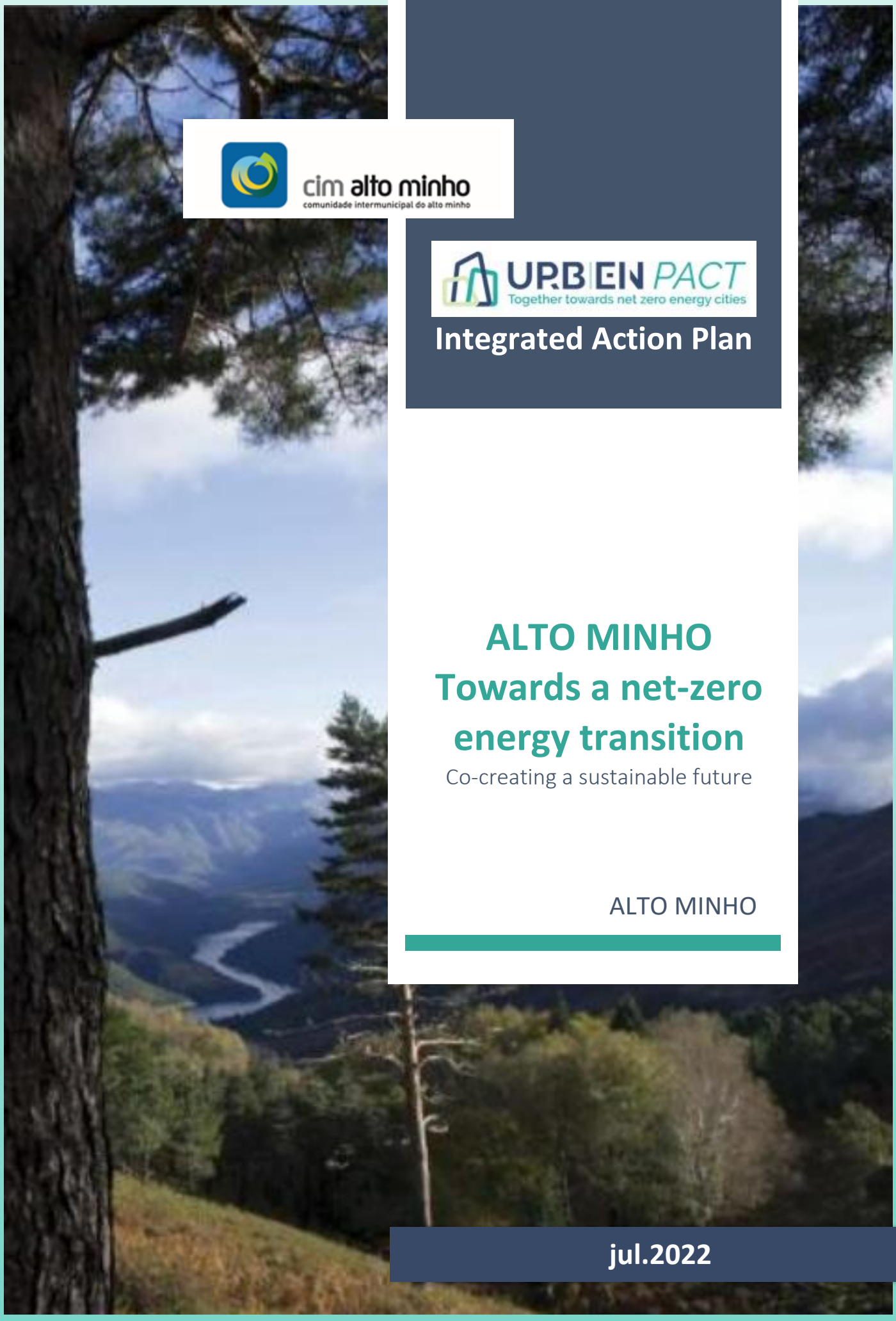

cim alto minho
comunidade intermunicipal do alto minho

URBIEN PACT
Together towards net zero energy cities

Integrated Action Plan

ALTO MINHO
Towards a net-zero energy transition

Co-creating a sustainable future

ALTO MINHO

jul.2022

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1. FEW WORDS FROM OUR POLITICAL LEADERSHIP…

According to estimates, globally, over half of greenhouse gas emissions (GHG) are created in and by cities and towns; 80% of the population lives and works in these urban areas, where up to 80% of energy is consumed; and about 78% of GHG emissions from human activity result from the production and consumption of energy.

Local authorities, being the closest administration to the citizens are ideally positioned to understand the local context, but also and foremost, "their" citizens' habits, priorities, concerns, and needs… hence, they play a crucial role in tackling climate change, whether it being through mitigation or adaptation actions - currently, subnational governments deliver 70 % of climate mitigation measures and 90 % of climate adaptation policies [1].

Local authorities can address the existing challenges in a comprehensive way, facilitating the conciliation between the public and private interests and the integration of sustainable energy into overall local development goals (amongst which the sustainable development goals set up in 2015 by the United Nations General Assembly), be it the development of alternative energy, more efficient energy use or changes in behaviour.

Local authorities must, therefore, be seen and recognized as leading actors in the implementation of sustainable energy policies, and must be endorsed, and supported in their effort. Their contribution must also be duly recognised to effectively avert the climate emergency.

Reiterating the words of the ICLEI – Local Governments for Sustainability Vice President and Mayor of Turku Minna Arve:"*Cities and their leaders need to become true partners in a multi-level governance system. They must be enabled to contribute to the shaping of the legal, fiscal and financial frameworks that rule the implementation of their ambitious local strategies. Only on this path, we will be able to move fast from plans and strategies to real action.*"

Aware of the role they play the municipalities of: Arcos de Valdevez, Caminha, Melgaço, Monção, Paredes de Coura, Ponte da Barca, Ponte de Lima, Valença, Viana do Castelo and Vila Nova de Cerveira - with full support and encouragement from the Alto Minho's Intermunicipal Community (CIM Alto Minho) - jointly decided to become signatories of the Covenant of Mayors [2] initiative. All, benefiting from the inputs from local/regional stakeholders, carried out a baseline emission inventory and defined a sustainable energy action plan, translated into concrete measures and projects. Furthermore, all committed to allocating sufficient human and financial resources to the tasks; to mobilising society in their geographical areas to take part in the implementation of their action plan, including organisation of local energy days, and networking with other cities…. The target year was, then, the year 2020.

Several actions were undertaken, several more need undertaking, if we are to meet the goals of the Paris Agreement and reach climate neutrality.

Participating in the URB EN PACT – together towards net-zero energy cities project allowed us mayors, jointly with local stakeholders and through a participative approach, to plan action beyond 2020, as far as energy transition and carbon/climate neutrality are concerned, aspiring Alto Minho to become a net-zero energy territory before 2050.

On behalf of ALTO MINHO's mayors, ALTO Minho is committed to doing its part…

Manoel Batista Calçada Pombal
President of CIM Alto Minho's Intermunicipal Council

[1] https://cor.europa.eu/en/news/Pages/cop26-local-leaders-call-eus-vice-president-timmermans-include-reg-local-dimension.aspx
[2] An ambitious initiative of the European Commission that gives the lead to Europe's pioneering cities to mitigate climate change through the implementation of intelligent local sustainable energy policies that create stable local jobs and increase citizens' quality of life and address crucial social issues.

2. INTRODUCTION: ALTO MINHO AND URB-EN PACT

The Emissions Gap Report 2021[3] shows that new national climate pledges combined with other mitigation measures put the world on track for a global temperature rise of 2.7°C by the end of the century. That is well above the goals of the Paris Climate Agreement and would lead to catastrophic changes in the Earth's climate. To keep global warming below 1.5°C this century, the aspirational goal of the Paris Agreement, the world needs to halve annual greenhouse gas (GHG) emissions in the next eight years.

Globally, about 78% of GHG emissions from human activity result from the production and consumption of energy. This includes activities such as using gasoline for transportation, non-renewable electricity production, oil and gas production, and heating and cooling of buildings.

At national level, according to the Portuguese 2021 National Emissions Inventory (2019 GHG emission estimates), dated from April 15th 2021[4], the most representative GHG is CO2 – which represents about 75% of total national emissions – and highlight as a source is given to the energy sector (transport included), due to the usage of fossil fuels. Despite not being the sole source of GHG, the energy sector, transports included, represented, in 2019, about 70% of national emissions, hence the direct linkage between energy transition goals and carbon neutrality.

Portugal's energy and climate policies push for carbon neutrality primarily through broad electrification of energy demand and a rapid expansion of renewable electricity generation, alongside increased energy efficiency. There is a strong focus on reducing energy import dependency and maintaining affordable access to energy.

Alto Minho's approach, despite this territory's specificities, cannot deviate much from the national approach, if it aims to be, by 2050, a Net-zero Energy Territory [5] before 2050.

The current document, entitled "**ALTO MINHO towards a net-zero energy transition | co-creating a sustainable future**", is an integrated action plan (IAP); is the end-result of 2,5-year co-creation process; was defined through a participatory approach, which benefited from both the inputs of a wide variety of local stakeholders (ULG meetings) and a fruitful exchange between partners/experts (Transnational meetings) and was produced in the framework of the Urban Energy Pact (URB-EN PACT) project, funded by the URBACT programme [6].

figure 1. Schematic representation of IAP definition process and links to its content
(courtesy of URB-EN PACT project's ad Hoc expert **Birgit Georgi**)

[3] https://www.unep.org/resources/emissions-gap-report-2021?utm_term=greenhouse%20gases&utm_campaign=Search_Global_Climate_Action&utm_source=adwords&utm_medium=ppc&hsa_acc=1970971754&hsa_cam=15139102696&hsa_grp=128680613985&hsa_ad=558137628930&hsa_src=g&hsa_tgt=kwd-300953942775&hsa_kw=greenhouse%20gases&hsa_mt=p&hsa_net=adwords&hsa_ver=3&gclid=Cj0KCQiAys2MBhDOARIsAFf1D1dCvNLlrDc8Cyy8nSundBd7NxkvB9Nwws8RGAv5Z48UlmrsSx35Zy4aAoQ8EALw_wcB

[4] https://apambiente.pt/sites/default/files/_Clima/Inventarios/20210309MemoEmissoes.pdf

[5] A Net Zero Energy territory must produce and deliver the required energy for its citizens, public services, businesses, by including the whole of society in the energy loop, designed as a local circular economy.

[6] URBACT is an instrument of the Cohesion Policy, co-financed by the European Regional Development Fund (ERDF) and the 28 Member States.

In terms of content, it establishes the vision and compiles the overall strategy which will allow Alto Minho to become a Net-zero Energy Territory before 2050 in line with the Portuguese commitment to reduce the country's greenhouse gas (GHG) emissions so that the balance between emissions and removals from the atmosphere will be zero by 2050 – according to resolution no. 107/2019, which approves the Portuguese carbon neutrality roadmap 2050 (RNC2050) - and with Alto Minho's Strategic Development Plan (Alto Minho 2030). A strong focus on expanding renewables and energy efficiency while cutting reliance on imported fossil fuels is backed by measures to safeguard energy security and ensure a just transition.

The URB-EN PACT project

Selected within the framework of the III[rd] URBACT Action Planning Networks programme, the URBAN ENERGY PACT (URB EN PACT) project is a network composed of 8 European cities and territories – being Alto Minho one of these territories [7] -, which share a common urban challenge they wish to commit to and for which they want to develop new solutions with a participatory approach.

Benefitting from the support of the URBACT programme, URB-EN PACT is a project that addresses energy issues and the challenges arising from the necessity, every day more pressing considering nowadays climate emergency, to locally produce the energy we use and consume for all our activities.

By fostering territorial cooperation and sustainable urban development, this project aims to assist the municipalities in each of the partner cities/territories to develop an integrated action plan for becoming a Net-zero Energy territory before 2050.

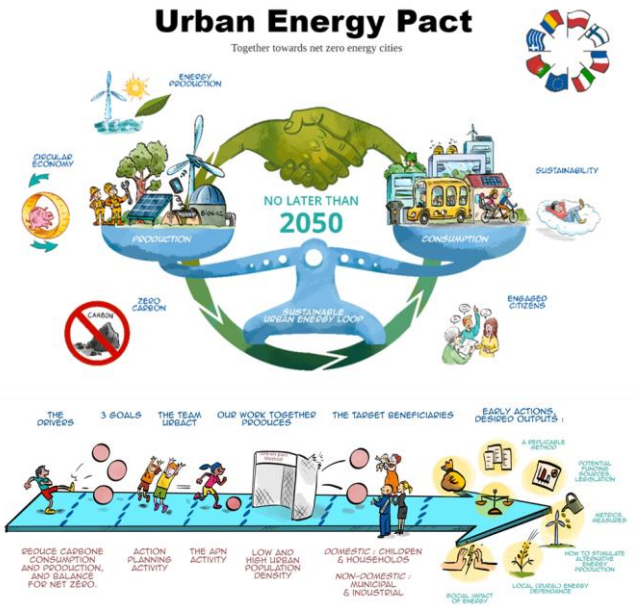


figure 2. URB EN PACT´s goals, vision, and process in images

Reasons which led Alto Minho to integrate the URB-EN PACT project

Today, 75% of European citizens live in the city, which accounts for close to 80% of natural resource consumption. These cities produce 50% of global waste and 75% of greenhouse gas emissions. Consequently, cities, as systems of production and consumption, are among the first factors responsible for the degradation of the environment, climate, air quality and their impact are felt throughout the world. If nothing is done the situation will only worsen - the United Nations estimate that 66% of the global population will be living in urban areas in 2050.

Citizens, institutions, and businesses are becoming increasingly aware of the role they play and of the efforts and collective progress which is needed to reduce the ecological footprint of our cities, effectively and efficiently. Involving all from an early stage of the planning process is, therefore, of paramount importance, as is a guarantee of policy and action coherence and integration.

The topic of energy, whether concerning its production or consumption, is a core issue that the URB-EN PACT project intends to address; partner territories becoming Net-zero Energy before 2050 is this project's main objective, and the definition of concrete action plans which allow this objective to be achieved is this project's main outcome.

[7] Besides Alto Minho (Portugal), the Urb-En Pact network integrates the following territories: Clermont Auvergne Métropole (France), Lead Partner; the Municipality of Galati (Romania); the Bialystok territory (Poland), composed of 10 Polish municipalities; the City of Palma di Montechiaro (Italy); Métropole Rouen Normandie (France); the Municipality of Elefsina (Greece); Eco-Fellows Ltd. (City of Tampere) (Finland).

To attain such an objective, numerous aspects need to be pondered and various challenges need to be addressed, ideally through a participatory approach aiming to maximize the likelihood of these plans' implementation, hence their success. "Who to engage and how?"; "Who is responsible for what?"; "How to guarantee long term engagement?"; "How to ensure an integrated holistic approach?"; "How to manage uncertainty?"; "How to guarantee a just transition?"; "How to assess, monitor and communicate action's implementation and impact?"; "Are there seasonal changes that should be accounted for, both for energy production and consumption?"; "Which is the optimal energy mix?"; "How to mobilize finance to boost energy investments?"; "How to store and to deliver the energy which is being produced at a local level?"… the list goes on.

Beyond the technical and technological aspects, the "Net-zero Energy territory" objective cannot be achieved without the contribution of all: families, active citizens, businesses, public institutions [each and every one will need to participate to reduce energy consumption on the territory so that the residual needs may be met by green and sustainable energy, produced and delivered locally], therefore citizen inclusion and raising consumer awareness at the local level will also be a core challenge - the key aim being to reinforce citizen and consumer involvement in renewable energy production, fair trade, and resource efficient consumption in everyday life.

Its commitment to the carbon neutrality goal; its full awareness of the importance of local action to achieve such goal and of the need to pursue a holistic, systemic, integrated (territorial, vertical and horizontal integration), and participatory approach, both to planning and to project implementation, led Alto Minho to integrate the URB-EN PACT network.

3. LOCAL CONTEXT ANALYSIS

3.1. Main characteristics of the local area

The proposed action will take place in an eligible area under the Convergence Objective, located in the Portuguese Norte region, namely in Alto Minho which, in terms of NUT III, coincides with PT111 – Alto Minho (figure 3).

figure 3. URB-EN PACT partners' geographic location, amongst which, Alto Minho (detailed)

Alto Minho has, according to the Portuguese 2021 census, an area of 2,218.8 km^2 and a population of 231,488 inhabitants, distributed by its 10 municipalities as shown in table 1. According to the latest Portuguese population census, from 2011 to 2021, this territory's population has decreased at an average rate of 6.72%.

table 1. Alto Minho's surface and resident population per municipality (INE, 2021 | provisional data).

Municipality	LAU 1	Area (km^2)	Residents (n.)	Population growth rate (%)
Arcos de Valdevez	1111601	447.6	20,729	-9.3%
Caminha	1111602	136.5	15,828	-5.1%
Melgaço	1111603	238.2	7,776	-15.6%
Monção	1111604	211.3	17,829	-7.3%
Paredes de Coura	1111605	138.2	8,636	-6.1%
Ponte da Barca	1111606	182.1	11,058	-8.3%
Ponte de Lima	1111607	320.3	41,204	-5.3%
Valença	1111608	117.1	13,634	-3.5%
Viana do Castelo	1111609	319.0	85,864	-3.2%
Vila Nova de Cerveira	1111610	108.5	8,930	-3.5%

The Alto Minho region is the only NUT III in Continental Portugal fully certified by the European Charter of Sustainable Tourism Award, given in 2015 by the European Federation "EUROPARC", it is also, according to the assessment of ESPON (European Spatial Planning Observation Network), one of the few regions in Europe that still has more than 50% of its natural areas, thus possessing a rich, diverse and complex landscape mosaic, corresponding to a significant portion of the Fundamental Nature Conservation Network, in which are currently classified three spaces of the National Network of Protected Areas (the National Park of Peneda-Gerês - the only national park in Portugal and at the same time a UNESCO World Biosphere Reserve; the Protected Landscape of Corno do Bico; and the Protected Landscape of Bertiandos and S. Pedro de Arcos Lagoons) and six sites of the "NATURA 2000" Network ("Serra da Peneda e Gerês", "Rio Minho", "Rio Lima", "Litoral Norte", "Serra de Arga" and "Corno de Bico"). Together with the valleys of the two great rivers and the seafront of the north coast, the forest area of Alto Minho is one of the main elements that demarcate the landscape of this territory.

figure 4. "Postcards" from Alto Minho [© António Sá; © CIM Alto Minho]

Alto Minho is an urban low-density territory, comprising 2 small cities (Viana do Castelo and Valença) and several dispersed urban settlements (being the most relevant, due to their size, the towns of Arcos de Valdevez; Caminha; Vila Praia de Âncora; Melgaço; Monção; Paredes de Coura; Ponte da Barca; Ponte de Lima and Vila Nova de Cerveira). Viana do Castelo is the principal conurbation with circa 37% of Alto Minho's population (INE, 2021 provisional data).

Alto Minho has an average population density of about 103.8 n/km^2 (INE, 2020), which can be split by urban-rural typology according to the following: intermediate: 152.3; predominantly urban: 377.4; predominantly rural: 34. This represents a challenge to network planning, operation and maintenance (energy, waste, potable water and wastewater); energy supply (especially if the production is centralized) as well as to mobility (particularly relevant as far as the transports are concerned).

A quarter of Alto Minho's population is aged over 65 while there is a notably lower proportion in the 20 to 24 and the 25 to 34 age groups (table 2). Amongst others, this reflects an observed outward migration of young people both to study and work in the early and, for 25-34 age band, often the most productive stages of their careers. These represent challenges that Alto Minho is looking to address.

table 2. Demographic profile of Alto Minho's population (percentage breakdown) (INE, 2020).

