

ANALYSIS OF INTERNATIONAL STATE EXPERIENCES ON ENERGY POVERTY AND ENERGY JUSTICE: DEFINITIONS, INDICATORS, MEASURES AND GOVERNANCE.

English Version

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THE ENERGY RESEARCH OFFICE (EPE IN ITS PORTUGUESE ACRONYM) CONDUCTS STUDIES AND RESEARCH TO SUPPORT THE FORMULATION, IMPLEMENTATION AND EVALUATION OF BRAZILIAN ENERGY POLICY AND PLANNING.

WITH THIS TECHNICAL NOTE, EPE CONSOLIDATES AND ANALYZES HOW GOVERNMENTS HAVE FORMULATED LEGISLATION, USED INDICATORS, PROPOSED MEASURES, AND INSTITUTED GOVERNANCE MECHANISMS RELATED TO ENERGY POVERTY AND ENERGY JUSTICE. WITH THIS SURVEY, EPE PROVIDES INPUT FOR DECISION-MAKING AND PRESENTS A SET OF ALTERNATIVES TO COMBAT ENERGY-RELATED INEQUALITIES IN BRAZIL.

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▪ Abbreviations Glossary

BID	Inter-American Development Bank
ECOWAS	Economic Community of West African States
DEA	Division of Energy Economics and Environmental Studies
EPAH	Energy Poverty Advisory Hub
EPE	Energy Research Office
EPOV	Energy Poverty Observatory
FPAG	Fuel Poverty Advisory Group
LIHC	Low Income High Cost
LILEE	Low Income Low Energy Efficiency
MIS	Minimum Income Standards
2M	Double Median Indicator
M/2	Half Median Indicator
NGO	Non-Governmental Organization

1. Introduction

This technical note presents an analysis of the main international experiences about the theme *energy poverty* and *energy justice*. The document provides an overview of official definitions, social, economic, and environmental indicators, government plans, and established goals for reducing *energy poverty* and promoting *energy justice*.

The further examination of *energy poverty* and *energy justice* in the Environmental Studies Department stemmed from the need to structure socio-environmental databases and information systems on the relationship between energy and well-being, as foreseen in the Division of Energy Economics and Environmental Studies (DEA) within the scope of action DEA.07 of the Institutional Master Plan 2020-202331. It was from the understanding of how the lack of access to energy services can affect well-being that the research focused on the themes of combating energy poverty, promoting energy justice, and reducing inequalities.

In the European context, the field of study dates to the oil crises of the 1970s, which resulted in energy price increases, raising concerns about energy costs for the lower classes under the concept of *energy poverty*. The privatization of energy companies in the 1990s and recent energy transition policies have reignited this issue (Bouzarovski, 2018). More recently, the US government has linked energy poverty to environmental justice to create *energy justice* policies. Given that other governments have formalized policies based on these concepts, the analysis of these experiences in this technical note aims to provide insights for the Brazilian context.

To analyze state experiences related to *energy poverty* and *energy justice*, this technical note utilizes literature review and analysis of approaches adopted by other countries. Thus, it is structured into six topics:

1. Description of information sources and material collection supporting the document;
2. Presentation of concepts of *energy justice* and *energy poverty*;
3. Legal or official definitions of *energy poverty* used in different countries;
4. Indicators used in planning instruments;
5. Goals and measures established in plans, policies, and strategies;
6. Governmental organization techniques for addressing *energy poverty* and *energy justice*.

This structure enables a detailed approach to the tools currently employed to combat *energy poverty* and promote *energy justice*, providing relevant information for energy planning and policy formulation.

¹ Available at: <https://www.epe.gov.br/sites-pt/acao-a-informacao/acoes-e-programas/Planos%20Estrategicos%20e%20Tticos/PDI%202020.pdf>. Accessed on 05/22/2023.

2. Reference Material: Academic Literature, Planning Documents, and Monitoring Platforms

With the aim of structuring a database of socio-environmental information applied to energy planning, a comprehensive review was conducted to understand how the literature addressed the concepts of *energy poverty and energy justice* and which data and indicators were used.

Subsequently, experiences of state agencies in the following countries were explored: Chile, Cyprus, Colombia, Scotland, Slovakia, Spain, United States, France, England, Ireland, Italy, Mexico, New Zealand, Wales, Portugal, United Kingdom, Romania, Togo and Uruguay.

In analyzing legislation and medium to long-term plans, policies, and strategies, it was verified which countries already developed indicators to measure *energy poverty* or *energy justice*, establishing reduction targets and strategic actions to address the issue. The objective in this case was to understand how data were articulated with approaches in each country.

Furthermore, state georeferenced monitoring tools for *energy poverty* levels and *energy justice* were identified, with emphasis on the **United States**: [Energy Justice Dashboard](#) and [Low-Income Energy Affordability Data \(LEAD\)](#); **European Commission**: [Energy Poverty Advisory Hub \(national indicators\)](#); **France**: [Cartographie de la précarité énergétique](#); and **United Kingdom**: [Domestic Energy Map](#).

Searches for references in African and Asian countries were conducted, but few results related to *poverty* and *energy justice* were found. There was difficulty in finding information in other regions², probably because the origins of these debates were in the United States, for "energy justice", and the United Kingdom, for "energy poverty", and then disseminated in Europe. For this reason, there is a greater presence of Europeans in the bibliography of this technical note. Table 1 below presents the main plans, policies and government strategies found that address the topics. Other reference documents used are listed in the bibliography section.

The data were collected and analyzed between mid-2020 and mid-2023, with updates occurring within this timeframe that could not be feasibly incorporated into the analysis.

² For a compilation of public policies on energy poverty in Latin America, see Calvo *et al.*, 2021.

Table 1 - Plans, Policies and Strategies Consulted

Country	Plans, policies, or strategies	Year of publication
Uruguay	Política Energética 2005-2023	2008
New Zealand	Investigating different measures of energy hardship in New Zealand	2017
Chile*	Energía 2050: Política Energética de Chile	2017
	Transición Energética de Chile: Política Energética Nacional	2022
Spain	Estrategia Nacional Contra la Pobreza Energética 2019-2024	2019
Italy	Integrated National Energy and Climate Plan	2019
Mexico	Programa Sectorial de Energía 2020-2024	2020
Colombia	Plan Energético Nacional 2020-2050	2020
France	Plan National Intégré Energie-Climat de la France	2020
Togo	Plan d'Action National 2020-2024 de la République du Togo pour la Politique d'Intégration du Genre dans l'Accès À l'Énergie de la CEDEAO	2020
Scotland	Tackling Fuel Poverty in Scotland: A Strategic Approach	2021
Portugal	Estratégia Nacional de Longo Prazo para o Combate à Pobreza Energética 2021-2050	2021
England	Sustainable Warmth: Protecting Vulnerable Households in England	2021
Ireland	Energy Poverty Action Plan	2022

*The document has been updated and both versions are used in this Technical Note

In addition to the information listed above, the techniques of state organization oriented by these concepts were also researched. A search was conducted out on websites of secretariats, agencies, commissions and observatories established by countries to address the issues using the terminology of poverty or energy justice. Although similar actions in other countries may be carried out without mentioning these terms, the intention was to highlight how these issues have been institutionalized and how countries have structured themselves to overcome these challenges. In the following sections, the concepts used in the literature and the legal and official definitions of *poverty and energy justice* in countries will be addressed.

