheme that informs potential buyers/renters of buildings (residential, commercial, …) about the energy performance of the building in question
- Displaying an energy performance certificate in all "public" buildings
- Setting up an inspection scheme of the cooling and heating systems above a certain size This regulation was supposed to be in force in all Member States as of January 2006 (with some possible delay till January 2009 for some of the chapters), but many Member States have been late in adopting the necessary measures and laws
- Communication COM (2009) 490 "Action Plan on Urban Mobility" aimed at establishing the actions to be implemented through programmes and instruments
- Directive 93/116/EC of 17 December 1993 adapting to technical progress Council Directive 80/1268/EEC relating to the fuel consumption of motor vehicles
- Directive 2009/28/EC on the promotion of the use of energy from renewable sources
- Directive 2003/30/EC on the promotion of the use of biofuels for other renewable fuels for transport

[27] source: Guidebook "how to develop a sustainable energy action plan (seap)" annex III

- Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.

7.2 Baseline review and baseline emission inventory.[28]

SECAP should be developed on the basis of reliable information related to energy consumption and greenhouse gas emissions in the territory of local self-government bodies. Due to this, at the initial stage a comprehensive assessment of the current (baseline) situation and structures should be made. The assessment starts with determination of the level of energy consumption in respective sectors of the city's/town's economy and development of the Baseline Emission Inventory (BEI), determination of the volume of carbon dioxide (CO2) emission related to energy consumption in the baseline year.

The BEI and further inventory-making of CO2 emission (if available) constitute the main tool allowing local authorities to determine priority measures and efficiency of the measures implemented by them, aimed at reduction of greenhouse gas emission.

7.2.1 Preamble:

The first step required of the municipal administration by the adhesion to the Covenant of Mayors is the drafting of the Baseline document, i.e. the cognitive framework of greenhouse gas emissions (CO2) related to energy uses and energy production that insist on the municipal territory, as well as the territorial, social and economic factors that contribute to it and that influence its evolution in the future.

The Baseline document is therefore organized into two sections: a first part dedicated to providing the framework data of the territory and the socio-economic data; a second part dedicated to the available energy data and their reprocessing for the purposes of reconstructing the Emissions Inventory.

The framework data are structured as follows:

- Contextual framework

- Buildings present on the territory

- Climatic zone and average annual temperature

- Annual expenditure incurred by the municipal administration

- Annual energy consumption

- Consumption attributable to school buildings

The analysis of the framework data is also aimed at identifying opportunities or possible critical elements that must be taken into account during the development of the Action Plan.

The Baseline Emissions Inventory is the inventory of annual CO2 emissions in a selected year, related to final energy use attributable to activities of direct and/or indirect competence of the Municipal Administration.

[28] http://com-east.eu/en/faq-3/item/137-what-is-a-baseline-emission-inventory/

The former include the energy consumption of public buildings, public lighting and the municipal vehicle fleet. To the latter refer the emissions of the private building stock, the tertiary sector, small and medium enterprises and urban transport.

The years 2017-2018-2019 were considered as the base year for the BE.

In order to build the Baseline Inventory, consumption data (end uses) for the different energy vectors were collected, where possible over multiple years, in order to identify any energy use trends.

The municipal administration of Mirabello Sannitico, aware that the energy costs related to the operation of buildings and public services constitute a large part of the expenses on the municipal budget and heavily affect the annual energy budget, has worked over time to carry out specific interventions of energy efficiency, with particular attention to the structures and systems most energy intensive: school building, municipal building, sewage treatment plant, public lighting system.

7.2.2 Territorial and socio-economic context

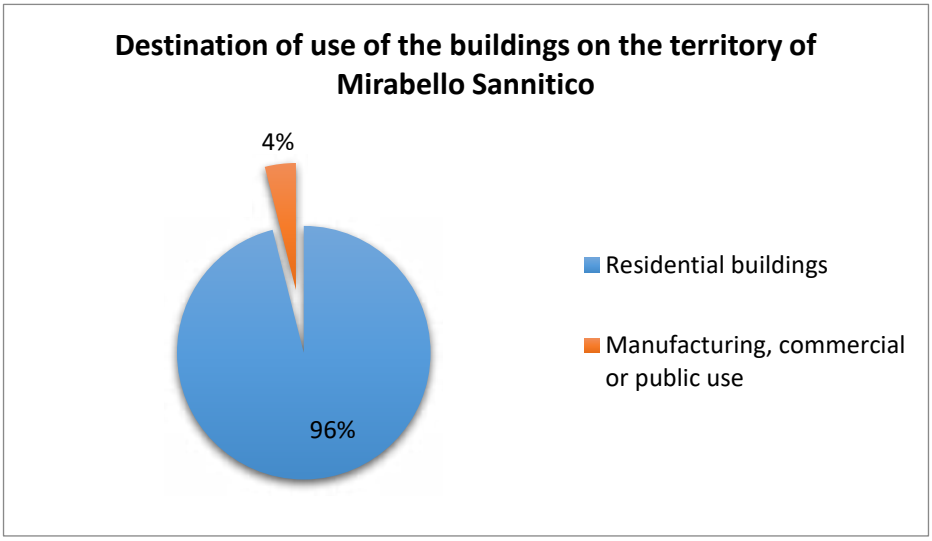
Mirabello Sannitico is a town of 2'139 inhabitants located in Molise, in the province of Campobasso. It presents a prevalently hilly territory, placed at an altitude of 600 m.s.l.m. and extended on a surface of 21,45 Km.

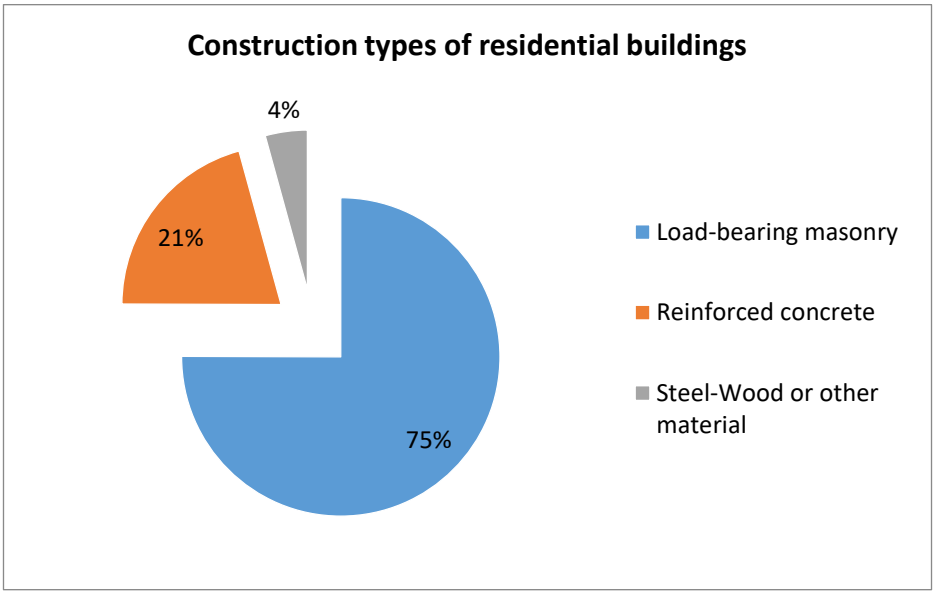
The nucleus of the country is constituted by the historical center, that still maintains the original architectonic characteristics, around which the more modern part of the country is extended.

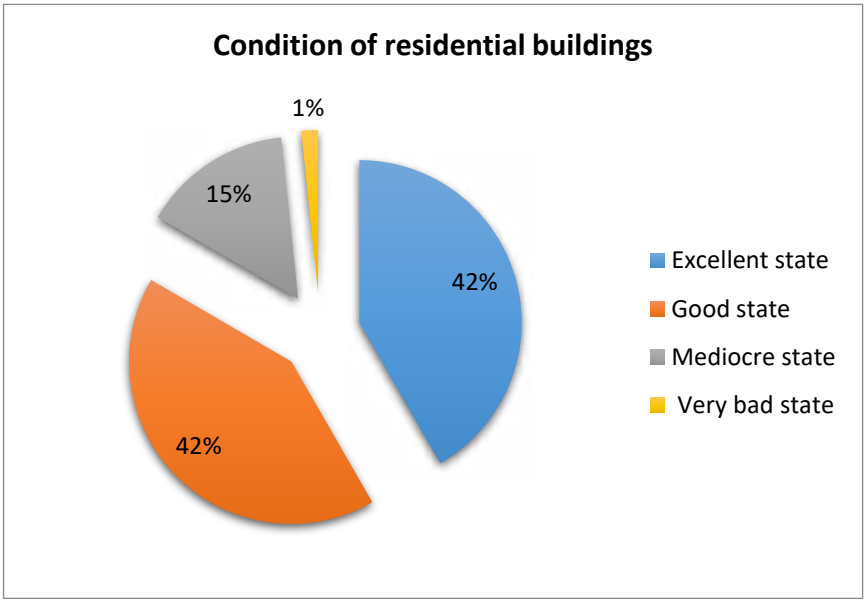
The demographic data show a trend at times in countertendency with respect to the variation of the population in the entire province of Campobasso, which is mainly due to the favorable position of the territory, which borders the capital of the region and is a few kilometers from the latter.

7.2.3 Buildings present on the territory

In the municipality there are a total of 511 buildings, of which only 489 are used; the following graphs summarize their below summarize their characteristics:







7.2.4 Climatic zone and average annual temperature

The municipality of Mirabello Sannitico falls within the climatic zone E, with 2'130-degree days. In general, the degree day indicates, for the whole year, the sum of the average daily temperature increments necessary to reach the set point temperature of 20°C, i.e. it shows the energy requirement necessary to maintain a comfortable climate inside the buildings: the higher the value of degree days (GG), the greater the need to keep the heating system running. In the specific case of climate zone E, the winter heating period runs from October 15th to April 15th, for a total of 14 hours per day.

Identification of climatic zones in Italy

The hot season lasts 2.8 months, with an average maximum temperature ranging from 24°C to 28°C, with peaks of 33°C. 28°C, with peaks equal to 33°C; the cold season lasts 4,1 months with an average minimum temperature of 2°C, with peaks equal to -3°C.