Demographic breakdown of the population (%)								Population	
age	<19	20-24	25-34	35-44	45-54	55-64	65+	Total (n.)	Density (n/km²)
region	15.9	5.3	10.8	13.3	14.6	14.5	25.6	229,066	103.24

In 2011, according to INE's 2011 census, the majority of Alto Minho's population was unemployed - only 37.49% of Alto Minho's residents were employed (91,794), being "Manufacturing Industries" the sector which employed most individuals (17,016), followed by "Wholesale and retail trade; repair of motor vehicles and motorcycles" (15.190) and "Construction" (13,229). On this matter it should also be noted that, according to "Census 2011 Definitive results – Northern Region" [8], in 2011 and in Alto Minho, "Agriculture, Forestry, Hunting and Fishing" was the predominant specialization sector in 6 of the 10 municipalities that integrate this territory (namely: Arcos de Valdevez, Caminha, Melgaço, Monção, Paredes de Coura and Ponte da Barca), followed by, *ex aequo*, "Industry" (in Valença and Vila Nova de Cerveira) and "Construction" (in Ponte de Lima and Viana do Castelo), which corroborates the markedly rural nature of the territory of Alto Minho.

In terms of education, according to INE (2011), only 11.36% of Alto Minho's residents have a higher education degree and most of this territory's population (61,18%) has only concluded the basic level of education (table 3) - which is not surprising considering this territory's demographic profile and its history of outward migration.

table 3. Educational stage profile of Alto Minho's population (percentage breakdown) (INE, 2011).

Demographic breakdown of the population (%)							Population
	none	Pre-school	Primary education	Secondary education	Post-Secondary education	Higher education	Total (n.)
region	9,32%	2,31%	61,18%	15,03%	0,80%	11,36%	244,836

As for income levels, in 2019, the average monthly basic remuneration (835€) and the average monthly earnings (1,013.3€), in Alto Minho, were both lower than those of the Northern region, of Continental Portugal and of Portugal (table 4), which may represent a constraint to sustainable energy investments, especially those that need to be carried out by households dealing with energy poverty, unemployment and/or single parenthood.

table 4. Alto Minho's average monthly income levels (basic remuneration and earnings) (INE, 2019).

Income levels		
	average monthly basic remuneration	average monthly earnings
Portugal	1 001,5	1 206,3
NUT I - Continente	1 005,1	1 209,9
NUT II – Norte	924,5	1 100,4
NUT III - Alto Minho	835,0	1 013,3

[8] Available for consultation *and/or download* at: http://censos.ine.pt/xportal/xmain?xpid=CENSOS&xpgid=ine_censos_publicacao_det&contexto=pu&PUBLICACOESpub_boui=156638623&PUBLICACOESmodo=2&selTab=tab1&pcensos=61969554

Alto Minho's local industry base is skewed significantly towards micro and small businesses (table 5). In 2019, only 28 out of the existing companies were registered in the Portuguese Management of Intensive Energy Consumption System (SGCIE), 17 of which, in terms of energy consumption levels, consumed less than 1000toe/year.

table 5. Alto Minho's business profile (INE, 2019).

Business profile					
	total	Micro (<10)	Small (10-49)	Medium (50-249)	Large [250+]
firms (n.)	30,317	29,333	870	94	20
% of total	-	96.75%	2.87%	0.31%	0.07%

Primary sectors dominate, with just under one-fifth of the business stock being engaged in "Agriculture, Farming, Hunting and Fishing" (17.45%). Also important are "Wholesale and Retail" (17.00%) and "Construction" (12.69%). Tourism's importance is increasing in Alto Minho, both for revenue and employment, especially sustainable tourism. In Alto Minho, the transport sector, which is mostly made up of road traffic, has low statistical relevancy (1.51%). It should however be noted that this territory's mobility patterns are highly dependent on the usage of privately owned vehicles and heavily reliant on imported fossil fuels (which represents a hurdle both to the economy and to the environment, being this one of the main sectors responsible for GHG emissions). In this context and within the framework of sustainable development, as most territories, Alto Minho's must reverse its mobility habits.

As far as Alto Minho's housing stock, according to INE's estimates, in 2020, there were 123,961 buildings of traditional family housing - 27.13% of which located in Viana do Castelo, 16,44% in Ponte de Lima and 12,69% in Arcos de Valdevez.

3.2. Energy issues in ALTO MINHO

3.2.1. Energy issues in my area

The Alto Minho region is mountainous and sparsely populated. Good sunshine levels and its terrain make solar, hydro and wind generation potential sources. Wood resources are also significant.

figure 5. "Postcards" from some of Alto Minho's power plants | wind; hydro; biomass and offshore wind

In terms of energy production by energy source, according to available statistical data it was, in 2018, as follows:

table 6. Alto Minho's energy production (DGEG, 2018 | provisional data).

Energy production (GWh)					
Source	Total (p.a)	solar	hydro	wind	bio fuel*
	2,692	N/A	1,047	910	735

*Bio Fuel = Sustainable wood, waste, bio-gas etc

- Hydro is a key component but is dependent on rainfall – consequently, generation has ranged from 398 GWh to 1,265 GWh in the previous 4 years;
- Although not shown in table 6, there have been several Solar installations (mostly thermal, being PV of a residual nature) in recent years. Ambient sunshine levels are reasonably good (2,000 hours p.a.);
- The region uses electricity that is generated nationally using oil, natural gas and also imported electricity from Spain, despite the region's capacity to generate more electricity than it uses;
- Geothermal sources for heating municipal swimming pool are being used in the municipality of Monção;
- Waste generated in Alto Minho is being used to produce electricity from biogas in the Municipalities of Valença and Viana do Castelo;
- Biomass is used to produce electricity at DS Smith Viana Paper Mill and for heating [dwellings, for example].

All Alto Minho's municipalities are investigating solar PV for municipal buildings and are considering the introduction of energy measurement sensors when renovating buildings. These would track water, electricity, and heat usage. Besides solar energy and biomass, offshore wind and wave energy are also opportunities.

As for the energy consumption, Alto Minho's energy consumption in 2017 can be split per type and user group as follows:

table 7. Alto Minho's energy consumption (DGEG, 2017 | provisional data).

			Energy usage by type and user group [GWh per annum]						
		Domestic	Non-domestic						
Alto Minho	Total	463.20							3,499.74
		Domestic dwellings	Agriculture, Farming, Hunting and Fishing	Services				Public Street lighting	Industry
				Public administration	Schools and Universities	Transport (Public and Private)	Other		
	3,962.92	463.20	61.05	37.17	39.59	879.96	239.71	37.60	2,204.64

In terms of Carbon and other GHG emitted per annum in Alto Minho, related to energy usage, a total of 1,033.80ktCO_2eq were emitted, split by type and user group as follows:

table 8. Alto Minho's Carbon and other GHG emissions per annum [considering, solely, Alto Minho's energy consumption].

			GHG emissions by type and user group [ktCO_2eq per annum]						
		Domestic	Non-domestic						
Alto Minho	Total	146.51							887.29
		Domestic dwellings	Agriculture, Farming, Hunting and Fishing	Services				Public Street lighting	Industry
				Public administration	Schools and Universities	Transport (Public and Private)	Other		
	1,033.80	146.51	17.66	11.91	9.24	230.57	76.32	13.57	528.02

On average CO_2 levels between 2013-2017 excl. emissions from asphalts, lubricants and oil were 1,025 $ktCO_2$ eq.

It should however be noted that forest fires are major contributors to Alto Minho's GHG emissions. Overall, in 2017, according to the National Inventory of GHG emissions[9], a total of 3,206kt $ktCO_2$ eq were emitted, being forest fires responsible for 2,383kt $ktCO_2$ eq – which reinforces the importance of using Forestry Residues for energy generation.

Most travels are made using privately owned vehicles, despite there being several companies which provide public transportation services (either by train, bus, taxi, or ferryboat). Despite the investments made in recent years, there is margin for improvement.

A final remark on Alto Minho´s building stock, due to its potential to contribute to the net-zero energy goal. In addition to oil and gas, most houses use wood for heating which has both air quality and carbon impacts. There is very low domestic Solar PV/Heat adoption despite the relatively good sunshine levels (2,000 hours p.a.). Solar PV and Solar Thermal (water heating) are opportunities.

In terms of energy performance certificates (EPC) for marketing purposes, renting and sale of dwellings, until 2021, in Alto Minho, only 30,606 EPC were formally issued (https://www.sce.pt/estatisticas/), the majority of which (57,0%) with an energy efficiency rating, on an A–F rating scale, below B- [minimum energy performance rating for new buildings, before the enforcement of the Decree-law n. 101-D/2020, dated from December 7th) (figure 6).

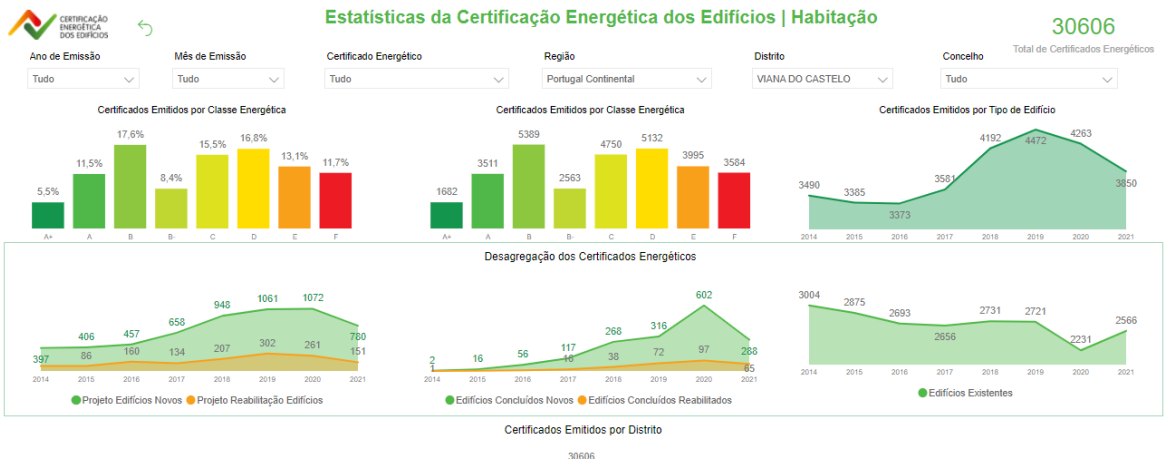


figure 6. Screenshot of Alto Minho's status on energy performance certificates (EPC) for the marketing, sale and let of dwellings [SCE, 2021 - https://www.sce.pt/estatisticas/]

In terms of content, namely as far as the measures that need to be undertaken to improve the building's energy rating, the most mentioned were "building envelop (walls, roofs, and floors)" (49.4%), followed by "heating and cooling" (18,6%) and "renewable energy systems" 13,8% (SCE, 2019).

As far as non-domestic buildings, by November 2021, only 4,365 EPC were issued, the majority of which (45,22%) corresponded to buildings with a D class energy efficiency rating.

9 The National Inventory of GHG emissions is the instrument which is used for monitoring and verifying national compliance against the assumed targets and is therefore a key element of climate policy. All emissions and sequestration of human origin are accounted for, including carbon dioxide (CO_2), methane (CH_4), nitrogen oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur (SF_6) and nitrogen trifluoride (NF_3). Indirect GHGs, such as carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NOx) and non-methane volatile organic compounds (NMVOCs), are also included. Data is available for consultation and/or download at: https://rea.apambiente.pt/content/emiss%C3%B5es-de-gases-com-efeito-de-estufa (last updated: 5 June, 2019)

3.2.2. Our institutional context

CIM Alto Minho is a legal person under public law formally constituted, as Alto Minho's municipalities association, in October 2008, under the August 27th Law n. º 45/2008, with a geographical scope which encompasses the municipalities of Arcos de Valdevez, Caminha, Melgaço, Monção, Paredes de Coura, Ponte da Barca, Ponte do Lima, Valença, Viana do Castelo and Vila Nova de Cerveira.

In terms of ENERGY, CIM Alto Minho, as well as Alto Minho's 10 municipalities, find support in AREA Alto Minho – Agência Regional de Energia e Ambiente do Alto Minho [Alto Minho's Regional Energy and Environment Agency] which: was formally constituted on November 20th 2009 after the statutory revision of its predecessor (AREALIMA-Lima Valley's Regional Energy and Environment Agency); collaborated with all 10 Alto Minho's municipalities in the definition of their Sustainable Energy Action Plans and has a five-year experience in monitoring Alto Minho's public street lighting energy consumption.

In Alto Minho, there isn't a non-profit organization (NGO) dedicated solely to ENERGY issues, and energy poverty is mainly dealt with by Alto Minho's municipalities and by DECO (Portuguese Association for Consumer Protection).

Besides the 10 Alto Minho's municipalities, there are two companies responsible for solid waste disposal/treatment/valorisation - RESULIMA and VALORMINHO - and one, ÁGUAS DO ALTO MINHO, responsible for water distribution to consumers.

Because of market liberalization there are several energy suppliers, whether it be electricity or gas (natural gas, butane, propane). There are also several companies which produce green electricity (RESULIMA; VALORMINHO; DS Smith; Empreendimentos Eólicos do Vale do Minho (EEVM); Eólica da Espiga; amongst others). Currently there is a relevant opportunity to further develop renewables, whether being self-consumption or energy communities.

Electricity distribution is the responsibility of E-REDES and the distribution of natural gas of REN Portgás Distribuição.

Alto Minho has a university, the Universidade Fernando Pessoa, and a Polytechnic Institute, the Instituto Politécnico de Viana do Castelo (IPVC). Both institutions offer courses at a higher level. The IPVC comprises six Schools offering undergraduate and postgraduate degree courses, some focusing on energy and climate-action related issues, often delivered in collaboration with national and international polytechnics and universities. It also offers Master's courses and specialist subject-matter courses. In terms of research and development, there is an opportunity for further investment. Despite this provision, young people tend to leave to pursue their higher education studies elsewhere.

As for the companies which provide public transportation services (either by train, bus, taxi, or ferryboat), for their relevance, the following should be highlighted: Auto Viação do Cura; Auto Viação do Minho; AVIC Group; Barquense; CP - Comboios de Portugal; EBA; Rede de Expressos; Ovnitur; Transcolvia; Transdev Group and UTS. CIM Alto Minho is Alto Minho's intermunicipal and inter-regional transport authority and Alto Minho's municipalities are municipal transport authorities. ANTRAM - Associação Nacional de Transportadores Públicos Rodoviários de Mercadorias, ANTROP - Associação Nacional de Transportes de Passageiros and ANTRAL - Associação Nacional dos Transportadores Rodoviários em Automóveis Ligeiros need also referencing due to the role they play, as associations, in the transport sector.

3.2.3. Our existing strategies, policies, and main actions

Alto Minho's municipalities are at different stages in their transition, and each has its own resources to respond to the ambitions set out in the Paris Agreement – hence the need for a differentiated approach. Despite there being a common vision for the Alto Minho region (see 2.1 Our vision: ALTO MINHO in 2050, for further details on the vision for Alto Minho by 2050), it is up to each municipality to define their intermediate milestones on the

road to climate neutrality by 2050, as is setting mid and long-term targets, consistent with the EU objectives[10], and at least as ambitious as our national targets.

At a national level, the following documents are of relevance and influence Alto Minho's energy-related activities:

table 9. Relevant national policy documents

Policy	Detail
Programa Nacional para as Alterações Climáticas 2020/2030 (PNAC2020-2030)	Aims to ensure a sustainable path of greenhouse gas emission reduction to achieve a target of -18% to -23% in 2020 and from - 30% to -40% in 2030 compared to 2005
República Portuguesa - XXII Governo _ Ministério do Ambiente e Ação Climática	Includes a 55% carbon emissions reduction goal by 2030
Lei de Bases do Clima – law no.98/2021 of december 31	The Portuguese climate law includes: ambitious 2030 and 2050 climate targets of at least 55% and 90% reduction of net emissions of greenhouse gases as compared to 2005, respectively, with clarity on the contribution of emission reductions and removals; the establishment of a Climate Action Council (CAC), that will provide independent scientific advice; stronger provisions on adaptation to climate change; strong coherence across Portuguese policies with the climate neutrality objective (inclusively at local level); a commitment to engage with sectors to prepare sector-specific roadmaps charting the path to climate neutrality in different areas of the economy.
Plano Nacional De Energia Clima 2021-2030 (PNEC 2030)	The National Energy and Climate Plan, together with other sectorial policies and strategies, translate the Portuguese commitments for the 2030 horizon and states the national commitment to achieve carbon neutrality in 2050. Its goals for achievement by 2030 include: reducing greenhouse gas emissions by 45% to 55%; increasing energy efficiency by 35%; increasing the share of renewable energy to 47% of energy use, increasing the share of renewable energy to 20% of energy use in transport and guaranteeing at 15% electricity inter-connection levels.
Programa Nacional de Investimentos 2030 (PNI2030)	The 2030 National Investment Program aims to be the planning tool for the next cycle of national strategic and structural investments. Its scope is multi-sectoral, focusing on the mobility and transport sectors - key factors for Portugal's external competitiveness and internal cohesion – as well as on the environment, energy, and irrigation - key areas necessary to meet the challenges of decarbonization and energy transition.
Roteiro Para A Neutralidade Carbónica (RNC2050)	There is a commitment to achieve carbon neutrality in Portugal by 2050. It sets an objective to reduce GHG emissions in Portugal by between 85% and 90% by 2050 compared with 2005, and to compensate for remaining emissions through land use and forests. Intermediate goals include emissions reduction between 45% and 55%, by 2030, and between 65% and 75%, by 2040, compared to 2005.

Despite not being national policy documents, due to the relevance they have in the delivery of sustainable energy investments, emphasis should be given to the Portuguese Recovery and Resilience Plan (PRR) [11] and to the Portugal 2030 Partnership Agreement [12].

[10] The European Union has renewed its ambition through the adoption of the EU Green Deal. Within this framework, a target is set of at least 55% reduction of greenhouse gas emissions by 2030 and a long-term vision to reaching climate neutrality in Europe in 2050. These objectives - as enshrined in the 2030 Climate Target Plan and the European Climate Law - are to be achieved through a transformational change happening in all sectors of our society.

[11] PRR is an investment plan to be implemented at national level until 2026. It foresees a set of reforms and investments which will allow Portugal to resume sustained economic growth and strengthen convergence with Europe over the next decade. Is organized in 3 different dimensions, amongst which **Climate Transition** (aiming at achieving a more sustainable use of resources, an increase in production of renewable energies and the decarbonisation of the economy and society). The dimension of Climate Transition includes 4 components that can be considered as directly relevant for the energy sector.

[12] The Portugal 2030 Strategy provides guidance for the planning of public policies to promote Portugal's economic and social development. It also guides the design of instruments to support economic and social development, especially those financed by European funds, such as the

At a local level, Alto Minho has 10 action plans (one *per* municipality) which focus on energy issues and need updating and one regional action plan that addresses climate action [mitigation as well as adaptation (PIAAC do Alto Minho – dated from December 2019)].

All 10 Alto Minho municipalities defined and approved an action plan for their territories committing to use energy more sustainably. In addition to including a baseline emissions inventory, these plans integrated several measures that aimed at reducing the carbon & greenhouse gas (GHG) emissions in buildings, transport, by citizens and through policy. These action plans were produced under the Covenant of Mayors initiative and had corresponding targets for CO_2 emission reduction (20% emission reduction compared to baseline by 2020).

