

Madeira

Study on living conditions and access to selected basic needs in the EU outermost regions

REQUEST FOR SERVICES 005 Under Framework contract 2020CE160AT013

1.0 Key economic and social structure of Madeira

Specificities of the region: The Autonomous Region of Madeira is an archipelago of volcanic origin, made up of the islands of Madeira, Porto Santo, Desertas, Selvagens and their respective islets, located in the Atlantic Ocean near the coast of West North Africa. With an area of approximately 801 km², it is located about 900 km from mainland Portugal. Only the islands of Madeira and Porto Santo are permanently inhabited and are separated by 42 km. The Autonomous Region of Madeira benefits from governmental and administrative autonomy in economic and financial matters, having its own Regional Government and Regional Legislative Assembly. In 2021, the Autonomous Region of Madeira had 250,744 inhabitants and its population has decreased by 6.4% since 2011. Its population density declined from 333.8 in 2011, the year with the highest density since 2004, to 315 inhabitants per km² in 2021. The municipality of Funchal, located on Madeira Island, has the highest



Figure 1. Madeira map. Source: DG REGIO

population density (1,396 inhabitants per km²), while Porto Moniz, also on Madeira Island, has the lowest density (30 inhabitants per km²). This difference illustrates the heterogeneity throughout the region. Madeira faces social and economic challenges associated with its insularity and small market size.

- Electricity, cooling and heating, and water and sanitation, were identified as key basic needs to be analysed in the Autonomous Region of Madeira. Key facts and figures on the overall access to the two needs, further developed in this fiche, are summarised below:
 - Key area 1 "*Electricity, cooling and heating*": The region enjoys universal access to electricity and has at its disposal an array of technical solutions that ensure the smooth running of the regional energy system. However, its energy grid is not connected to the mainland and is dependent on its own energy sources, generation capacity and the import of fossil fuels.
 - Key area 2 "Water and sanitation": An overall positive evolution in access to drinking water in the region in recent years is observed, including water quality levels. However, the island's geographic profile and highly dispersed and fragmented urbanisation poses major obstacles to the development of supply and sanitation networks.

2.0 Electricity, cooling and heating

2.1 Access to electricity, cooling and heating in Madeira

2.1.1 Conditions in place to meet the needs and main factors constraining access

Conditions in place

- World Bank data for Portugal (including Madeira) points to 100% access to electricity since 1990¹. This results from a series of investments made by the Regional Government that have enabled widespread access to electricity and the provision of technical solutions that ensure the smooth running of the regional energy system. Social tariffs are also planned for households with fewer financial resources to ensure their access to this service.
- The regional electricity production system has been able to meet demand. According to the National Institute for Statistics (INE) data, gross electricity production in the region² stood at 947,414.621 kWh in 2011, the highest figure for the period between 2011 and 2021. The lowest values occurred in 2013 (866,229.126 kWh) and in 2021 (888,445.860 kWh). The latter value corresponds to 1.75% of the country's total energy production.
- Between 2010 and 2021, electricity consumption per inhabitant in the region was lower than at the national level, ranging from 3,285.3 kWh in 2010 (highest value) to 3,005.7 in 2013 (lowest value), while at the national level, these figures

were 4,776.8 kWh and 4,420.9, respectively. In 2021, the Region's figure was 3,178.7 kWh (4,650.7 kWh for the national value). As for energy costs, applying a simple tariff on the regulated market, the price averaged $0.1605 \in kWh$ nationally, while in Madeira it was lower at $0.1524 \in kWh^3$, with a social tariff⁴ of $0.1119 \in kWh$.