3. The Concepts of Energy Justice and Energy Poverty

A wide bibliography on the concepts of *energy justice* and *energy poverty* has been identified in both scientific journals and government documents of different countries, including in energy planning. The concept of *energy poverty* underpins the indicators used in most international experiences. In the United States, it was observed that the predominant concept is that of *energy justice*.

These two concepts are interconnected in that studies on *energy justice* are structured in three dimensions: distributive justice, procedural justice, and justice as recognition (Mccauley *et al.*, 2013), as detailed in the section below. Considering that distributive justice refers to equity in the distribution of energy production impacts and access to energy services, *energy poverty* can be conceived as a complex form of distributive injustice (Bouzarovski, 2018).

3.1. Energy Justice

The concept of *energy justice* has been used since the late 1990s to advocate transparency and social justice in the production chain (generation, transmission and distribution) and energy consumption. This concept, as well as that of *climate justice*, is derived from the principles of *environmental justice*, which have a long history in the United States (Mccauley *et al.*, 2013). *Environmental justice* is a set of principles that seeks to ensure equity in the distribution of negative environmental impacts resulting from economic activities and political decisions. In this way, it seeks to prevent ethnic, racial or social class groups from being disproportionately affected by these impacts (Herculano, 2002).

The predominance of these concepts in the United States explains the attempt at integration and practical application by the U.S. government, as explained in the *Justice40 Initiative*³, which aims to "ensure *environmental justice* and economic stimulus for disadvantaged communities that have been historically marginalized and burdened by pollution and underinvestment (...)" (White House, 2021), with a significant portion of the programs managed by the Department of Energy (DoE).

Some argue that the concept of *energy justice* has an explicit focus on public policies, making it a distinct field, while others argue that it is intrinsically linked to the debate on *environmental justice*. There are also those who argue that these concepts should be treated together, both from a political and conceptual standpoint, encompassing *environmental*, *climate*, and *energy justice* (Lacey-Barnacle *et al.*, 2020), with the aim of promoting fairer and more democratic societies.

This conceptual integration aims to understand the interconnections between the environmental, climate, and energy dimensions, recognizing that injustice in relation to one of them

³ U.S. Federal Government target (2021) that 40% of overall benefits of certain investments go to disadvantaged communities that are marginalized, underserved, and burdened by pollution. Available at: < <https://www.whitehouse.gov/environmentaljustice/justice40/>>. Accessed on 07/26/2023.

can affect the others. In this way, it seeks to establish more comprehensive and coherent approaches to address environmental challenges and promote social equity.

Box 1- Energy Justice

Energy *justice* encompasses the entire process of energy generation, transmission, distribution, and consumption. Its goal is to understand where injustices occur, which social groups are affected, and how to avoid or remedy these situations (Sovacool and Dworkin, 2015).

There are three pillars in these conceptions of justice:

1. The first refers to *distributive justice*, which originally focused on exposing the unequal distribution of benefits and environmental impacts of energy systems among income and racial groups, being essentially territorial. As mentioned, distributive injustice in energy access to and consumption (*energy poverty*) has become an autonomous field of research and public policy.
2. The second pillar addresses *procedural or processual justice*, which concerns the assessment of fairness, equity and impartiality of procedures and decision-making, ensuring the participation of all involved in a non-discriminatory manner.
3. The third pillar is *recognition justice*. In addition to participation, recognition aims to avoid any situation or process of "disrespect, insult and degradation that devalues the identities of some people and places in compared to others" (Walker, 2009 *apud* Mccauley *et al.*, 2013). This includes recognizing divergent perspectives rooted in social, ethnic, racial, and gender differences to overcome forms of cultural and political domination, insults, degradation, and devaluation (Mccauley *et al.*, 2013).

To transform this concept into guidelines for public policies, Sovacool and Dworkin (2015) propose eight parameters to be followed in the decision-making process, expressed in Table 2.

Table 2 - Energy Justice Parameters

Values	Description
Availability	People deserve sufficient energy resources of high quality.
Affordability	Energy services should not compromise more than 10% of household income, harming other expenses in the household budget.
Due Process	Countries should respect due process and human rights in their production and use of energy.
Good governance	All people should have access to high quality information about energy and the environment and fair, transparent, and accountable forms of energy decision-making
Sustainability	Energy resources should not be depleted too quickly.
Intragenerational Equity	All people have a right to fairly access energy services.
Intergenerational Equity	Future generations have a right to enjoy a good life undisturbed by the damage our energy systems inflict on the world today.
Responsibility	All nations have a common, but differentiated, responsibility to protect the natural environment and minimize energy-related environmental threats.

Source: Adapted from Sovacool and Dworkin (2015) and Ribas and Simões (2020).

3.2. Energy Poverty

Energy poverty can also be situated within multidimensional poverty debates. From the nineteenth century until the mid-twentieth century, the predominant concept of poverty focused exclusively on physical survival, based on nutritional parameters, to determine whether people's income was sufficient to meet physiological needs. In the 1970s, the conception of poverty was expanded to include other basic needs, such as clean water, sanitation, health, education, and culture. Finally, between the 1980s and 1990s, the conception was further broadened to include a certain level of comfort and the resources necessary for the development of individual potential within valued social roles in specific contexts (Crespo *et al.*, 2002). Thus, multidimensional poverty encompasses dimensions such as income, nutrition, education, health, culture, energy, isolation (geographical or social) and vulnerability to disasters and wars, aiming to ensure people freedom of choice and the resources to realize them (Pereira *et al.*, 2011).

The concept of *energy poverty* was established based on the work of Boardman (1991), who originally dealt with the heating homes in the English winter. Over the last decades, the concept has expanded to encompass energy as an essential resource for the minimum satisfaction of needs such as lighting, cooking and thermal comfort in houses.

There are different legal, official and conceptual definitions on the subject, focusing on energy services, residential consumption, household characteristics and family income (Thomson and Snell, 2016). However, it is important to highlight a distinction in the definition of *energy poverty* between the Global North and the Global South. In the Global South, *energy poverty* refers to the lack of access to physical infrastructure that enables the consumption of modern energy services (Thomson *et al.*, 2020; Sokolowski, 2019; Sovacool, 2012). In 2014, about 2.8 billion people were consuming solid fuels such as wood, agricultural residues, and charcoal. This dependency was concentrated in low- and

middle-income countries in Asia, Africa, and Latin America (World Health Organization, 2014), and this is another facet of *energy poverty* in these regions. In the Global North, the primary focus is on energy expenditures in relation to family income, especially during the winter (Buzar, 2007). In all mentioned cases, attention is drawn to residential consumption, household characteristics and household income.

The diversity of contexts and conceptions of key factors relating energy and human well-being contributes to this conceptual elasticity, generating a polysemy of the term "energy poverty". Below are the definitions from the literature regarding *energy poverty*.

Table 3 - Definitions of Energy Poverty

	Source	Year	Definition
1	Boardman	1991	"The inability to afford adequate warmth because of the energy inefficiency of the home"
2	Reddy	2000	"The absence of sufficient choice in accessing adequate, affordable, reliable, high-quality, safe, and environmentally benign energy services to support economic and human development"
3	Modi <i>et al.</i>	2006	"The inability to cook with modern cooking fuels and the lack of a bare minimum of electric lighting to read, or for other household and productive activities after sunset"
4	Buzar	2007	"The inability to heat the home up to a socially – and materially - necessitated level"
5	Bouzarovski <i>et al.</i>	2014	"Problems of inadequate access to energy in developing countries, involving a host of economic, infrastructural, social equity, education and health concerns"
6	Gonzalez-Eguino	2015	"A level of energy consumption that is insufficient to meet certain basic needs"
7	Scarpellini <i>et al.</i>	2015	"When a household cannot afford to purchase enough energy to satisfy domestic needs"
8	Nathan <i>et al.</i> *	2020	"An energy-poor individual is one who belongs to a household with some dependency on any energy inefficient fuels"

Source: Halkos and Gkampoura (2021) (Adapted) and *our selection.