It should however be noted that, the economic crisis of 2010 and, more recently, the COVID-19 pandemic – alongside their inherent financial constraints - prevented some of the proposed measures from being implemented as planned. Some were delayed, others needed adjustment (in terms of ambition) – but the commitment to implementing them remains. These measures include:

- Successfully implemented - LED public street lighting; enhancement of sports pavilions' and swimming pools' energy performance (solar heat and "shallowing" of the pool to make it more efficient); energy awareness-raising actions having children as target groups;
- Postponed - electrification of the railway network, expansion of the EV municipal fleet and EV fast-charging points – although key parts of CIM Alto Minho mobility strategy have seen partial implementation (pedestrian ways and bicycle lanes, for instance);
- Adjusted in terms of ambition – awareness-raising actions addressing the overall population, urban planning;
- Put on hold - green procurement.

The PIAAC do Alto Minho, on the other hand, integrates several adaptation and mitigation measures, that are to be implemented by 2030, and aims at increasing Alto Minho's resilience to climate change. As far as climate action goes, it should also be emphasised that Viana do Castelo, being the capital of the district of Viana do Castelo, integrated the ClimAdaPT project (funded by EEA grants), in the ambit of which it defined its municipal strategy for adapting to climate change (EMAAC de Viana do Castelo). As PIAAC do Alto Minho, the EMAAC sets no goals in terms of carbon & GHG emission reduction. At present some of the foreseen measures are being implemented by the municipality of Viana do Castelo and, currently, action is being taken to another level – the scope has been broadened to meet the UN Sustainable Development Goals (SDG)[13].

By enabling Alto Minho to plan beyond 2020 and by raising this territory's ambition as far as energy transition and carbon neutrality are concerned, Alto Minho's IAP may encourage Alto Minho's municipalities to sign the EU Covenant of Mayors for Climate & Energy[14] and will certainly contribute to localising SDG[15], both at regional and local levels [emphasis on SDG 7, 11, 12, and 13, but also contributing to SDG 1, 3, 4, 5, 8, 9, 10, 12, 13, and 17].

3.2.4. Identification of past hurdles on the implementation of sustainable energy investments

The hurdles that Alto Minho came across while implementing its low carbon initiatives had mainly to do with the following:

Recovery and Resilience Plan, the Partnership Agreement, the Operational Programmes (OP) included therein and the Strategic Plan for the Common Agricultural Policy, to be implemented in the 2021-2027 programming cycle. It comprises four Thematic Agendas, considering the range of challenges that must be tackled to enable a sustainable and inclusive growth for the next decade, one of which being **Climate transition and resources sustainability** (aims at promoting climate transition and the sustainability and efficient use of resources, promoting the circular economy, and responding to the challenge of the energy transition and of territorial resilience.

[13] https://odslocal.pt/viana-do-castelo?lang=PT

[14] https://eumayors.eu/en/

[15] https://sdgs.un.org/goals

- need to adjust the foreseen financing programs/models (namely: savings which result from the implementation of sustainable energy projects should not be considered as income – also applies at EU level, not just national level; need to adjust the co-financing rates; need to revise the standard cost tables as they serve as a reference for determining eligible investment; the need to diversify the types of eligible actions [considering, for example, information and awareness-raising actions; capacity building actions as well as the purchase of low/Zero-Emission Vehicles];
- need to supplement available support data with real-time assessment/measurements (ex. the statistical data, per municipality, currently available is dated and is, sometimes, provisional - i.e., doesn't fit real-time management needs nor is a valuable asset to the decision-making process);
- lack of inhouse expertise to address specific technical areas of expertise (amongst which innovative financing schemes (revolving funds, EPC, third party financing, cooperative models);
- lack of knowledge and need for professional training in specific technical areas of expertise;
- further clarify which entity(ies) has(ve) the competence/responsibility to act and which are the terms/boundaries of their action;
- legislative and technical constrain of various nature;
- the absence of an overall cohesive investing ecosystem, inhibits information flow, investor confidence, and, consequently, consistent capital allocations toward novel clean energy development.

Besides these, there are issues that have to do with, for instance: Procurement – Strategic Procurement as a tool to tackle social, economic, and environmental challenges; People's mindset and Consumption habits – Circular economy transition and resource use efficiency; Innovation and Digital transition, amongst others, that also need to be carefully addressed if we are to guarantee the success of the implementation of Alto Minho's IAP.

3.2.5. Summary: the SWOT analysis

As far net-zero energy issues are concerned, based on the inputs from Alto Minho's ULG members (see 4.4.2. A participative process through the URBACT Local Group (ULG), Alto Minho's SWOT analysis is as shown in table 10.

On this basis, the main challenges faced by Alto Minho in becoming a net-zero energy territory before 2050 are:

- Reducing GHG emissions and increasing carbon sequestration;
- Increasing energy efficiency;
- Renovating building stock and inefficient fleet;
- Improving energy networks and increasing energy security;
- Increasing the share of RES in gross final energy consumption;
- Increasing decentralized green energy production;
- Moving away from fossil fuels;
- Moving towards nearly zero-emission transport system;
- Moving towards a more circular economy;
- Raising awareness on resource efficiency (raw material, energy, and water);
- Alleviating energy poverty;
- Ensuring long term stakeholder involvement and commitment,

and, to properly address these challenges, there is a need to:

- Ensure impact measurement and assessment (sensing and monitoring), so that adjustments can be made if/when needed;
- Ensure long-term integrated strategic planning (beyond 2030);
- Ensure availability of funding and financing opportunities to boost sustainable energy investments;
- Encourage research, experimentation, and innovation as well as capacity building/training;
- Guarantee stakeholder long term participation, not only during the planning and implementation phases but also during this IAP's monitoring and assessment.

table 10. Alto Minho's SWOT analysis

Strengths	Weaknesses
• A mild, temperate climate • High potential and diversity of RES (wind, ocean, biomass, water/hydro, solar, geothermal) • Installed energy capacity (hydro, wind, and biomass) • Pioneers in offshore wind production • Good industrial cluster: the presence of renewable energy industries/companies and of industries that produce components to support green energy transition (namely wind energy clusters) • Increased availability of EV charging solutions (rapid, fast, and slow charging points) • Good facility to mobilise stakeholder networks • Strong business and industrial links to Galicia • Installed optical fibre network (required for control systems) • Construction - Newbuild legislation standards are good • Lithium deposits	• Policymaking is a centralised process and Alto Minho is a peripheral region (located in Northern Portugal) • Public transportation network: old fleet and poor coverage • Railway keeps to the coast – inland areas are not served • Territorial dispersion [Large area, small/dispersed population makes it difficult to service cost-effectively (ex. transport, water supply, electricity, sewage)] • Prevalence of small landholdings (minifundium) and unclear ownership of land/small plots (the existing land register is dated and doesn't reflect current land ownership or property limits) - this applies both to vacant and forested land • Building stock's low energy efficiency (ex. historical buildings have poor energy and environmental standards) • Current mindsets towards the use of energy (e.g., If the energy bill is paid by someone else, then energy is likely to be wasted; Public space illumination issue: public expect all houses' facades to be appropriately lit to feel safe) • Ageing demographic • Difficulty to retain population and talents (lots of young, educated people leave for Porto and abroad, especially since 2010) • Lack of applied research ability within the region – must buy-in this expertise • Lack of opportunities for younger people/entrepreneurs • Low employment and low-income levels
Opportunities	**Threats**
• Proximity to Galiza (Euroregion) – common problems, opportunities, and challenges [possibility to implement cross border projects and to benefit from EU funding] • Upgrading of overhead power lines to increase capacity • Political context favourable to climate action [PNEC2030 encourages energy efficiency (in buildings and infrastructures as well as in mobility) and production of energy from RES] • Decentralized production of energy policy - endorses self-production [prosumers] • Action at a community level [energy communities (Renewable Energy Communities and Citizen Energy Communities) • Ocean energy potential and product available • Tourism sector growth • Rail electrification • Biogas from waste and other sources (for example agriculture) • Broader use of more efficient water pumps • Use residual/wastewater for gardens and sports pitches	• Population's reluctance towards the increase of the interconnection capacity between Portugal and Spain based on its possible impacts on health, biodiversity, and landscape (an asset to tourism) - NIMBY effect -> may compromise new energy installations (impact significantly on hydro and wind projects) • Climate change leads to: (i) unpredictable rainfall levels that, in turn, impact significantly on the ability to generate hydroelectricity; (ii) increased temperatures and lesser rainfall that, in turn, increase the risk of forest fires, especially in the summer; (iii) uncertainly of wind patterns - this makes planning difficult • 4-year period election cycle, both at national and local levels, which often do not coincide -> this makes long term planning difficult and may lead to a change in priorities/ policies (national, regional and/or local)

4. POLICY CHALLENGES FOR THE IAP

4.1. Our vision: ALTO MINHO in 2050

The Portuguese government has publicly declared its intention to become carbon neutral by 2050. While this long-term global/national vision is clear, at a local level it is not so.

As established in its strategic development plan, Alto Minho aims at being, by 2030: "a competitive region which creates jobs and generates wealth; which is attractive to live in, to visit and to invest in; which is connected, both to Europe and to the world; and which is resilient, able to adapt itself to change".

figure 7. Vision for the region as set in Alto Minho's Strategic Development Plan (Alto Minho 2030)

In line with this vision and coherent with RNC2050 and PNEC2030, as far as the goal of becoming, before 2050, a net-zero energy territory, one word can summarize Alto Minho´s ULG members' vision for this territory, that word being "GREENER"…. Greener energy production; Greener procurement and purchases; Greener economy; Greener jobs; Greener landscapes; Greener consumption habits; Greener mobility patterns; Greener buildings, infrastructures, networks; Greener planning …

"ALTO MINHO + Verde"... is the inspiration, the motto, the overall goal for the 2050 horizon, whereas "PROMOTING THE BALANCE BETWEEN ENERGY PRODUCTION AND ENERGY CONSUMPTION AS WELL AS THE DECARBONISATION OF ALTO MINHO'S ECONOMY TO ACHIEVE NET-ZERO ENERGY AND CARBON NEUTRALITY BY 2050, AS AN OPPORTUNITY FOR THE TERRITORY, BASED ON A DEMOCRATIC AND FAIR MODEL OF TERRITORIAL COHESION WHICH EMPHASISES THE CREATION OF WEALTH AND THE EFFICIENT USE OF OVERALL RESOURCES", is Alto Minho's strategic vision for the 2050 horizon.

In terms of goals, the following were identified:

- Reduce energy consumption (and therefore reduce carbon emissions);
- Increase local renewable energy production (and therefore increase low carbon energy sources);
- Balance energy production and consumption to achieve the net-zero energy territory status,

the target being to meet, percentagewise, at local level, the targets set for the national level.

4.2. Our priority policy areas to achieve net-zero

To turn this vision into reality, an integrated action plan needs to be set out and, despite all sectors of activity contributing toward reducing GHG emissions, the energy sector (transports included), will, due to the previously mentioned reasons, play an especially relevant role in the energy transition towards a net-zero energy and decarbonised society. Accordingly, Alto Minho's strategy for the 2050 horizon is based on a combination of different actions and measures, seeking to encounter synergies between the various possible alternatives… in both, times of uncertainty (due to the unknown repercussions of the COVID-19 pandemic, for example) and of climate emergency, but also times of empowerment, of experimentation and of innovative thinking and acting.

The energy mix is shifting from fossil fuels to renewables. In Alto Minho there are several examples of public and private organizations working hard to decarbonize the economy. As this energy transformation or "Green Deal" gains momentum, new ecosystems are forming, and new technologies are emerging. These developments are helping to grow renewables, develop new energy carriers, improve energy efficiency, reduce emissions, and create new markets for carbon and other by-products as part of an increasingly circular economy. At the same time, many of these commonly pursued steps to decarbonization, such as increased electrification, wide-scale use of renewable energy, and intensifying energy efficiency measures pose unique challenges.

The path for Alto Minho to become a net-zero energy territory requires joint coherent action across several strategic areas, with priority being placed on: energy efficiency; greater diversification of energy sources (amongst which ocean energy); decentralized energy production (whether it being individually or collectively, via self-consumption or through energy communities); increase electrification and moving towards a more sustainable mobility; reinforcement and modernisation of infrastructures; research (including sensing and monitoring), experimentation, innovation and competitiveness; promotion of low carbon processes, products and services; improved energy services; empowerment, awareness-raising and informed choice for consumers.

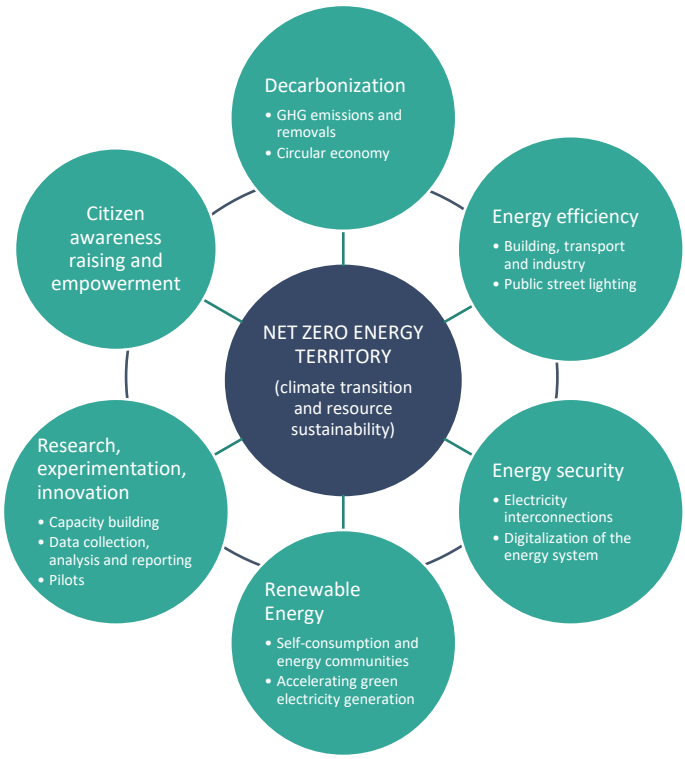


figure 8. Priority policy areas to achieve net-zero

It should however be noted that Alto Minho's strategy – hence its foreseen climate and energy goals - faces notable challenges, with an economy that remains heavily reliant on imported fossil fuels today. To achieve net-zero, Alto Minho must reduce its oil demand and associated emissions through, for example, transport decarbonisation – soft modes, electrified rail and public transport improvement, replacement of inefficient fleet (in favour of electric vehicles (EV), for instance) and expansion and densification of EV charging points network. In the long run, a key role may be played by hydrogen produced from renewable energy in hard-to-decarbonise sectors and for achieving carbon neutrality (on this matter it should be highlighted that the National Hydrogen Strategy sets a goal for hydrogen produced from renewable energy to cover 1.5-2% of Portugal's energy demand by 2030, with use in industry, domestic maritime shipping, road transport and for injection into the natural gas network and potential exports).

4.3. Our strategy in a glance

Alto Minho´s strategy to become a net-zero energy territory before 2050 may be summarized as follows:

table 11. Alto Minho's overall strategy to become net-zero energy before 2050

Main Problem (s)	Challenge (s)	Specific objective (s)	Foreseen action (s)
Overall GHG emissions increase	• Reducing GHG emissions and increasing carbon sequestration; • Encouraging research, experimentation, and innovation.	#1 Decarbonizing Alto Minho's economy	1.1 DECARBONISING URBAN SETTLEMENTS 1.2 DECARBONISING LOCAL PUBLIC ADMINISTRATION 1.3 REDUCING WASTE PRODUCTION AND DIRECT DEPOSIT OF WASTE IN LANDFILLS AND PROMOTING RECYCLING CHAINS 1.4 PROMOTING THE TRANSITION TO A CIRCULAR ECONOMY
Overall low energy performance of buildings/infrastructures Energy poverty	• Increasing energy efficiency; • Renovating building stock; • Ensuring capacity building and training.	#2 Prioritising energy efficiency	2.1 PROMOTING ENERGY EFFICIENCY IN BUILDINGS 2.2 PROMOTING ENERGY EFFICIENCY IN STREET LIGHTING 2.3 PROMOTING VOCATIONAL TRAINING FOR THE ENERGY EFFICIENCY SECTOR AND ENCOURAGING R&D&I ON ENERGY EFFICIENCY
Overall economy remains heavily reliant on imported fossil fuels and on centralized produced energy	• Increasing the share of RES in gross final energy consumption; • Increasing decentralized green energy production.	#3 Strengthening Alto Minho's commitment to renewable energy, thus reducing the territory's energy dependency	3.1 ACCELERATING ELECTRICITY GENERATION AND STORAGE FROM RENEWABLE ENERGY SOURCES 3.2 PROMOTING THE SPREAD OF DISTRIBUTED GENERATION, VIA RENEWABLE ENERGY COMMUNITIES
	• Improving energy networks and improving energy supply	#4 Ensuring security of energy supply	4.1 ADJUSTING THE ADEQUACY AND PROMOTING THE DIGITALISATION OF THE ENERGY NETWORK SYSTEM
The transport sector remains heavily reliant on imported fossil fuels (which represents a hurdle both to the economy and to the environment); the public transportation network lacks coverage, leading to a high dependency on the usage of privately owned vehicles, particularly relevant considering dispersed nature of the territory.	• Moving away from fossil fuels; • Moving towards nearly zero-emission transport system/fleet.	#5 Promoting sustainable mobility	5.1 PROMOTING MODAL SHIFTS TO PUBLIC SUSTAINABLE TRANSPORT 5.2 BOOSTING THE ENERGY TRANSITION IN THE TRANSPORT SECTOR (includes promoting and supporting electro-mobility) 5.3 PROMOTING ACTIVE MOBILITY AND MORE EFFICIENT BEHAVIOUR (includes promoting car-sharing, bike sharing and carpooling)

Main Problem (s)	Challenge (s)	Specific objective (s)	Foreseen action (s)
Over the years, intense wildfires have devastated Alto Minho's forests, contributing to GHG emissions, and diminishing forest's capacity to act as a carbon sinks.	• Reducing GHG emissions and increasing carbon sequestration	#6 Promoting sustainable agriculture and forestry; boosting carbon sequestration	6.1 INCREASING THE NATURAL SINK CAPACITY OF AGRICULTURE AND FOREST 6.2 ENCOURAGING THE ROLE OF THE BIOECONOMY
Alto Minho's Linear economy approach	• Moving towards a more circular economy	#7 Developing an innovative and competitive industry	7.1 FOSTERING ECO-INNOVATION AND CLEANER PRODUCTION PROCESSES, PROMOTING CIRCULAR ECONOMY AS WELL AS THE DIGITISATION OF INDUSTRY (INDUSTRY 4.0)
A quarter of Alto Minho's is aged over 65 _ population with lower levels of education; less prone to accommodate change/innovation; often with lower monthly incomes; lower capacity/wish to invest in sustainable energy measures.	• Raising awareness on resource efficiency (raw material, energy, and water); • Alleviating energy poverty,	#8 Ensuring a just, democratic and cohesive transition	8.1 TACKLING ENERGY POVERTY AND ALLIVIATING ENERGY POVERTY OF VULNERABLE CUSTOMERS 8.2 DEEPENING KNOWLEDGE ON CLIMATE CHANGE MITIGATION, DISSEMINATING GOOD PRACTICES AND DRIVING LOW-CARBON BEHAVIOUR IN SOCIETY 8.3 PROMOTE SUSTAINABLE DEVELOPMENT DIALOGUE PLATFORMS AND LEVERAGE INTERVENTION CAPACITY AT REGIONAL AND LOCAL LEVEL

4.4. A co-building process for our IAP

4.4.1. The general process

Being part of an Action Planning Network, the implementation URB EN PACT project in Alto Minho foresaw the mobilisation of local stakeholders around a common objective – to cocreate Alto Minho's IPA - thus reinforcing this territory's institutional cooperation and territorial cohesion. This has contributed to the mainstreaming of a multi-level approach, strengthening existing cooperation bonds between Alto Minho's local entities - both public and private; associations, cooperatives, local authorities, and businesses (regardless of their type and size); overall citizens, etc - and, allowing to connect European and National objectives/targets to Local context, priorities and needs and as far as Energy Transition, *latu sensu*, is concerned.