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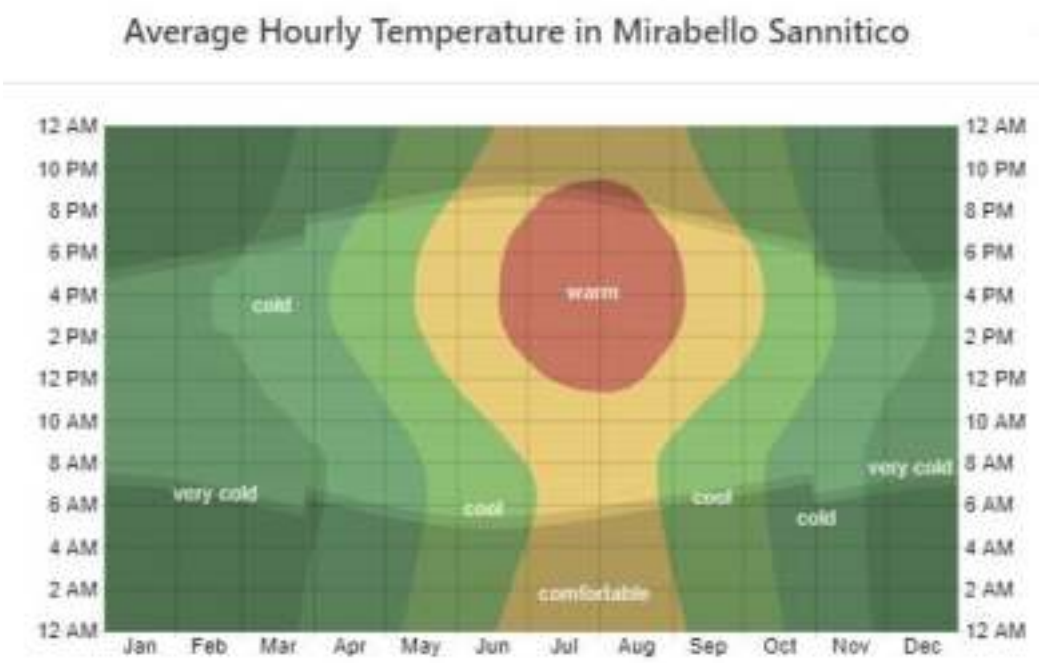

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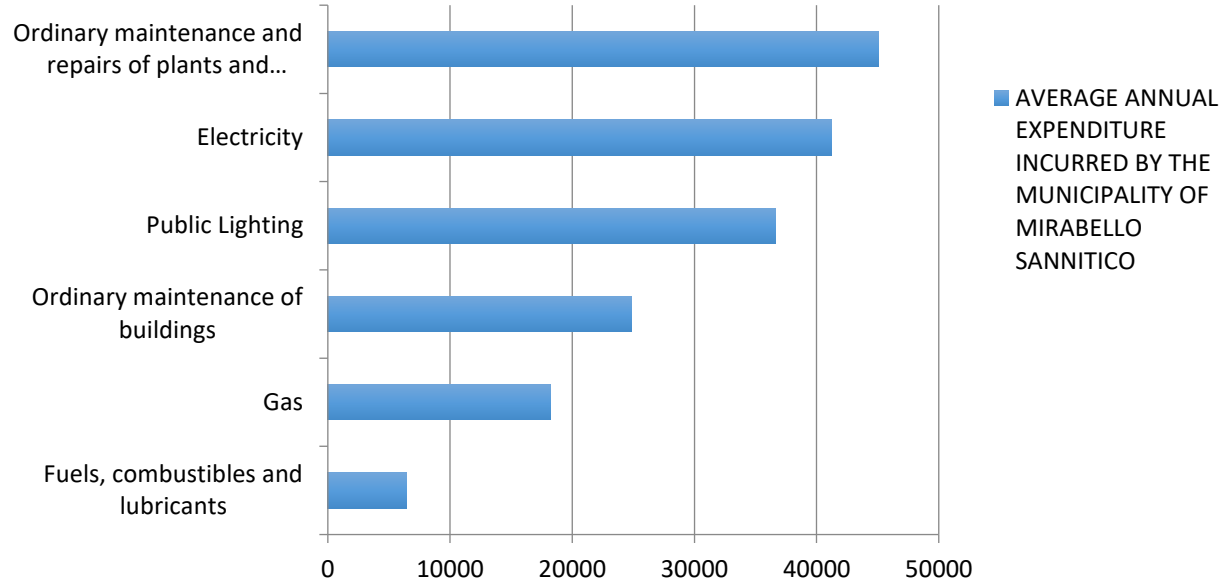
7.2.5 Annual expenditure sustained by the municipal administration

In the annual budget of a Public Administration always occupy the first places the expenses related to the energy consumption, maintenance of plants and buildings and management of the municipal vehicle fleet. Also for this reason, implementing actions to implement energy efficiency and technology installed offers an enormous advantage for municipal coffers, freeing up resources that can be reinvested on the development of the territory itself. The following graph and table summarize the items relating to the main expenses incurred by the municipality of Mirabello Sannitico, for an overall total of 172,345.09 €/year; the data are extrapolated from the Siope management service and refer to the year 2019.

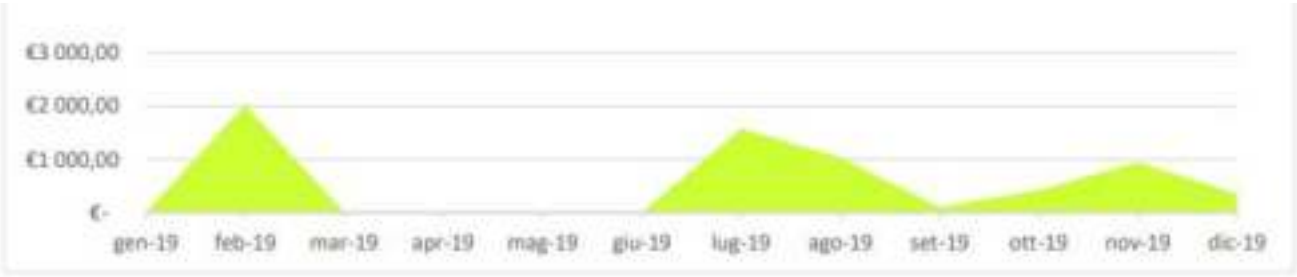
AVERAGE ANNUAL EXPENDITURE INCURRED BY THE MUNICIPALITY OF MIRABELLO SANNITICO



	Fuels, combustibles and lubricants	Gas	Ordinary maintenance of buildings	Public Lighting	Electricity	Ordinary maintenance and repairs of plants and machinery
AVERAGE ANNUAL EXPENDITURE INCURRED BY THE MUNICIPALITY OF MIRABELLO SANNITICO	6434	18191,42	24867,98	36609,86	41203,92	45037,91

Plant and machinery maintenance cost trend - Year 2019

Fuel costs trend- Year 2019



7.3 Annual Energy consumption

From the data described in the previous paragraph, it is possible to obtain the average consumption of gas and electricity as a function of the average unit cost of the respective energy vectors recorded in the bill during the energy audit. The calculation of the average annual unit cost per cubic meter and per kWh has led to the following values the identification of the following values:

AVERAGE UNIT COST OF THE ELECTRICAL ENERGY VECTOR: 0.22 - 0.25 €/kWh

MEDIUM UNIT COST OF THE METHANE GAS CARRIER: 0.6 - 0.7 €/smc

The estimated average annual consumption, calculated by dividing the total cost by the specific unit cost, is as follows specific unit cost:

EXPENSE ITEM	Total expenditure	Unit expenditure	Electricity consumption
Electricity	41'203,92 €	€ 0,24 €/kWh	171’683 kWh
GAS	18'191,42€	€ 0,65 €/smc	27’987 smc

Where the consumption of Standard Cubic Meters corresponds to:

ETHERMAL ENERGY CONSUMED = 27'987 smc X 10,69 kWht/smc = 299'181 kWht

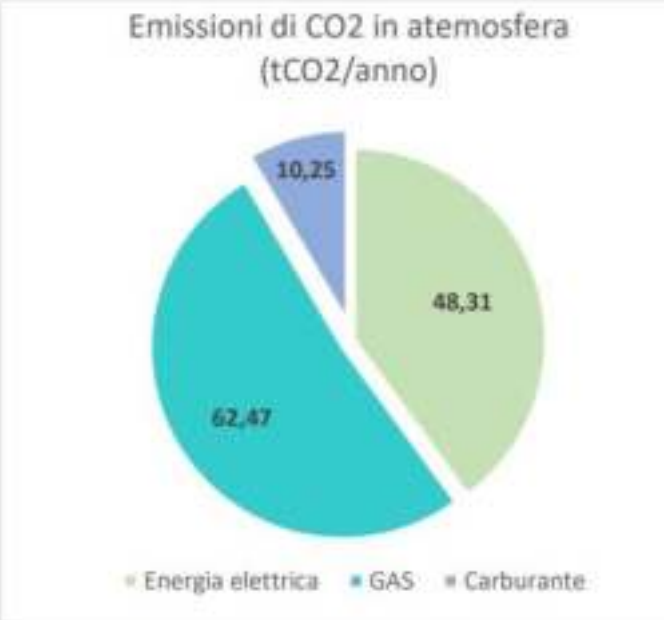
For the reference year an average cost per liter of fuel of 1.57 euros per liter was assumed, the value of which is the result of the average of the unit prices of petrol and diesel during the period in question, resulting from the average of the unit prices of petrol and diesel in the period under consideration.

VOCE DI SPESA	Total Expenditure	Unit expenditure	Cost
Fuel	6'434,00 €	1,57 €/l	4’098 l

On the basis of this data, primary energy consumption was defined, expressed in Tonnes of Oil Equivalent, and the corresponding quantities of climate-changing gas emissions expressed in KgCO2.
Oil Equivalent Tons, and the corresponding quantities of climate-changing gas emissions into the atmosphere expressed in KgCO2. The conversion factors useful for defining these consumptions are as follows:

The calculations carried out show that the town of Mirabello Sannitico consumes an average of 59.60 TEP/year, 121.03 tCO2 emitted into the atmosphere.

Primary energy consumption (left) and CO2 emissions into the atmosphere (tCO2/year) (right)

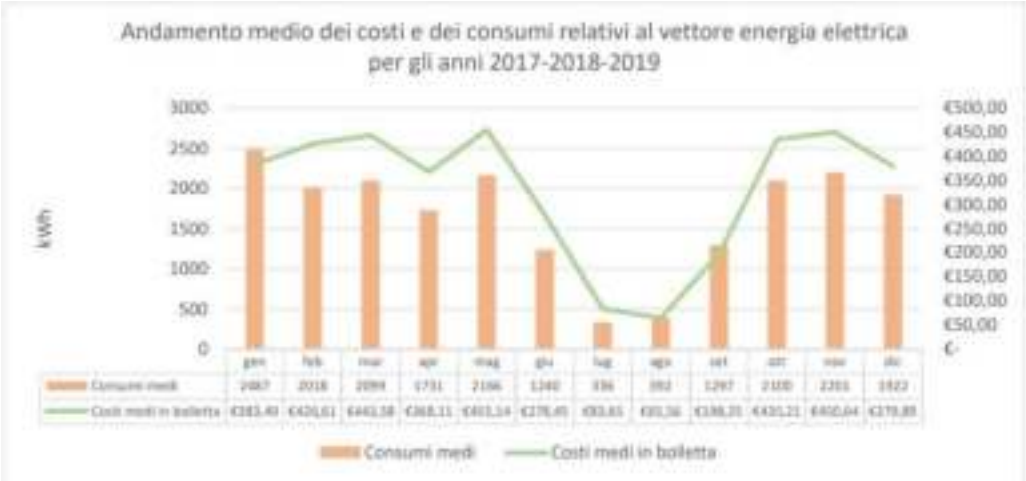


7.3.1 Consumption attributable to school buildings

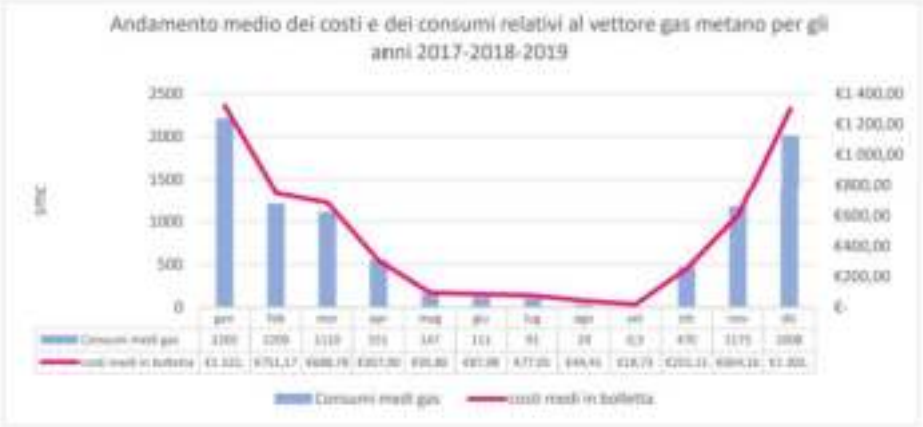
As anticipated, the attention from the energy point of view is mainly focused on the school building Guido Nebbia located in via Firenze in the municipality of Mirabello Sannitico, as it is a structure that, in addition to hosting the host schools of various grades, has inside a multipurpose building that is often used for recreational activities, so it is particularly energy efficient.
The three years taken into consideration for the reference consumption are 2017, 2018, 2019 respectively, as it was not possible to consider the year 2020 because, as of March 2020, the consumption trend is strongly influenced by the new rules of use of the facility, the consumption trend is strongly influenced by the new rules for the use of the facility imposed by COVID-19.
From the data analyzed, the average consumption over the three years is as described in the graphs below:

CONVERSION FACTORS FOR THERMAL ENERGY:	0.836 x 10-3 TEP/smc	0.2088 x 10-3 tCO2/kWht
CONVERSION FACTORS FOR ELECTRICAL ENERGY	0.187 x 10-3 TEP/kWhe	0.2814 x 10-3 tCO2/kWhe
CONVERSION FACTORS FOR FUEL:	0.001 TEP/l	0.0025 KgCO2/l (average value between diesel and gasoline)

Average trends in costs and consumption related to the electricity carrier for the years 2017-2018-2019



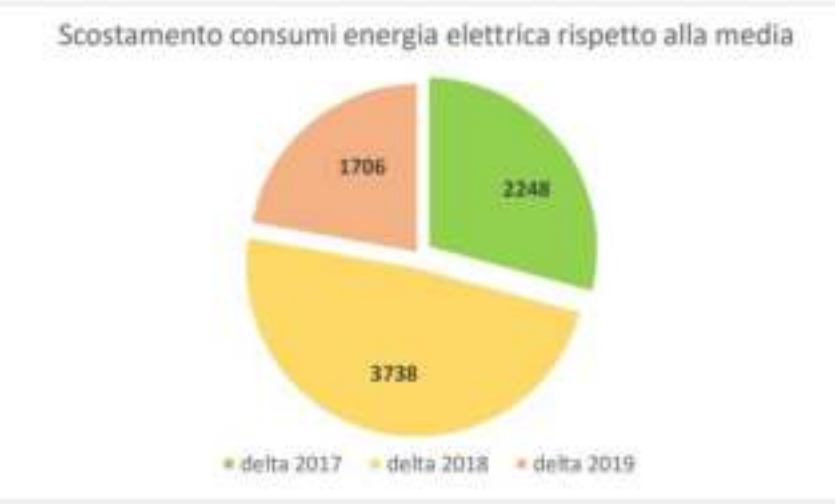
Average trends in costs and consumption related to the natural gas for the years 2017-2018-2019



In order to define an **energy baseline**, it was evaluated the deviation of consumption for each year analyzed with respect to the average described above, and consequently, the two years with the closest trend to the latter were taken as the basis. The following graphs indicate the deviation verified:

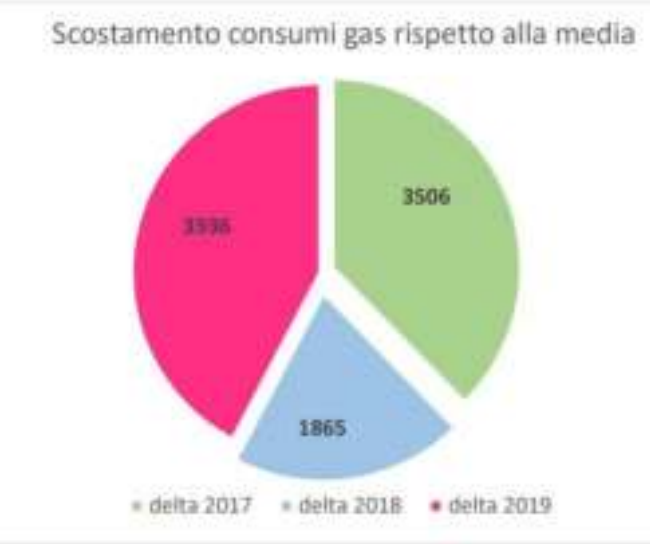
Trends in consumption of the electricity vector compared to the average Years 2017-2018-2019

Deviation in electricity consumption compared to average



Trend in gas consumption compared to average - Years 2017-2018-2019

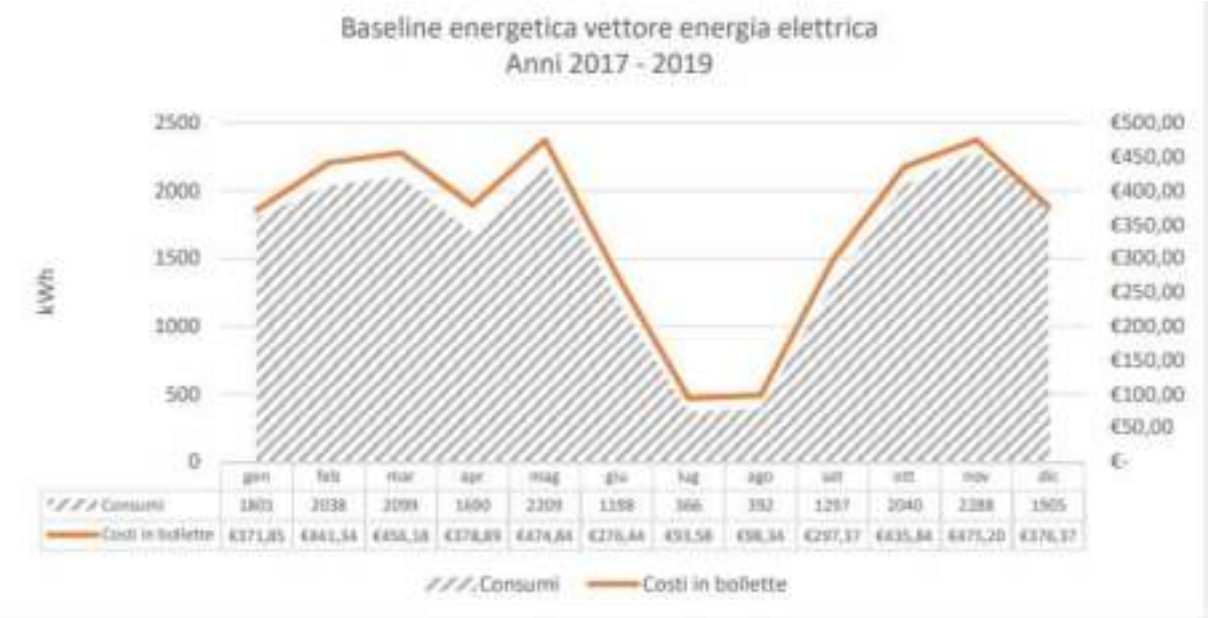
Deviation in gas consumption compared to average



7.3.2 School buildings electricity baseline

For the baseline related to electricity were therefore chosen the years 2017-2019, with an average consumption of 19'321 kWh / year and an average cost of € 4'176.24 / year.

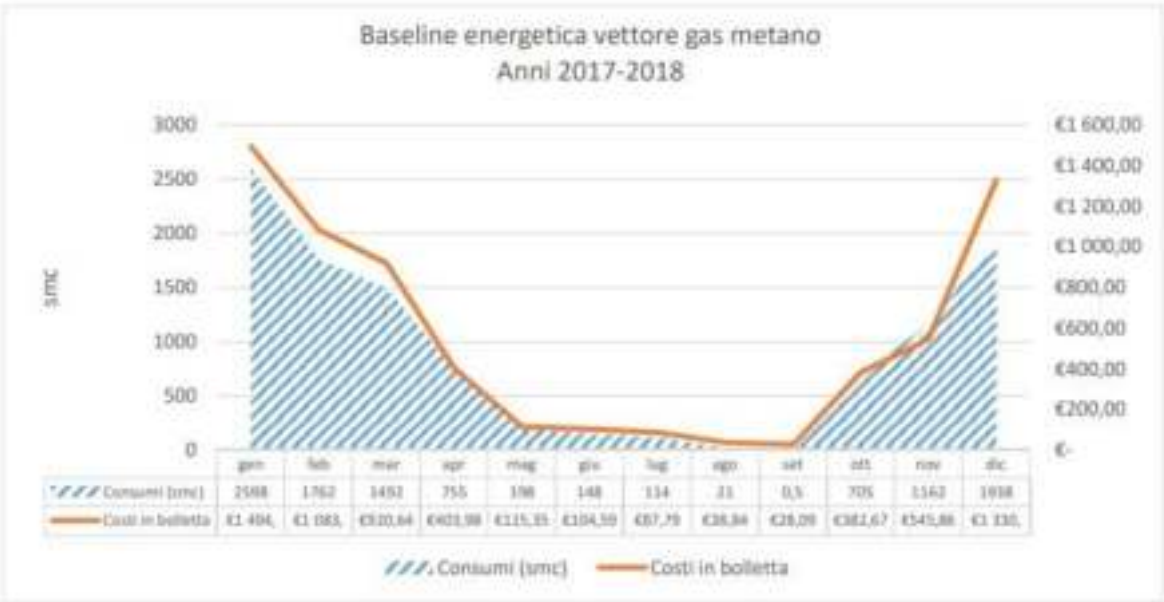
Electricity vector energy baseline -Years 2017 - 2019



7.3.3 School buildings methane gas baseline

For the baseline relative to the methane gas vector, instead, the years 2017-2018 have been chosen, with an average consumption equal to 10'893 smc/year and an average cost equal to 6'535,46 €/year.

Baseline energy vector methane gas



7.4 Current costs of Mirabello Sannitico Municipality

Summarizing the data described in the previous paragraphs, we have that the total current consumption of the municipality of Mirabello Sannitico, minus the electric energy produced by photovoltaic and self-consumed (see the cap. 7.3.1. Efficiency actions implemented on the school building Guido Nebbia), is the following as follows:

GLOBAL CONSUMPTION OF MIRABELLO SANNITICO MUNICIPALITY			
Thermal Energy	27987 smc	23,40 TEP	62,47 tCO2
Electric Energy	135300 kWh	25,30 TEP	38,07 tCO2
Fuels	4098|lt	4,10|TEP	10,25|tCO2
		52,80 TEP	110,79 tCO2

GLOBAL CONSUMPTION SCHOOL BUILDINGS MIRABELLO SANNITICO			
Thermal energy	10893 smc	9,11 TEP	24,31 tCO2
Electric energy	7046|kWh	1,32|TEP	1,99|tCO2
		10,42 TEP	26,3 tCO2

7.5. Examples of Local Actions

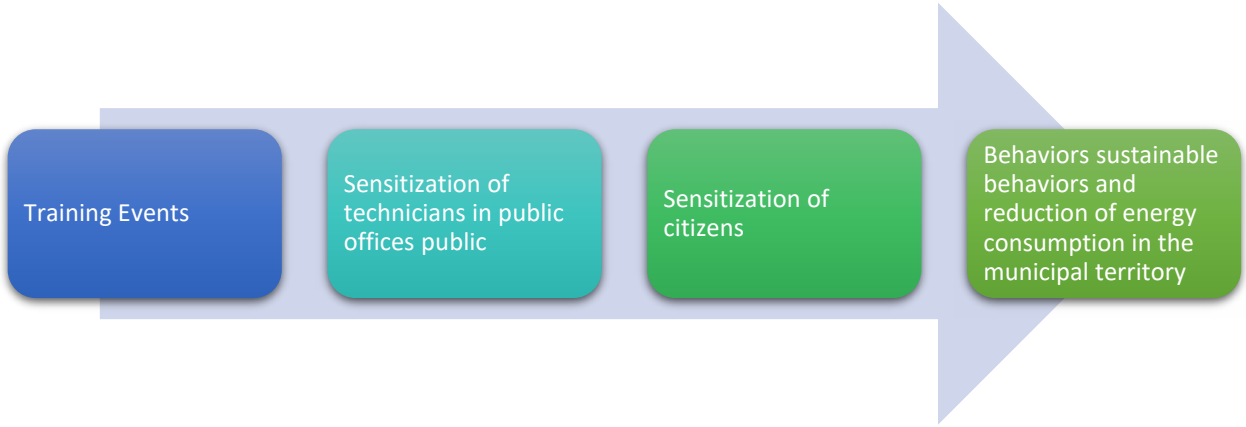
7.5.1. Efficiency actions implemented on the school building Guido Nebbia:

With reference to the school building Guido Nebbia, the Municipality of Mirabello Sannitico has worked to carry out interventions of photovoltaic RES installation in order to reduce part of the electricity consumption of public facilities and plants. More specifically, on the flat roof of the school building has been installed, in the year 2020, a photovoltaic system of the grid-connected type, three-phase low voltage. In total there are N. 98 photovoltaic modules for a total installed power of 26.95 kWp.