Several studies have been conducted to establish a level or threshold at which a household can be identified as experiencing *energy poverty*, however, precisely defining when a person is considered energy poor, or determining the level of *energy poverty* in an individual or household, is a complex challenge (Romero *et al.*, 2018).

Various indicators have been proposed to identify and measure households experiencing *energy poverty*. The *Energy Poverty Observatory* (EPOV)⁴ and several European countries identify *energy poverty* when energy expenditures exceed 10% of household income, resulting in the inability to cover other expenses. However, it is important to note that this measure focuses on consumption and relative expenditure. Therefore, it may include households with higher incomes that waste energy or consume excessively.

⁴ Energy Poverty Observatory, linked to the European Commission. Currently renamed the *Energy Poverty Advisory Hub – EPAH*.

This factor has led to the development of new criteria and indicators tailored to low-income households, such as the Unidimensional Low Income High Costs (LIHC) indicators and the Minimum Income Standards (MIS), both referenced against a poverty line as an additional criterion to identify the energy poor (Romero *et al.*, 2018). In addition, recent proposals have pointed out *hidden energy poverty*, which is revealed through residential energy consumption below expected levels. This situation indicates that households may be consuming below what is necessary or experiencing energy deprivation (Bouzarovski, 2018), affecting their physical and mental health. More information on these indicators can be found in the table below:

Table 4 - Indicators of energy poverty based on energy expenditure and/or consumption

No.	Name	Definition
1	10% of income	Proposed by Boardman (1991), it defines as an economic limit that energy costs greater than 10% of income indicate that the household is in a situation of <i>energy poverty</i> .
2	Low Income High Costs (LIHC)	Proposed by Hills (2012), the indicator is based on the identification of households whose energy costs are higher than the national median and whose income is below the official poverty line.
3	Minimum Income Standards (MIS)	The method proposed by Moore (2012) defines that energy poor are those whose disposable income, after deducting essential expenses with food and housing, does not allow them to afford adequate energy consumption to meet the minimum energy needs of the household.
4	Double Median Indicator(2M)	The 2M limit has been established on the basis that it represents a disproportionately high expenditure, indicating the proportion of the population whose percentage of energy expenditures in relation to income is more than twice the national median of the population.
5	Hidden Energy Poverty (or Half Median Indicator(M/2))	This method is based on the assumption that energy-poor households are those whose energy consumption is exceptionally below a determined and/or expected minimum level. The M/2 indicator represents the proportion of the population whose absolute energy expenditure is less than half of the national median, i.e. exceptionally low.
6	Low Income Low Energy Efficiency (LILEE)*	Under this indicator, households are considered fuel poor if they reside in a household with an energy efficiency rating of fuel poverty equal to or lower than band D and their disposable income, after deducting housing costs and energy needs, falls below the official poverty line.

Source: adapted from Soares *et al.* (2023) and England (2021) *our addition.

Studies have also progressed based on the concept of vulnerability. Monitoring annual *energy poverty rates* allows obtaining the total number of households each year, pinpointing the families that enter or leave this condition. Analysis and vulnerability indicators help to understand the probability of households facing *energy poverty*, going beyond the situation in a specific year (Bouzarovski, 2018).

Energy poverty and *energy vulnerability* are interconnected concepts, although the term vulnerability refers to a potential situation and poverty to an established situation. In practical terms, this work seeks to reveal distributional imbalances within a social group and develop actions to reduce inequalities in people's ability to access and consume energy (Pye *et al.*, 2015).

4. Legal and Official Definitions

The definition and conceptualization of *energy poverty* are considered fundamental steps in creating indicators that can measure this phenomenon (Thomson and Snell, 2016). According to Boardman (2010: 21), who is considered energy poor depends on the definition adopted and the focus of analysis, as well as involving a political judgment.

In the European literature, the terms *energy poverty* and *fuel poverty* are occasionally used interchangeably to refer to the deprivation of energy services (Thomson and Snell, 2016). Some authors differentiate the terms, with *energy poverty* referring to the lack of access to modern energy services in developing countries, and *fuel poverty* referring to an access issue due to financial reasons in developed countries (Bouzarovski and Petrova, 2015). However, in recent years, the terms have been used to mean the same thing (Boardman, 2010), as seen in Table 3.

Some countries use other concepts to refer to the situation of deprivation of energy services. In the United States, for example, the notion of "energy burden" is used in public policies, which is defined as the percentage of gross household income spent on energy costs (U.S. Department of Energy, 2023). The *U.S. Census Bureau* also employs the concept of energy insecurity⁵, defined from three conditions: (1) difficulty paying energy bills (2) reducing or forgoing basic needs such as food and medicine to pay an energy bill, or (3) maintaining the home at an unsafe temperature due to concerns about the cost of energy. In this definition, the focus is on the situation of low-income families and, in the research highlights the condition of ethnic-racial minorities. In New Zealand, the government has developed a definition of energy scarcity and uses the term "*energy hardship*" which can be interpreted as people's energy difficulties in accessing a sufficient amount of energy in their homes and, at the same time, controlling spending.

According to the European Commission's Recommendation (2020), there is no standardized definition of *energy poverty*, "so it is up to the Member States to define their own criteria, according to the national context". The recently adopted legislative package provides only general principles and useful perspectives on the possible causes and consequences of *energy poverty*. However, the European Commission, in the recommendation itself, considers that "Energy poverty is a situation in which households do not have access to essential energy services".

Definitions of *energy poverty* were found in 16 countries, as outlined in Table 5. Among them, seven countries have established definitions through laws (Cyprus, Scotland, Slovakia, France, Wales, United Kingdom, and Romania), three through energy plans and policies (Chile, Colombia and Togo), five through Strategies (Spain, England, Ireland, Italy, Portugal) and, finally, in New Zealand the concept was defined by the Ministry of Business, Innovation and Employment and published in an official document. Most countries with definitions of *energy poverty* or similar concepts are located in Europe (12 of the 16 countries mapped). In 2000, the first official definition of the concept was established by the United Kingdom, and other European countries adopted other definitions from 2010 onwards. Since 2017, official definitions began to be established outside the European axis. It should be noted that some of these documents are texts with legal character, with mandatory binding effects on the institutions, while others are publications of official institutions without legal effects.

⁵ <https://www.energy.gov/diversity/articles/households-color-continue-experience-energy-insecurity-disproportionately-higher>, accessed at 29/08/2023.

According to the EPAH (2023a), a definition of *energy poverty* should allow for full recognition of the problem. Furthermore, it should recognize not only the issue of access and inability to pay, but also the difficulty in obtaining adequate energy services. A definition should be comprehensive enough to frame a broad set of future policies and measures. The EPAH recommends that a definition of *energy poverty* integrate the main determinants: (1) Low income; (2) High energy prices (through the purchasing power parity bias); (3) Inefficient housing stock and equipment.