Due to COVID-19 pandemic, most of the meetings, whether transnational or local, were held online and digital tools were used to allow and encourage active participation of all attendees. Whenever possible, a local meeting (either an ULG meeting or solely amongst the Alto Minho's URB EN PACT project team) was organized after each transnational meeting (TM) – thus allowing the exchange of ideas and the capitalization of the lessons learnt.

The overall process and the main steps taken to co-build Alto Minho's IAP may be summarized as follows:

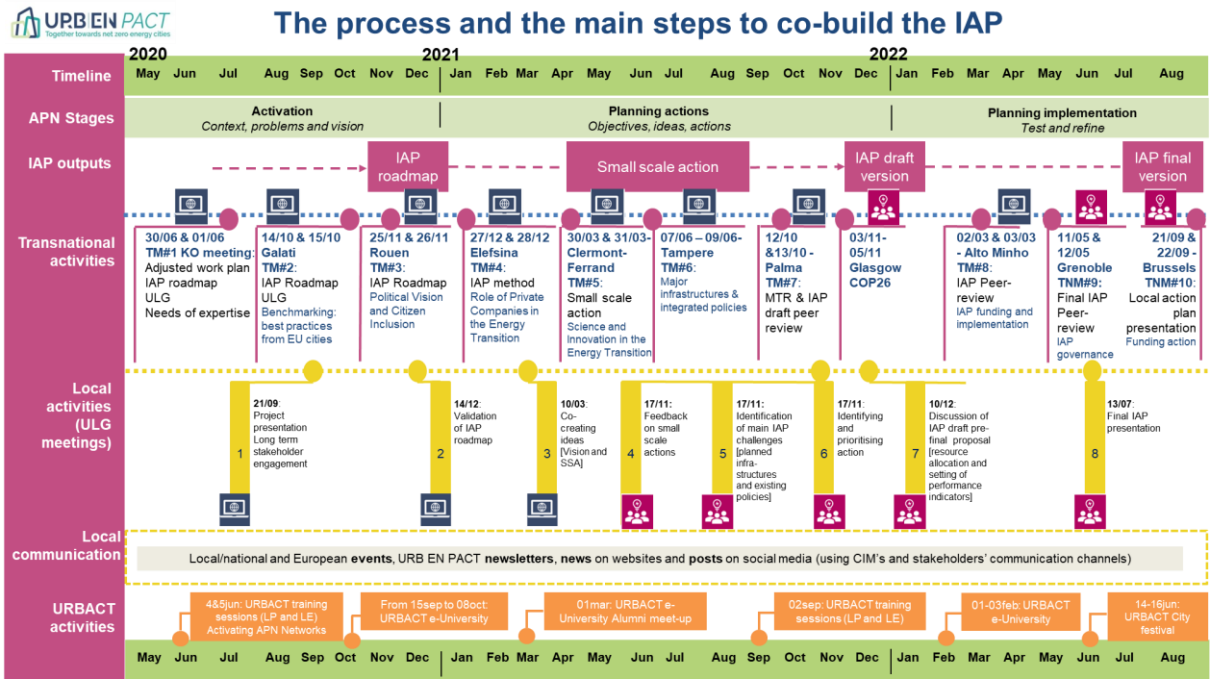


figure 9 - Process and the main steps taken to co-build Alto Minho's IAP (updated version of Alto Minho's IAP roadmap)

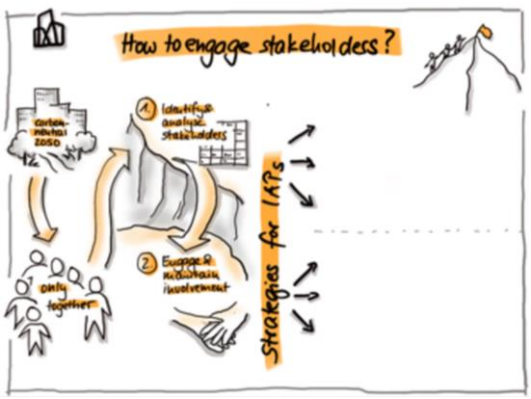
As for the topics which were addressed during such meetings, despite all being relevant to the topic in question – becoming, before 2050, net-zero energy territories – they varied yet complemented each other. Climate action; circular economy; energy efficiency; renewable energy sources (PV; geothermal; offshore wind; ocean energy); district heating; sustainable mobility (EV; hydrogen; soft modes); citizen involvement and awareness-raising; long term strategic planning; digital transition; just transition (including gender equality), are examples of such topics. Aside from these, issues at the network level were also discussed – general reporting; communication chart; setting up a common vision; stakeholder engagement and involvement (including ULG); IAP roadmap; action

planning and prioritising; IAP content; peer review; small scale actions; IAP implementation and funding as well as common communication network activities are examples of such issues.

figure 10. "Postcards" from transnational meetings.

4.4.2. A participative process through the URBACT Local Group (ULG)

At a local level, the participative approach was carried out by setting up Alto Minho's URBACT Local Group (ULG) - which integrated several representatives from social, economic, environmental, and energy sectors (Alto Minho's municipalities, NGOs, SMEs, universities, citizens, and other relevant stakeholders) – and by organizing joint events - mostly online meetings due to the ongoing COVID-19 pandemic crisis.



Alto Minho's URB EN PACT ULG common objective was to jointly, through a participative approach, agree on integrated solutions to meet Alto Minho's needs and challenges for it to become net-zero energy territory before 2050.

Amongst others, issues associated with stakeholders' engagement, maintaining their interest and involvement, and organising joint decision-making throughout the entire delivery process of Alto Minho's Integrated Action Plans, in times of COVID-19, had to be dealt with.

figure 11. Schematic representation on "How to engage stakeholders?" (courtesy of URB-EN PACT project's ad Hoc expert **Birgit Georgi**)

a) Who is part of the ULG?

To determine which stakeholders were to integrate Alto Minho's ULG, the Stakeholders Ecosystem Map tool (URBACT's toolbox) was used - both at the beginning of the project and then repeated during the project cycle to readjust this group's composition. The aim being to bring together a multi-stakeholder group, made up of relevant individuals and entities, interested in or related to the policy challenge at hand, and to engage this group in the process right from the outset of the URB EN PACT project.

Alto Minho's core ULG structure may be schematically represented as follows:

figure 12. Alto Minho's core ULG structure

Despite not integrating Alto Minho's core ULG, the following entities were also called upon to contribute to the cocreation process of Alto Minho's IAP "**ALTO MINHO towards a net-zero energy transition | co-creating a sustainable future**", and will also play an important role in this plan's future implementation and assessment: **ACIAB** – Associação Comercial e Industrial de Arcos de Valdevez e Ponte da Barca; **ACICMM** – Associação Comercial e Industrial dos Concelhos de Monção e Melgaço; **AEPL** – Associação Empresarial de Ponte de Lima; **AEV** – Associação Empresarial de Valença; **AEVC** – Associação Empresarial de Viana do Castelo; **IP** – Infraestruturas de Portugal; **AdAM** – Águas do Alto Minho; **APFVMINHO** – Associação de Produtores Florestais do Vale do Minho; **AFLIMA** – Associação Florestal do Lima. Furthermore, **citizens** were also invited to give their contribution, namely by filling out an online survey on energy transition in Alto Minho made available during the URB EN PACT's project implementation – sharing their points of view on commitments; responsibilities and priorities of intervention to achieve the net-zero territory goal (for further information see 3.2. **Small scale actions description and feedbacks, namely Small Scale Action #3 – TEST the use of digital collaborative tools to promote population integration and participation).**

b) How has the ULG worked on the IAP?

Overall, 8 ULG meetings were set up, from May 2020 to August 2022, each dedicated to a certain topic, aiming to allow the exchange of ideas and joint decision making.

In the IAP roadmap they were scheduled to be held after each transnational meeting (TM) – thus allowing the exchange of ideas and the capitalization of the lessons learnt – however some adjustments need to be made.

The undertaken approach can be summarized as follows:

			Objectives and main content of the ULG	Specific involved stakeholders (beyond ULG members)	Link with Transnational meetings (TM) (pre & post)	Main outputs and results of the ULG meeting	Local communication activities	Risks to anticipate / manage (elections…)
May-Dec 2020	ACTIVATION	ULG1 21.09	- Presentation of URBACT programme and of URB-EN Pact objectives - Sharing of the context/ baseline study (phase 1): SWOT analysis, local needs / expectations - Definition of shared vision and of common objectives at the local level - Invitation to access Urbact e-University contents / tools	Just ULG members	- Project timeline / deliveries - Presentation of the Integrated Action Plan Roadmap - Upcoming events	- Main stakeholders identified; - Shared vision of our context and of our objectives in URB EN PACT network; - Identified needs / lacks of data / main expectations; - Compromise to share ULG members' strategic plans.	- Publication of news on CIM Alto Minho's institutional *website*; - Publication of posts on CIM Alto Minho's institutional as well as on stakeholders' communication channels / social media	- Difficulty to mobilise ULG members through digital tools - Overlapping of digital events (agenda overbooking) - Imperative to articulate ULG members' strategic plans
		ULG2 14.12	- Presentation of the IAP roadmap proposal - Participatory problem analysis - Discussion on how to "replicate" shared best practices from EU cities in Alto Minho's territory [TM2] - Discussion on ways to promote citizen inclusion - Presentation of the "Mayor's conference & Citizen Inclusion" main results [TM3]	Just ULG members	- Presentation and sharing of the IAP template provided by the LE - Sharing content of TM2 and TM3	- Feedback and validation of Alto Minho's IAP roadmap; - Participatory diagnosis; - Shared vision on the potential of best practices replication (benchmarking and political / citizen's engagement). - Exchange on how and when to involve citizens	- Publication of news on CIM Alto Minho's institutional *website*; - Publication of posts on CIM Alto Minho's institutional as well as on stakeholders' communication channels / social media	- Difficulty to mobilise ULG members through digital tools - Overlapping of digital events (agenda overbooking) - Challenges of the participatory approach - Imperative to articulate ULG members' strategic plans
Jan-Dec 2021	PLANNING ACTIONS	ULG3 10.03	- Generating and co-creating ideas (IAP) - Presentation and discussion of the best options to ensure company inclusion - Small scale actions pre-assessment [baring in mind the baseline study (phase1)] - Presentation of "Inclusion of the economic world" main results [TM4]	Local businesses (Micro and SMEs) or their representatives	- Presentation and sharing of company inclusion examples provided during TM4 - Sharing content of TM4	- List of ideas based on potential impact vs implementation challenge - Draft of possible small scale actions to undergo during the implementation of the URB EN PACT project	- Publication of news on CIM Alto Minho's institutional *website*; - Publication of posts on CIM Alto Minho's institutional as well as on stakeholders' communication channels / social media	- Difficulty to mobilise ULG members through digital tools - Overlapping of digital events (agenda overbooking) - Challenges of the co-creation process - Imperative to articulate ULG members' strategic plans
		ULG4 17.11	- Joint action planning (SMART) - Feedback on small scale actions - Presentation of "Innovation & public-private partnerships" main results [TM5]	Just ULG members	- Inputs on small scale actions provided during TM5 - Sharing content of TM5	- Action planning (1st draft); - List of small scale actions to undergo during the implementation of the URB EN PACT project	- Publication of news on CIM Alto Minho's institutional *website*; - Publication of posts on CIM Alto Minho's institutional as well as on stakeholders' communication channels / social media	- Difficulty to mobilise ULG members - Overlapping of events (agenda overbooking) - Challenges of joint planning - Imperative to articulate ULG members' strategic plans - Changes in local policies/priorities as a result of the outcome of the Mayor's elections
Jan-Dec 2021	PLANNING ACTIONS	ULG 5 17.11	- Joint action planning (policies and infrastructures integration) - Presentation of "Major infrastructures & integrated territorial policies" main results [TM6]	Just ULG members	- Inputs on Major infrastructures and integrated territorial policies provided during TM6 - Sharing content of TM6	Identification of main IAP challenges [ensure the IAP is operational; is integrated; is coherent with existing/foreseen policies and with major infrastructures]	- Publication of news on CIM Alto Minho's institutional *website*; - Publication of posts on CIM Alto Minho's institutional as well as on stakeholders' communication channels / social media	- Difficulty to mobilise ULG members - Overlapping of events (agenda overbooking) - Challenges of joint planning - Imperative to articulate ULG members' strategic plans - Changes in local policies/priorities as a result of the outcome of the Mayor's elections
		ULG 6 17.11	- Discussion on IAP draft version - Presentation and discussion of the different possibilities to fund energy action - Sharing inputs from "Glasgow COP26"	Just ULG members	- Sharing inputs from "Glasgow COP26"	- Set of available sources of funding - ULG members' inputs on IAP draft version proposal	- Publication of news on CIM Alto Minho's institutional *website*; - Publication of posts on CIM Alto Minho's institutional as well as on stakeholders' communication channels / social media	- Difficulty to mobilise ULG members - Overlapping of events (agenda overbooking) - Challenges of joint planning - Imperative to articulate ULG members' strategic plans - Changes in local policies/priorities as a result of the outcome of the Mayor's elections
Jan-Aug 2022	PLANNING IMPLEMENTATION	ULG 7 10.12	- Setting of performance indicators [Monitoring IAP implementation]	A technical/academic expert on territorial policies [energy related] A technical expect on resourcing [both human and financial means for IAP implementation]	- Preparation of TM8	Defined strategy for making IAP's implementation visible [allocation of indicators per action]	- Publication of news on CIM Alto Minho's institutional *website*; - Publication of posts on CIM Alto Minho's institutional as well as on stakeholders' communication channels / social media	- Changes in local policies/priorities as a result of the outcome of the Mayor's elections - Difficulty to politically validate IAP content
		"ULG 7.2"						
		ULG 8 14.07	- Final IAP proposal presentation - Presentation of peer review feedback [TM9]	Just ULG members	- Sharing of peer review feedback - Sharing content of TM9	IAP Final version [for political/technical validation]	- Publication of news on CIM Alto Minho's institutional *website*; - Publication of posts on CIM Alto Minho's institutional as well as on stakeholders' communication channels / social media	- Changes in local policies/priorities as a result of the outcome of the Mayor's elections - Difficulty to commit to IAP's implementation

figure 13. Alto Minho's ULG meetings details (an updated version of Alto Minho's IAP roadmap).

Due to the covid pandemic crisis, the majority of the ULG meetings were Virtual meetings - Cisco Webex Meetings.

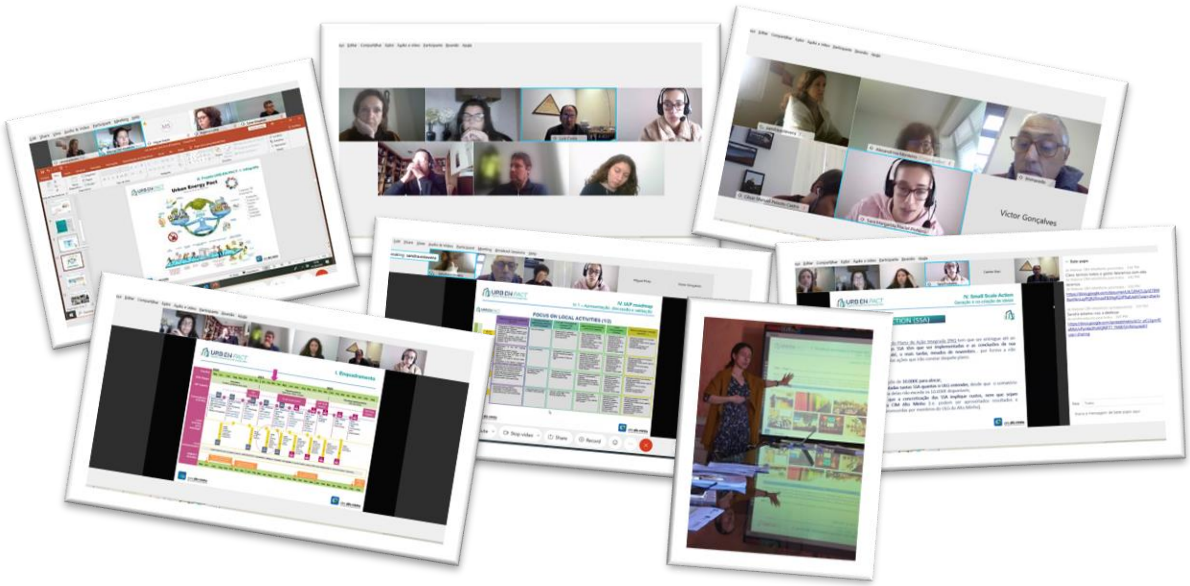


figure 14. “Postcards” from ULG meetings.

Besides being invited to participate in the ULG meetings, all ULG members were encouraged to attend each TM and some of them were formally invited to share their perspectives on certain aspects during such meetings. This allowed Alto Minho’s ULG members to interact first-hand with the various attendees (either project partners, experts, or speakers); to give their opinion and inputs on the topics which are being discussed; to exchange contacts with not just the whole URB EN PACT partners and experts but also with the presenters themselves.

All the information, which was produced, both at local and transnational levels, was forwarded to all ULG members, as were the links to all the working documents and to the information which was made available during the URBACT e-Universities and the URBACT City Festival.

5. PLANNED ACTION IMPLEMENTATION

In 2016, during the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), Portugal adopted the target of being carbon neutral by 2050, having developed a Roadmap for Carbon Neutrality 2050 (Roteiro para a Neutralidade Carbónica – RCN 2050), which sets out Portugal's vision, trajectories, and guidelines for the policies and measures to be implemented within this time frame.

The RCN 2050 was published through Council of Ministers Resolution No 107/2019 of 1 July 2019 and constituted the long-term development strategy for low greenhouse gas emissions submitted to the UNFCCC on 20 September 2019. In keeping with the conclusions of the IPCC Special Report on 1.5°C, RCN 2050 also concluded that greater efforts must be made during the 2021-2030 decade to reduce GHG, this being an essential decade to align the national economy with a carbon-neutral trajectory. Thus, ambitious but attainable goals were established, coordinated with the RCN 2050 objectives for the 2030 horizon. These were set out in the National Plan for Energy and Climate 2030 (PNEC 2030), which is the main Portuguese climate and energy policy tool for 2021-2030, approved by Council of Ministers Resolution no. 53/2020, of July 10th, aiming to achieve a carbon-neutral future.

At national level, the Long-Term Strategy for the Renovation of Buildings (ELPRE), approved by Resolution of the Council of Ministers No. 8-A/2021, of 3rd February, should also be highlighted, being fully aligned with the national goals in terms of energy and climate to achieving carbon neutrality in 2050, as well as for the fulfilment of other strategic objectives, namely the fight against energy poverty.

As far as the regional/local level is concerned, the cocreated strategy established for the territory of Alto Minho, was set to be fully aligned with the strategy defined by the Portuguese Government at national level but comprising the necessary adjustments to guarantee it meets this territory's specificities, challenges, and needs.

