

National Council for the Environment and Sustainable Development

**POSITION PAPER ON ENERGY EFFICIENCY IN BUILDINGS,
WITH A FOCUS ON RESIDENTIAL BUILDINGS**

May 2022

Technical note

Title: Position paper on Energy Efficiency in Buildings, with a Focus on Residential Buildings

Author: CNADS - National Council for Environment and Sustainable Development

This CNADS Position paper was drawn up as part of the CNADS Working Group (WG) on Energy Efficiency in Buildings. The WG was coordinated by Councillors José de Matos and João Joanaz de Melo and included the following members of the Council: Jaime Braga, Jorge Moedas, Luísa Schmidt, Júlia Seixas and Nuno Ribeiro da Silva. The WG had the active participation of the President of CNADS, Filipe Duarte Santos, as well as the collaboration of the executive secretary Adília Lopes and Carla Martins, from CNADS' technical advisory services. The WG's work also included a hearing with Professor Vasco Peixoto Freitas, whose contribution is gratefully acknowledged.

This Position paper was generally approved at the 3rd Ordinary Meeting of the CNADS in 2022, held on 27 April, and the final draft was approved by electronic consultation on 16 May 2022.

This document may be freely disseminated and distributed for non-commercial purposes, in full or as an executive summary. References to the document should be properly cited.

Recommended citation: CNADS (2022). Position paper on Energy Efficiency in Buildings, with a Focus on Residential Buildings. National Council for the Environment and Sustainable Development, Lisbon, May 2022. 14 pp.

Index

1. Framework and motivation	3
2. Diagnosis: summary indicators	4
3. Discussion of past policy outcomes	5
4. General guidelines for energy policy	6
5. Guidelines for promoting energy efficiency in buildings	7
5.1. Target groups	7
5.2 Priorities and criteria for designing measures	7
5.3 Public resources to be mobilised	8
6. Guidelines by type of measure	9
6.1 Tax measures	9
6.2 Combating energy poverty	10
6.3 Promoting new business models	11
6.4 Capacity building in the building refurbishment sector	11
References.....	13

1. Framework and motivation

In recent years there have been several important international initiatives on energy and climate, among which we can highlight the Paris Agreement (UN, 2015), the European Green Deal (https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_pt, <https://ec.europa.eu/eurostat/cache/egd-statistics/>), and the approval of the Climate Law in the European Union and also in Portugal. Despite this, some of the most important environmental indicators have not evolved in a desirable way: there has not yet been a structural reduction in greenhouse gas emissions. (<https://ec.europa.eu/eurostat/web/climate-change/visualisations>, <https://www.ipcc.ch/assessment-report/ar6/>) and biodiversity and nature conservation indicators, among others, are increasingly worrying (<https://www.wwf.org.uk/living-planetreport>, https://ec.europa.eu/environment/publications/state-nature-eu_pt).

The global energy and materials crisis, which is characterised by uncompetitive prices and unsustainable methods, is evident in practically every country. This problem was less visible during the economic crisis, but has been exacerbated by the economic disruption caused by the Covid-19 pandemic and, even more so, by the war in Ukraine. The ability of the world economy to recover will depend to a large extent on the outcome of the war, but there are aspects that are already clear: the hope of a collaborative global world in the short and even medium term has been severely shaken and it has become more evident that Europe is highly dependent and vulnerable in terms of energy and raw materials — in addition to the continuing and, in some cases, worsening problems of environmental degradation, resource scarcity and social inequalities.

In this context, as many authors have argued, the best option will be to invest in a more circular economy, where efficiency is central, and in a more sustainable lifestyle, which includes a thriftier consumption pattern. One of the important dimensions of this commitment includes intervention in the building stock, especially in the housing sector.

In Portugal, despite multiple one-off measures over the years and new initiatives that have resulted in various strategies and incentives, the housing stock continues to be of poor quality. Structurally changing this situation will also have a positive impact on public health, human comfort, climate change mitigation and adaptation, reducing the impacts of energy use and strengthening resilience in and strengthening resilience in various areas of the economy and society.