Therefore, they suggest that a definition of *energy poverty* should include the following aspects: *energy poverty* occurs when households are unable or have difficulty to access essential energy services at an affordable cost and is caused by a combination of low incomes, high energy prices and inefficient housing, among others. Among the relevant determinants to compose a definition of *energy poverty* according to the EPAH, we found the following references in the 16 countries listed in Table 5:

1. **Low income:** Most countries include the issue of income in their definitions, but it is presented in different ways. Some of the terms used are "inadequate financial resources" (France), "low income" (Cyprus and Portugal), "insufficient level of income" (Spain). In addition, some countries define *energy poverty* by relating energy costs and income (Scotland, Wales, the United Kingdom, and England). However, there are countries that do not explicitly include the issue of income in their definitions, such as Ireland, Romania, Togo, Chile and New Zealand.
2. **High prices:** Implicitly, most definitions address the issue of high prices by relating energy costs and household income. Ireland, Portugal and Chile explicitly incorporate the theme into the definitions.
3. **Housing stock and inefficient equipment:** Most countries address this issue in their definitions, either through the issue of residential thermal comfort as in the definition of Wales, the United Kingdom and Romania, or from the housing conditions as in France, Spain, Colombia, Portugal and England.

In addition to these conditions of *energy poverty* listed by the EPAH, it is worth highlighting the issue of physical access to the electricity grid which, despite not being relevant to European countries and, therefore, not appearing expressively in the definitions, is relevant mainly to Africa. According to the World Bank⁶, 100% of the population in Europe and North America had access to electricity in 2021, while in sub-Saharan Africa it corresponded to only 50% of the population.

⁶ *Tracking SDG7: The Energy Progress Report*. Available at: <
[https://trackingsdg7.esmap.org/results?p=Access to Electricity&i=Electricity access rate, Total \(%\)](https://trackingsdg7.esmap.org/results?p=Access to Electricity&i=Electricity access rate, Total (%))>.
Accessed at 26/07/2023.

Table 5 - Definitions of Energy Poverty in Countries

Country	Year	Definition	Reference
Wales, United Kingdom	2000	For the purposes of this Act, a person is to be regarded as living “in fuel poverty” if he is a member of a household living on a lower income in a home which cannot be kept warm at reasonable cost.	United Kingdom (2000). Warm Homes and Energy Conservation Act 2000.
France	2010	In accordance with this law, a person is considered to be in a situation of energy precariousness when they experience particular difficulties in their home in obtaining the energy supply necessary to meet their basic needs due to the inadequacy of their resources or living conditions.	République Française (2010). LOI n° 2010-788 du 12 juillet 2010 portant engagement national pour l'environnement.
Slovakia	2012	Energy poverty is a situation where the average monthly household expenses on electricity, gas, heating, and hot water preparation represent a significant proportion of the household's average monthly income.	Slovenskej Republiky (2012). Zákon o regulácii v sieťových odvetviach (250/2012 Z. z.).
Ireland	2014	Situation whereby a household is unable to attain an acceptable level of energy services (including heating, lighting, etc.) in the home due to an inability to meet these requirements at an affordable cost.	Ireland (2014). Warmer Homes: A Strategy for Affordable Energy in Ireland.
Cyprus	2015	The situation of customers who may be in a difficult position because of their low income as indicated by their tax statements in conjunction with their professional status, marital status, and specific health conditions and, therefore, are unable to respond to the costs for the reasonable needs of the supply of electricity, as these costs represent a significant proportion of their disposable income.	Cyprus Energy Regulatory Authority (2015). Law Regulating the Electricity Market of 2003 to 2016.
Romania	2016	Impossibility of the vulnerable consumer to meet their minimum energy needs for the optimal heating of the home during the cold season.	Guvernul României (2016). Legea nr. 196/2016 privind venitul minim de incluziune.
Italy	2017	Difficulty for buying a minimum basket of energy goods and services, or condition where access to energy services implies a diversion of resources (in terms of expenditure or income) higher than socially acceptable.	Italia (2017). Strategia Energetica Nazionale.
New Zealand	2017	Energy hardship is the situation when individuals, households and whānau are not able to obtain and afford adequate energy services to support their wellbeing in their home or kāinga.	New Zealand (2017). Defining energy hardship.

Country	Year	Definition	Reference
Scotland	2019	A household is in fuel poverty if (a) the fuel costs necessary for the home in which members of the household live to meet the conditions set out in subsection (2) are more than 10% of the household's adjusted net income, and (b) after deducting such fuel costs, benefits received for a care need or disability (if any) and the household's childcare costs (if any), the household's remaining adjusted net income is insufficient to maintain an acceptable standard of living for members of the household.	Scotland (2019). Fuel Poverty (Targets, Definition and Strategy) Act 2019.
Spain	2019	The situation in which a household cannot meet basic energy supply needs due to insufficient income, which may be exacerbated by having an energy-inefficient dwelling.	Gobierno de España (2019). Estrategia Nacional contra la Pobreza Energética 2019-2024.
Colombia	2020	It is a multidimensional concept that measures a household's ability to meet a minimum amount of energy for its basic needs. This indicator combines a household's income and energy expenses, the technologies it uses, and the thermal comfort of the place where it resides.	República de Colombia (2020). Plan Energético Nacional 2020-2050.
Togo - West Africa	2020	Lack of sufficient choice to access adequate, affordable, reliable, clean, quality, safe and benign energy services to support economic and human development.	République Togolaise (2020). Plan d'Action National 2020-2024 de la République du Togo pour la Politique d'Intégration du Genre dans l'Accès À l'Énergie de la CEDEAO.
England	2021	A household is considered fuel-poor when: 1. After paying energy bills, household income is below the poverty line; 2. Higher than standard energy costs. In 2019, one more classification criterion was added: 3. Live in a home that has an energy efficiency rating below Class C (The rating ranges from G to A, with A being more efficient).	England (2021). Sustainable Warmth: Protecting Vulnerable Households in England.
Portugal	2021	Inability to maintain housing with an adequate level of essential energy services due to a combination of low income, low energy performance of the housing, and energy costs.	República Portuguesa (2021). Estrategia Nacional de Longo Prazo para o Combate à Pobreza Energética 2022-2050.
Chile	2022	The situation households experience when they lack access to quality energy services at affordable costs to meet the energy needs of their members; a multidimensional problem in its causes and manifestations.	Chile (2022). Transición Energética de Chile: Política Energética Nacional.

Source: Prepared by the authors based on data from the Energy Poverty Advisory Hub (2023a) and plans, policies and strategies consulted.

After analyzing the definitions presented in Table 5, we can observe some characteristics and particularities:

1. **Metrics for identifying *energy poverty*:** Only Scotland establishes a metric in its definition to identify families in *energy poverty*. This metric relates energy expenditure to household income. This type of approach is more suitable when the country has reliable data available for analysis.
2. **Emphasis on heating and thermal comfort:** Some countries explicitly highlight the issue of heating and thermal comfort in their definitions. Terms such as "adequate heating level" (United Kingdom, Scotland, Wales), "heating" (Slovakia, Ireland), "optimum level of warming" (Romania) and "thermal comfort" (Colombia) are used to describe this aspect of *energy poverty*.
3. **Social status and ethnicity:** Some countries present specific characteristics in their definitions. In Cyprus, for example, employment status, marital status and health conditions are important elements in identifying *energy vulnerability*. In Togo, the definition of *energy poverty* is linked to access to energy services and the economic and human development of households. In New Zealand, terms are used in the Māori language⁷, such as "whānau", which means "family", which have a specific meaning in Māori society.
4. **Emphasis on energy services:** Some countries use the term "energy services" in their definitions, such as Ireland, Italy, Togo, Portugal, Chile, and New Zealand. This approach recognizes that it is not the energy itself that is demanded and consumed, but rather the services that energy can provide, such as lighting, cooking, heating, and cooling (Simcock and Petrova, 2018). Energy services are considered the benefits that energy provides to human well-being (Modi *et al.*, 2006).