The challenges overall society faces require concerted action between energy and climate policies, since this is the only possible way to achieve a carbon-neutral economy and a society that both promotes economic growth and better quality of life. To this end, Alto Minho's IAP is a fundamental tool to ensure that energy, but also climate goals for 2050 are achieved and it is a forward-looking plan to implement Alto Minho's long-term objectives.

5.1. Actions description and planning

5.1.1. The action plan in one glance

In line with the National Plan for Energy and Climate 2030 (PNEC 2030) and aiming for Alto Minho to become, before 2050, a net zero energy territory, Alto Minho's IAP foresees a total of 19 actions, in the following 8 strategic objectives:

- Specific objective #1: DECARBONISING ALTO MINHO'S ECONOMY: integrates 4 actions which aim to contribute to Alto Minho's GHG emission reduction trajectory in all sectors of activity, including energy and industry, mobility and transport, agriculture and forestry and waste and wastewater, and promote mainstreaming of mitigation objectives;
- Specific objective #2: PRIORITISING ENERGY EFFICIENCY: integrates 3 actions which aim to reduce primary energy consumption in a context of sustainability and cost-effectiveness, focus on energy efficiency and resource efficiency, focus on rehabilitation, reallocation, and renovation of buildings;
- Specific objective #3: STRENGTHENING ALTO MINHO'S COMMITMENT TO RENEWABLE ENERGY, THUS REDUCING THE TERRITORY'S ENERGY DEPENDENCY: integrates 2 actions which aim to enhance the diversification of energy sources through increased and sustainable use of indigenous resources and to encourage decentralized energy generation;
- Specific objective #4: ENSURING SECURITY OF ENERGY SUPPLY: integrates 1 action which aims to ensure the maintenance of a resilient and flexible system with diversification of energy sources, strengthening,

modernising, and optimising energy infrastructure, redesign and digitalisation of the energy system, maximising its flexibility;

- Specific objective #5: PROMOTING SUSTAINABLE MOBILITY: integrates 3 actions which aim at decarbonising the transport sector by fostering modal shift and improving public transport service and networks, promoting electric and active mobility and the use of clean alternative fuels;
- Specific objective #6: PROMOTING SUSTAINABLE AGRICULTURE AND FORESTRY; BOOSTING CARBON SEQUESTRATION: integrates 2 actions which aim at reducing the carbon intensity of farming practices and promoting effective agro-forestry management by contributing to increasing the natural sink capacity;
- Specific objective #7: DEVELOPING AN INNOVATIVE AND COMPETITIVE INDUSTRY: integrates 1 action which aims at promoting industrial modernisation by focusing on innovation, decarbonisation, digitalisation (Industry 4.0) and circularity, contributing to increasing the competitiveness of the local economy;
- Specific objective #8: ENSURING A JUST, DEMOCRATIC AND COHESIVE TRANSITION: integrates 3 actions, which aim to strengthen the role of the citizen as an active actor in decarbonisation and energy transition, combat energy poverty, promote active citizen engagement and territorial development.

Detailed description of each of the foreseen actions can be found on section 5.1.2 – Detailed action sheet bellow.

5.1.2. Detailed action sheet

Specific objective #1: DECARBONISING ALTO MINHO'S ECONOMY					
Action #1.1	DECARBONISING URBAN SETTLEMENTS				
Context and objectives	According to the United Nations, cities are responsible for 75% of global CO_2 emissions, transport and buildings being among the largest contributors, making them vulnerable to climate change, natural disasters such as heat waves, flooding, droughts, landslides, and health problems. If no measures are undertaken, this percentage tends to increase (according to the European Commission estimates, by 2050, approximately 85% of Europeans will be living in urban areas). It is therefore imperative to make cities more resilient, sustainable, inclusive, and safe, where achieving climate-resilience is key to avoid human, social and economic losses. The aim is to reduce the carbon intensity of the building stock (residential and non-residential) and to use energy more efficiently; to improve knowledge on climate change mitigation, by disseminating good practices and boosting low-carbon behaviour in society; to promote the sustainable and rational use of the territory, minimising GHG emissions and intensifying carbon sequestration.				
Description of activities	1.1.1. Assess overall public urban development policy integration, at local level, and, if needed, establish mechanisms to promote integration; 1.1.2. Set up a digital platform for GHG emission and energy consumption accounting and reporting, based on the prior definition of a set of smart process and result indicators; 1.1.3. Encourage dissemination and demonstration of good practices and set up of information sharing networks with climate action objectives [e.g., promoting participation in initiatives to disseminate best practices on climate change mitigation; setting up and/or integrating climate action networks; disseminating and raising public awareness, through local media, on climate action; 1.1.4. Plan regeneration and revitalization of urban settlements, taking into account sustainability criteria [by, for e.g., promoting functional densification of urban settlements, including diversification and enhancement of the establishment of local services and commerce in order to encourage sustainable mobility patterns; promoting energy sustainability in public spaces and urban systems, including energy efficiency of street lighting and energy and water efficiency of urban water and wastewater systems; promoting the energy sustainability of industrial, technological and business parks, as well as ports and logistic platforms; promoting urban agriculture by contemplating the creation of dedicated spaces integrated into the urban structure prone to agriculture usage (urban gardens); fostering the creation, expansion and/or quality improvement of urban green areas enhancing their role as carbon sinks and urban microclimate regulators]; 1.1.5. Assess the viability of promoting urban settlements' decarbonisation living labs, involving municipalities, knowledge institutions and businesses in the development of pilot projects.				
Output/deliverables	Shift to an increasingly sustainable strategic urban planning, prioritising resource efficiency (including energy) and promoting sustainable mobility.				
Lead organization	Local public administration (municipalities)		**Key Partners**	Regional and National public administration; AREA Alto Minho	
Timescale	2020-2025				
Cost estimation	10.000.000,00 €	**Type of expenditures**	Staff; external expertise; studies; services	**Main sources of funding**	Life programme, EEA grants, National or Regional Operational Programmes
Indicators	% of plans/strategic documents, at municipal and regional levels, which take into account sustainability criteria; n. best practices exchange events; n. of platform inputs				
Status	Planned				
Inspiration	TNM#2 - Benchmarking: Best Practices from EU cities / TNM#3 – Political Vision and Citizen Inclusion / TNM #6 – Major Infrastructures & Integrated Policies / COP 26 / URBACT City Festival (site visit: new sustainable sites]				

Specific objective #1: DECARBONISING ALTO MINHO'S ECONOMY					
Action #1.2	DECARBONISING LOCAL PUBLIC ADMINISTRATION				
Context and objectives	In Alto Minho, local authorities are at the forefront of tackling most of the issues addressed by the Sustainable Development Goals (SDGs), playing a fundamental role in ensuring the safety, security, livelihoods, and wellbeing of their communities. As far as local public administration's energy transition and decarbonization are concerned, despite the already undertaken actions, there are still actions to be implemented. Decarbonising local public administration - as far as transport, mobility, buildings, and public procurement are concerned - and continuing to contribute to meeting the SDGs and to lead by example, inspiring others to do the same, are objectives to be pursued and accomplished.				
Description of activities	1.2.1. Promote rehabilitation as the main form of action at building and urban development level, in line with the EU renovation wave [priority will be given to tackling energy poverty and worst-performing buildings; renovation of public buildings and decarbonisation of heating,]; 1.2.2. Decarbonise local government building stock, by implementing energy efficiency measures and/or by incorporating renewable energy solutions [e.g., electrification of energy use in buildings; implementation of more efficient air-conditioning solutions and installation of solar thermal collectors for heating in buildings or equipment with major energy needs such as swimming pools, sports grounds, schools, and multipurpose halls; installation of PV systems for self-consumption; etc.]; 1.2.3. Implement public strategic procurement, by embedding social and environmental criteria into local authorities' public procurement procedures (e.g., promoting the purchase of low-carbon services instead of products; incorporating low-carbon requirements in public purchases of goods and services (including energy), of equipment and buildings and of vehicles and transport services]; 1.2.4. Implement municipal sustainable mobility strategies [e.g., assessing the viability of home office; promoting low emission vehicle penetration in the municipal vehicle fleet; eco-driving training, awareness raising and encouraging active mobility (soft modes of transport), the use of public transports, car sharing and car-pooling initiatives targeting municipalities' employees as means to induce behavioural change].				
Output/deliverables	Significant improvement of Alto Minho's local administrations' environmental footprint by: (i) leading innovative and ambitious policies; (ii) prioritizing low-carbon mobility options; (iii) reducing energy intensity and increasing the efficiency of the municipal fleet; (iv) promoting a low-carbon building stock and by (iv) adopting low-carbon requirements in public procurement.				
Lead organization	Local public administration (municipalities)		**Key Partners**	National public administration; ADENE; DGEG; CIM Alto Minho	
Timescale	2020-2030				
Cost estimation	24.751.231,23 €	**Type of expenditures**	Staff; external expertise; studies; equipment; works	**Main sources of funding**	Energy Performance Contracts (EPC); European City Facility (EUCF); Energy Efficiency Fund (FEE); Environmental Fund (FA); Innovation Support Fund (FAI); National or Regional Operational Programmes
Indicators	n. of sustainable energy investments; energy savings (expressed in MWh/year); renewable energy production (expressed in MWh/year); n. of strategic public procurement tenders launched; n. of buildings that have undergone intervention; % municipal fleet renewed; n. of attendees in the training and in the awareness raising actions				
Status	Ongoing				
Inspiration	TNM#3 – Political Vision and Citizen Inclusion / COP 26 / URBACT - Online Strategic Procurement Course [March 2021 edition] / SSA#1				

Specific objective #1: DECARBONISING ALTO MINHO'S ECONOMY					
Action #1.3	REDUCING WASTE PRODUCTION AND DIRECT DEPOSIT OF WASTE IN LANDFILLS AND PROMOTING RECYCLING CHAINS				
Context and objectives	Over the last decades, Alto Minho has increasingly shifted its focus regarding waste from disposal methods to prevention and recycling. Moving waste management up the 'waste hierarchy' is essential to extract more value from resources while reducing the pressures on the environment and creating jobs. To decarbonise the waste sector, it is a priority to reduce waste generation and, when it is not possible, to return it to the economy with the highest added value. In compliance with EU and national legislation and with the national strategy in this area, the most noble operations of the waste hierarchy are to be encouraged by reducing landfilling and increasing the separate collection of biowaste and of recyclable materials with a view to promoting circularity as well as recycling chains.				
Description of activities	1.3.1. Promote awareness raising actions targeting both the citizens (special emphasis to schools) and the HORECA sector, aiming: to reduce landfilling; to encourage the separate collection of biodegradable urban waste (thus also contributing to increasing the quantity and quality of biowaste); to enhance re-use, recycling, and to improve recyclable waste quantity and quality; 1.3.2. Consolidate and optimise waste management networks (e.g., favouring proximity of the collection network to the user and selective separation; leveraging synergies in waste collection and treatment in a complementary logic and improving treatment efficiencies by using the best available techniques); 1.3.3. Increase energy generation efficiency in waste management facilities, by promoting the replacement of inefficient equipment (namely motor-generator groups), hence improving energy production from the recovery of landfill gas.				
Output/deliverables	By 2035, no more than 10% of municipal waste is to be landfilled; landfilling of waste which has already been separated and sorted for recycling is to be banned and recycling and re-use of municipal waste should reach 65%, with a target of 75% set for the recycling of packaging waste.				
Lead organization	Local public administration (municipalities); RESULIMA; VALORMINHO		**Key Partners**	CIM Alto Minho; schools; businesses [HORECA sector]; society	
Timescale	2020-2030				
Cost estimation	31.122.539,10 €	**Type of expenditures**	Staff; external expertise; studies; equipment; services	**Main sources of funding**	Environmental Fund (FA), National or Regional Operational Programmes.
Indicators	% of waste reduction in landfills; % of recycling and re-use of waste; % of recycling of packaging waste; estimated increase in renewable energy production from biowaste (expressed in MWh/year); n. of awareness raising actions carried out; n. of attendees in the awareness raising actions				
Status	Ongoing				
Inspiration	TNM#2 - Benchmarking: Best Practices from EU cities / TM#4 - The role of Private Companies in the Energy Transition / TNM#5 – Science & Innovation in the Energy Transition / COP 26				

Specific objective #1: DECARBONISING ALTO MINHO'S ECONOMY					
Action #1.4	PROMOTING THE TRANSITION TO A CIRCULAR ECONOMY				
Context and objectives	Despite not being as relevant in Alto Minho as is in other regions, the overexploitation of natural resources (raw materials, water, and energy) required to achieve economic growth and development continues to negatively impact the environment and to adversely affect these resources' availability and cost. Planning the transition from a traditional linear economy pattern to a circular economy, which offers new ways to create a more sustainable economic growth model, is crucial and the implementation of such plan/strategy will prove to be beneficial to businesses, society, and the environment. In contrast to the 'take-make-waste' linear model, a circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources and subsequently plays a vital role in decarbonising Alto Minho's overall economy.				
Description of activities	1.4.1. Create a Circular Economy Forum to access/support/encourage the transition to an increasingly circular economy model, based on regional/local metabolism analysis and identification of opportunities for closing cycles [aiming to ponder and, if applicable, promote: (i) the recirculation of materials (e.g. boosting the market for recyclable materials; strengthening management systems for specific waste streams from a synergies perspective; planning and setting up new industrial areas from an industrial symbiosis perspective, with plans to rationalise materials and energy and rehabilitating existing industrial areas; developing innovation projects; promoting the production and use of water for reuse, obtained from waste water treatment; promoting the use of compost which result from the recycling of bio-waste; encouraging design to enable dismantling and further facilitating the separation of materials; recovering material energy; promoting the use of biogas for energy production; promoting the incorporation of waste into biofuels); (ii) material efficiency of products [by, for e.g. improving production processes aiming to generate less waste; reusing components in the production process; encouraging product design (privileging the use of less materials, of materials that are more resistant and durable and favouring the incorporation of natural or recovered materials)].				
Output/deliverables	Circular economy "task force"; Strategic multisectoral integrated plans which foresee/promote: the efficient use of resources; increased recycling and usage of recycled materials; remanufacturing, refurbishment and reuse of products and components; the transition towards a more circular product and process design, whilst, at the same time, promote growth, investment, and employment.				
Lead organization	Public administration (local/regional in articulation with national authorities)	**Key Partners**	National public administration; academia; businesses; society; NGO's		
Timescale	2020-2025				
Cost estimation	350.000,00€	**Type of expenditures**	Staff; external expertise; studies	**Main sources of funding**	EEA grants; Environmental Fund (FA), National or Regional Operational Programmes
Indicators	n. of plans and/or strategic documents; n. of municipalities that will benefit from the undertaken action; n. of engaged stakeholders				
Status	Planned				
Inspiration	TNM#3 – Political Vision and Citizen Inclusion / TNM#4 - The role of Private Companies in the Energy Transition / COP 26				

Specific objective #2: PRIORITISING ENERGY EFFICIENCY					
Action #2.1	PROMOTING ENERGY EFFICIENCY IN BUILDINGS				
Context and objectives	In Portugal the buildings sector is responsible for approximately 30% of the final energy consumption. However, more than 50% of this consumption can be reduced through energy efficiency measures, with the inherent repercussions in terms of CO_2eq emission reduction. Renovating both public and private buildings is an essential action, and has been singled out in the European Green Deal as a key initiative to drive energy efficiency in the sector and deliver on objectives. Additionally, given the labour-intensive nature of the construction sector, which is largely dominated by local businesses, building renovations can also play a crucial role in local economic recovery after the COVID-19 pandemic. For Alto Minho to become a net zero energy territory, as far as the overall building stock is concerned, the goal is to: reduce the carbon intensity of the building stock; increase the number of energy efficient buildings [either new constructions (preferably Nearly Zero-Energy buildings (NZEB)) or renovated existing buildings); privilege the use of energy efficient equipment; replace fossil fuels by renewable energy sources; promote further electrification of the sector (by, for e.g. decarbonising heating and cooling); promote the use of low carbon materials; promote the replacement of inefficient/obsolete/dated equipment and well as promote behavioural change.				
Description of activities	2.1.1. Implement the Portuguese long-term strategy for buildings renovation in Alto Minho [by, for e.g., renovating Alto Minho's building stock (residential and non-residential); promoting the transition to NZEBs, thus reducing emissions, enhancing quality of life for people living in and using the buildings, and creating green jobs in the construction sector); 2.1.2. Promote the electrification of energy use in buildings and increase the incorporation of renewables; 2.1.3. Promote the purchase and refurbishment of renewable heating and cooling systems; 2.1.4. Promote the replacement of inefficient plug-in equipment.				
Output/deliverables	Building stock renovation leading to improved building stock energy and environmental performance; improved quality of life of building users; economic recovery and creation of green jobs; alleviated energy poverty [non-vulnerable consumers].				
Lead organization	Building sector (amongst which, building owners/managers)		**Key Partners**	Public administration (local/regional and national authorities); ADENE; DGEG	
Timescale	2021-2050				
Cost estimation	1.145.536.000,00€	**Type of expenditures**	Staff; external expertise; equipment; works	**Main sources of funding**	Energy Performance Contracts (EPC); Energy Efficiency Fund (FEE); Horizon Europe; Programme for the efficient use of gas and electricity (PPEC); National or Regional Operational Programmes; Private funds
Indicators	energy savings (expressed in MWh/year); renewable energy production (expressed in MWh/year)				
Status	Ongoing				
Inspiration	TM#3 – Political Vision and Citizen Inclusion / TNM#5 – Science & Innovation in the energy transition / TNM #6 – Major Infrastructures & Integrated Policies / COP 26				

Specific objective #2: PRIORITISING ENERGY EFFICIENCY					
Action #2.2	PROMOTING ENERGY EFFICIENCY IN STREET LIGHTING				
Context and objectives	In Alto Minho, Street Lighting (IP,) accounts for 3,27% of this territory's overall electricity consumption (DGEG, 2020 provisional data) thus representing a very significant annual financial burden for the municipalities. On the other hand, despite the investments already made by Alto Minho's Municipalities and by E-Redes, there is still a great potential for energy savings. In this context, it is essential to promote investment in an efficient, new-generation IP that can adapt the necessary lighting levels for pedestrian and vehicle safety (in line with existing standardisation for public roads), increase energy savings, enable the introduction of new functionalities and applications for consumption management and control, and enhance Smart Cities.				
Description of activities	2.2.1 Upgrade and installation of street lighting infrastructure in compliance with EN 13201 road lighting standards and in line with green public procurement criteria (includes installation of LED luminaries); 2.2.2 Provide inputs to the Nacional Street Lighting Energy Management System (includes installation of intelligent metering systems; street lighting mapping draw up and reporting; and elaboration of an IP's energy upgrading plan for 2030, with annual reporting of the energy savings achieved).				
Output/deliverables	Renovated and increasingly efficient public street lighting.				
Lead organization	Public administration (local/regional in articulation with national authorities)	**Key Partners**	E-redes; DGEG; ERSE; ANMP		
Timescale	2.2.1.: 2021-2040 || 2.2.2.: 2021-2030				
Cost estimation	10.000.000,00€	**Type of expenditures**	Studies; external expertise; works	**Main sources of funding**	Energy Performance Contracts (EPC); European City Facility (EUCF); Energy Efficiency Fund (FEE); Programme for the efficient use of gas and electricity (PPEC); National or Regional Operational Programmes
Indicators	energy savings (expressed in MWh/year); n. of replaced lightbulbs; n. of plans and/or strategic documents.				
Status	Ongoing				
Inspiration	TNM#2 - Benchmarking: Best Practices from EU cities / TNM#3 – Political Vision and Citizen Inclusion / COP 26				