- ► The survey on energy consumption in the domestic sector, conducted by INE in 2010 and 2020, shows an increase in electricity costs. Available data indicates that the annual expenditure on electricity by households in Madeira in 2010 was 382€ (523€ at the national level), a value that rose to 667€ in 2020 (751€ at the national level), which represents an increase of 74.6% (43.4% at the national level). These numbers do not yet reflect the increase in energy costs triggered by Russia's invasion of Ukraine, and it is likely that these figures have risen recently.
- The Energy System of Madeira includes the production, storage, transportation, commercialization and management under a public service regime, and these activities are carried out by Empresa de Eletricidade da Madeira, S.A. (EEM)⁵.
- Despite Madeira's administrative autonomy, the National Energy Services Regulatory Authority (ERSE) exercises regulatory powers in the region, without prejudice to the specificities of the region, namely monitoring investment plans and the costs of the region's energy systems. Madeira has representatives in various bodies of the regulator, namely the Advisory Board and the Tariff Board.
- The Action Plan for Sustainable Energy and Climate in the Autonomous Region of Madeira provides an important baseline, as it seeks to ensure energy provision throughout the process of achieving a fair energy transition and climate change.
- Various funding opportunities help improve energy use and efficiency in the region. The European Regional Development Fund (ERDF) and the European Social Fund Plus (ESF+) Programme for Madeira in 2021-2027⁶ dedicates a specific objective to energy efficiency (and to the reduction of greenhouse gases emission)⁷ that foresees a total investment of 17 million euro to help reduce energy consumption to around 3,000,000 MWh/year in 2029. The ERDF-ESF Operational Programme for 2014-2020⁸ financed the transition to a low-carbon economy with 14.4 million euro, which included energy efficiency. The Operational Programme "Sustainability and Efficiency in the Use of Resources"⁹ (POSEUR¹⁰) also supported the installation of the Calheta III hydroelectric power plant, which can provide an important part of the region's energy needs, while making a relevant contribution to increasing the share of renewable sources in the regional energy mix. This is expected to help achieve greater energy efficiency in public buildings, companies, and private housing. The Portuguese Recovery and Resilience Plan (RRP) for Madeira provides assistance by supporting the installation of battery power stations¹¹ and ensuring that newly constructed housing units fully comply with energy efficiency rules¹².

Constraining factors

The region faces challenges which partially constrain access to this basic need or are likely to constrain access in the future:

- The insularity and location of Madeira means that the region cannot be connected to the continental energy network, and requires it to be self-sufficient in energy production. The region relies on the import of natural gas and other fossil fuels by maritime transport to ensure the production of electricity. This results in a high dependence on the regular functioning of supply chains to ensure a smooth operation of energy production systems. The absence of energy connections or links to a grid also results in a lack of redundancy in energy systems.
- In 2021¹³ 71.5% of energy production in the region came from thermal (non-renewable) sources, followed by energy generated from wind power, with a weight of 15.3%. At national level, thermal energy (non-renewable) was also the most common source of energy, accounting for 42.9% of total production, followed by hydroelectric power (26.4%) and wind power (25.9%), representing a more diversified energy mix compared to the regional situation.
- Renewable energy sources play an increasingly important role, as they can reduce dependence on external and nonrenewable energy sources and contribute to reducing greenhouse gas (GHG) emissions, while presenting challenges due to their intermittency.
- Renewable energy sources still have a limited preponderance in the region¹⁴. In 2021, 58.4% of the electricity produced in Portugal came from renewable sources, while in the region this figure was 33.45%. Nevertheless, the region's figure increased by 46 percentage points compared to 2011 (22.91%), while in Portugal this increase was more moderate, given that the base figure was higher (45.78% in 2010).

- Data from the Madeira Regional Directorate of Statistics for 2016 shows that only 4.8% of households in the region had air conditioning, while 11% had heating. Water heating was available in 98.6% of households. This situation reflects the mild temperatures throughout the year, with an average annual temperature in coastal areas (where most of the population is concentrated) of 19°C¹⁵. Average temperatures drop to around 13°C in winter, while the average temperature in summer is around 23°C.
- There are significant differences in electricity consumption by sector¹⁶ between the region and the mainland. The domestic sector accounted for 35.4% of consumption in Madeira, while the national figure was 29.4%. Consumption for street lighting and indoor lighting in government buildings is also higher in the region. On the other hand, the region's consumption in industry (11.7%) and agriculture (0.5%) is lower than at national level (respectively, 39.9% and 2%)
- Climate projections made within the scope of the CLIMA-Madeira Strategy¹⁷ show a general tendency for temperatures to rise between 1.3 and 3°C by 2100. This could increase the need for cooling buildings and homes during the summer period, bringing about an increase in energy needs.
- The capacity of the region's electricity generation infrastructure has remained stable over the last few years. According to data from the Energy Observatory¹⁸, the capacity of the region's power generation plants in 2009 was 686.40 MW, a value that peaked in 2011 at 945.72 MW. In 2019, this number stood at 883.76 MW.
- Thermoelectric plants play an essential role in regulating the operating parameters of the various infrastructures in the region's energy network¹⁹, neutralizing variations in the generation of energy from renewable energy sources (intermittent) and variations in consumption. On the island of Porto Santo, which has only one thermoelectric power station, its inoperability would result in the unavailability of energy, while on the island of Madeira, the existence of two thermoelectric infrastructures helps to mitigate this problem.
- Climate change may potentially lead to an increase in the intensity and frequency of extreme weather events, which could therefore damage essential infrastructures. The rise of the average sea level, which in the region is projected to reach 50 cm by the end of the century, as well as a greater likelihood of extreme weather events, such as extreme precipitation, rural fires, and heat waves²⁰, can pose a challenge to the integrity and functioning of these fundamental structures.