These characteristics demonstrate the variety of approaches and nuances present in the definitions of *Energy poverty* in different countries.

In the next section, we will highlight the importance of measurement and present the indicators identified in the survey.

⁷ Māori are a traditional population that represents around 15% of New Zealand's population.

5. Indicators Used in Planning Instruments

In the context of *energy poverty*, indicators play a fundamental role in effectively measuring the different facets of this situation. The diagnostic process is shaped by the context, the available data, and the indicators chosen to conduct the analysis. They also assist in monitoring and evaluating trends in relation to the established goals. An effective *energy poverty* indicator addresses the various causes and dimensions of the problem, considering social, economic, environmental and infrastructural aspects. It should be able to identify different affected population groups and target policies and interventions accurately. In addition, a good set of indicators avoids redundancies and captures the nuances of a complex phenomenon like *energy poverty*. Another important criterion is the indicator's ability to test the effect of interventions, thus allowing the assessment of the effectiveness of adopted measures and making necessary adjustments.

In order to provide a more comprehensive outcome than a simple binary answer (*energy poverty* or not), the indicator must capture multiple dimensions and nuances of this phenomenon. Additionally, the indicator must be usable and reliable at different spatial and temporal scales, enabling comprehensive analysis over time and at different geographical levels. Lastly, it is recommended that the construction of this indicator be grounded in scientific methods, involving the participation of stakeholders and experts. This includes the appropriate selection and weighting of indicators to be used, in order to ensure the objectivity, robustness, and validity of the *energy poverty indicator* (EPAH, 2023a).

In the European context, sets of statistical indicators have been developed to assess the potential factors and consequences of *energy poverty*. These indicators cover multiple dimensions and are aggregated, as no single indicator can capture all aspects related to *energy poverty* (European Commission, 2020).

Some institutions propose certain thematic groupings of indicators. For example, The *European Commission* (2020) proposes a division of indicators into four groups:

"(a) Indicators comparing energy expenditure with income: quantify energy poverty by comparing the amount households pay for energy with an estimate of their income (e.g. percentage or number of households spending more than a certain percentage of their available income on energy services).

(b) Self-assessment-based indicators: households are directly questioned to assess their ability to afford energy (e.g. the ability to keep the house adequately warm in winter and cool in summer).

(c) Direct measurement-based indicators: measure physical variables to determine the adequacy of energy services (e.g. ambient temperature).

(d) Indirect indicators: measure energy poverty based on related factors, such as utility service debts, number of supply suspensions, and of housing quality."

The EPAH (2023b) establishes a grouping of local *energy poverty* indicators into six Macro Areas: "Climate", "Facilities/Housing", "Mobility", "Socioeconomic Aspects", "Policy and Regulatory Structure" and "Participation and Awareness". The same organization makes available on its website a dashboard containing an interactive database composed of *the energy poverty indicators* available for European Union countries⁸. The inclusion of the mobility theme in understanding the concept is

⁸ https://energy-poverty.ec.europa.eu/observing-energy-poverty/national-indicators_en.

noteworthy here, and the concept of "transport poverty" has even been coined⁹. Another relevant point refers to participatory mechanisms in energy management.

In order to organize the indicators and facilitate the analysis and comparison between countries, the indicators included in plans, policies and strategies were classified in this Technical Note under different themes: Income; Energy access; Residence characteristics; (Payment) Delay or Default; Health; and Vulnerability variables. The indicators presented in the following tables were identified in the plans, policies or strategies of the following countries: Chile, Colombia, Spain, France, Ireland, Italy, Mexico, New Zealand, Portugal and the United Kingdom. It should be noted that, in the case of the United States, there is an *energy justice monitoring tool (Energy Justice Dashboard Beta)* that uses, in addition to indicators related to energy and income, others related to the environment (air quality, water quality, basic sanitation), health (cancer risk due air toxins, respiratory risks) and vulnerable communities (disadvantaged communities; tribal lands, and minorities).

Regarding energy access, indicators were only found in Latin American countries, not in countries of the Global North, as shown in Table 6, since these countries generally already have a more consolidated infrastructure for access to electricity. The two indicators measure accessibility to energy services, with one indicator focusing exclusively on the percentage of households with access to electricity and the other on energy services, such as heating or cooking food from clean sources. It is worth highlighting the importance of access to energy services for individuals' well-being, as they materially contribute to people's daily lives (Nussbaum, 2011; Saith, 2001; Sen, 2009).

Table 6 - Indicators related to "Access to Energy"

	Country	Indicators
1	Chile, Colombia, Mexico	Percentage of households with access to electricity in relation to the total number of households
2	Chile, Colombia	Percentage of households that have heating, domestic hot water and food cooking from clean, low-emission energy sources
3	Chile	Percentage of rural electrification projects led by the Ministry of Energy whose target population is indigenous
4	Chile	Percentage of rural electrification initiatives for indigenous peoples in isolated areas that develop participatory processes in relation to the total number of rural electrification initiatives for indigenous peoples in isolated areas

It is also worth noting that Chile is the only country with indicators for a specific group, in this case, the indigenous peoples. There are two indicators related to energy access specifically for this group (3 and 4).

Regarding income-related indicators (Table 7), their predominance stands out: out of a total of 10 countries with indicators, 9 of them incorporate the income dimension. This fact demonstrates the importance of income as a fundamental aspect for measuring *energy poverty*.

⁹ "We understand transport poverty as the forced lack of mobility services necessary for participation in society, resulting from lack of access and/or inaccessibility and/or unavailability of transport" (Lowans et al., 2021).

Table 7 - Indicators related to "Income"

	Country	Indicators
1	Chile	Lower energy expenditure than similar households
2	Spain, Italy	Percentage of households whose absolute energy consumption is less than half of the national median
4	France	Households whose energy expenditure is greater than 8% of income and is less than the third decile of income per unit of consumption ¹
5	Ireland, New Zealand, Portugal	Households whose energy expenditure accounts for more than 10% of total income
6	Italy	Vulnerable households with zero expenditure for heating
7	Italy, New Zealand, Chile	After deducting energy costs, the family's income is below the poverty line
8	Italy, Spain	Percentage of energy expenditures in the total household budget that exceeds twice the median
9	Mexico	Variation of fuel prices and domestic electricity tariffs in relation to the national consumer price index
10	New Zealand	Households with fuel costs above the median
11	Portugal	Households with Social Electricity Tariff
12	Portugal	Households with Social Tariff for Natural Gas
13	United Kingdom	Households with a Fuel Poverty Energy Efficiency Rating of band D or below or those with residual income falling below the official poverty line after energy expenditures

¹ Unit of Consumption (CU) is a measure used in France to assess the consumption needs of a household or household based on the number of members and specific criteria and is used in various areas related to social and budgetary policy.

The indicator most often used in European countries measures absolute energy expenditure greater than 10% of total household income (indicator 5). In this case, it reveals the financial weight of energy expenses in household income. However, there are some considerations about this measurement method, as it does not reference the analyzed family income, meaning it establishes a metric standard that does not cover other contexts and is sensitive to changes in energy prices (Romero *et al.*, 2018). England's strategy (2021) mentions that this indicator (5) was used in the country's first strategy in 2001. Currently, it is recognized that this measurement method needs to be applied with other incorporated analyses, especially to focus on low-income families.