The purpose of this document is to contribute, by setting out a set of principles and guidelines for the design of appropriate measures, to make significant progress in improving energy efficiency, centred on the area of residential buildings, which must be taken on as one of the main priorities at national level.

At a later stage, it is the intention of CNADS to go into more detail about the measures outlined and how to maximise their effects, as well as to delve into some specific issues, such as energy poverty, and to extend the scope to the field of non-residential buildings.

2. Diagnosis: summary indicators

The major recent trends in the energy-climate nexus in Portugal are as follows:

- Greenhouse gases (GHG) emissions decreased significantly between 2005 and 2013, but in the last decade the trend has been stagnant, with national emissions of 63 Mt CO₂eq in 2019 (in 2020 emissions were lower, but it was an atypical year due to the pandemic). A reduction in GHG is expected in 2021 due to the closure of the two coal-fired power stations (Sines and Pego) and of the Matosinhos refinery;
- Despite the intention to prioritise efficiency, energy policies continue to focus primarily on energy supply. An example of this is the primacy given in the National Investment Programme to sectors such as lithium mining, hydrogen or centralised photovoltaic plants, with residual amounts allocated to energy efficiency and decentralised production (CSOP, 2020). Portugal's Recovery and Resilience Plan (RRP) provides 610 M€ directly for energy efficiency in buildings by 2026 (C13 - Component 13 of RRP), although energy efficiency requirements are included in other components associated with the construction or rehabilitation of buildings, whether social housing or health infrastructures;
- Energy intensity is still above the European average; it has been slowly improving, but has stagnated in recent years at around 3.4 TJ/M€'2016 (final energy) - whereas to converge with the European Green Deal we would have to get closer to 2.7 TJ/M€'2016;
- The potential for energy savings in all sectors ascends to 25-30% of consumption. The most recent investment support instruments under the RRP and the Community Support Framework (CSF) (currently under discussion) mention efficiency improvements of 30 per cent as an objective or condition for funding. This potential has so far not been realised due to a lack of appropriate policies (the improvement in energy intensity has mainly been the result of normal technological renewal);
- In the last decade, the country's energy dependence has oscillated around 75% (DGEG/ADENE, 2021) - with buildings (housing and services) being one of the most important sectors, in addition to transport and industry;
- Over time, the national energy market has accumulated a set of taxes, tax benefits and subsidies totalling 3.9 M € /year (Melo et al., 2021), which are often contradictory or perverse in terms of the objectives of sustainability policies;
- There is still a high level of complexity, opacity and lack of evaluation of energy and climate policies, among others (CSOP, 2020).

The building stock in Portugal, either housing, commerce or services, requires systematic and coherent intervention over the coming decades: official information from building certification and various other studies indicate that 75% of families live in homes that do not meet modern requirements for the thermal behaviour of buildings. According to European statistics corroborated by various national studies, 19 per cent of Portuguese households have difficulty heating their homes in winter (Eurostat, 2020) - a situation resulting from the combination of poor-quality building stock and a socio-economic context with high fractions of an ageing and/or low-income population.

According to the most recent official estimates (Long-Term Strategy for Building Renovation, ELPRE), the cost of rehabilitating buildings in Portugal by 2050 will be around 143 000 M€, 110 000 M€ of which in the residential sector. The criteria that led to this estimate are debatable in terms of detail, but existing studies (e.g., Palma et al., 2022) are convergent in terms of the type and size of the

investments required. It is clear that there will have to be a collaborative effort from all sectors, including households, the construction and renovation sector, companies in general and the various public institutions. It is also clear that there are insufficient effective instruments to fulfil the necessary targets in the near future.

Buildings account for more than 30 per cent of final energy consumption (DGEG, 2021), and it is estimated that it is possible to reduce energy consumption in the residential sector by around 50 per cent with comfort gains (Melo et al., 2020).