3.0 Water and sanitation

3.1 Access to drinking water and sanitation in Madeira

3.1.1 Conditions in place to meet the needs and main factors constraining access

Conditions in place

- In 2021, 99.25% of the region's (monitored) water was of good quality, complying with the legal parametric values²¹, which is higher than the national figure (98.87%).
- The supply of drinking water is in line with national levels, but the sewerage network is lacking. In 2022, Águas e Residuos de Madeira (ARM) supplied 54.8 million m³ of drinking water to the municipalities and treated 3.2 million m³ of sewerage²² (both at bulky supply services). In 2020, 99.5% of homes in the region were served by a water supply²³, however, only 68% were connected to sewerage systems (the national figure being 85% in 2020). Between 2011 and 2020, the percentage of dwellings served by sewerage²⁴ increased by 1.8% (from 66.1 to 67.9%), while mainland Portugal saw a higher increase, from 80% to 85%.
- The base infrastructure has been in operation since 1950 but has undergone maintenance and remodelling over the years to increase its capacity in the face of increased demand for water, mainly for human consumption²⁵.
- Due to the orographic conditions of the Portuguese OR groundwater sources have a higher relevance when compared to the mainland. The region has 180 water sources, part of a complex and highly capillary system. Data from 2020 shows that of the 60,412,000 m³ abstracted, 40,776,000 m³ came from groundwater sources (67.5% of the total), while only 19,636,000 m³ came from surface sources (32.5% of the total). In the case of the island of Porto Santo, all the water comes from a desalination plant²⁶.

- There is a higher volume of water supplied/used by the population (domestic sector) in the region. This figure rose from 98.7 m³ in 2011 to 101.4 m³ in 2020, which is higher than the national figure (63.27 m³ in 2020).
- Data for 2021 and 2022 from a study on the price of water carried out by DECO Associação de Defesa do Consumidor²⁷, points to an average cost of 0.71€/m³ for consumption of up to 120 m³ (0.69€/m³ in 2021), with the average monthly tariff being around 7.08€ for water supply and 2.64€ for sanitation (6.85€ and 2.56€ in 2021, respectively). The availability of social tariffs in some municipalities make the cost of water supply and sanitation even lower. In mainland Portugal, data from 2021²⁸ indicates that the average cost of the water supply service was 11.39€/month, while in the case of sanitation, it was 8.99€/month.
- From an administrative perspective, Águas e Resíduos da Madeira (ARM)²⁹ is responsible for bulky supply of water and waste management in the region under a public service concession and exclusivity regime. This entity is owned by the Government of the Autonomous Region and 5 other municipalities, to whom it also provides retail distribution services. The Madeira Archipelago River Basin Management Plan for 2021-2027 aims to increase the quality and availability of water, defining necessary measures to ensure efficient water management.
- The ERDF-ESF+ Programme in 2021-2027 provides some opportunities to support water and sanitation, having as a specific objective to promote access to water and sustainable water management with 45 million euro³⁰. A complementary action "*Plano de Eficiência e Reforço Hídrico dos Sistemas de Abastecimento e Regadio da RAM*" is also planned with a budget of 70 million euro³¹. Regarding wastewater, in the framework of "Promover o acesso à água e a gestão sustentável da água" the programme allocates 7 million euro to the collection and treatment of wastewaters³².