For the photovoltaic system described above it has been estimated an annual production of 36,383 kWh, which means that it covers the electricity needs during the daytime for 6.08 TEP/year. The plant just described is connected to the school and enjoys the exchange on site elsewhere, that is, the energy produced is consumed by the school building, while the surplus production is exploited by the purification plant that serves the municipal territory.

7.5.2. Actions planned and/or to be implemented with the aim of energy efficiency of public facilities:

The awareness of the various actors operating in the area, with particular reference to citizens and their habits, has a fundamental role in the pursuit of energy efficiency objectives in the territory, as it aims to obtain collective behavior and sustainable consumption habits, or that look to the future with look to the future with respect for available resources and protection of the territory.



a. Public information events on energy issues held by appropriate professionals in the field.

These are thematic days organized by the Public Administration of Mirabello Sannitico, using technicians specialized in the field, with the aim of raising awareness among citizens on issues of environmental sustainability, air pollution and sustainable mobility. These training events are to be held also and above all within the schools, with the conviction that future generations may already be aware of the importance of respecting environmental resources and their conscious use and not wicked.

b. Energy efficiency training for civil servants

The involvement of technicians within the Public Administration is essential in order to keep the municipality abreast of regulatory updates on energy efficiency and, above all, in order to take advantage of public funding, incentives and all the opportunities that arise to be able to find funds useful for the implementation of interventions also provided by this action plan. The overcoming of organizational-managerial problems related to the internal competences of the administrative offices is fundamental for the support of investments in energy efficiency of public property and for the relations with the various stakeholders.

c. Creation of an information point ONE STOP ENERGY POINT

This is a permanent installation of a centralized information point with the aim of constantly offering, to anyone interested, information on regulations, technologies, opportunities related to the use of renewable sources and high energy efficiency technologies.

7.5.3 Support for the creation of energy communities

Creating innovative forms of aggregation aimed at an intelligent use of energy, with a consequent increase in the quality of life both from the point of view of comfort and from the economic/social point of view, inevitably leads to an increase in both the quality of life and the environmental quality of the territory in which one lives. The role of the Public Administration in this sense is to stimulate and support the citizen to be not just a consumer of energy, not a producer whose interest is profit, but a "Prosumer", ie a producer who, in addition to self-consumption of energy produced from renewable sources, it gives the surplus to allow the use to the community.

a. Creation of a municipal energy park serving public facilities and private houses

The creation of an energy park, powered primarily by renewable sources such as photovoltaics (photovoltaic benches, photovoltaic shelters, photovoltaic trees, charging stations, etc. ...) will not only have a collective self-sustainable meeting point, but also to create that sensitivity to environmental issues referred to in point 4.1, as it can also bring together the information point ONE STOP ENERGY POINT. The energy produced by the installed RES will be used in part to self-sustain the park itself, in part can be exploited by public facilities, in part can be provided to the private homes of individual citizens depending on their annual income, resulting in significant savings of primary energy in the area and increased social and economic well-being in full compliance with sustainable development.

7.5.4 Energy efficiency of the municipal public lighting system

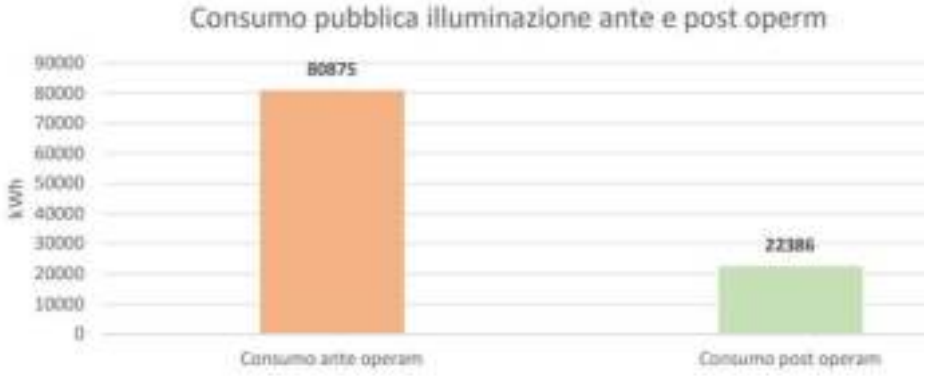
Over the last few years, the municipality of Mirabello Sannitico has taken steps to upgrade a portion of the public lighting system by installing LED technology lighting fixtures.

The main interventions are

A) Replacement of the remaining portion of obsolete lighting fixtures with high-efficiency LED technology fixtures and/or lamps, in compliance with lighting criteria and Regional Law 2/2010 that regulates measures to reduce light pollution towards the sky;

B) Installation of flow regulators and adjustment of astronomical clocks for the abatement of light flow as a function of vehicular and/or pedestrian traffic and the actual hours of light

Public lighting consumption ante and post operam



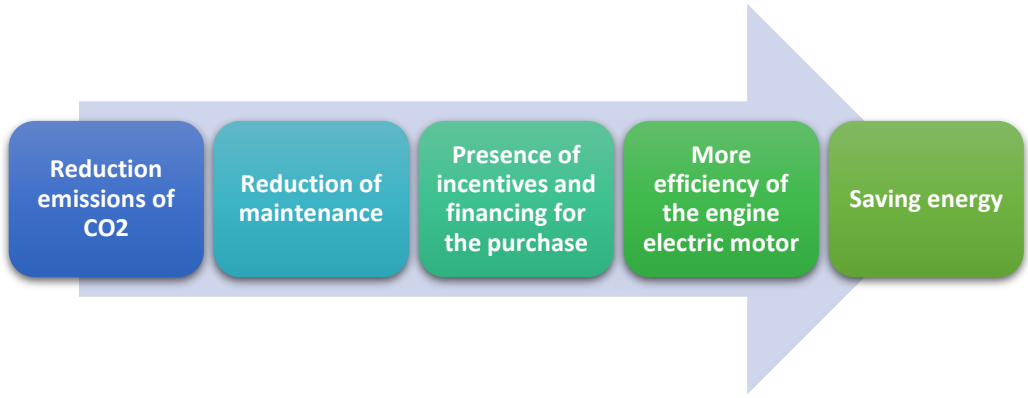
7.5.5 Public transport and vehicle fleet

The transport sector in Italy accounts for about one third of the country's total primary energy consumption. Although technology in the field of electric mobility has made great progress in recent years

Unfortunately, it is still not very widespread in Italy in general and in Molise in particular. The goals set for energy savings in the transport sector are ambitious, but there is a need for all and communities to collaborate and that the Public Administrations not only set an example with their vehicle fleets, but ensure the fluidity of services with particular attention to electric charging stations.

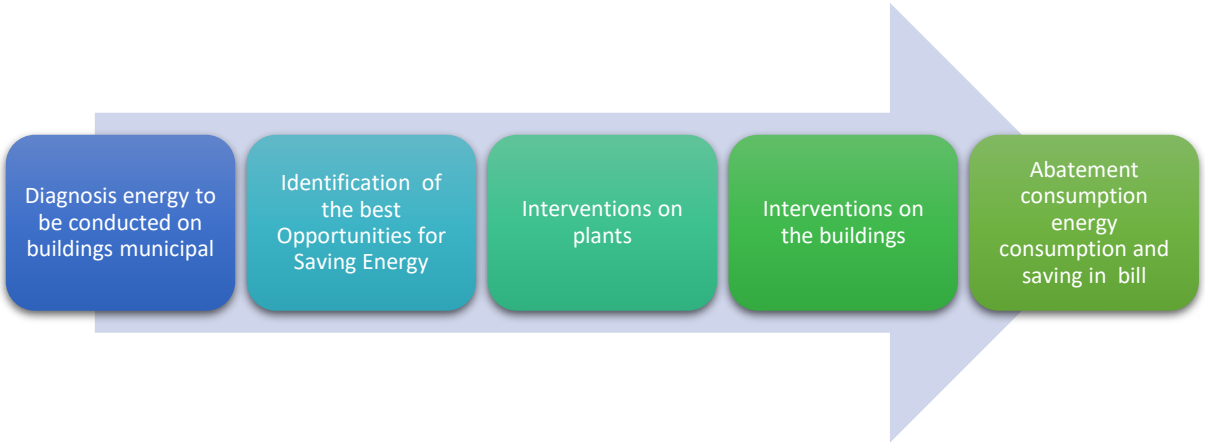
The municipality of Mirabello Sannitico has already installed a charging station at the school plexus Guido Nebbia school complex located in Via Firenze, however, the service offered is unused because there are no
electric vehicles owned by the community, let alone by public transport. Although the current consumption of fuel is equal to 4% of the overall costs of the administration, it must be said that this expenditure increases if we refer to the reference to the maintenance to be performed on the vehicles. The presence of a fleet of electric vehicles would not only contribute to raising the awareness of the population towards this issue, but it would also lead to a reduction in the costs inherent in both fuel consumption and maintenance of the transport machines.
Ultimately, the actions to be taken are:

a) Implementation of electric bicycling for travel within the municipality with provision of e-bikes and electric scooters;
b) Activation of car sharing service for urban mobility with electric cars;
c) Replacing the fleet of vehicles within the competence of the Municipal Administration with vehicles of electric type electric vehicles;
d) Implementation of the electric charging service for cars with the installation of appropriate stations.



7.6 Energy renovation of municipal buildings

The actions proposed in this plan are described below:



1. **Energy diagnosis of municipal buildings**

The objective of the energy diagnosis is the development of an analysis activity aimed at defining the actual state of the buildings from the point of view of energy-performance, in order to define the interventions of energy upgrading most appropriate to promote for each specific case.

2. **Interventions on the air conditioning systems of public buildings**

The totality of the municipal buildings of Mirabello Sannitico has an obsolete heat generation plant, of the standard methane gas type, often badly sized compared to the thermal demand. obsolete, of the standard methane gas type, often also badly sized compared to the thermal demand. The replacement of these systems with efficient systems consisting of condensing boilers in cascade or heat pumps combined with a puffer heat pumps combined with a storage puffer and solar thermal panels in support for preheating water certainly involves a reduction in thermal energy consumption that can range from 30% to 60%.