3. Discussion of past policy outcomes

Historically, energy policy in Portugal has undergone frequent inflections caused by the political, social and economic context. The common denominator is that considerably more attention has tended to be paid to energy supply than to demand management.

In recent decades, several national plans and programmes have been created with the stated aims of reducing carbon emissions and external dependence and, in some cases, improving energy efficiency: Programme for the Valorisation of Endogenous Energies (VALOREN, 1986), Energy Efficiency and Endogenous Energies (E4: PCM, 2001), National Plan for Climate Change (PNAC: PCM, 2015), National Programme for Dams with High Hydroelectric Potential (PNBEPH: INAG/DGEG/REN, 2007), National Energy Strategy (ENE: PCM, 2010), National Action Plan for Renewable Energies, National Action Plan for Energy Efficiency (PNAER 2020 and PNAEE 2016: PCM, 2013) and, more recently, the Long-Term Strategy for Building Renewal (ELPRE: PCM, 2021).

The effectiveness of these efforts has been modest in the field of energy efficiency. The supply perspective has always dominated over demand, and political choices have favoured supply over cost-effectiveness. The few incentives for energy efficiency and the tax reductions, e.g., in the form of ISP (tax on oil and energy products) for some industries and transport activities, have favoured energy-intensive consumers — although it must be recognised that this situation has been pressured by the need to restore companies' competitiveness in the face of existing incentive policies in other European countries.

Energy intensity improved significantly from 2005 to 2011 due to energy rationalisation and technological modernisation plans, but this trend slowed down during the crisis and has stagnated since 2013 due to the ineffectiveness of current policies.

There was also a measure in 2009 to support affordable solar thermal panels (between direct subsidy and IRS deduction), but with poor results, mainly due to a lack of publicity and insufficient technical installation capacity (Bartiaux et al., 2016); to the point where Portugal is now one of the EU countries with the fewest solar hot water panels and decentralised photovoltaic production, despite having the highest number of hours of sunshine per year (Horta et al., 2019).

In addition, with the financial crisis and the subsequent period of austerity (2011-14), support for thermal insulation of buildings was suspended for almost a decade. Later, the "Efficient Home 2020" programme, based on bank loans, had practically no effect. The interest rate offered to potential clients, instead of being subsidised, was increased, so the 200 M€ planned were not used.

The More Sustainable Buildings Support Programme (PAE+S), which began in 2020, was initially supported by the Environmental Fund (FA) and, more recently, by the RRP, for a total of 75 M€. According to information published online by the Environmental Fund on 3 May, 106 133 applications had been submitted by 30 April 2022, of which 25 953 were considered eligible

(incentive of 43.4 M€), 21 510 ineligible, 50 442 under analysis and the remaining 8 228 corresponding to other situations. The remaining funds totalled 31.6 M€. If we consider that all the applications are for first homes, and that the cases under analysis maintain the eligibility rates, this programme will benefit 1.9% of the three million families living in homes with poor energy performance.

Analysing the application of these funds indicates that this instrument is limited in that it only reaches part of the population, namely households with higher incomes. The need for initial investment in the application, the complexity of filling it in and the means of publicising the incentive were identified as the main factors restricting the possibility of accessing and enjoying this financial support (Albuquerque, 2021), which is in line with the high ineligibility rates.

In this context, private investment is naturally presupposed, but it will have to be stimulated through more appropriate public policies. For example, the aforementioned PAE+S, while relevant (and illustrative as a pilot programme), offers no guarantees of cost-effectiveness (because the nominal percentages of support are high and the ceilings are out of step with reality), which results in the benefit of those who have more knowledge and money available to invest.

On the other hand, the National Strategy to Combat Energy Poverty, and in particular the "Efficiency Vouchers", are of very limited use, since they provide minimal amounts (1 300 euros + VAT) and only apply to needy families who own their homes (CNADS, 2021). The result is that so far, according to information from the Environmental Fund, only 11.9% of the Efficiency Vouchers made available have been used.