Constraining factors

The region faces challenges which partially constrain access to this basic need or are likely to constrain access in the future:

- The region's steep terrain is one of the main obstacles to the development and expansion of sewerage networks, which also explains the lower coverage rate for this service. This geographic situation together with the dispersion of the population result in higher cost per home of this type of infrastructure deployment in Madeira.
- ► The dispersion of human occupation of the territory presents an obstacle to the extension of drainage and sanitation networks³³ and the low cost of water and sanitation means that the rate of return on investment is low.
- A significant part of the water abstraction is located in the north of Madeira Island and is then transported to the main areas of human habitation along the southern coastline³⁴. This polarization between the place of abstraction and consumption also results in the need for a more extensive network and additional costs associated with its maintenance and operation which, due to the orography and relief, are particularly complex.
- The low cost of water does not encourage a more restrictive resource management at household level³⁵.
- Rising sea levels could increase the risk of salinization of groundwater³⁶, and less rainfall could negatively influence groundwater sources recharge³⁷, which is particularly relevant given the region's dependence on them.
- Water losses are one of the biggest problems in terms of water management in the region³⁸, while they are not homogeneous throughout the region, with some municipalities having losses of around 70%³⁹.
- Between 2012 and 2019 there was a 25% increase in the water losses-volume. However, in 2020 losses decreased by 3.4% compared to the previous year⁴⁰. This may be related to the contraction in tourism and less pressure on the water supply system caused by the COVID-19 crisis and the reduction of economic activity.
- The proportion of dwellings served by sewerage increased slightly between 2011 and 2021, from 66.1% to 67.9%. This situation reflects the constraints already observed on the expansion of drainage networks due to orography and a highly diffuse urbanization pattern. This means that the volume of sewerage drained per inhabitant has not changed significantly either, rising from 50m³/inhabitant in 2014 to 52.8 m³/inhabitant in 2020.
- In terms of the volume of wastewater by source⁴¹, the domestic sector was the most relevant, accounting for 90% of the wastewater treated in 2020. It should be noted that the fact that some industrial facilities have their own treatment plants may contribute to a decrease in their relative weight. Finally, in 2020, 90.3% of sewerage underwent primary treatment, while 3.4% and 5.2% had secondary and tertiary treatment⁴².

4.0 Mitigating actions and recommendations

Needs identified in Key Area 1: Access to electricity, cooling and heating

PROMOTE ENERGY EFFICIENCY, REDUCE DEMAND AND PRESSURE OVER ENERGY SOURCES

- Raise awareness to promote energy efficiency within the domestic sector i.e., in households, and encourage sustainable behaviour on energy use through campaigns for residents and tourists.
- Increase visibility and ease of access to existing supporting mechanisms and schemes to increase energy efficiency in domestic and non-domestic sectors, including thermal insulation of dwellings and energy production for self-consumption.

CONTINUE TO SUPPORT A DIVERSE ENERGY MIX AND GREATER UPTAKE OF RENEWABLE SOURCES

- Maintain the diversification efforts of energy sources to reduce dependency on fossil fuels (imported to the region).
- Increase the share of renewable energy sources in the regional energy mix.
- Increase the capacity to store energy and reduce the effects of intermittency of renewable energy sources.

PROMOTE THE USE OF SMART MONITORING MECHANISMS

- Maintain the efforts to promote smart management systems to more efficiently manage public illumination, temperature and electric vehicle charging.
- Promote the modernisation of meters to increase awareness about how energy is used and to optimise periods of less and more demand for energy.

Needs identified in Key Area 2: Access to water and sanitation

PROMOTE REUSE OF WATER AND CIRCULARITY

- Promote efficient water-use and the reuse of water also for non-human consumption uses, such as using rainwater or treated sewerage for cleaning, watering gardens and other compatible uses.
- Improve the capacity to retain water by installing groundwater reservoirs and separate/dual drainage systems (sewerage and rainwater).

ADDRESS WATER LOSSES BY IMPROVING THE INFRASTRUCTURE

- Maintain the efforts on the renewal and reparation of water networks to reduce losses.
- Increase the monitoring capacity of water networks to allow efficient management and timely corrections and interventions.

PROMOTE RESPONSIBLE CONSUMPTION OF WATER

- Promote the conscious use of water through awareness campaigns for the population and training actions for organisations.
- Promote more efficient networks and lower water loss values to encourage a better alignment between the price of water and the costs associated with water production and distribution.