3. **Interventions on lighting systems serving public buildings**

Currently, most of the lighting systems serving public facilities are mainly made of neon technology lamps or, in any case, different from LED. It should also be considered that in many cases the visual comfort is poor or null, not being verified at the base of the suitable lighting conditions for each specific case.

The replacement of the current lighting fixtures serving public buildings with lamps and / or ceiling lights with LED technology allows not only to save on the final consumption of electricity, but also allows to limit the expenses related to the maintenance of lighting systems and, following an adequate study allows to guarantee the right visual comfort.

4. **Interventions of energy efficiency to be conducted on the walls**

The main intervention to be carried out is the insulation of opaque walls, together with the correction of thermal bridges. The purpose of the intervention is to reduce the transmittance of the walls, bringing it within the limits of the law, in order to increase the resilience of the building.
The insulation of the walls allows an annual energy saving in the bill of about 15-20%, due to to the ability of the building envelope to maintain the internal temperature set point and therefore to the lesser heating operation.

5. **Energy efficiency interventions to be carried out on the transparent building envelope**

The replacement of windows and doors of type standard with low emissivity fixtures, capable of taking care of the luminous behavior of the glazing systems in general, allows to increase considerably the efficiency of the structure in correspondence of the volumes more exposed to temperature changes and solar radiation, ensuring greater comfort in the spaces of the building subject to comfort in the spaces of the building subject to intervention and a reduction of energy carriers.

7.7 Others

7.7.1 Existing interventions

Over the years, the municipality of Mirabello Sannitico has developed a series of energy rehabilitation interventions on its real estate assets. More specifically, works have focused on the installation of photovoltaic RES on the school building (already discussed in the previous paragraphs), on the municipal building and at the service of the sports facility, although the main need would be to intervene on heat generation systems, heat emission, interior lighting systems and on the opaque and transparent building envelope.

The interventions implemented in recent years on municipal facilities and/or plants have allowed a significant decrease in CO2 emissions into the atmosphere and in the overall primary energy demand. More specifically, the municipality of Mirabello Sannitico has undertaken the following actions, some of which are in place at the time of writing this plan:

a) Energy efficiency of a portion of the municipal public lighting system by replacing sodium and/or mercury vapor lamps with LED technology and high efficiency lamps;
b) Installation of a photovoltaic system with a power of 26.95 kWp to serve the school building and the municipal water purifier;
c) Installation of a charging station for electric vehicles at the service of citizens Installation of a thermal RES plant and an electric RES plant at the service of the sports field;

d) Securing and energy efficiency of the building envelope of the building used as municipal headquarters, with simultaneous installation of a photovoltaic system of 19.80 kWp on the roof.

An intervention of extraordinary maintenance on the municipal building located in via Roma is in progress. This intervention includes the installation of a photovoltaic system with a total power of 19,80 kWp and an expected annual production of 24'300 kWh/year. The system will consist of 72 modules of 275 Wp, divided into 4 strings of 18 modules each, and a 20 kW inverter.

The installed system will allow an overall energy saving of 4.54 TOE/year, as follows indicated in the table below:

Comparison of global consumption in Mirabello Sannitico municipality pre and post installation of PV system in municipal building

GLOBAL CONSUMPTION POST INTERVENTION		
	PRE	POST
	TEP	TEP
THERMAL ENERGY	23,40	23,40
ELECTRICITY	25,30	20,76
FUELS	4,10	4,10
	52,80	48,25

Comparison of CO2 emissions before and after PV system installation Mirabello Sannitico

GLOBAL POST INTERVENTION MISSIONS		
	PRE	**POST**
	tCO2	**tCO2**
Thermal energy	**62,47**	**62,47**
Electricity	**38,07**	**31,23**
Fuels	**10,25**	**10,25**
	52,80	**103,95**

7.7.2. Implementation of a pilot action on the school building "G. Nebbia"

As a result of the energy balance described in this plan, a considerable incidence of the thermal consumption related to the Guido Nebbia school building compared to total consumption.

Comparison of thermal energy consumption school building VS other buildings

For this reason, in view of the cost/benefit ratio and the idea of making public buildings more and more efficient with targeted interventions, the primary action to be taken as a "pilot" for the interventions described in paragraph 7.2. is the replacement of the generation system of the above school.
The intervention will be calibrated on a precise census of the emission system, which will allow to evaluate the current thermal load installed in the building and define precisely the most suitable characteristics of the new generation system.
More specifically, it is expected the replacement of the current generator with boilers wall-hung condensing boilers installed in cascade, which will allow significant advantages from the energy point of view:

1. The power can be modulated on larger intervals, maintaining efficiencies decidedly high and consistently reducing the losses related to intermittent operation on-off of the current generation system;
2. The installed power can be increased in successive phases until the maximum is reached according to the needs of the moment, excluding the generator not interested without compromising the functioning of the plant;
3. The space occupied will be less and the ease of maintenance will increase considerably.

In addition to the two boilers, both for the production of domestic hot water, and for the contribution of thermal energy, it is assumed the installation of an inertial storage within which the water will be preheated thanks to the support of solar thermal RES to be installed on the roof of the building subject to intervention.
To implement the thermo-hygrometric welfare and increase the energy performance of the building, on all radiators surveyed is expected to install dynamic thermostatic valves, capable of being managed via a wireless system.
All components of the new air conditioning system must be able to be managed remotely through a digital panel capable of allowing the programming of various All the components of the new air conditioning system must, however, be able to be managed remotely through a digital panel capable of allowing the programming of the various operating options, as well as the temperature and relative humidity control of a specific thermal zone.

The installed power can be increased in successive phases until the maximum is reached according to the needs of the moment, excluding the generator not interested without compromising the functioning of the plant;
The space occupied will be less and the ease of maintenance will increase considerably.
This panel should be interfaced with a computer or an APP system from a cell phone or tablet, so as to better manage the air conditioning. in order to better manage the indoor air conditioning on the basis of functional parameters, environmental and economic most appropriate economic parameters. The remote panel and the system manager board will in fact be able to acquire the data related to the external temperature, thanks to the special probe included in the system kit, and the internal temperature of the structure, as well as environmental parameters.
Finally, in order to follow up on the lines of action identified in this plan, the installation of electricity and thermal energy meters required by the building will make it possible to analyze the trend of energy vectors, optimizing their consumption.

Summarizing, the pilot action includes the following interventions on the school building Guido Nebbia:
1. REPLACEMENT OF THE GENERATION PLANT
2. INSTALLATION OF SOLAR THERMAL FER
3. INSTALLATION OF INTELLIGENT THERMOSTATIC VALVES WITH REMOTE CONTROL
4. INSTALLATION OF ENERGY METERS
5. PROGRAMMING OF SMART SYSTEM OF VISUALIZATION AND REMOTE CONTROL OF ENERGY AND THERMO-HYGROMETRIC ENERGY AND THERMO-HYGROMETRIC PARAMETERS INSIDE THE STRUCTURE.

The realization of the interventions described above may be carried out in subsequent steps, in accordance with the economic resources available to the municipal administration

8. Local Actions in Tirana (AL)

8.1 Analysis of relevant laws and regulations in Albania starting from the engagement taken with the signature of the Covenant of Mayors. Describe the EU, National and local framework

8.1.1 National Level[29]

The Renewable Energy Law (No 124/2016) in Albania has set out the legal framework to facilitate the wider use and deployment of renewables within the country's energy system, thereby striving to achieve national targets for the share of renewables. The purpose of this law is to draft national rules and policies for the promotion, promotion and improvement of efficient use of energy, with the aim of saving energy and increasing the security of supply, as well as the removal of barriers in the energy market; setting national energy efficiency targets; increasing the competitiveness of operators. This has seen the deployment of various renewable energy projects, increased investments and the setting up of various enterprises offering related services. In the immediate term, the development of renewable energy targets beyond 2020 is needed. Plans are already underway to develop the NECP, in which such targets will be defined up to 2030. Apart from target-setting, existing support mechanisms for renewable energy deployment are to be further strengthened, approval processes need to be streamlined, and a dedicated renewable energy agency

[29] Source: https://www.energycharter.org/fileadmin/DocumentsMedia/IDEER/IDEER-MontenegroEN_2018.pdf

should be established. Furthermore, legislative and regulatory frameworks must be reliable, transparent and credible, with changes announced in a timely manner for future projects, no unannounced changes for future projects and no retroactive changes.
Fiscal incentives – such as tax breaks, FiTs and premiums – comprise one of the main supporting mechanisms for attracting renewable energy investments. Although Albania has made progressive efforts in establishing various support incentives for the greater uptake of renewables. Namely, although import duties are waived for renewable energy equipment, VAT could be reduced to incentivise deployment. ALL 50 million (USD 487 000) and for project capacities above 500 kW (Deloitte, 2018). However, in the domestic sale of equipment, especially for systems below 500 kW, which are mainly used for residential and institutional power production and for all other renewable energy technologies, a full 20% VAT is applied. In reducing overall project costs for renewable energy investors, and indirectly the costs of electricity production and incentivised tariffs, a VAT reduction could be applied on all machinery and equipment related to all renewable energy technologies, including measurement equipment for assessing renewable energy potentials such as wind masts.
Some 10-12% of electricity consumers are bypassed from the renewable energy obligation, as they receive their electricity through bilateral contracts with the transmission system operator.

8.1.2 Upon the sensitivity of the question and aiming to be part of European integration processes, Albania has issued the Law No 116/2018 For the Energy Performance of Buildings

This law aims to create the legal framework for improving the energy performance of buildings, taking into account the local and climatic conditions of the country, the comfort conditions of interior of buildings as well as cost effective. The purpose of this law is to define:

a) the general framework for the National Methodology for Calculating the performance of integrated energy of buildings and building units.
b) minimum requirements for energy performance of new buildings and units of new buildings.
c) minimum requirements for energy performance of existing buildings, units and elements of existing buildings that will undergo a major renovation.
d) minimum requirements for energy performance of technical systems of buildings, whenever that they are installed, replaced, or reconstructed in existing buildings.
e) national plans to increase the number of buildings consuming almost zero energy.
f) requirements for energy certification of buildings and units of buildings.
g) requests for regular verification of the technical systems of the building, preparation of reports verification or taking alternative measures.
h) requirements for the establishment of an independent control system for performance certificates of energy of buildings, building units and for reports of technical systems verifications.

This Law will be the Guiding Law of the newly Created Agency of Energy Efficiency (Dec 2021) which will also prepare the Managers and Auditors of Energy Efficiency for buildings.
The Energy Efficiency Agency (AEE) is a public, budgetary legal entity, under the responsibility of the Ministry of Infrastructure and Energy.
AEE is responsible for improving and promoting energy efficiency throughout the energy cycle, in all sectors and economic zones of the country, enabling consumers to reduce their energy supply costs and reduce the negative impact on environmental pollution and climate change.
To achieve this, the AEE undertakes a series of activities, such as the preparation of secondary legislation and its implementation, setting minimum requirements for the energy performance in buildings, professional training on energy efficiency, issuing certificates to energy auditors and energy managers, concluding voluntary agreements, etc.
Another key responsibility is the preparation of the National Energy Efficiency Action Plan and the monitoring of its implementation step by step, aiming at achieving the set objectives and promoting the relevant Energy Efficiency measures for all public and private sectors (sector of buildings, industry,

transport, and agriculture). In its day-to-day operations, the Agency works closely with other public institutions to support citizens and businesses to invest in technology and efficient solutions, promoting various incentives, information sharing and best practices

8.1.3 Local Level

The City of Tirana signed the SEAP with Covenant of Mayors in 2013. Sustainable Energy Action Plan (SEAP) is the main document, which on the basis of collected data on the current situation, identifies and provides precise and clear guidelines for the implementation of projects and measures of energy efficiency and use of renewable sources of energy at the city level, which result in the reduction of CO2 emissions by more than 20 % by the year 2020.