Table 1 - Good practices for incentivising energy efficiency in buildings (adapted from Melo et al., 2021)

Instrument	Country
Interest-free bank loans for renovations of up to €30 000 that result in improvements to the energy efficiency of homes	France
Condominiums are obliged to develop energy-saving plans with performance-based contracts	France
Subsidies appropriate to the size of the investment and reduced VAT for energy renovation work	France
Income tax benefits for the purchase of efficient equipment	United Kingdom; France
Subsidies and incentives for minor remodelling and replacement of inefficient equipment	Germany
Subsidies for energy audits of residential buildings	Germany
National platforms for suppliers of energy-efficient housing solutions, as well as a list of certified auditors	United Kingdom; Germany; Spain
Funding for renewable energy installation projects: up to 50%, with a maximum of CAD 25 000 (around € 16 000), for projects implemented on a neighbourhood/parish scale; up to 33% for projects on an individual home scale.	Canada
Limiting imports of inefficient equipment	Canada
Local authorities have the capacity to intervene to renovate buildings on a neighbourhood scale, if necessary, coercively	Spain
Incentives for urban renewal, especially for landlords	Italy

4. General guidelines for energy policy

Portugal already has general objectives and a favourable political orientation towards energy transition and efficiency, reflected in documents such as the Roadmap for Carbon Neutrality (PCM,

2019), Long-term Strategy for Building Renovation, ELPRE (PCM, 2021) and, in some areas, the RRP. However, sectoral policies are still very much focused on energy supply; the targets that are still in force, namely in the National Energy and Climate Plan - NECP (PCM, 2020), are unambitious and fall short of both the technical and economic possibilities and the targets that were subsequently set by the European Green Deal; in addition, as discussed above, the tools and incentives to put the stated objectives into practice are still lacking.

In order to create successful conditions for the requalification of buildings, ELPRE needs instruments that can lead to their effective implementation.

Key issues:

- a) Energy policy must consider an integrated package of measures that covers all sectors of society. The energy transition will not take place without friction and upheaval, and a social pact logic is needed, with costs and benefits correctly distributed, in order to avoid increasing social inequalities and reducing the competitiveness of companies;
- b) In terms of instruments, a tax-based approach should be considered, establishing a tax reform that on the one hand penalises and on the other rewards behaviour. Energy tariffs, particularly in their contracted power component, should be progressive to encourage efficiency. Social tariffs must be properly scrutinised and targeted. Revenues obtained through energy-related eco-taxes should be reinvested in promoting energy efficiency, especially in the sectors that contributed to the tax revenue. This type of mechanism has a very positive effect on economic dynamics (Pereira & Pereira, 2017a, b; Coady et al., 2015);
- c) Still on the subject of instruments, the financing instruments for energy and climate policies must be created on an appropriate scale and be stable over time. For families and especially for companies, both energy consumers and operators in the sector (refurbishment, building materials, energy equipment), clarity of purpose and stability in the economic and financial framework are fundamental.

5. Guidelines for promoting energy efficiency in buildings

5.1. Target groups

Some critical target groups and preferred instruments to mobilise them include:

- a) Middle-class families and service companies. Essential instruments: fiscal measures to support large-scale investments in efficiency and comfort;
- b) "Hard-to-reach" groups, including vulnerable families and small and medium-sized enterprises (SME). Essential instruments: local technical and social support to effectively manage the financial resources needed to realise the objectives they are intended for;
- c) SME working on the requalification of buildings, municipalities, local energy agencies and energy service companies. Essential instruments: incentives for the creation and expansion of capacities, including the structuring of new clusters dedicated to the implementation of energy efficiency. Among other things, it will be necessary to train more construction professionals specialising in building refurbishment, and to promote the training of the agents who drive the transformation processes.