Other indicators assess *energy poverty* based on average energy expenditure. Thus, indicators with energy expenditure above the median (indicator 10) and those exceeding twice the median (indicator 8) have been established. In these cases, the aim is to identify which households are spending too much, compared to the population median. Additionally, there are indicators that associate this high expenditure in households with low income (indicators 3 and 4), as it identifies low-income households with disproportionately high energy expenditure.

Portugal stands out by adding indicators on energy tariffs in the analysis (indicators 11 and 12). The intention is to identify whether mechanisms for protecting vulnerable consumers and promoting energy accessibility occur by establishing indicators that measure households benefiting from some type of social electricity and natural gas tariff.

Furthermore, indicators highlighting energy consumption below the national median (indicator 2) or of similar households (indicator 1) have been identified. This is an indicator that signals

hidden energy poverty; unlike high energy expenditure, there is an expenditure below the median, or zero (indicator 6), indicating that the household may be experiencing energy service deprivation. It is a popular indicator in European countries, as they experience low temperatures, and individuals suffer from thermal discomfort due to the inability to pay expenses (Bouzarovski *et al.*, 2018). In general, consumption below the median would indicate that households are consuming less energy and possibly experiencing energy deprivation.

Additionally, there are indicators that assess household income after energy expenditures (indicators 7 and 13). This aspect focuses on families below the poverty line after paying expenses to identify households with socioeconomic vulnerability and the burden of energy bills for these families.

Lastly, bringing a specific aspect, there is an indicator (9) that evaluates the variation in fuel prices and electricity tariffs relative to the national consumer price index. The objective of the indicator, as signaled in the country's program, is to assess the social development of its population, aiming to ensure universal access to energy.

In the literature addressing *energy poverty*, it is noted that access and income alone are not enough for understanding the issue (Boardman, 2010; Romero *et al.*, 2018; Bouzarovski, 2018). Therefore, other indicators assist in the overall diagnosis and identification of families in this situation. The first refers to the inability to maintain housing at an adequate temperature, observed in 5 countries (as shown in Table 8), capable of identifying families living in cold and damp dwellings, leading to severe health problems, both physical or mental – and in some cases, even death. In addition, housing with low energy performance requires high energy consumption to maintain the house at a comfortable temperature, a factor that influences energy expenditure. These scenarios can be associated with low-income residences, which often lack the capacity to invest in improving household energy efficiency (Boardman, 2010).

Table 8 - Indicators related to "Characteristics of the residence"

	Country	Indicators
1	Chile, Spain, France, New Zealand and Portugal	Percentage of the population that is unable to maintain housing at an adequate temperature
2	Portugal	Population living in dwellings with problems of infiltration, humidity or rotting elements*
3	Portugal	Population living in housing that is not comfortably cool during the summer*
4	Portugal	Energy performance of dwellings*

*Secondary indicators

It is necessary to highlight that, in addition to the primary indicator regarding the ability to "maintain housing at an adequate temperature", Portugal also has three secondary indicators that complement and expand the measurement of *energy poverty* in the country, including an indicator that considers the ability of families to keep their homes cool during the summer, a condition still underexplored in other countries.

Table 9 - Indicators related to payment "Delay or default"

	Country	Indicators
1	Spain	Percentage of the population in arrears in the payment of energy bills
2	New Zealand	Electricity disconnection due to non-payment of bills
3	Portugal	Population with debts to public utilities*
4	Portugal	Interruptions due to customer-assigned cause*

*Secondary indicators

Indicators related to "delay or default" provide another perspective on the phenomenon of *energy poverty*, as late or non-payment of bills indicates the inability of families to allocate part of their income to pay for energy services. Consequently, there is a disruption in energy supply to households and the inability to use energy services. Thus, this indicator contributes to revealing the percentage of the population that needs government measures to help them pay their energy bills. It is necessary to highlight that there is still a gap in the analysis, as quantitative indicators do not allow understanding the reasons for delay or default.

Table 10 - Indicators related to "Health"

	Country	Indicators
1	Chile	Percentage of households accessing heating, domestic hot water and cooking from clean, low-emission energy sources
2	New Zealand	Excess mortality in winter

Regarding indicators mentioning health aspects, two dimensions have been identified: the use of clean energy sources in homes, which indirectly addresses the internal pollution generated by polluting fuels and excess mortality during the winter. As for indicator 1, it reflects on households that are using polluting fuels in the residence, which is a common aspect of *energy poverty* in Latin American countries - mainly the use of solid fuels for cooking (World Health Organization, 2014).

According to the World Health Organization (2016), *energy-poor* households use other types of fuels for cooking, heating, and lighting such as wood, coal and kerosene. Exposure to pollutants emitted by these fuels poses health risks to individuals, as their inhalation is a risk factor for heart disease, lung cancer, chronic obstructive pulmonary disease (COPD), stroke, and pneumonia. Women and children are the highest risk of exposure to pollutants due to woman spending long periods in the household and the presence of children during household activities - including the preparation of meals.

Winter mortality is particularly prevalent in countries with low temperatures. In this case, the low energy efficiency of the residence and exposure of individuals to inadequate temperatures favor the illness of the residents. *Energy poverty*, in this case, is linked to the difficulty of maintaining adequate heating in residences - either due to its high cost or low energy efficiency of the household, affecting the physical and mental health of the individual. In a more severe situations, with low winter temperatures, *energy poverty* is associated with increased mortality (Bouzarovski *et al.*, 2018).

Box 2 - Variables to characterize vulnerable population

The primary indicators aim to provide accurate monitoring of the *energy poverty situation*. However, it is necessary to refine and make analyses more precise to measure specific circumstances of *energy poverty*. Thus, it becomes possible to tailor measures to the particularities of certain groups or types of consumers. For this reason, in Spain, for example, characterization variables were used to complement the analysis. In additionally, variables and indicators that, individually, do not directly describe or measure *energy poverty* can provide an overview of the vulnerability context.

Spain and England include complementary variables for characterizing vulnerable populations in their Policies and Strategies. The Spanish national strategy measures specific situations of *energy poverty* to adapt measures to some groups or consumers typologies through these variables. In the case of England, vulnerability variables serve as a prioritization in the formulation of public policies. Table 11 shows these variables.

Table 11 – Variables to characterize vulnerable population

	Country	Variables
1	Spain	Number of residents in the household
2	Spain	Employment status: unemployed; Retired
3	Spain	Income quintile per unit of consumption
4	Spain	Status of residents: single persons aged 65 and over, childless couples in which at least one member is 65 years old, or single-parent households, in which one adult lives with children
5	England	At least one member of the household is 65 years of age or older
6	England	At least one member of the household is under school age
7	England	At least one member of the household is living in a health condition that makes them likely to spend most of their time at home or is at higher risk of suffering a cold-related illness

Portugal presents some secondary indicators used to complement the main ones. In addition, for some indicators, it establishes two cut-offs, one for the general population and the another for the population in poverty, such as: "Population in poverty living in households unable to adequately heat the house"; "Households in poverty whose energy expenditure represents +10% of total income"; "Population in poverty with debts to utility services" and "Population in poverty and living in homes with infiltration, humidity or rotting elements", with the last two indicators being considered secondary. Only indicators related to the general population were considered in Tables 6 to 10.