Specific objective #2: PRIORITISING ENERGY EFFICIENCY					
Action #2.3	PROMOTING VOCATIONAL TRAINING FOR THE ENERGY EFFICIENCY SECTOR AND ENCOURAGING R&D&I ON ENERGY EFFICIENCY				
Context and objectives	When it comes to implementing energy efficiency projects, the lack of practitioner skills can become a barrier. Despite there being several training organisations, which are currently involved in technical and vocational training (TVET) for energy-efficiency, there is a gap in the actual training curricula and the skills needed on energy efficiency at the local level. Bearing in mind that skills and vocational training are key factors for competitiveness, economic growth and job creation, and aiming at supporting energy transition, it is crucial to encourage the development of local TVET for energy-efficiency related professionals, to enhance skills for faster, higher quality and more effective energy efficiency implementation, for strengthening the professional skills and qualifications of technicians on energy efficiency will allow to meet the targets and objectives set at local, regional, national and European levels. On the other hand, when it comes to energy transition, boosting innovation on energy efficiency is of paramount importance as is supporting the development of technologies, practices, products, and services that, per se, promote more and better energy efficiency in the various strands (buildings, transport, industry, etc.), as well as supporting the participation of local/regional stakeholders in research and innovation programmes that contribute to the overall promotion of energy efficiency.				
Description of activities	2.3.1. Promote new training strands for specialised technicians in the energy efficiency and renewable energy sector (including training for NZEB construction technicians and specialists) [amongst the new skills to be promoted, focus on: (i) Energy Efficiency Project and Audit; (ii) Design and installation of solar thermal and PV systems; (iii) Energy Management in non- residential buildings, together with the existence of Installation and Maintenance Technicians (TIM); (iv) Design, installation and maintenance of street lighting systems; (v) Control and Management Systems to meet the requirements of the new EPBD Directive and to introduce new technological solutions in buildings; (vi) Measurement & Verification of energy efficiency improvement projects, based on IPMVP — International Measurement and Verification Protocol]; 2.3.2. Training of technicians and specialists on construction and NZEB [privileging a life cycle approach, to ensure these buildings' "proper" performance during their lifetime, from the design phase of the project, through the construction phase and ending in the exploitation/use phase of these buildings]; 2.3.3. Encourage research and innovation in the field of energy efficiency [for e.g. aiming: to increase the uptake of sustainable solutions, of local resources, of innovative materials; at developing/experimenting creative/innovative solutions and strategies for the integration of renewable energy systems, storage and management of energy consumption and information].				
Output/deliverables	Development of energy efficiency related training; improved skills and increased knowledge on energy related issues.				
Lead organization	Academia [IPVC and Alto Minho's vocational schools]		**Key Partners**	Local public administration; businesses	
Timescale	2021-2035				
Cost estimation	1.000.000,00€	**Type of expenditures**	Staff; external expertise, services (research and investigation)	**Main sources of funding**	Energy Efficiency Fund (FEE); Foundation for Science and Technology Portugal (FCT); National or Regional Operational Programmes
Indicators	n. of training courses developed; n. of trainees				
Status	Planned				
Inspiration	TNM#5 – Science & Innovation in the Energy Transition / COP 26				

Specific Objective #3: STRENGTHENING ALTO MINHO'S COMMITMENT TO RENEWABLE ENERGY, THUS REDUCING THE TERRITORY'S ENERGY DEPENDENCY					
Action #3.1	ACCELERATING ELECTRICITY GENERATION AND STORAGE FROM RENEWABLE ENERGY SOURCES				
Context and objectives	Despite being highly dependent from weather conditions and, therefore, highly vulnerable to climate change, in Alto Minho, the contribution of indigenous renewable energy sources to electricity production has greatly increased over the last few years, thus contributing to the overall reduction of GHG emissions, to decreasing energy dependency, and to generating wealth, employment and economic growth/recovery. However, Alto Minho still has a huge a potential to produce clean energy from renewable resources, which is largely untapped [e.g., solar, offshore wind and ocean energy]. Achieving the net zero energy goal will only be possible if energy investments aiming to increase electricity storage and generation from renewables and to diversify the mix of used renewable energy sources in energy sector are put in place.				
Description of activities	3.1.1. Encourage increased offshore wind production [evaluating the economic and environmental viability of expanding offshore wind farms and/or offshore hydrogen production]; 3.1.2. Increase onshore wind production, by revamping and repowering dated wind farms; 3.1.3. Promoting ocean renewable energy [by, for e.g., exploiting Alto Minho's potential for ocean renewable energy, encouraging research and innovation in this area, and creating favourable conditions for the emergence of competitive industries, which may lead to the creation of a new exporting sector in these new energy technologies]; 3.1.4. Access means to increase green energy storage.				
Output/deliverables	Greener energy production; better use of high-value indigenous resources and resource areas, meeting faster the energy transition and carbon neutrality goals, with positive effects also in terms of environmental impacts, energy price, expenditure for incentives policy, employment, and energy dependence.				
Lead organization	Stakeholders from the Energy sector [production]		**Key Partners**	Local public administration (municipalities); DGEG; Academia	
Timescale	3.1.1., 3.1.3. and 3.1.4.: 2021-2030 || 3.1.2.: 2025-2050				
Cost estimation	516.300.000,00€	**Type of expenditures**	Staff; external expertise; services (research and investigation); equipment; works	**Main sources of funding**	Energy Efficiency Fund (FEE), Innovation Support Fund (FAI); Environmental Fund (FA); Programme NER300; horizon Europe; structural funds; National or Regional Operational Programmes; InnovFin Energy Demo Projects; Private funds
Indicators	renewable energy production (expressed in MWh/year); n. of studies/plans/scientific papers; n. of onshore wind park that have undergone intervention; installed power capacity increase [expressed in MW]				
Status	Ongoing				
Inspiration	TNM#5 – Science & Innovation in the Energy Transition / COP 26				

Specific Objective #3: STRENGTHENING ALTO MINHO'S COMMITMENT TO RENEWABLE ENERGY, THUS REDUCING THE TERRITORY'S ENERGY DEPENDENCY					
Action #3.2	PROMOTING THE SPREAD OF DISTRIBUTED GENERATION, VIA RENEWABLE ENERGY COMMUNITIES				
Context and objectives	Most of the energy production in Portugal is centralized, as is in Alto Minho. Under the current centralized generation paradigm, electricity is mainly produced at large generation facilities, shipped though the transmission and distribution grids to the end consumers; energy supply is adapted to demand, and consumers play a passive role in the management of the system. However, the recent quest for energy efficiency and reliability and reduction of greenhouse gas emissions led to explore possibilities to alter the current generation paradigm and increase its overall performances. In this context, one of the foreseen solutions to complement or even replace the existing paradigm is local and/or distributed generation where electricity is produced at or close to its point of use. Promoting the spread of local/distributed generation, i.e., production at or close to the place of consumption, leads to lower transmission and distribution network costs, reduced losses and optimisation of energy generation solutions, therefore, in a territory such as Alto Minho, with a significant number of dispersed urban settlements, should be promoted. Creating and developing renewable energy communities and encouraging self-consumption, will not only allow active participation of citizens in the energy system (for instead of passive consumers of transformed and transported energy to consumption points, these communities are responsible for the production and management of their own energy, sharing costs and benefits), but also contribute to the achievement of national goals for the use of renewable energy sources and for the reduction of greenhouse gas emissions, essentially relevant to the specific goals of photovoltaic solar generation.				
Description of activities	3.2.1. Implement renewable energy communities, leading to social innovation, citizen empowerment for the energy sector and its problems, local social and economic development, while contributing significantly to alleviating energy poverty [includes technical, legal, and/or financial support to the creation of renewable energy community projects at municipal level, accompanied by investments to disseminate information and to support their implementation).				
Output/deliverables	Boosted local and decentralized energy generation from renewables; improved local energy supply; increased overall grid efficiency and improved knowledge on renewable energy communities (technical, legal, and/or financial aspects/requirements).				
Lead organization	Public administration (local/regional in articulation with national authorities); businesses	**Key Partners**	DGEG; CIM Alto Minho; AREA Alto Minho		
Timescale	2021-2030				
Cost estimation	250.000.000,00€	**Type of expenditures**	Staff; external expertise	**Main sources of funding**	Energy Efficiency Fund (FEE); Innovation Support Fund (FAI); National or Regional Operational Programmes
Indicators	n. of established of renewable energy communities; n. of people/businesses that benefited from support; energy savings (expressed in MWh/year); renewable energy production (expressed in MWh/year)				
Status	Planned				
Inspiration	TNM#5 – Science & Innovation in the energy transition / TNM #6 – Major Infrastructures & Integrated Policies / COP 26 / SSA#1				

Specific objective #4: ENSURING SECURITY OF ENERGY SUPPLY					
Action #4.1	ADJUSTING THE ADEQUACY AND PROMOTING THE DIGITALISATION OF THE ENERGY NETWORK SYSTEM				
Context and objectives	As a result of the COVID 19 pandemic, the energy sector has undergone significant transformations, and will continue to undergo in proxy years, partly due to the increasing digitalisation of the sector and of the overall society. Promoting the energy transition in the energy sector will necessarily require a new approach, new network models, both for transmission and distribution, based on the search for synergies between the various available options, amongst which rapid and progressive upgrading and modernisation of infrastructure and market redesign and digitalisation.				
Description of activities	4.1.1. Revisit/adjust the adequacy of the current grid infrastructure (electricity and gas) for it will no longer be a passive grid, but will integrate a whole set of new concepts, from network intelligence, management support systems, smart metering, storage, energy management, local/decentralized energy generation, renewable energy communities, electric vehicles, among others; 4.1.2 Promote the expansion of smart meters (considering the key role smart meters play in an increasingly modern and digitalised energy system and their paramount importance to energy transition – for they allow access to real-time energy consumption and thus enable an improved, more dynamic, and efficient system management, favouring energy efficiency, improving offers to consumers and greater efficiency in the operation of networks – the installation of smart meters, for electricity and gas) is to be reinforced, promoting its roll-out for all consumers).				
Output/deliverables	Increasingly efficient energy distribution supply, whilst ensuring quality of service and security of supply; Consumer engagement; Installation of smart meters.				
Lead organization	REN; REN PORTGÁS; E-redes	**Key Partners**	Public administration (local/regional in articulation with national authorities); DGEG		
Timescale	4.1.1.: 2021-2031 || 4.1.2: 2021-2027				
Cost estimation	88.351.000,00€	**Type of expenditures**	Staff; works; equipment; services	**Main sources of funding**	CEF – Connecting Europe Facility; Horizon Europe; Recovery and Resilience Plan (Recuperar Portugal); National or Regional Operational Programmes; Private funds
Indicators	n. of installed smart meters; % of consumers with smart meters; n. of smart grids projects developed; natural gas network coverage (expressed in km); electricity network coverage (expressed in km)				
Status	Ongoing				
Inspiration	TNM #6 – Major Infrastructures & Integrated Policies / COP 26				

Specific objective #5: PROMOTING SUSTAINABLE MOBILITY					
Action #5.1	PROMOTING MODAL SHIFTS TO PUBLIC SUSTAINABLE TRANSPORT				
Context and objectives	Making public transport more attractive and promoting intermodality will make it possible to reduce urban congestion and achieve more efficient and clean mobility, providing greater comfort, speed, and quality of service with lower energy consumption. The aim is to provide citizens with a high-quality, more convenient, faster, and easily accessible public transport service, helping to foster social cohesion and maximising accessibility for all citizens. The aim is also to promote modal shifts by improving the supply of and access to public transport, reducing dependence on individual transport on everyday journeys.				
Description of activities	5.1.1. Expand and/or improve public transport networks and equipment throughout the territory; 5.1.2. Promote and implement an integrated information and ticketing system (for public transport and complementary services, based on new real-time information technologies and dematerialised forms of payment, specifically suitable for the resident population, young people, and tourists); 5.1.3. Strengthen rail transport (passenger and goods) [Minho line's complementary works and new line Porto-Valença-Vigo].				
Output/deliverables	More efficient and sustainable transport system.				
Lead organization	5.1.1. and 5.1.2.: Local public administration; 5.1.3 Public administration [via Infraestruturas de Portugal, SA]	**Key Partners**	Transport service providers; Alto Minho's transport authority		
Timescale	5.1.1 and 5.1.2.: 2021-2040 || 5.1.3.: 2021-2030				
Cost estimation	945.750.000,00 €	**Type of expenditures**	Staff; external expertise; works; equipment	**Main sources of funding**	Recovery and Resilience Plan (Recuperar Portugal); Environmental Fund (FA), National or Regional Operational Programmes
Indicators	n. of public transport passengers; passengers/km in public transports; km of public transport network benefited; km of public transport network created				
Status	Ongoing				
Inspiration	TNM#2 - Benchmarking: Best Practices from EU cities / TNM#3 – Political Vision and Citizen Inclusion / TNM #6 – Major Infrastructures & Integrated Policies / COP 26				

Specific objective #5: PROMOTING SUSTAINABLE MOBILITY					
Action #5.2	BOOSTING THE ENERGY TRANSITION IN THE TRANSPORT SECTOR (includes promoting and supporting electro-mobility)				
Context and objectives	Achieving the decarbonisation of the transport sector is crucial to meet the energy and climate targets set for Portugal, for 2030 and 2050, and Portugal has set a target of 20 % share of energy from renewable sources in transport already for the next decade. In this sense, the aim is to ensure an effective energy transition and energy efficiency gains in all transport sectors, ensuring the use of clean energy, such as electricity, advanced biofuels, and hydrogen. Electric mobility will play a key role in ensuring the progressive substitution of fossil fuels in road transport to renewable electricity, contributing to an effective reduction in GHG emissions, hence the importance of promoting and supporting electro-mobility by encouraging the introduction of electric vehicles and by strengthening the available charging network. Encouraging energy efficiency is also of paramount importance to achieve the energy transition and carbon neutrality goals.				
Description of activities	5.2.1. Renew bus fleets (when viable, promoting fleet renewal, by replacing old obsolete buses with low carbon emissions alternatives); 5.2.2. Incorporate and value environmental and low-carbon performance criteria in the process of contracting concessions for public passenger transport services; 5.2.3. Replace fossil fuelled private vehicles with low carbon emission alternatives (e.g., EV); 5.2.4. Expand EV charging network [e.g., installation of recharging stations, in residential and commercial areas, and in publicly accessible infrastructures]; 5.2.5. Assess the viability of the installation of green hydrogen refuelling stations.				
Output/deliverables	Development of sustainable alternative transport systems.				
Lead organization	5.2.1. Transport sector companies; 5.2.2. and 5.2.5. Local public administration; 5.2.3. Vehicle owners; 5.2.4. Local public administration, businesses, and EV owners	**Key Partners**	Local public administration (municipalities); CIM Alto Minho		
Timescale	2021-2050				
Cost estimation	678.634.500,00€	**Type of expenditures**	Staff; external expertise; equipment; works	**Main sources of funding**	Recovery and Resilience Plan (Recuperar Portugal); Environmental Fund (FA), National or Regional Operational Programmes; Private funds
Indicators	n. of charging points of EV installed; n. of vehicles replaced; n. of studies produced				
Status	Ongoing				
Inspiration	TNM#2 - Benchmarking: Best Practices from EU cities / TNM#3 – Political Vision and Citizen Inclusion / TNM #6 – Major Infrastructures & Integrated Policies / COP 26				

Specific objective #5: PROMOTING SUSTAINABLE MOBILITY					
Action #5.3	PROMOTING ACTIVE MOBILITY AND MORE EFFICIENT BEHAVIOUR (includes promoting car-sharing, bike sharing and carpooling)				
Context and objectives	In parallel with promoting public transport and boosting overall energy transition in the transport sector, it is important to encourage other forms of urban mobility that reduce road traffic pressure, reduce GHG emissions and promote people's well-being and quality of life. Car-sharing, bike sharing and carpooling services as well as active mobility over individual motorised transport are growing trends in developed societies, all of which, because of the excellent value for money, huge benefits in key areas (such as increased health and better quality of life) and contribution for the achievement of energy transition and carbon neutrality goals, should be encouraged.				
Description of activities	5.3.1. Boost shared mobility initiatives such as car-sharing, bike sharing and carpooling; 5.3.2. Promote the adoption of mobility management support tools and information systems and technologies supporting mobility and communication (for e.g., public information portals, *apps* for mobile devices); 5.3.3. Promote cycling and other active modes aiming to increase soft modes in modal split; 5.3.4. Promote cycling through changing mobility behaviours in school and/or university age groups of the population; 5.3.5. Create new and/or improve existent walking & cycling infrastructures and create a network of complementary equipment to support active mobility.				
Output/deliverables	Awareness and communication campaigns; *mobility as a service* tools and services; behavioural change towards an increasingly active mobility.				
Lead organization	Local public administration		**Key Partners**	CIM Alto Minho; Academia; Schools; AREA Alto Minho; Local media	
Timescale	2021-2030				
Cost estimation	101.189.800,00€	**Type of expenditures**	Staff; external services; works	**Main sources of funding**	Environmental Fund (FA), National or Regional Operational Programmes
Indicators	n. of people who benefited/participated in the awareness and communication campaigns; n. of improved of walk/cycling infrastructures				
Status	Ongoing				
Inspiration	TNM#2 - Benchmarking: Best Practices from EU cities / TNM#3 – Political Vision and Citizen Inclusion / TNM #6 – Major Infrastructures & Integrated Policies / COP 26				

Specific objective #6: PROMOTING SUSTAINABLE AGRICULTURE AND FORESTRY; BOOSTING CARBON SEQUESTRATION					
Action #6.1	INCREASING THE NATURAL SINK CAPACITY OF AGRICULTURE AND FOREST				
Context and objectives	Efficient agro-forestry management is essential for the future of Alto Minho's forests and for achieving the decarbonisation objectives of the region. It is necessary to promote forest resilience by reducing the burnt area and the area affected by pests, and by increasing afforestation to enhance the natural sink capacity of the forest as well as increasing its productivity. There is also a need to focus on the redistribution of ecosystem services, on protective species and on converting poor pastures into biodiverse pastures.				
Description of activities	6.1.1. Downscale, to the local level, Alto Minho's regional landscape strategy, promoting its integration in the various territorial management instruments, namely in the municipal land use plans; 6.1.2. Implement landscape plans that promote multifunctionality in forest areas, thus increasing landscape's resilience to rural fires and pests, hence reducing their occurrence, increasing income for forest owners/managers, and making the territory more resilient to rural fires and pests]; 6.1.3. Support afforestation and improvement of the environmental value of forests [to be achieved by, for e.g.,: (i) afforestation of non-agricultural land, (ii) actions to improve the resilience of forest stands; (iii) conservation and restoration of habitats and forest areas with high natural/conservation value; (iv) maintenance and conservation of riparian galleries; (v) conversion of stands set up under inappropriate ecological conditions, using better adapted species (namely endogenous species); (vi) the increase of the area subjected to forest management plans; (vii) sustainable forest management; amongst others].				
Output/deliverables	Increased sink capacity of Alto Minho's agriculture soils and forests [involves increasing the sequestration of the agro-forestry area and reducing emissions and/or increasing soil sequestration].				
Lead organization	Local public administration		**Key Partners**	APA; ICNF; DRAPN; Common land managers (Baldios); Forest Associations; Landowners and Land managers	
Timescale	6.1.1.: 2021-2030 || 6.1.2. and 6.1.3.: 2023-2050				
Cost estimation	5.593.848,33€	**Type of expenditures**	Staff; external expertise; works; studies	**Main sources of funding**	Recovery and Resilience Plan (Recuperar Portugal); Life Programme; National or Regional Operational Programmes
Indicators	n. of studies carried out; land that has undergone intervention (expressed in ha); n. of actions carried out to increase natural sink capacity; estimated CO2eq capture (expressed in Mt CO_2eq)				
Status	Ongoing				
Inspiration	TNM#4 - The role of Private Companies in the Energy Transition / COP 26				