5.2 Priorities and criteria for measure design

The design of incentive measures must comply with clear criteria, including the following:

- a) Measures should be financed which generate public benefits (environmental protection, better quality of life for the population, especially the most vulnerable sectors), and whose beneficiaries do not have the economic capacity to realise them;
- b) Emerging technologies should only be funded to overcome market entry barriers; high-profit measures should not be funded;
- c) The type of measures should be the simplest for each purpose - favouring fiscal instruments whenever possible, precisely because of their simplicity and universality;
- d) When designing and evaluating measures, indicators of actual performance should be used (e.g., comfort, long-term profitability, environmental effects), rather than indicators of mere execution or technological prescriptions, which tend to create distortions. To fine-tune the design and evaluation of measures, seek collaboration between universities, companies and local and national institutions;
- e) The effects of the measures must be periodically evaluated to guarantee their effectiveness and make the necessary adjustments;
- f) Passive measures (insulating and protecting windows and roofs; ensuring natural ventilation) should be encouraged and prioritised, with active measures (equipment, except for water efficiency) only being used as a second priority;
- g) Decentralised energy production (e.g., solar thermal for domestic hot water and solar photovoltaic) and energy communities should also be encouraged;
- h) Promoting design quality and the use of appropriate tools (e.g., Building information modelling (BIM), already mandatory in many countries), both in new buildings and in refurbishment.

Some types of measurement are not appropriate, such as:

- a) Artificially lowering energy prices (without prejudice to regulatory stability measures when necessary). Reducing prices gives the market the opposite signal to that intended and reduces the profitability of efficiency measures;
- b) Creating blind subsidies, even if they are theoretically aimed at energy efficiency, without taking into account a clear definition of priorities or the concrete conditions of the beneficiaries;
- c) Putting the public means of promoting efficiency in the hands of the big companies in the energy sector: both because of the conflict of interest this creates, and because it tends to lead to situations with poor cost-effectiveness for consumers, especially the most disadvantaged families.

5.3 Public resources to be mobilised

Taking ELPRE 's official estimates as a reference, it will be necessary to invest 110 000 M€ in the housing stock over 30 years. To illustrate the budgetary effort, consider the following scenario: assuming that the most prioritised interventions to benefit 3 million homes over 10 years account for 40% of this figure, a total of 44 000 M€ will need to be invested over this period (i.e. a 50% increase in the annual gross value of building construction/rehabilitation in Portugal). Let's assume that the incentives will be directed mainly towards the refurbishment of buildings and the installation of solar and photovoltaic sanitary hot water; Let's also assume that, in order to mobilise these investments, the net public contribution rate of the incentives for most middle-class families will be 15% (the balance between a tax benefit of 30% and the increase in VAT and corporate income tax revenue), and for hard-to-reach families it will be 70% (the average balance between

contribution rates that vary according to income, and which could be as high as 100%, and the foreseeable increase in VAT and corporate income tax revenue) - indicators in line with international experience and national studies. These figures are indicative, only in order to understand the budgetary effort required.

These assumptions mean that to fulfil the goal of guaranteeing all families living in Portugal decent and efficient housing, it will be necessary for the public purse to invest in renovating the housing stock (in the form of tax benefits, other incentives and EU funds) to the tune of 1 500 M€/year over the next 10 years. Taking the above assumptions as a reference scenario, and the planned expenditure of 300 M€ by 2026 for energy efficiency in residential buildings in the RRP, it may be necessary to multiply the estimated annual amount by 25.

These figures could certainly be revised downwards if we manage to optimise the processes and technologies to be applied, but the order of magnitude will not be far from these amounts. It should also be noted that if the energy transition and the implementation of efficient technologies and processes are successful, the operating costs of energy use will reduce over time and will therefore make it possible to unlock additional resources.

6. Guidelines by type of measure

6.1 Tax measures

Of the 3 million families in Portugal living in homes with poor energy performance (class C or lower, uncomfortable homes), around 2 million are middle-class families, most of whom own the house they live in.