By signing the Covenant, the Mayors commit to the development of the Sustainable Energy Action Plan, which must be submitted to the European Commission within the period of one year.

The key goals of the development and implementation of the Action Plan were:

- Reduction of the CO2 emissions in the sectors of building, transport and public lighting through the implementation of energy efficiency measures, through the use of renewable sources of energy, management of consumption, education, etc;
- Maximal contribution to the security and diversity of city's power supply;
- Reduction of consumption of energy in the building, transport and public lighting sectors; Increase of the share of power obtained from renewable sources;
- Enabling the transformation of urban areas into ecologically sustainable areas.

The Action Plan focuses on the long-term transformations of power systems within cities, and provides measurable goals for reduction of energy consumption and accompanying emissions of CO2.

The obligations from the Action Plan were applicable to the entire city area, including public and private sectors. The Plan defined the measures and activities in the building, transport and public lighting sectors, excluding the sector of industry. The Action Plan in all its segments should have been in line with the institutional and legal frameworks at the EU, national and local levels, and cover the period up to 2020.

There is no data so far if the objectives set up by SEAP has been fulfilled yet, but the city of Tirana is working on the direction of energy efficiency of buildings as part of the National Action Plan as well as upon the Tirana Green City Action Plan issued on 2018.

One of the objectives of the Action Plan namely Sustainability Energy 5 (SE5) is the "Implementation of legislation for enabling building energy efficiency measures" Under this Objective the MoT is to be engaged with the Ministry of Energy and Industry to assist in implementing national level policy measures on energy efficiency actions in buildings, including:

- Adoption of the calculation methodology for energy performance of buildings prepared at national level under REEP Plus.
- Adoption of minimum energy efficiency standards for new buildings and for major renovation of existing buildings prepared at national level under REEP Plus.
- Insertion of obligation to comply with energy efficiency standards (such as use of LEDs for common parts lighting; recourse to thermo-insulation and other energy efficiency solutions, use of a minimum share of renewable sources for power supply and heating and cooling in buildings, etc.) in project designs of new buildings or major renovations as a condition for issuance of construction permits, including recourse to a fixed minimum rate of renewable sources.
- Request of issuance of an Energy Certificate proving compliance of the building with proposed energy efficiency features proposed at national level, at the end of the construction phase as a condition for issuance of the use permit.

Also, as a policy measure in relation to Energy Efficiency in the Green City Action plan are stressed the mechanisms to incentivize investment in energy efficient technologies

The implementation of energy efficiency streetlamps falls under the scope of Law 124/2015 on energy efficiency. Municipal applications for LED lighting include traffic lights and signals, streetlights, public/municipal buildings (e.g. hospitals and schools), 24-hour emergency lighting, shopping malls and offices, parking lots and underground parking, exteriors and employee access ways, etc.
The best lighting technologies, such as long-lasting light-emitting diodes (LEDs), are already available. Municipality of Tirana should replace high-pressure sodium bulbs with LEDs to reduce both consumption and operation/maintenance costs. Brighter LED light also increases visibility in adverse conditions.

A key element in the implementation of this measure is to identify relevant sources of funding, e.g. by setting up mechanisms to incentivise private partners to invest in energy efficient technologies in the public sector. The Municipality should also consider the possibility to make recourse to the Energy Efficiency Fund – which is aimed at providing grants and loans or financial guarantees for the implementation of energy efficiency projects in Albania.

It is crucial to ensure effective implementation of provisions on ESCOs under the Law on Energy Efficiency and the possibility for the Municipality to make recourse to Energy Performance Contracts (or "EPCs"). Issuance of secondary legislation removing all obstacles, if any, to the functioning of ESCOs and EPCs is very important.

Training of Municipal staff on the elaboration of proposals for the request of funding to national and international institutions, and on the drafting and negotiating of Energy Performance Contracts and on the functioning of ESCOs is recommended.

Also, in the GCAP, the Municipality of Tirana emphasizes the engagement with the National Government on the following policy measures in order to support our long-term green city vision:

- Effective implementation of the EV (Electric vehicles) charging infrastructure measure should be by the improvement of the legal framework on air quality at national level.
- Implementation of the recently adopted National Action Plan for Energy Efficiency. The progress towards the implementation of the national plan will be reported every 3 years by reporting also the current measures and instruments as well as the proposed measures.
- It is further recommended that all energy performance requirements, when set up at national level, are inserted in the Territorial planning instruments and Construction Code of Albania and become directly applicable for all.
- Pursuant to the relevant legislation implementing EU acquis, the adoption of secondary legislation and other implementing tools is still needed, for the Government to be able to comply with all obligations, including: the inventory of building stock in Albania, the adoption of a calculation methodology for each typology of building; the setting up of minimum energy performance requirements for all categories of buildings in relation to new constructions and major renovations.
- Following adoption of the Law No. 7/2017 on the Promotion of the Use of Energy from Renewable Sources, development of regulation and policy to support the development of grid-scale renewable energy (solar and wind). If provided at national level, the Municipality of Tirana could promote development of solar and wind farms in rural areas of Tirana.

8.2 A short context analyses regarding of Buildings present on the territory, Climatic zone, and average annual temperature. Annual expenditure incurred by the Municipal administration; Consumption attributable to public buildings

The Republic of Albania is a coastal country in South East Europe, bordering Montenegro and Kosovo* to the north, North Macedonia to the east, Greece to the south, and the Adriatic and Ionian Seas to the west. Its capital, Tirana, is the largest city and the political and economic centre of the country. The second largest city is the port city of Durrës.
The country is predominantly mountainous, with the more densely populated lowland coastal region spanning the western part of the country. Albania's climate is typically Mediterranean with warm, dry summers and mild, wet winters. Average rainfall varies seasonally and across the country with about 95% of the annual precipitation occurring in the winter season, predominantly in the North Albanian Alps, while the southwestern part of the country commonly experiences droughts in the summer (Encyclopedia Britannica, 2020). According to a World Bank study, Albania is one of South East Europe's most vulnerable countries to climate change. Changing weather patterns have already resulted in increased temperatures, decreased precipitation and more frequent extreme events such as floods and droughts (World Bank, 2013).

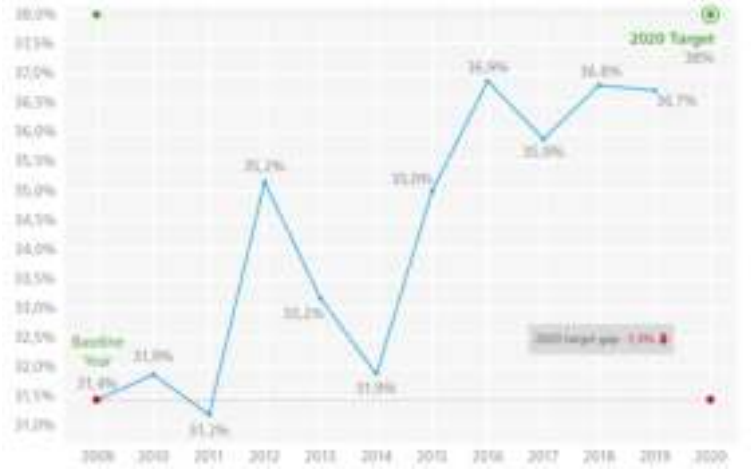
Albania has a population of approximately 2.9 million (INSTAT, 2019a). Tirana's population of around 896 000 has doubled in the past three decades and amounts to almost a third of the country's population. Durrës accommodates about 10% of the population (INSTAT, 2019b). More than 98% of the population aged 15 years and older is literate (UNESCO, 2018). In 2018, unemployment rates stood at just over 12% and were highest among young people (15-29 years; 23%) (INSTAT, 2019c).
Albania has made significant economic progress during the past three decades, moving from a low-income economy to a middle-income country in Europe, with gross domestic product (GDP) per capita increasing from its lowest point of USD 200 (US dollars) in 1991 to USD 5 268 in 2018 (World Bank and OECD, 2018a). The real annual GDP growth rate in 2018 was 4.15%, one of the highest in the Southeast European region (INSTAT, 2019d).
The structure of the Albanian economy has remained relatively unchanged over the past decade, with the services sector dominating, contributing to over half (54.1%) of the country's gross value added in 2019.

8.2.1 Renewable energy – Albania

In advancing the development of the sector, the renewable energy obligation would have to be embedded into electricity pricing for non-tariff consumers connected to the transmission system.
Additionally, there is a need for various permitting and approval processes for the generation of renewable power to be streamlined to shorten development timeframes, provide clarity and further incentivise investments. The private sector entities installing distributed renewable power systems in Albania often report that improvements should be made in the standardisation of application forms for grid connection approval, and that the duration for such approvals should be considerably shortened. Given that the private sector bears the risk of connection approval, prolonged duration times for approval affect the operations and finances of enterprises. Therefore, standardising approval processes for interconnection is particularly important for distributed generation, as this ensures that all systems that meet certain technical and safety requirements can connect to the distribution grid without unnecessary delay. In February 2021, Albania adopted a decision to prolong the revised National Renewable Energy Action Plan (NREAP) and to extend the 2020 renewable target until the end of 2021, with the aim to bridge the gap until targets for 2030 are adopted. Albania's legislation enables a net-metering scheme for consumers with installed capacity up to 500 kW. Surplus electricity can be sold to the universal service supplier. However, it is not yet implemented

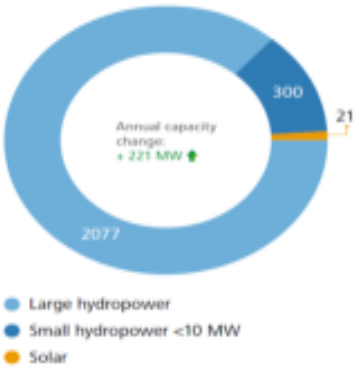
and the methodology that should define the price at which the surplus is to be redeemed is yet to be adopted.

Shares of energy from renewable sources[30]



Albania's high dependence on hydropower means hydrology has a significant impact on the achievement of the 2020 target. According to the amendments to the NREAP, additional efforts are envisaged for the diversification of the electricity sector by adding 490 MW of solar PV, 150 MW of wind and 57 MW of hydropower energy by the end of 2021. In March 2021, the Albanian Ministry of Infrastructure and Energy announced the winner of the auction for the solar power plant Spitalle with a bid of 29,89 EUR/MWh. 70 MW are envisaged to be supported via an offtake agreement for 15 years, while an additional 30 MW will be sold on the market. A power purchase agreement (PPA) is signed and being implemented. In June 2021, Albania announced a 100 MW wind auction. Bidders can compete with projects between 10 MW and 75 MW and the winners will be awarded a 15-year power purchase agreement. Developers are invited to submit their qualifications by June 2022. This will be followed by a request for proposals from applicants successful in the first phase.

Figure: Total Capacities of Renewable Energy 2020 (MW)[31]



Sustainable energy supply and consumption in Tirana may generate economic and environmental benefits.

[30] Source: EUROSTAT

[31] Source: MIE

8.2.2 SEAP Tirana

In the SEAR of Tirana is mentioned that the subsector of buildings owned by the City of Tirana is divided into the following categories: 1. Educational institutions; 2. Cultural institutions; 3. City administration buildings and business facilities; 4. Other public buildings. Division into the mentioned categories was done in order to get the best and the most precise insight into the actual thermal (heating and cooling) and electrical energy consumption in the subsector buildings owned by the City of Tirana. Due to the year of SEAP signature the data may be obsolete but still they may represent a roughly picture of energy consumption in public buildings owned by the MoT.