Specific objective #6: PROMOTING SUSTAINABLE AGRICULTURE AND FORESTRY; BOOSTING CARBON SEQUESTRATION					
Action #6.2	ENCOURAGING THE ROLE OF THE BIOECONOMY AND OF THE USE OF BIOMASS FOR ENERGY				
Context and objectives	In Alto Minho, forest fires are recurrent phenomena which tend to worsen (in frequency, magnitude, and impact) due to climate change. Considering the overall importance of the forest and associated sectors in the Alto Minho's context and given the problem and the economic and social impact of rural fires, it is essential to, in parallel with the development and improvement of forest management and planning systems, undertake actions that contribute to the reduction of fuel load in forest areas whilst generating added value and promoting green jobs. Focus on the use of biomass as a renewable energy source for energy generation, on increased energy efficiency and efficient water use, and on bioeconomy are also important for the intended energy transition in this sector.				
Description of activities	6.2.1. Produce and/or disseminate information (e.g., on ways to promote energy and water efficiency in agriculture and forestry; on ways to improve and optimise the collection and processing of residual forest biomass, on the potential uses of residual forest biomass, as well as on the various types of biomass user/consumer equipment available), share best practices and promote awareness raising actions, aimed at encouraging the use of agricultural and forestry (by)products as substitutes for fossil raw materials; 6.2.2. Ponder and, if viable, densify Alto Minho's network of available centres for the collection, storage and provision of biomass at municipal or inter-municipal level; 6.2.3. Promote local energy generation based on biomass (by, for e.g., promoting and supporting the installation of small decentralised thermal power plants that do not put so much pressure in terms of biomass availability and on the energy grid).				
Output/deliverables	Forest fire reduction; renewable energy generation; increased energy and water efficiency; increased awareness.				
Lead organization	Local public administration (municipalities)		**Key Partners**	APA; DRAPN; ICNF; Common land managers (Baldios); Forest Associations; landowners and land managers	
Timescale	2021-2035				
Cost estimation	100.000.000€	**Type of expenditures**	Staff; external expertise; works; studies; equipment	**Main sources of funding**	Recovery and Resilience Plan (Recuperar Portugal); National or Regional Operational Programmes
Indicators	estimated energy savings (expressed in MWh/year); estimated renewable energy production (expressed in MWh/year); reduction of the burnet area (expressed in ha)				
Status	Ongoing				
Inspiration	TNM#4 - The role of Private Companies in the Energy Transition / COP 26				

Specific objective #7: DEVELOPING AN INNOVATIVE AND COMPETITIVE INDUSTRY					
Action #7.1	FOSTERING ECO-INNOVATION AND CLEANER PRODUCTION PROCESSES, PROMOTING THE DIGITISATION OF INDUSTRY (INDUSTRY 4.0)				
Context and objectives	As part of the strategic objective of promoting an innovative, competitive industry, the decarbonisation of industry is advocated, promoting resource efficiency, the use of renewable energy sources, energy storage, and electrification. With an electricity system highly based of renewable sources, the aim is to promote and enhance the use of electricity in the different sectors of activity and the economy, while increasing the use of other renewable energy sources such as solar, biomass, biofuels, and renewable gases. The industrial sector will play a very important role, being one of economy's main poles of need for innovation. Strengthening the prospects of the circular economy, industry 4.0 and technology innovation are crucial on the way forward to identify and create innovative, efficient and emission solutions very close to zero in the next 30 years. It is also imperative to encourage energy and resource efficiency in industry by optimising, as much as possible, the link between energy, water, and material efficiency at the level of production processes while developing innovation, new products, and new business models. Eco-innovation, digitalisation and more sustainable (circular) business models are tools that drive decarbonisation, boost competitiveness, and can be translated into economic and environmental gains and, for these reasons, are to be pursued and encouraged.				
Description of activities	7.1.1. Support Alto Minho's Industries, at political level, to carry out and/or to find the necessary support to boost investments in eco-innovation, digitisation, and cleaner production processes [e.g., usage of renewable energy sources; uptake of more low carbon technologies and processes; transition to a circular economy model; set up of industrial symbioses, at urban, local even at regional levels; development of low-carbon and multi-life-cycle products and services].				
Output/deliverables	Increased industry resilience; improved resource productivity; reduced waste generation; decoupling economic growth from resource use and increasing competitiveness.				
Lead organization	CIM Alto Minho		**Key Partners**	Overall industry sector; local public administration; CEVAL; AIP; ADENE	
Timescale	2021-2050				
Cost estimation	2.385.000,00€	**Type of expenditures**	Staff; external expertise; travel; accommodation	**Main sources of funding** available for industries to boost their climate/energy investments	Compete2030; Recovery and Resilience Plan (Recuperar Portugal); Environmental Fund (FA); Innovation, Technology and Circular Economy Fund (FITEC); National or Regional Operational Programmes
Indicators	n. of industries supported; n. of industrial synergies set up; estimated energy savings (expressed in MWh/year); estimated renewable energy production (expressed in MWh/year); € in energy investments mobilised; n. of leveraged sustainable energy investments				
Status	Ongoing				
Inspiration	TM#4 - The role of Private Companies in the Energy Transition / TNM#5 – Science & Innovation in the Energy Transition / COP 26				

Specific objective #8: ENSURING A JUST, DEMOCRATIC AND COHESIVE TRANSITION					
Action #8.1	TACKLING ENERGY POVERTY AND ALLIVIATING ENERGY POVERTY OF VULNERABLE CUSTOMERS				
Context and objectives	Portugal is one of the EU countries more exposed to energy poverty. Energy poverty has an impact not only on citizens' well-being and comfort, but also on health, educational attainment, adult income, social isolation of families and young people, among others. It is therefore important to design and develop inclusive strategies to combat energy poverty and increase energy efficiency among the population in poorer socio-economic conditions and e-exclusion. To combat effectively, it is necessary to know in greater detail the current situation to target measures more effectively, such as the rehabilitation of buildings, the promotion of renewable energies and communication and education campaigns.				
Description of activities	8.1.1. Plan a long-term strategy to assess and combat energy poverty, at regional and local levels; 8.1.2. Establish a local/regional system for assessing and monitoring energy poverty and to produce and disseminate information to alleviate energy poverty; 8.1.3. Support the renovation of or renovate (depending on the ownership) Alto Minho's social housing building stock aiming to contribute to alleviating energy poverty, reducing inequalities (including gender).				
Output/deliverables	Local/regional long-term strategy to combat energy poverty; local/regional system for assessing and monitoring energy poverty; information and counselling; Alto Minho's overall social housing renovation.				
Lead organization	Local public administration		**Key Partners**	NGOs; DECO; AREA Alto Minho; Academia; IHRU	
Timescale	8.1.1.: 2021-2025 || 8.1.2.: 2023-2030 || 8.2.3.: 2021-2050				
Cost estimation	60.837.642,71€	**Type of expenditures**	Staff; external expertise; works; services; studies	**Main sources of funding**	Energy Efficiency Fund (FEE), Environmental Fund (FA), Innovation Support Fund (FAI), National or Regional Operational Programmes
Indicators	% of the population exposed to energy poverty; n. of supported individuals; n. of individuals who received counselling on energy; n. of renovated social housing				
Status	Ongoing				
Inspiration	TNM#3 – Political Vision and Citizen Inclusion / COP26 / "Gender equality - what does it mean for your city?" webinar				

Specific objective #8: ENSURING A JUST, DEMOCRATIC AND COHESIVE TRANSITION					
Action #8.2	DEEPENING KNOWLEDGE ON CLIMATE CHANGE MITIGATION, DISSEMINATING GOOD PRACTICES AND DRIVING LOW-CARBON BEHAVIOUR IN SOCIETY				
Context and objectives	Promoting rapprochements with the citizen and civil society is key to the success of climate and energy policies. This requires a message of greater proximity and connection to people. It is therefore necessary to make visible the role that everyone can play in adopting solutions, particularly in terms of behavioural change and adopting more sustainable consumption decisions. Despite the actions which have already been taking place in Alto Minho – especially those having schools as target groups - it is imperative to continue this endeavour, empowering society and creating skills that should be associated with green job creation, orienting individual behaviours towards resource-efficient and low-carbon decisions, and promoting the active involvement of society in this transition, supporting the dissemination of good practices and participation in networks to exchange experiences.				
Description of activities	8.2.1. Downscale Alto Minho's Intermunicipal Adaptation Action Plan (PIAAC do Alto Minho), by elaborating municipal climate plans, hence deepening knowledge in climate change mitigation and low-carbon economy at local level; 8.2.2. Set up a communication action plan on energy and climate, at regional and municipal levels, establishing the needed resources, the target groups to be mobilized and the strategy to mobilize them; 8.2.3. Deepen knowledge in climate change mitigation and low-carbon economy at local level, by promoting awareness-raising and empowerment (education and training) actions on low carbon behaviours and on more sustainable production and consumption patterns (involving and coordinating with the various stakeholders with a particular focus on sectors with a particular multiplier effect, such as tourism sector and in education at compulsory school level).				
Output/deliverables	Studies and projects to help deepen knowledge, improve access to information, develop tools to support decision making at local level; awareness-raising campaigns.				
Lead organization	Local public administration	**Key Partners**	NGOs; DECO; AREA Alto Minho; Academia; Schools; CEVAL		
Timescale	8.2.1.: 2021-2025 || 8.2.2.: 2025-2030 || 8.2.3.: 2021-2050				
Cost estimation	23.822.250,00€	**Type of expenditures**	Staff; external expertise; services; studies	**Main sources of funding**	Environmental Fund (FA), National or Regional Operational Programmes
Indicators	n. of studies/plans/awareness-raising and empowerment actions carried out; n. of individuals who benefited from awareness actions; n. of individuals who benefited from education and training				
Status	Ongoing				
Inspiration	TNM#3 – Political Vision and Citizen Inclusion / COP26 (The Climate Fresk workshop) / SSA#2 and #3				

Specific objective #8: ENSURING A JUST, DEMOCRATIC AND COHESIVE TRANSITION					
Action #8.3	PROMOTE SUSTAINABLE DEVELOPMENT DIALOGUE PLATFORMS AND LEVERAGE INTERVENTION CAPACITY AT REGIONAL AND LOCAL LEVEL				
Context and objectives	Given its profile, its aim, its proximity to local actors and citizens, AREA Alto Minho – Alto Minho's Regional Energy and Environment Agency has played an important role in promoting, at local level, the sustainable development of the Alto Minho territory, having, over its 23 years of existence: promoted energy efficiency and the rational use of energy; encouraged the use of local indigenous renewable energy sources; compiled and disseminated relevant information on energy and carried out awareness raising actions and campaigns addressing various target groups. At present, given the outlined commitments to tackle climate emergency, at EU, National and regional/local levels, it is imperative not only to strengthen the role played by AREA Alto Minho - considering the role it plays in the achievement of national objectives, acting at local level, in terms of energy transition and carbon neutrality - but also to establish an independent Advisory Board on Energy Transition and Carbon Neutrality, to process data, to monitor progress and to support decision making – namely as far as the implementation of this IAP is concerned.				
Description of activities	8.3.1. Structure and implement Alto Minho's Power BI to improve and transform the way sustainable energy is managed and to generate value across energy production, supply, distribution, and consumption; 8.3.2. Establish an Advisory Board on Energy Transition and Carbon Neutrality to support intervention and decision making and to promote dialogue/discussion at regional/local level, in terms of carbon neutrality and energy transition. Amongst the "common" tasks, the following are to be highlighted: (i) to provide debate, at local level, between the various social, cultural and economic forces in seeking consensus on energy related issues; (ii) to issue opinions and recommendations on the topics of energy and climate action (mitigation and adaptation), namely upon request from Alto Minho's municipalities; (iii) to accompany local, national, EU and international energy and climate policies; and (iv) to support the implementation and monitoring of Alto Minho's IAP.				
Output/deliverables	Establish permanent and lasting knowledge platforms for a constructive dialogue/discussion on the topic climate action (emphasis on energy), involving both civil society and the main actors in the various sectors (public and private) which have an active role in energy transition, ensuring that local/regional energy and climate targets and commitments are met.				
Lead organization	CIM Alto Minho		**Key Partners**	Local public administration; RNAE; ADENE; DGEG; AREA Alto Minho and Academia	
Timescale	2021-2025				
Cost estimation	852.929,18€	**Type of expenditures**	Staff; external expertise; services; studies	**Main sources of funding**	National or Regional Operational Programmes
Indicators	n. of jobs created; n. of jobs maintained; n. of supported entities (public and private); n. of monitoring reports produced				
Status	Planned				
Inspiration	TNM#3 – Political Vision and Citizen Inclusion / TNM #6 – Major Infrastructures & Integrated Policies / COP26				

5.2. Small scale actions description and feedbacks

Small Scale Actions (SSA) play an important role in assessing the overall relevancy, feasibility, and acceptance of a certain action. They also allow to check a hypothesis and/or a solution at a small scale before embarking on larger scale actions through the IAP and help to refine planned strategies and/or assess their impact, thus helping to determine whether some changes or adaptations are needed.

Alto Minho's ULG jointly decided to carry out the following SSA:

Small Scale Action #1

DEMONSTRATE the advantages of decentralized green energy production systems [PV panels] in buildings

Objective	Boost the production/usage of decentralized green energy in Alto Minho's buildings - either public, private, or residential – thus: reducing consumers' CO_2 footprint; supporting the energy transition and slowing down climate change; increasing autonomy, improving demand management, and reducing energy related costs. Relevant to the **Specific Objective #3 STRENGTHENING ALTO MINHO'S COMMITMENT TO RENEWABLE ENERGY, THUS REDUCING THE TERRITORY'S ENERGY DEPENDENCY**
Description	Implementation of an integrated energy efficiency service that includes a technical and financial feasibility study; the installation of a photovoltaic self-consumption system in a public building and monitoring this building's energy performance. This demonstrative pilot action was carried out is a public service building owned/managed by CIM Alto Minho, located in Valença, and its aim is to demonstrate the viability, reliability as well as advantages of self-consumption in the hope of encouraging others - local administration as well as other building owners/managers - to replicate this solution in buildings/infrastructures.
Target group	Building owners/managers
Results (quantitative and qualitative)	Number of PV panels: 23 Overall installed power: 10 kW Overall estimated energy production: 14.167kWh/year
Lessons learnt	Savings, operation, and maintenance costs need to be properly accounted for prior to installation (a technical and financial feasibility study is highly recommended); peaks of consumption need to be taken into account; building's infrastructure and energy demand need to be evaluated prior to system deployment; it's crucial to combine decentralized green energy production and energy efficiency (equipment/appliances and behaviour); to ensure sustainability and maximize effectiveness of the PV system, maintenance is paramount; PV panels base should be well fixed on the rooftop or in a solid foundation on the ground on well-established mounting structures; PV panels should be placed so that solar exposure and production are optimised (avoid shades and chose the best possible solar orientation); make sure to have a plan B in case of system failure (especially relevant in health care services); carrying out awareness-raising actions, may be considered of added value; make sure the works are carried out by trained professionals and that the PV system is up to code.
Key words	Solar PV; Proof of concept and viability check; Public authorities' leadership by example; Decentralized green energy production

Small Scale Action #2

EVALUATE the appeal of energy awareness-raising actions in public schools

Objective	Assess the interest of both Alto Minho's municipalities and schools in the development of awareness-raising initiatives on Climate Action (mitigation and adaptation) - with an emphasis on the topic of energy – and determine the openness and effectiveness of using "Gaming" in schools as an empowerment and awareness-raising tool. Relevant to the **Specific Objective #8 ENSURING A JUST, DEMOCRATIC AND COHESIVE TRANSITION**
Description	A joint reflection and a critical analysis were carried out, based on AREA Alto Minho's experience on implementing awareness-raising actions in schools, both before and after COVID-19 pandemic crisis. Special emphasis was given to those projects which foresaw the use of "Gaming" as a tool to raise awareness, namely: "Alto Minho Energenius" – interactive puppet theatre play and energy quiz; "Alto Minho adaPT" – iBook interactive joint exploration and strategic card game; "Kids4energy" – computer game on energy which uses Wii remotes as primary game controllers.
Target group	Teachers and students from Alto Minho's basic education schools – 1st, 2nd, and 3rd cycles.
Results (quantitative and qualitative)	All Alto Minho's municipalities manifested interest in the suggested activities, some even assigned staff to benefit from capacity building actions on the tools which were developed and then explored during the awareness-raising actions. It soon became clear that students are more prone to an approach which uses entertainment as a means of learning (Wii remotes; tablets; computer games and card games, for example) as opposed to conventional learning methods. Despite "just" being pilot actions, during the 2018-19 school year, 2,180 students and 123 teachers participated in the above-mentioned actions. The overall feedback from participants was extremely positive, but due to COVID-19 pandemic crises, their roll-out was, up until now, put on hold.
Lessons learnt	It is imperative to engage teachers from an early stage (planning phase, preferably); need to establish a strategy, define clear objectives, communicate effectively the methodology and what role is to be played by each individual – stating what is expected from the teachers' involvement as well as what's for them to gain; instead of giving teachers additional work, make sure they benefit from capacity building actions and gain knowledge; students are, by definition, social influencers, they play a crucial role in disseminating messages; it is imperative to update the tools (in terms of content) and to ensure coherence between what's taught in schools and the information which is provided through the awareness-raising actions; there is no such thing as an "optimal approach", the tool, the language and the depth need to be adjusted to the topic as well as to the target group.
Key words	Assessment; Gaming; Awareness-raising actions; Schools (pupils and teachers); Climate action

Small Scale Action #3

TEST the use of digital collaborative tools to promote population integration and participation

Objective	Determine the effectiveness of using digital tools to engage and get feedback from Alto Minho's citizens while promoting their involvement in the IAP co-creation process. Relevant to the **Specific Objective #8 ENSURING A JUST, DEMOCRATIC AND COHESIVE TRANSITION**
Description	Preparation, publication online, and advertising of a digital survey on the topic of energy transition aiming to assess citizens' opinions on: **Responsibilities** – Who is responsible for Energy Transition? What is the main role that local authorities play in terms of Energy Transition?; **Commitment** – Daily and at an individual level, which energy consumption good practices are implemented? Which future commitments are citizens willing to make in order to contribute to the "net-zero energy territory by 2050" goal?; **Priorities** – In Alto Minho, which sector of activity is the most relevant in terms of Energy Transition? Which are the top 3 priority areas of intervention which will allow PNEC 2030's targets to be met in Alto Minho? Which are the top 3 domains of intervention which need to be included in Alto Minho's IAP to accomplish the net-zero energy goal before 2050. Result assessment and communication, both at local and transnational level.
Target group	Overall Alto Minho population (despite the need to have internet access) Communication action: local media; ULG members; subscribers of CIM Alto Minho's Facebook page
Results (quantitative and qualitative)	**On Responsibility** | the majority of the respondents recognize that energy transition is everyone's responsibility and feel that Alto Minho's local and regional authorities play a key role in reaching the energy and climate objectives; **On Commitment** | respondents act and are willing to commit further _ resource usage efficiency being the most preeminent response || prevalence of actions that do not require the allocation of financial resources; **On Priorities** | education and awareness are priority areas of intervention as is sustainable and efficient use of resources (energy, water and raw material) || IAP must include actions on energy efficiency; energy production from renewables as well as sustainable mobility (e-mobility and soft modes of transport). Statistically, the results of the survey were neither relevant nor representative, for the sample of those who participated does not mirror Alto Minho's demographic profile. Furthermore, those without computer and/or internet access could not participate in the survey.
Lessons learnt	In times of COVID-19 pandemic crises the use of digital collaborative tools is a valuable asset, but it's not a "one size fits all" type of solution, for it excludes the participation of those who lack knowledge on digital tools and/or lack resources (internet access; computer availability, for instance); the language used needs to be adjusted to the topic which is being addressed but it also needs to be target group oriented, in order to maximize participation and to obtain valid/useful inputs; holiday periods should be avoided for carrying out online surveys (exception being if the target group are tourists); advertising is key to help spread the word and encourage participation; despite being an effective tool in times of confinement, the sample of those who participate might not correspond to the territories' population profile (in Alto Minho, this was clearly the case); digital fatigue, lack of interest, lack of internet and/or computer access may limit participation, its best to foresee a complementary approach in order to guarantee social equity and inclusion.
Key words	Citizen engagement; Public participation; Online tools (survey); Energy transition

5.3. Financial resources

Alto Minho needs to transform its way of producing and consuming energy to become a net-zero energy territory before 2050. This transformation requires, for example, major investments in decarbonization, energy efficiency, renewable energy sources, awareness-raising, capacity building, and infrastructures.