Attractive tax incentives can be a democratic, horizontal, effective and relatively simple instrument to promote efficiency in housing for the majority of middle-class families: families invest in improving their own home, with an immediate gain in comfort. In this day and age, it's a more attractive investment than banking or the financial market. This approach is equally valid for companies in general (although SME and some families may require additional incentive measures). It is also a way of boosting the real economy, with very positive macroeconomic effects. An economic and fiscal strategy to promote energy efficiency with annual reductions of 2% in energy intensity generates significantly better macroeconomic indicators than those of the base scenario: gross domestic product (GDP) +2.4%, employment +1.4%, effects on the well-being of disadvantaged households +1.8 % (Melo et al., 2020).

Taking into account national and international experience, we expect that tax benefits of around 30% of the investment, specifically in terms of personal income tax (households) and corporate income tax (companies), will help to mobilise priority investments over a 10-to-15-year horizon. Real spending by the state will be around half the nominal incentive, because it will recover value added tax (VAT) from end consumers and corporate income tax from installers.

Fiscal measures may also include reduced VAT rates on installation and construction work, complemented by zero-rate repayable financing, as has been used in several European countries (see Table 1).

These measures can be financed by eliminating perverse incentives. It's not a trivial exercise, but existing studies make two important points clear: the amount of existing perverse incentives is far greater than the cost of effective measures to promote efficiency; and a stable and meaningful fiscal

framework is far more important to companies than one-off benefits (however much they may be appreciated at the moment).

6.2 Combating energy poverty

Energy poverty has a significant effect on the physical and mental health, social well-being and absenteeism of the people who suffer from it. It's not just a social or energy policy problem - it's also a question of public health and decent living conditions.

In Portugal we can identify three main causes of energy poverty (which intersect in some households, but we can find all combinations) that tend to worsen in climate change scenarios, especially during extreme weather events:

- Very low-income families, for whom energy consumption becomes almost a luxury. This is a situation associated with the vicious circle of poverty (a combination of family income, level of education, health conditions and socio-demographic factors), which is essential to take into account, but which cannot be analysed in detail in this paper;
- Houses with poor or very poor thermal performance, which account for 75% of first homes in Portugal. We have a general historical cause, which was the great surge in construction supported by public policies from the 1970s to the 1990s, most of which was of poor quality, aggravated by various circumstances: the disappearance of the rental market and a lack of building maintenance, of credible incentives for upgrading and of motivation or financial means for families to invest;
- Lack of information: there are many cost-effective solutions available on the market today, but they are not sufficiently publicised among families.

We can also distinguish a wide variety of family circumstances, some of which can be typified, identifying the most effective measures to deal with them:

- a) *Middle-class families who own the house they live in.* In these cases, any energy poverty (understood as an uncomfortable home) is not related to economic poverty, but to other factors. Tax incentives are the instrument to favour, for the reasons mentioned above;
- b) *Families living in rented accommodation with poor thermal behaviour and maintenance deficits.* In most cases, these are elderly families and/or those on lower-middle incomes, and therefore have greater difficulties in finding solutions. In the majority of cases, landlords are not interested in improvement work because they have nothing to gain from it. The condition of these houses varies greatly, as do family incomes. This is one of the most complex situations, because it involves analysing each case, both technically and in terms of determining the level of public support needed;
- c) *Low-income families living in their own homes.* These are often elderly people or in other vulnerable situations. In these cases, simplified measures of substantial public support and a neighbourhood infrastructure that can manage the whole process will be necessary;
- d) *Low-income families living in social housing, the owner of which is a public institution.* Most of this housing is of very poor quality. Depending on the local circumstances, there are two types of solution: rehousing in modern social housing; or in-depth renovation work on the buildings, in both cases with a dedicated infrastructure for which the public institution is responsible.

In all these cases, the technical requirements are similar: it's a question of refurbishing residential buildings, a subject that has been extensively studied in technological terms and has an emerging market. However, the organisational requirements for practical implementation will be different.