8.3 Educational Buildings

According to General directorate Nr.3 of city workers, educational buildings in the City of Tirana are divided into three categories: 1 - Primary schools – 57 objects, total area 155 676 m2; 2 - Kindergartens – 75 objects, total area 36 478 m2; 3 Secondary schools and dormitories – 20 objects, total area 240 961 m2. Total number of educational buildings is 152 with total area of 240 961 m2. The total electricity consumption in educational buildings in 2011 was 5 058 295 kWh, which gives the specific consumption of 20,99 kWh/m2.

Table : Parameters for thermal energy consumption in Educational Institutions

Energy Source	Total heated floor area (m2)	Thermal Energy Consumption (kwH)	Specific Consumption (kwh/m2)
Diesel	76 582	4 674 216	61,04
Electricity	164 379	7 627 224	46,40
Total	240 961	12 301 440	51,05

From the conducted energy analysis of the educational buildings, it can be concluded that the heat consumption is expected and typical for educational facilities in Albania. The reason for this lies in the fact that all educational buildings owned by the City are heated not more than 4 hours a day. By comparing the average specific heat consumption, it was observed that kindergartens have greater consumption, so the recommendation is to conduct detailed energy audits to detect and successfully remove the causes of high consumption.

The average specific electricity consumption of this building category is expected for objects of related purposes in Albania. Nevertheless, there is potential for electricity savings in this category that cannot be ignored.

8.3.1 Cultural institutions

The following buildings belong to category of cultural institutions, total area of 710 m2: Zyra e Turizmit, total area 70 m²; 1 Teatri i Metropolit, total area 190 m2; 2 Cirku i Tiranes, total area 110 m²; 3 Tirana Sport Club, total area 340 m2.
The total of 30 987 kWh of electricity was spent in the category of cultural institutions in 2011, which gives a specific electricity consumption of 43,64 kWh/m2.
All buildings for cultural purposes used electricity as heating source. Table 3.2 shows parameters for thermal energy consumption in the category of cultural institutions.

Table shows parameters for thermal energy consumption per energy type in the category of educational buildings.

Table: Parameters for thermal energy consumption in Cultural Institutions

Energy Source	Total heated floor area (m2)	Thermal Energy Consumption (kwH)	Specific Consumption (kwh/m2)
Electrical Energy	710	72 303	101,84
Total	710	72 303	101,84

Based on conducted energy analysis of the cultural buildings, it can be concluded that the heat consumption is expected and typical for cultural facilities in Albania.

Specific thermal consumption of Teatri i Metropolit (134,18 kWh/m2) and Tourism Office (126,40 kWh/m2) are high, and it is necessary to determine the causes of increased energy consumption. For this reason, it is recommended to conduct a detailed energy audit of the building to detect appropriate measures to increase energy efficiency.

8.3.2 City administration buildings and business facilities

Data on energy consumption of City administration buildings and business facilities include 12 administration buildings with a total area of 8 640 m2 and 9 objects of business facilities total area of 5 650 m2. It should be noted that all buildings use electricity as heating source.

This category spent a total of 827 934 kWh of electricity in 2011 which gives the specific consumption of 57,94 kWh/m2.

Table below shows the parameters of thermal energy consumption by fuel in the category of administrative building and business facilities.

Table: Parameters for thermal energy consumption

Energy Source	Total heated floor area (m2)	Thermal Energy Consumption (kwH)	Specific Consumption (kwh/m2)
Electrical Energy	14 290	1 931 846	135,19
Total	14 290	1 931 846	135,19

Based on conducted energy analysis of this building category, it can be concluded that the electricity as well as heat consumption are expected and typical for this kind of buildings in Albania. By comparison of specific consumption of electrical and thermal energy, it is obvious that administrative institutions spend more energy, so it is important to detect the reasons for increased energy consumption.

8.3.3 Other public buildings

The following 4 community houses belong to this category of cultural institutions, with total area of 1 460 m2: 2 Të qëndrojme se bashku, total area 280 m2; 3 Qend.per moshen e trete, total area 410 m2 ; 4 Qend.Multifunksionale TEN, total area 380 m2 ; 5 Qend.sociale te Zeri Popullit, total area 390 m2.

The total of 8 244 kWh of electricity was spent in 2011 in this category, which gives a specific electricity consumption of 5,65 kWh/m2. Table 3.4 shows parameters for thermal energy consumption per energy type.

Table: Parameters for thermal energy consumption per energy type

Energy Source	Total heated floor area (m2)	Thermal Energy Consumption (kwH)	Specific Consumption (kwh/m2)
Diesel	1 218	97 440	80,01
Electrical Energy	242	19 234	79,44
Total	1 460	116 677	79,92

Consumptions of electrical and thermal energy of this building category are within the expected limits. Despite this, there is energy savings potential, especially for thermal energy which cannot be ignored.

The main building systems which consume energy are the air conditioning and heat pumps. These tend to be both old and inefficient. Electricity consumption in buildings is high and thus the main area for saving energy is to improve energy efficiency of buildings and infrastructure. Building standards are regulated and delivered at national level, with the city having little control beyond the consumption of the municipality's own building stock. However, the municipality owns relatively little building stock. The SEAP recorded 181 municipal buildings, 123 680 residential buildings and 23 143 commercial buildings in 2011.

8.4 Green City Action Plan of Tirana

In 2018 the Municipality of Tirana launched the Green City Action Plan.
The Green City Action Plan (GCAP) provides MoT vision and a concrete set of actions to address the pressing environmental challenges affecting Tirana over the coming years, and to secure investment in priority environmental infrastructure projects.
The GCAP is based on a robust evidence base collected over the past year on Tirana's environmental challenges and policies, supported by interviews and workshops with city stakeholders and technical experts, and consultations with the public. The GCAP supplements key city plans and strategies, including Tirana's General Local Plan, the Masterplan of Tirana, the Sustainable Energy Action Plan, the Vulnerability Assessment and Adaptation Plan for Tirana, and the Integrated Intersectoral Plan for Durana (Tirana – Durres) economic zone.
Tirana's baseline assessment led to several findings which were used to prioritise the main challenge areas for the city:

- **Transport.**
- **Green & Blue Infrastructure.**
- **Resource Management.**
- **Water.**
- **Energy**
- **Resilience.**

Leading from the prioritized challenges above, the strategic objectives to address those challenges are as follows:

1. Sustainable Mobility
2. Green Spaces & Biodiversity
3. Sustainable Energy
4. Resource Management
5. Climate Change Resilience & Adaptation

8.4.1 Sustainable Energy

Albania enjoys a significant hydroelectric energy resource, which currently provides reliable, affordable and low carbon energy for Tirana. The city has the ambition, however, to improve the secure supply of energy in the long-term and ensure that it can meet its energy needs reliably through renewable sources.
It is also important to improve energy efficiency of buildings and infrastructure as they contribute to CO2 emissions in the city and add to air pollution.

8.4.2 Strategic Objectives

SO. Secure and diverse energy supplies: Ensure that energy is available from a variety of sources to ensure security of supply in the long term.
SO. Higher energy efficiency of buildings and infrastructure: Ensure that buildings and infrastructure require less energy to build and operate and thus have minimal environmental impact.

8.5 Main Challenges in Tirana

8.5.1 Energy Security

Tirana has seen major improvements in reliability of electric power supply. There is still a high number of interruptions, for which further improvement of supply is ongoing. 100% of electricity supply is from renewable, hydropower plants. Most non-transport energy for the city comes from electricity. The completion of the Trans Adriatic Pipeline (TAP) will introduce the opportunity for natural gas, a fossil fuel, to become an additional source of energy for Tirana. The implications of this are as yet uncertain. Energy is a matter regulated and delivered at national level, with the city having little control over generation. Tirana currently lacks fiscal incentives for renewable energy facilities in residences and non-domestic buildings. It is considered an important issue to improve overall energy supply in the city, but beyond the direct control of the MoT.

8.5.2 Energy Theft

A concern for future investment and maintenance of the energy network is the extensive practice of energy theft and poor revenue collection rates from registered energy customers. Recognising the concern about energy theft, the National Government launched an anti-theft campaign to crack down on energy theft in 2014. These measures have meant that there has been a reduction in people not paying energy from 52% in 2013 to approximately 29.8% during the first six months of 2015 across Albania. This change has removed one of the major obstacles to introducing renewable energy systems and energy efficiency measures across the Albanian energy system. Now that the energy consumption is better regulated there is an incentive for increasing renewables and energy efficiency.
Energy consumption has significantly increased in Tirana in line with the country's population and economic growth. Albania adopted the National Action Plan on Energy Efficiency (2011-2018) and based on this, Tirana adopted the Sustainable Energy Action Plan (SEAP) (2013-2020). The SEAP indicates that in 2011 residential energy consumption accounted for 66% of total energy consumption, commercial and service buildings for 33%, and public buildings for 1%.

8.5.3 Energy Consumption in Transport

The transport sector is the highest oil consumer in Albania.
In Tirana, the transport sector fuel consumption is made up of 54% of gasoline, 45% of diesel and 1% of LPG. Passenger and commercial vehicles consume 88% of the total transport fuel consumed, public transportation consumes 11%, and the municipal fleet consumes only 1%.
The subsector of personal and commercial vehicles is the most important in terms of energy consumption and potential energy savings.

8.5.4 Energy Consumption in Public Lighting

The public lighting system in Tirana consists of various types of lighting fixtures. About 70% of the installed lighting fixtures are metal halide lamps. While the most part are of the new generation with less than 15 years of age, environmentally friendly lamps such as LED lights are rare at about 4% of the total number of public streetlights.

It is necessary to replace all lamps with the new generation of LEDs. Estimates from the SEAP indicate that this would enable electricity savings of up to 60%, better lighting effects, longer life of lamps and minimised maintenance costs.

8.6 Energy consumption savings

Municipal Building Retrofit, Residential buildings retrofit, and public lightning retrofit will generate electrical and thermal energy savings, the largest savings coming from the energy efficiency programme in residential buildings as indicated in the following table

Modeling of the carbon reduction potential of above-mentioned actions indicates that action against energy theft may provide the largest carbon savings as indicated in Table below.

The carbon saving potential from electrical energy savings is relatively lower than that from the reduction of diesel, LPG and fuel wood use for thermal or vehicle energy provision. This is due to the low carbon intensity factor of the Albanian electricity grid (0.009 kg CO2/ kWh), which is largely supplied by hydroelectric power. Hence the largest carbon saving potential would come from the conversion of fossil fuel-based heating to electricity.

Table : Energy Savings from Sustainable Energy Actions

Action	Electrical Energy Saving 2018-2022	Thermal energy saving (2018 – 2022)
SE2. Municipal building retrofit	280,000 kWh_e	86,000 kWh_{th}
SE3. Residential building retrofit	5,300,000 kWh_e	1,600,000 kWh_{th}
SE4. Public lighting retrofit	3,200,000 kWh_e	-

Table : Carbon Savings from Sustainable Energy Actions

Action	Carbon saving from electrical energy saving (2018 – 2022)	Carbon saving from thermal / vehicle energy saving (2018 – 2022)
SE1. EV charging infrastructure	-	10,000,000 kg CO_2
SE2. Municipal building retrofit	2,000 kg CO_2	21,000 kg CO_2
SE3. Residential building retrofit	47,000 kg CO_2	309,000 kg CO_2
SE4. Public lighting retrofit	29,000 kg CO_2	-

These energy savings will lead to economic benefits from lower energy costs. Additionally, these savings may lead to reduced fuel poverty in socially disadvantaged households.