Annexes

Annex 1 - References

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³ Tarifário 2022, Baixa Tensão Normal, Escolha o Tarifário ajustado ao seu consumo. Fazer as Escolhas certas é Poupar no Ambiente na Futura, EEM - Empresa de Electricidade da Madeira, SA, 2022, <u>https://www.eem.pt/media/913149/monofolha_btn_2022.pdf</u>

⁴ The Social tariff applies to people/households who benefit from social support measures, such as solidarity supplements for the elderly, unemployment or household allowance and social disability pension. In 2022, the social tariff allowed a discount of 33.8% on the final invoice.

⁵ Decreto Legislativo Regional n.º 10/2023/M, Região Autónoma de Madeira, 2023,

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⁶ Madeira Regional Programme 2021-2027, page 89, <u>https://portugal2030.pt/wp-content/uploads/sites/3/2023/05/sfc2021-PRG-2021PT16FFPR001-1.2_PRMADEIRA.pdf</u>

⁷ Specific objective RSO2.1 - Promoting energy efficiency and reducing greenhouse gas emissions.

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 ⁹ PO SEUR - Programa Operacional Sustentabilidade e Eficiência no Uso de Recursos, Instituto de Desenvolvimento Regional, n. d., <u>https://www.idr.madeira.gov.pt/portal/Conteudo.aspx?IDMenu=2&IDSubMenu=187&Path=187&jmenu=5</u>
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¹¹ (TC-C14-i02-RAM).

¹² (RE-C02-i03RAM).

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¹⁵ Estratégia de Adaptação às Alterações Climáticas da Região Autónoma da Madeira. Secretaria Regional do

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¹⁶ Coal, oil, electricity and natural gas statistics, Instituto Nacional de Estatística e Direção Geral de Energia, 2023, https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_indicadores&indOcorrCod=0008222&contexto=bd&selTab=tab2

¹⁷ Estratégia de Adaptação às Alterações Climáticas da Região Autónoma da Madeira. Secretaria Regional do Ambiente e Recursos Naturais; Gomes, A., Avelar, D., Duarte Santos, F., Costa, H. e Garrett, P. (Editors), 2015, <u>https://observatorioclima.madeira.gov.pt/wp-content/uploads/pdfs/estr_clima_web_yeyxxt.pdf</u>

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¹⁹ Estratégia de Adaptação às Alterações Climáticas da Região Autónoma da Madeira. Secretaria Regional do Ambiente e Recursos Naturais; Gomes, A., Avelar, D., Duarte Santos, F., Costa, H. e Garrett, P. (Editors), 2015, <u>https://observatorioclima.madeira.gov.pt/wp-content/uploads/pdfs/estr_clima_web_yeyxxt.pdf</u> ²⁰ Ibid.

²¹ Safe water (%) by Geographical localisation (NUTS - 2013); Annual, Instituto Nacional de Estatística (INE) e Entidade Reguladora dos Serviços de Águas e Resíduos (ERSARA), 2023

https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_indicadores&indOcorrCod=0008663&contexto=bd&selTab=tab2 ^{22 22} Interview with the ARM– Águas e Resíduos da Madeira, S.A.

²³ Proportion of dwellings served by water supply (%) by Geographical localisation (NUTS - 2013); Annual, Instituto Nacional de Estatística (INE), Entidade Reguladora dos Serviços de Águas e Resíduos (ERSAR) and Direção Regional de Estatística da Madeira (DREM), 2023,

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- ²⁹ ARM Águas e Resíduos da Madeira, S.A. https://arm.pt/
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32 Ibid.

³⁴ Ibid.

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³⁶ Groundwater is found in cracks and spaces in the ground, sand, and rock. Surface water is any body of water above ground, including rivers, lakes, wetlands, or reservoirs. Cómo prevenir la contaminación de las aguas subterráneas y superficiales en la UE, European Parliament, 2023

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³⁸ Interview with the ARM– Águas e Resíduos da Madeira, S.A.

³⁹ Interview with the ARM- Águas e Resíduos da Madeira, S.A.

⁴⁰ Perdas nos sistemas de abastecimento de água (Série 2011) (m³) por Localização geográfica (NUTS - 2013); Anual, Instituto Nacional de Estatística (INE), Entidade Reguladora dos Serviços de Águas e Resíduos (ERSAR) and Direção Regional de Estatística da Madeira (DREM), 2023,

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³³ Interview with the ARM– Águas e Resíduos da Madeira, S.A.