Cases b), c) and d) are more complex: both because the levels of public funding required will be much higher on average, and because of the multiplicity of technical, social and economic circumstances. Multidisciplinary teams will always have to be deployed on the ground to carry out technical and economic analyses on a case-by-case basis and provide social and technical support. Local management will be necessary, which means involving local authorities, and in many cases establishing partnerships with civil society organisations that know the reality on the ground (social charities, parish councils). In the case of rented homes, legislation will need to be adjusted to create incentives for both landlords and tenants.

The National Strategy to Combat Energy Poverty (ELPRE) does not seem to guarantee a sufficiently fine diagnosis of the complex problem of energy poverty, nor does it seem to be concerned with finding the most appropriate measures for each situation (even though some of the measures recommended are along the right lines). There seems to be no concern for cost-effectiveness, which is critical because resources are scarce. Any coherent strategy for combating energy poverty must have a clear vision of the diversity of situations and the appropriate tools for each type, and mobilise resources on an appropriate scale. There will never be an effective fight against energy poverty without effective neighbourhood monitoring, which this Strategy does not seem to guarantee, and without major public investment.

6.3 Promoting new business models

Particularly in the case of condominiums, but not only, business models could be adopted or encouraged, as is already the case with the installation of photovoltaic panels, based on the intervention, for example, of energy service companies or institutions responsible for investments in the energy rehabilitation of buildings and their management, promoting the sharing of benefits. New business models need to be explored, possibly using new financial instruments.

Also, and as a way of combining the need for "qualification" or "accreditation" of companies (and certification of products, equipment and solutions) involved in energy rehabilitation work with the lack of response from construction/installation companies, largely due to their lower competence in the institutional areas and management of projects and solutions, the creation of the figure of certified "manager" (companies) of energy efficiency projects, accessible to other companies and activities in the value chain, should be studied in order to overcome the current constraints.

Construction companies must increasingly view the energy efficiency of buildings as a specialised business unit and not just as an integral part of refurbishment projects. This specialisation brings competitive advantages and, above all, a greater availability of services, which is currently still insufficient.

6.4 Capacity building in the building refurbishment sector

The refurbishment of buildings requires specialised labour, a situation that is common to all construction activities, but which is even more serious in this case due to the greater technical demands and complexity of the work, as well as the diversity of the size of the jobs, which is reflected in the costs and profitability of the teams.

The current situation requires not only a greater effort in vocational training, but also an adjustment of the framework of professions (not to mention the respective references), which is currently completely inadequate and outdated. Most of the professions related to this type of work don't even exist. There are no formally recognised professions for insulation installers, external thermal insulation composite systems (ETICS), partitions or roofing systems.

The training of these professionals should also include sustainability and energy efficiency issues, building on the work already developed by the National Laboratory of Energy and Geology (LNEG). In line with the 'Renovation Wave' guidelines, the creation of standardised solutions should be encouraged for each type of building to be rehabilitated, according to the respective construction systems and construction period.

[Unanimously approved in general at the 3rd Ordinary Meeting of CNADS in 2022, on 27 April; final version approved by electronic consultation on 16 May 2022]