6. Goals and Measures for Overcoming Energy Poverty

In this section, the goals and measures established in planning documents to consider energy poverty overcome, wholly or partially, will be analyzed, as well as the measures set in each country to achieve these goals. It is important to note that, depending on the country, similar goals and programs may be listed, but linked to different themes. In this context, goals and programs nominally focused on *energy poverty* were selected. The term "energy justice" is not used in the analyzed documents.

Regarding the inclusion of the topic of *energy poverty* in medium and long-term plans, Chile and the European Union member countries stand out. In the European Union, there is an official directive that establishes objectives, policies and measures to reduce the number of households in *energy poverty*, especially when a significant number of households are identified in this situation (European Commission, 2020).¹⁰ In the case of Portugal, a version of the document that was under public consultation at the time of the research was used, as it was a specific national strategy for the theme of *energy poverty*. In the case of Chile, the reference documents used were energy policies (and not a plan), with clear goals in relation to the theme, but related to the set of actions specific to an energy policy, yet with specific objectives, including special attention to indigenous peoples, rural areas and populations near large projects.

6.1. Goals

The goals presented reveal at first the difference between countries that have already achieved the goal of providing electricity access to the entire population, and those still facing this challenge. Secondly, the challenge emerges of ensuring uniform energy quality throughout the territory. Once access and uniform quality are ensured, as is the case in almost all European countries and the United States, the issue of high energy costs in household budgets stands out, requiring the adoption of different strategies and goals. Goals related to energy efficiency are highlighted, a topic emphasized – and funded – in the European context.

Finally, it is worth mentioning the goals related to population diversity, taking into account how the issue affects men, women, and indigenous peoples differently. Also notable is a single goal related to pollution in the domestic environment resulting from biomass cooking. It is important to note that transportation has recently been associated with *energy poverty*, although it was not a theme so strictly in most plans at the time of survey.

For these reasons, we classified the identified goals to combat energy poverty or injustice in the following aspects:

¹⁰ Since 2009, the issue of *energy poverty* has been disseminated in a number of energy policies in the European Union. The European Parliament's Electricity (2009/72) and Natural Gas (2009/73) Directives encourage the opening up of electricity and natural gas markets and the creation by Member States of support mechanisms to protect vulnerable consumers, recognizing the need to protect consumers if prices are dictated solely by market mechanisms, including by encouraging the prohibition of supply cuts at critical moments. In the most recent directive on the electricity market (2019/944), the obligation to account for energy poverty was placed, a requirement already present in the EU Governance Regulation on Energy and Climate Action (2018/1999), in all Member States. In addition, the topic has appeared in other directives, such as the new Energy Performance of Buildings Directive (2018/844) and the Energy Efficiency Directive (2018/2002).

1. **Physical access to energy services:** This goal aims to establish objectives regarding the total number of households connected to the integrated system or the implementation of supply alternatives. This goal was observed only in Latin American countries.
2. **Equity in quality:** This goal aims for all consumers, whether in integrated or isolated systems, to enjoy stable and equivalent quality energy supply. Also present only in Latin American countries.
3. **Reducing the financial burden of energy expenses on vulnerable families' budget:** This is one of the most frequent goals internationally. Some countries have established the percentage of the population that should be outside the *energy poverty* range. Among the more specific goals that should contribute to this end, in some cases, there is a proposal to improve the allocation of financial assistance for electricity and gas, self-consumption projects for families in *energy poverty* situations, price limit goals linked to inflation, or the legal definition of energy as a right.
4. **Energy efficiency:** Involves both goals to increase the efficiency of buildings and to improve the efficiency of energy devices and equipment used, focusing on the residential sector.
5. **Differentiated attention according to ethnicity or gender:** Chile stands out for setting goals for indigenous peoples, while Togo was the only country to explicitly establish the gender issue.
6. **Pollution reduction:** Goal related to reducing sources of pollution in the domestic environment, mainly for heating. This goal, found only in Chile, demonstrates a commitment to reducing the impacts of using polluting energies on the domestic environment.

In common, despite the different sets of goals in each country, the importance of reducing the burden of energy bills on household income stands out. To achieve this objective, there is a range of measures announced, presented in the next item. In Annex 1, there is a systematization of the goals and the countries that adopt them.

We also highlight the absence, in some plans, programs and strategies, of goals and objectives regarding the theme. Some countries announce generic objectives to improve access to clean energy at an affordable cost, but without any specific medium or long-term goals. Uruguay approaches this, with the only goal being the electrification of 100% of the country. No specific national goals were identified for the U.S.¹¹ (which may be attributed to the emphasis on state-level planning), despite the country having federal policies, such as the *Justice40 Initiative*¹², focused on an energy transition concerned with communities burdened by environmental impacts of different natures and with few investments in infrastructure in general.

¹¹ “While the UK and US have had similar responses to energy poverty reduction, one key area of divergence lies in their formal recognition (...) the United States lacks federal energy poverty recognition and strategy that encompasses definitions, reduction targets/objectives and periodic evaluation.” Bednar et al. 2020, p. 432

¹² See the “Justice40 Initiative” em: <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/>, accessed at 24/05/2023.

6.2. Measures

In medium and long-term plans, policies and strategies, some countries establish actions against *energy poverty*, thus defining strategies to achieve their goals. In this sense, we present in Graph 1, in an aggregated way, the set of measures planned to be implemented in several countries¹³. Each measure addresses a specific dimension of *energy poverty*, from creating metrics for diagnosis to interinstitutional partnerships, aiming to achieve a comprehensive and inclusive solution. It should be noted that ongoing actions are not included in this analysis, only those placed in medium and long-term planning. Additionally, there are several initiatives that aim for the same goal, but do not use the language of *energy justice* and *poverty* to establish their programs or measures, and therefore, they have not been included.

In the context of these strategic measures to combat *energy poverty*, it is observed that there is a trajectory to be followed, although not strictly linear. Initially, several countries intend to adopt or revise the legal framework that defines what *energy poverty* is. From this point, they establish a system for monitoring *energy poverty* through indicators that portray the situation in the different regions of the country. For those countries that have already established these databases, the focus is on continuously improving them to make public policies more effective or incorporating modifications in the understanding of the scope of the issue.

In countries where there is still a part of the population without access to energy sources, measures are proposed for local generation or expansion of the transmission and distribution network. Once this stage is overcome, countries aim for an improvement in the quality of energy, whether electricity or cooking fuels. Considering the significant impact of energy expenses on household budgets, measures aimed at reducing this burden are adopted. Although related to household energy expenditures, energy efficiency measures are considered in a separate category. Additionally, measures are established to better inform citizens about energy use, as well as their rights and responsibilities as consumers. In smaller numbers, some countries include measures within the energy market, such as imposing taxes on profits, reducing taxes for consumers or introducing flexible tariffs, among other approaches. Finally, measures are listed to establish partnerships, aiming for a deeper understanding of the impacts of *energy poverty*, as well as the expanding the implementation of initiatives and the consolidating technical exchanges, among other objectives.

The presented graph quantifies the measures taken by different countries to address *energy poverty*. These measures represent a variety of approaches and strategies implemented by governments around the world, seeking to effectively address and resolve this problem.

¹³ For an overview of the measures in the energy plans of the European Union countries, see Odysee-Mure, 2019.