Table 12 summarizes the overall estimated investments for the implementation of Alto Minho's IAP.

table 12. Foreseen financial resources for the implementation of Alto Minho´s IAP.

Strategic objective	Actions	Cost estimation (€)
#1: DECARBONISING ALTO MINHO'S ECONOMY	1.1 DECARBONISING URBAN SETTLEMENTS 1.2 DECARBONISING LOCAL PUBLIC ADMINISTRATION 1.3 REDUCING WASTE PRODUCTION AND DIRECT DEPOSIT OF WASTE IN LANDFILLS AND PROMOTING RECYCLING CHAINS 1.4 PROMOTING THE TRANSITION TO A CIRCULAR ECONOMY	66223770.33€
#2: PRIORITISING ENERGY EFFICIENCY	2.1 PROMOTING ENERGY EFFICIENCY IN BUILDINGS 2.2 PROMOTING ENERGY EFFICIENCY IN STREET LIGHTING 2.3 PROMOTING VOCATIONAL TRAINING FOR THE ENERGY EFFICIENCY SECTOR AND ENCOURAGING R & D & I ON ENERGY EFFICIENCY	1.156.536.000,00€
#3: STRENGTHENING ALTO MINHO'S COMMITMENT TO RENEWABLE ENERGY, THUS REDUCING THE TERRITORY'S ENERGY DEPENDENCY	3.1 ACCELERATING ELECTRICITY GENERATION AND STORAGE FROM RENEWABLE ENERGY SOURCES 3.2 PROMOTING THE SPREAD OF DISTRIBUTED GENERATION, VIA RENEWABLE ENERGY COMMUNITIES	766.300.000,00€
#4: ENSURING SECURITY OF ENERGY SUPPLY	4.1 ADJUSTING THE ADEQUACY AND PROMOTING THE DIGITALISATION OF THE ENERGY NETWORK SYSTEM	88.351.000,00€
#5: PROMOTING SUSTAINABLE MOBILITY	5.1 PROMOTING MODAL SHIFTS TO PUBLIC SUSTAINABLE TRANSPORT 5.2 BOOSTING THE ENERGY TRANSITION IN THE TRANSPORT SECTOR (includes promoting and supporting electro-mobility) 5.3 PROMOTING ACTIVE MOBILITY AND MORE EFFICIENT BEHAVIOUR (includes promoting car-sharing, bike sharing and carpooling)	1.725.574.300,00€
#6: PROMOTING SUSTAINABLE AGRICULTURE AND FORESTRY; BOOSTING CARBON SEQUESTRATION	6.1 INCREASING THE NATURAL SINK CAPACITY OF AGRICULTURE AND FOREST 6.2 ENCOURAGING THE ROLE OF THE BIOECONOMY	105.593.848,33€
#7: DEVELOPING AN INNOVATIVE AND COMPETITIVE INDUSTRY	7.1 FOSTERING ECO-INNOVATION AND CLEANER PRODUCTION PROCESSES, PROMOTING CIRCULAR ECONOMY AS WELL AS THE DIGITISATION OF INDUSTRY (INDUSTRY 4.0)	2.385.000,00€
#8: ENSURING A JUST, DEMOCRATIC AND COHESIVE TRANSITION	8.1 TACKLING ENERGY POVERTY AND ALLIVIATING ENERGY POVERTY OF VULNERABLE CUSTOMERS 8.2 DEEPENING KNOWLEDGE ON CLIMATE CHANGE MITIGATION, DISSEMINATING GOOD PRACTICES AND DRIVING LOW-CARBON BEHAVIOUR IN SOCIETY 8.3 PROMOTE SUSTAINABLE DEVELOPMENT DIALOGUE PLATFORMS AND LEVERAGE INTERVENTION CAPACITY AT REGIONAL AND LOCAL LEVEL	85.512.821,89€
Total foreseen investment		3.996.476.740,55 €

Meeting these investment needs is particularly challenging in the current economic scenario with energy prices climbing to unprecedented levels - with the inherent repercussions in overall pricing and, subsequently, in overall resource/product supply/availability, both for production and for consumption. The current uncertainty of future oil and gas supplies is also not to be neglected. Accordingly, access to financing is, therefore, of key importance for the implementation of Alto Minho's IAP.

Detailed information on the financial resources and funding opportunities *per* envisaged action can be found on section 5.1.2 – Detailed action sheet.

Despite there being several types of funding and financing opportunities, which are available to promotors (public, private, academia, citizens), it should be noted that currently we are in between Community Support Frameworks (CSF), so changes may occur in the short term, both at EU but especially at National and regional levels (with the inherent repercussions at a local level).

Summarizing, nowadays according to the interactive guide [16], made available on the Covenant of Mayors initiative website, the following funding and financing opportunities are available for Portugal, hence for the Alto Minho territory:

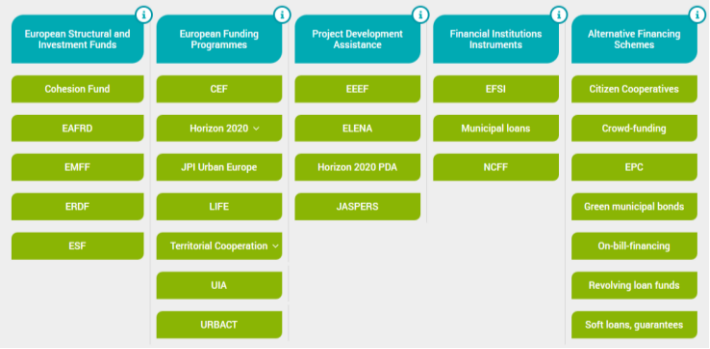


figure 15. Funding and financing opportunities available (https://www.eumayors.eu/support/funding.html)

5.4. Risk analysis

Considering that Alto Minho's IAP is a long-term strategy, being its target-year the year 2050, a risk analysis was carried out to identify the risks linked to its implementation, regardless of their magnitude and nature - Political, Economic, Social, Technological, Environmental and Legal - but also the measures which are foreseen/available to mitigate the likelihood and/or impact of such risks. To do so the PESTEL method was used and the risks, which were jointly identified, were grouped according to their nature, as follows:

[16] This interactive guide provides information on the funding initiatives managed by the European Union, the Member States, and key financial institutions such as the European Investment Bank. Furthermore, it includes information about support services (e.g., project development assistance) and innovative financing schemes (e.g., green municipal bonds; energy performance contracting; local energy cooperatives; crowdfunding; soft loans for home renovation works; third-party investment; revolving funds).

table 13. PESTEL risk analysis

Nature	Risks linked to the action's implementation	Measures which are foreseen/available to mitigate probability and/or impact
Political factor	• Political uncertainty, due to the four-year election cycle, both at national and local levels; • Policy shift at EU, national or local levels - currently there is a clear support of Climate Action, it might not be so after 2030.	• Political validation of Alto Minho's IAP – but at municipal level and regional level.
Economic factor	• "Price" being the most relevant criteria upon purchase - Inefficient equipment tends to be cheaper; • Lack of financial support to carry out sustainable energy investments; • Low wages may discourage the purchase of energy-efficient equipment (which tends to be more expensive at the time of purchase) and inhibit overall energy efficiency building improvement; • Unemployment rates registered in some sectors of activity due, for example, to the COVID-19 pandemic crisis and to automation, limit the income available to carry out sustainable energy investments and may increase energy poverty.	• Green and Sustainable Procurement (public and private) is envisaged; • Funding and financial resources are available, at local, national and EU levels; • At national level, incentives are in place to alleviate energy poverty and counselling on how to benefit from them is available, also at local level; • Phasing-out of inefficient equipment is in place, both at national and local levels (lamps, for example).
Social factor	• Alto Minho's demographic profile, considering that a quarter of Alto Minho's population aged over 65 – the fact that this is a long-term plan may diminish the interest/engagement of the elderly; • Despite the improvement in equipment's energy efficiency, there is an overall increase in number and in the number of "working hours" of energy consuming gadgets, appliances and equipment in buildings (residential; services and industries), from comfort (heating and colling) to entertainment; • Current lifestyle attitudes and reluctancy to change, particularly relevant as far as mobility is concerned; • Cross-cutting lack of specialized expertise on energy.	• Interim progress monitoring and reporting is foreseen; • Awareness-raising and communication actions on climate action (mitigation and adaptation) and on empowering (at individual and joint levels) is in place and is also foreseen; • Circular economy, cross-cutting to several economic activity sectors, is envisaged. • Capacity building actions and training are foreseen.
Technological factor	• Nowadays Covid related disruptions in the supply chain - component shortage, for example; • Technological innovation may alter the envisaged solutions.	• R&D&I actions are in place and are expected to continue to take place; • Interim progress monitoring and reporting is foreseen and adjustment to planning will be made if needed.
Environmental factor	• Climate uncertainty, might shift the net-zero balance, interfering both in energy consumption (heat and colling needs, for instance, may differ) and energy production from renewables (wind and hydro, for instance); • Pressure from NGO's against mineral resources extraction may influence energy transition.	• Energy mix - Investments on a mix of renewables are foreseen [wind (off-shore and onshore wind farms); solar; biomass; etc.) as is decentralised energy production. • Interim progress monitoring and reporting is foreseen and adjustment to planning will be made if needed.
Legal factor	• Some of the older buildings have a historical and architectural value that, according to legislation, must be preserved; this being often a constraint to the implementation of thermal improvement measures. This is particularly relevant in Alto Minho's historical centres and in some protected areas - amongst which Peneda-Gerês National Park - where the restrictions are even tighter (the constructers must not only maintain the façade of the buildings, but also follow the traditional regional construction procedures and building materials).	• Policy integration; • Awareness-raising and capacity building are envisaged

6. IMPLEMENTING AND MONITORING THE ACTION PLAN

6.1. Organizational/implementation framework and governance

As previously mentioned, the "ALTO MINHO towards a net-zero energy transition | co-creating a sustainable future" Integrated Action Plan is Alto Minho's first regional strategic plan "solely" dedicated to energy transition, using a multisectoral approach. It aims to enshrine Alto Minho's commitment to be, by 2050, a net zero energy territory.

Designing such a plan was a rather complex task, both technically and politically. Strategy needed to be grounded in the best available scientific data, but it also needed to suit this territory's socio-economic and geographical context and to be articulated with the broader policy aims, while encompassing all relevant stakeholders – either energy producers or energy consumers - ranging from industry, to agriculture, to transports, to services, to citizens... On the other hand, due to its nature, its ambition, the variety of involved players and the wide-ranging spectrum of foreseen actions, this plan's implementation will surely be challenging. Last, but certainly not least, considering the imperativeness and the urgency to effectively achieve climate neutrality and to become a net zero energy territory, it is of paramount importance to guarantee robust and independent monitoring and evaluation throughout this plan's implementation, aiming to better understand what works and what doesn't, to support the decision-making process and to allow making the necessary adjustments thus ensuring the foreseen targets are met – i.e., there needs to be a science-policy-action interface at local (municipal) / regional (supra municipal) levels.

Governance is, therefore, one of the key aspects to this plan's successful implementation, as good governance arrangements can contribute to more transparent, inclusive, responsive, and effective decision-making. To ensure implementation and monitoring of the energy transition in Alto Minho, it will be necessary to adopt a governance model that will guarantee data accuracy, policy articulation, climate action implementation evaluation, horizontal (sectorial) and vertical (from national to local level) coherence, both of policies and strategies, involvement of all relevant stakeholders (amongst which Alto Minho's ULG members) as well as public participation.

Because of the specificities of Alto Minho's IAP, CIM Alto Minho and its associated municipalities will play a leading role as far as this plan's governance is concerned. Besides carrying out the actions they are responsible for as lead organizations and supporting those where they are key players, they will also overlook and support this plan's overall implementation, from a strategic and political standpoint, at a regional and local scales, respectively. It is however important to emphasise the major role that citizens, private businesses, academia, and NGO's play in this plan's successful implementation for they are also responsible and/or co-responsible for some of the actions it envisages.

Via a participatory approach, it will be possible, on one hand, to ensure monitoring, follow-up, and reporting of implementation of the policies and measures as well as their effects/impacts and, on the other, to assess compliance with national obligations, including sectoral targets, under the Portuguese package of climate and energy for the 2030- and 2050-time horizons.

With the help of a scientific advisory board, which is to be established, continuous monitoring, evaluation, and reporting is to be carried out. By 2025, and every five years thereafter, CIM Alto Minho, benefitting from inputs from all relevant stakeholders, shall carry out an overall assessment of Alto Minho's IAP state of implementation. By 2030 Alto Minho's IAP will undergo an intermediate evaluation process and adjustments will be made, if, when and wherever needed, also using a co-creation process. By 2050, and benefitting from inputs from all relevant stakeholders, a final evaluation process is to be carried out and a final report is to be produced. The results of such assessments shall be made available for public consultation and participation. Meetings and discussion *fora* shall be organized whenever and wherever needed.

Advisory board

To support CIM Alto Minho and its associated municipalities, an Advisory Board on Energy Transition and Carbon Neutrality ("Advisory Board") is to be established. This advisory board will act as a "watchdog" and as an advisor in the policy-making process, assessing consistency between short-medium term decisions and long-term commitments. It shall be composed of experts covering a broad range of relevant disciplines - a varied disciplinary and sectoral expertise, as well as gender and geographical balance, will be sought. Its purpose is neither to produce nor to review existing science/policies regarding climate change and/or energy transition; instead, it will draw on various disciplines to apply the best scientific knowledge to the regional and local contexts to inform local policies/strategies/actions and assess whether they effectively address the net zero energy challenge. This advisory board is intended to: bring together experts with different but complementary academic and research backgrounds, all of whom are recognised as "authorities" in their respective fields; be able to increase the accountability and legitimacy of the implementation of increasingly stringent energy transition and climate policies on the road to net zero energy, and to support the local authorities' decision-making process.

Public consultation and citizen participation

Public participation describing the interaction between government and the public is considered to result in **better outcomes and better governance**. The main benefits are a higher acceptance of decisions and implementation as public interests are better reflected, but also the creation of new ideas and approaches.

In the field of sustainable energy (e.g., renewable energy production, energy savings, investment in local energy transition projects, etc.) as well as in the broader field of citizens' concern for better and more sustainable quality of life (new modes of housing, mobility, lifestyles, sustainable food systems and communal wellbeing etc.), collaboration between citizens and local authorities plays a vital role. To succeed in reaching the goals of an energy transition, moving away from carbon emitting energy resources to renewables, everyone needs to participate in its implementation.

Engagement practices are key, and Local Authorities, being the closest body of government to people, are strategically important. Accordingly, Alto Minho's local authorities, with CIM Alto Minho and AREA Alto Minho's support, shall engage with all parts of society to enable and empower them to act towards a just and socially fair transition to a climate-neutral and climate-resilient society. Alto Minho's local authorities shall facilitate an inclusive and accessible process at all levels, including at national, regional, and local level and with social partners, academia, the business community, citizens, and civil society, for the exchange of best practice and to identify actions to contribute to the achievement of the objectives of this IAP. Alto Minho's local authorities may also draw on the public consultations and on the multilevel climate and energy dialogues and shall use all appropriate instruments to engage citizens, social partners and stakeholders, and foster dialogue and the diffusion of science-based information about climate change and its social and gender equality aspects.

Multilevel climate and energy "dialogue"

Alto Minho's IAP governance has both horizontal and vertical dimensions, i.e., cross-sector, involving several organizations regardless of sectors of activity, and up-down through different levels of administration, from the national to the local. Aiming to engage all relevant stakeholders in meeting the net zero energy target, CIM Alto Minho shall establish a multilevel climate and energy dialogue, in which local authorities, civil society organisations, business community, investors and other relevant stakeholders as well as the general public are able to actively engage and discuss the achievement of the objectives set out in Alto Minho's IAP and the different scenarios envisaged for energy and climate policies, including for the long term, and review progress.

Possible methods for public participation may range from face-to-face settings to electronic and internet technology-based approaches and the level of interaction can reach from informing and listening over dialogue, debate, and analysis to implementing jointly agreed solutions.

6.2. Indicators for our IAP

As previously mentioned, Alto Minho's regional and local authorities, with the help of a scientific advisory board (which is to be established during the implementation of this IAP's action 8.3.2), and with the support of all relevant stakeholders, will promote the continuous monitoring, evaluation and reporting of Alto Minho's IAP implementation, reviewing the measures already implemented, assessing their effectiveness towards meeting foreseen the target and, if necessary, making the needed adjustments to ensure this target is met.

By 2025, and every five years thereafter, CIM Alto Minho, benefitting from inputs from all relevant stakeholders, shall carry out an overall assessment of Alto Minho's state of implementation. By 2030 Alto Minho's IAP will undergo an intermediate evaluation process and adjustments will be made, if, when and wherever needed, also using a co-creation process. By 2050, and benefitting from inputs from all relevant stakeholders, a final evaluation process is to be carried out and a final report is to be produced. The results of such assessments shall be made available for public consultation and participation. Meetings and discussion *fora* shall be organized whenever and wherever needed.

Aside from monitoring the evolution of the indicators mentioned in section **5.1.2 – Detailed action sheet,** for each action, data on the sectorial area of intervention (i.e., energy efficiency in buildings, equipment and facilities, transportation, renewable deployment, urban planning, awareness raising, etc.), the policy instrument (distinguishing between the national/regional and the local ones) and the responsible body (local authority or third parties) is to be reported. Furthermore, the timeframe, as well as the estimates on energy savings (expressed in MWh/year), on renewable energy production (expressed in MWh/year) and on CO_2 emissions reduction (expressed in tonnes CO2-eq/year) by the reporting year are to be reported, if applicable.

7. LET'S ACT FOR A NET-ZERO ENERGY EUROPE BY 2050 !

figure 16. URB EN PACT COP26 delegation

From Local to Worldwide level, together driving the change towards net-zero energy territories. The time to start acting was "YESTERDAY", "NOW" the time to make a difference!