The President

a) Filipe Duarte Santos

References

- Albuquerque, M. (2021). “Incentives for energy efficiency in residential buildings: an assessment of the Portuguese case”. Master's thesis Environmental Engineering, FCT NOVA.
- Coady, D., Parry, I., Sears, L. and Shang, B. (2015). How Large Are Global Energy Subsidies? WP/15/105 - IMF Working Papers series. International Monetary Fund, 42 p.
- CSOP (2020). Opinion on the National Investment Programme (PNI 2030). Superior Council of Public Works, Lisbon, June 2020.
- DGEG/ADENE (2021). Energy in numbers. DGEEG, Energy Agency, Lisboa, 2021. <https://www.dgeg.gov.pt/media/32skj5iv/dgeg-aen-2021e.pdf>
- Eurostat (2020). Income and living conditions – overview [online database]. Luxembourg: Eurostat. <https://ec.europa.eu/eurostat/web/income-and-living-conditions>
- INAG/DGEG/REN (2007). National Programme for Dams with High Hydroelectric Potential. Water Institute, DGEG, National Energy Networks.
- Melo, J.J., Sousa, M.J.F., Pereira, A.M., Fernandes, F., Galvão, A., Grilo, J. (2021). Strategy for a sustainable decarbonization of the energy sector in Portugal: identification of priority policy measures. In: Mauerhof, V. (Ed), *The Role of Law in Governing Sustainability*, 81-99. Series on Sustainable Development Research. Routledge, London and New York. ISBN: 978-0-367-74632-2 (hbk), 978-1-003-15883-7 (ebk)
- Melo, J.J.; Sousa, M.J.F.; Pereira, A.M.; Galvão, A.; Zúquete, E. (2020). Alternative energy strategy: environmental and economic assessment. FCT NOVA, December 2020. 79 pp. ISBN 978-972-8893-86-6
- European Commission (2019). Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions - European Green Deal. Brussels, 11th December 2019. COM (2019).
- Intergovernmental Panel on Climate Change (IPCC), (2022). IPCC Sixth Assessment Report “Climate Change 2022: Climate Change Impacts, Adaptation and Vulnerability”.
- Palma, P.; Gouveia, J. P.; Barbosa, R. (2022). How much will it cost? An energy renovation analysis for the Portuguese dwelling stock. March 2022. In: Sustainable Cities and Society. 78, 103607. https://www.sciencedirect.com/science/article/pii/S2210670721008726?casa_token=3nychak8mLwAAAAA:SA2r0KZfbNB7F3NfiHOKHvlpEk0cB_qXuinGncBifcfqCwTmFrY5gVxj2a-jBCpyaC3BxzOxuA
- PCM (2010). Council of Ministers Resolution n. º 29/2010 – Approves the National Energy Strategy 2020. Presidency of the Council of Ministers, Lisbon.
- PCM (2013). Council of Ministers Resolution n. º 20/2013 – Approves the National Action Plan for Energy Efficiency for the period 2013-2016 and National Renewable Energy Action Plan for the period 2013-2020. Presidency of the Council of Ministers, Lisbon.
- PCM (2015). Council of Ministers Resolution n. º 56/2015 – Approves the Strategic Framework for Climate Policy, the National Programme for Climate Change and the National Strategy for Adaptation to Climate Change, determines the reduction values for greenhouse gas emissions for 2020 and 2030 and creates the Interministerial Commission for Air and Climate Change. Presidency of the Council of Ministers, Lisbon.

PCM (2019). Council of Ministers Resolution no 107/2019 – Approves the Carbon Neutrality Roadmap 2050. Presidency of the Council of Ministers, Lisbon.

PCM (2020). Council of Ministers Resolution n. º 53/2020 – Approves the National Energy and Climate Plan 2030 (PNEC 2030). Presidency of the Council of Ministers, Lisbon.

PCM (2021). Council of Ministers Resolution n. º 8-A/2021 – Approves the Long-Term Strategy for Building Renovation (LTRS). Presidency of the Council of Ministers, Lisbon.

Pereira, A.; Pereira, R. (2017a). Achieving the triple dividend in Portugal: A dynamic general-equilibrium evaluation of a carbon tax indexed to emissions trading. *Journal of Economic Policy Reform*, published online July 2017.

Pereira, A.; Pereira, R. (2017b). On the relative roles of fossil fuel prices, energy efficiency, and carbon taxation in reducing carbon dioxide emissions. *Journal of Environmental Planning and Management* 60 (10), pp. 1825-1852.

UN (2015). Paris Agreement under the United Nations Framework Convention on Climate Change. United Nations. Signed in Paris on the 12th December 2015. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>