8.7 Climate change mitigation

The electric vehicle charging infrastructure, if supported by appropriate financial measures to incentivize the uptake of electric cars, may lead to carbon savings from the reduction in diesel and petrol fuelled vehicles.

Current data shows that the electric car ownership in 2011 was equal to nil. Modelling of action SE1 (EV charging infrastructure), based on the assumption that a complete shift to electric cars will take place by 2050, indicates carbon savings of 10 million kg CO_2 from 2018 to 2022.

The electricity grid's low carbon intensity factor also means that there is a revenue potential for Albania to export its electricity to neighboring countries reliant on coal and gas-fired power plants.

8.8 The good practices realized

The Actual Energy Efficiency ongoing project in Tirana are

8.8.1 Clean Energy Road Project

The Energy Efficiency Agency and the Ministry of Infrastructure and Energy of Albania have presented a pilot project in Tirana, small solar and wind power devices that will be used to generate electricity to supply the energy for public lighting and for recharging electric vehicles.

The pilot project in the Albanian capital involves the installation of innovative renewable energy production systems and the modernization of public lighting along a two-kilometer section of street located parallel to the Lana River in central Tirana. As part of the project, 460 street lights will be replaced with LED technology, which will save 359 MWh of electricity per year, according to the Energy Efficiency Agency. In addition, the Agency has estimated that the entire project will save a total of 1,900 tons of CO2 per year.

The pilot will be the first self-sufficient road in the country. After Tirana, the Energy Efficiency Agency plans to expand the project to other cities in the country. Indeed, the Agency is currently drafting a feasibility study, as it believes that the Clean Energy Road project is preparing the ground for the establishment of a nation-wide network of electric car chargers that will contribute to the improvement of air quality and climate protection by using zero carbon energy sources.

8.8.2 Energy Efficient Street Lighting

The Sustainable Energy Action Plan included an action to upgrade street lighting in Tirana to improve efficiency and reduce energy theft via the street lighting power supplies.

The program to update street lighting is currently on hold by the Directorate of Energy pending completion of a detailed lighting design and analysis prior to replacement of energy sources. According to the National Energy Directorate, unregistered electric energy consumption is approximately 50% of total consumption. A new network must be built to ensure illegal connections are controlled.

Description: Deployment of electric vehicle charging points across Tirana, extending into peri-urban areas. The plan will contribute towards a coordinated parking strategy with EV charging infrastructure roll-out.

Current context:

- There are currently 3-4 charging points across the city in underground parking, at the start of the boulevard, and next to the police station.
- The city currently lacks a coordinated charging infrastructure strategy.
- Electric buses are currently being tested.

MoT is prioritising electric taxi licensing. One company is operating electric taxis since 2017.

Scale of project:

Establishing at least one EV charging infrastructure supplier for the city, with 500 charging points installed by 2023

8.8.3 Municipal building energy efficiency programme

Description: Elaboration of a refurbishment plan of buildings owned or occupied by the Municipality in line with the Energy Efficiency Law, with a rate of 3% of renewal of the total occupied area per year. For the funding of this plan, MoT could make recourse to the Energy Efficiency Fund, which is aimed at improving

energy performance of buildings and whose eligible measures include “energy efficient renovation of buildings, including space heating, hot water, cooling and ventilation, measures for building envelope and heating installation and digital solutions aimed at improving the energy management of public buildings”.
The Municipality will:

- Appoint an energy manager responsible for the management of energy performance of its buildings
- Adopt a 5 years’ refurbishment plan of its building stock to improve energy performance (3% of
- Municipal owned/occupied buildings per year)
- Adopt energy saving approaches in its daily operations: i.e. obligation to purchase energy efficient buildings, products and services.

Current context:

- A total of 181 municipal buildings were identified in Tirana’s Sustainable Energy Action Plan comprising a total of 260,000m2.
- Energy consumption from these buildings is around 23kWh/m2 for electric power and 56kWh/m2 for heating, which compares favourably with residential building energy consumption.
- Measures identified in the SEAP included a target to provide insulation and high efficiency windows to 100 public buildings by 2020. The MoT is part way to meeting that goal.
- The programme should continue as part of the GCAP.

Scale of project:

- Install energy efficiency measures in a further 15% of the municipal building stock over the next five years (around 30 buildings).
- The project would follow best practice delivery principles, including a “data first” approach to ensure investment is directed where it can have the most impact, and actual “before and after” performance can be tracked to improve future investments and measures.
- The MoT would work with national and international organisations to identify a package of funding and technical assistance to support municipal buildings retrofit programme, including the Energy Efficiency Fund. A private finance solution through energy performance contracting will also be considered as part of a scoping and feasibility assessment.
- MoT will promote awareness and education on sustainable energy through displays in public buildings, information campaigns and educational initiatives in schools.

8.8.4 Residential building energy efficiency programme

Description: Implementation of energy efficiency retrofit measures in residential buildings. Specific goals to include

- Energy efficiency measures of the existing building stock such as space heating, hot water, cooling, ventilation, thermal insulation, lighting.
- A new energy code of construction for new buildings, to include central heating.
- Introduction of energy performance certification and energy audits.
- The plan will contribute towards a strategy for the Building Energy Efficiency policy and the City’s transition to LED lights and will outline the details of building energy efficiency ‘good performance’.

Current context:

There are around 40,000 existing residential buildings in Tirana. Many of these are 20th century condominium structures with poor thermal performance for both cooling and heating mode conditions.
MoT plans to introduce energy efficiency standards for new buildings and insulation measures for buildings older than 20 years.
Building energy certificates are to be developed in the EU approximation process through support from the Regional Energy Efficiency Programme (REEP Plus) of the EBRD.
Currently MoT gives 50% grant funding to owners for building efficiency improvements.

The General Local Plan provides a bonus if new constructions have a good performance in Building Energy Efficiency. The policy is in place but MoT needs to create a document setting out the details.

Scale of project:

The scale of the project will depend on available funding to support retrofit measures. A target to support energy efficiency measures in the worst performing third of Tirana's residential buildings by 2035 would indicate a scale of around 1000 retrofits per year. With additional funding these retrofits could extend to include installation of solar collectors.

- MoT secures funding source and deploys grants and low interest loans to building owners to invest in energy efficiency programmes. A programme which supported private financing through energy performance contracts could offer an alternative mechanism to stimulate private action on energy efficiency.
- MoT will promote awareness and education on sustainable energy through displays in retrofitted buildings, information campaigns and educational initiatives in schools.

8.8.5 Replacement of street lamps with smart and energy efficient lamps

Description: Replacement of street lamps with multi-function low energy LED street lamps, reducing GHG emissions and providing: highly controllable LED lamps, environmental monitoring equipment, and advertisements and messages through fixed or variable message banners.

Current context:

A previous SEAP action was to replace lamps with low energy luminaires. A higher value approach would be to incorporate smart features for data collection and active control as part of the renewal programme. MoT plans to introduce this measure through a private sector service contract. The contractor would receive payments based on the energy and operational savings from investing in new lamps and luminaires.

Scale of project: 50% of City's street lamps replaced by 2023

8.8.6 New programmes on Energy Efficiency:

- A grid-connected rooftop solar PV programme could be undertaken by PV developers/aggregators and end users for installation of rooftop solar systems on the rooftops of commercial, institutional and industrial buildings. This will make up a decentralized generation system with the ability to strengthen the grid.

- To promote recourse to renewable sources, also in relation to the refurbishment of existing buildings, the Ministry of Energy could set a regulated tariff for solar PV projects with a capacity of up to 50kW.

- We will promote awareness and education on sustainable energy through displays in buildings, information campaigns and educational initiatives in schools.

The following actions are proposed to support the implementation of the policy measures with regards to Energy Efficient Street lighting:

- We will consider the possibility to make recourse to the Energy Efficiency Fund, which is aimed at providing grants and loans or financial guarantees for the implementation of energy efficiency projects in Albania. Eligible energy efficiency measures and technologies to be funded through the Energy Efficiency Fund may be aimed at improving living comfort level and quality of public services and may include energy efficient lighting and appliances.

8.9 Municipality of Tirana Pilot project in the framework of LEC project

The Project that will be implemented under the LEC project is: ***ENERGY SAVING INTERVENTION AND RECOSTRUCTION OF KOPSHTIT NR.27 building.*** This is a Kinder Garden school located in Tirana that is a 2-storey building, where the ground floor has a basement. of 331.6m2, while the first floor with 391.9m2.
The maximum height of the existing building reaches 6.96 m.
Access to the property is reached from the main road on the north side from via "HAKI STERMILLI"

The building is equipped with:

- n. 13 spaces designed for 80 children and the following functions will be carried out:
- Playgrounds, libraries, kitchens, sleeping areas, etc.
- n. 1 room for celebratory gatherings, etc.

The building was built from the beginning as an educational institution serving the children of the area. There are no structural problems, but there is a lot of humidity, windows that have deteriorated over the years, as well as plasters that fall due to poor insulation
Our goal is to contribute to the improvement of quality and design with particular attention to the construction of a building with the necessary technical parameters
Tirana Municiplaity will execute the works, putting attention to the components relating to Energy Efficiency in a sustainable and ethical way.
The main objectives of the intervention will be directed towards a better energy efficiency of the building, the planned interventions will focus on the following activities:
1. Thermal insulation of the building
2. Double glazed windows
3. Installation of solar panels

Our goal is to contribute to the improvement of quality and design with particular attention to the construction of a building with the necessary technical parameters.

9. Recommendations and Conclusions

This “Draft of common LEC action plan elaborated”, will be tested and adopted by the project’s partners thanks to the implementation of 4 coordinate pilot projects and the active involvement of 4 local communities, in order to promote investments in the sector of renewable sources, energy efficiency of public buildings and to encourage the right citizens’ behaviours in the energy field.

Despite differences in the implementation of each pilot action, depending on different needs and strategies, up to each partner to be decided at local level, and considering the diversity of the already implemented activities in each Municipality and territory, as described in the local sections, the common section put in evidence some important points that all the 4 created LEC should be committed to achieve common goals. Indeed, after the inputs coming from the local stakeholders participating in the meetings organized for discussing the document, each LEC partner agreed about the contents of this common document.

The next step will be the formal adoption of this “Common Action Plan” through the signing of a cross border Agreement on “Sustainability of the Municipalities” of the 4 target areas. The agreement will be signed by the LEC, the Mayors and the industrial organizations involved in each area and will draw

inspiration from the "Covenant of Mayors" to which the municipalities involved in the project will be invited to join, but it will include also the commitment to carry on with the implementation of the created LECs and the realized pilot actions as well as the actions reported in the sections dedicated to the local activities. In order to ensure their own involvement of within the wider European energy policy and to help themselves to realize their ambitions related to the mitigation and adaptation, the signatories will be committed to implement the following action plan:

ACTION	TIMEFRAME	DATA TO BE REPORTED
Creation of the LEC	By 31.12.2022	Stakeholders involved, outputs realized and implemented activities.
Realization of the LEC Pilot Action	By 31.12.2022	Implemented action.
Progress Report on the LEC	By 31.12.2024	Information about the implemented activities, the financial investments and savings and the CO2 reduction.
Progress Report on the LEC Pilot Action	By 31.12.2024	Information about the the CO2 reduction and financial savings.
Progress Report on the Local Actions planned in the "Common Action Plan"	By 31.12.2024	Information about the implemented activities, the financial investments and savings and the CO2 reduction.

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