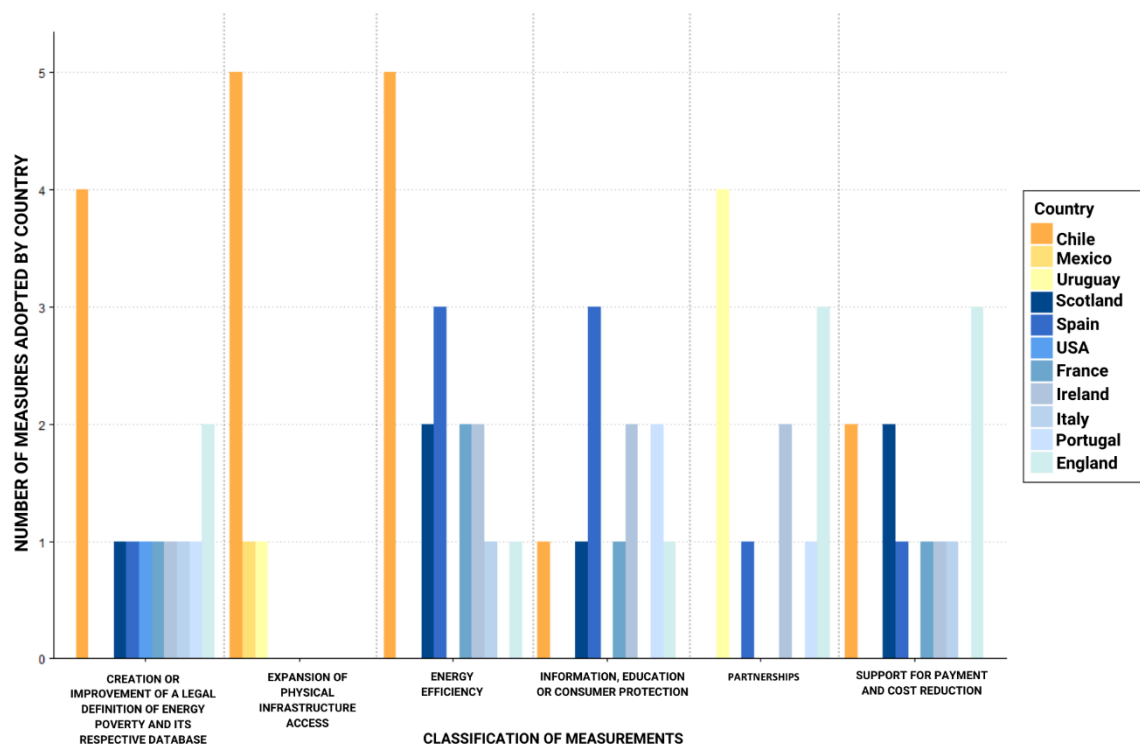


Figure 1 - Measures taken by countries to address energy poverty

The following analysis provides an overview of the adopted approaches and how they are used to overcome *energy poverty*:

1. **Creation or improvement of a legal definition of *energy poverty* and its respective database:** includes countries aiming to establish a legal framework defining an official measure of *energy poverty* or a minimum level of energy supply, as well as databases capable of monitoring the population's situation at all times. Also included are actions to improve existing databases; with a view to enhancing eligibility criteria for social benefits based on the available data (such as the inclusion of gender, ethnicity, health condition, age, among others). Finally, measures to improve data dissemination and generate maps with the available data are also included.

It is quite significant that this is the measure established by the largest number of countries (10 in all). This result reflects the importance given to a legal definition to guide efforts to overcome *energy poverty*, as well as the commitment of the state apparatus to monitor the issue with increasing accuracy to identify the most vulnerable and thus propose focused public policies. In addition, at the planning level, such databases allow for scenarios to be projected based on policy choices and their effects on this segment of the population (for example, whether measures for electricity, gas or transport will have a greater effect on household budgets), as done in France.

2. **Expansion of physical infrastructure access:** Includes actions to supply electricity to rural or isolated areas, through the expansion of transmission or isolated electrical systems. In Chile, it involves a specific effort for communities located near large-scale energy projects and special attention to the quality of service in public or community establishments.

As mentioned earlier, this measure stands out for being emphasized in Latin American countries. Chile presents a significant number of measures, partly justified by the choice to detail different

measures for indigenous territories, communities near large projects, schools, hospitals, and community structures in isolated areas. The Chilean mapping of households without electricity, isolated and self-generation systems, and those with partial supply, with information at the municipal and household levels¹⁴, is highlighted here.

3. **Energy efficiency:** Includes measures to increase the efficiency of public buildings – including social housing – or private ones, in most cases, due to home heating. This includes building renovations, material research, supply chain, and distribution of new technologies throughout the territory, incentives for companies supplying materials and services for the efficient construction industry, creation of labels and minimum efficiency standards for household devices.

Regarding energy efficiency, once again Chile stands out quantitatively by establishing detailed measures. However, the importance of building renovations as one of the main focuses in the European context is perceived, and in the Chilean case, associated with efforts to provide more efficient materials in various parts of the territory.

4. **Information, education or consumer protection:** Includes measures to improve audit mechanisms and complaint resolution to ensure better quality of service from electricity distributors, improve regulation or implement measures to protect low-income consumers, implement legal mechanisms to prevent energy supply cutoffs in critical periods (such as gas for heating in the European winter), disseminate information about available new technologies, best practices and consumer rights, and establish mechanisms for raising awareness and generating collective consciousness of the *energy poverty* problem.

These measures are more widespread in Europe, focusing on both consumer habits and limitations on companies' actions in case of non-payment, especially in winter.

5. **Partnerships:** Include actions such as creating links with academia for diagnosis and impact assessment on health, education, employment, productivity, among others; training of community agents or at the municipal level in the scope of energy access projects in vulnerability contexts, promoting technical exchanges and establishing partnerships between ministries to integrate housing, energy and social inclusion policies.

Partnerships refer to two types: those aimed at actions with families in *energy poverty* situations, which can range from local social assistance to other ministries focused on policies correlated with *energy poverty* (such as housing, employment and citizenship) and those aimed at knowledge generation, which may involve other ministries or academia, the latter being a strategy adopted by Uruguay and Ireland.

6. **Support for payment and cost reduction:** Includes measures to create, expand access to, or increase the value of assistance for electricity and/or gas payment, improve mechanisms for tariff equity, implement mechanisms that allow gas to be sold at a fair price, improve the reach of support for households with high energy costs (e.g. households difficult to restructure, off-grid homes, multi-family occupation homes), make economic benefits for combating *energy poverty* easier for families with access barriers (communication barriers e.g.), and implement programs to increase household incomes and reduce costs.

¹⁴ https://www.energia.gob.cl/sites/default/files/documento_de_metodologia_y_resultados_0.pdf. Accessed on 05/31/2023.

The adopted measures vary in focus, some on social and equivalents tariffs, others on households and finally, those aimed at increasing household income. Almost all countries aim to adopt measures of this nature.

7. **Energy generation:** Includes measures such as developing of information tools that indicate the energy potential of the territory (allowing the selection of the most suitable technologies, materials and self-sufficiency options for each region), feasibility studies of solar thermal systems, photovoltaic generation, biomass, biogas, among others according to the characteristics of the territories, with special attention to indigenous lands, in the case of Chile. In the case of Mexico, it includes "rural production units" with a view to self-sufficiency.
8. **Energy quality:** Includes measures for the responsible use of certified quality (dry) and low-emission wood, working with distributors to achieve quality electricity, prioritizing those communities with the most critical unavailability indices in the country, and regularizing everyone's connection.
9. **Changes in the energy market:** Include measures to tax windfall profits, reduce taxes paid by consumers, introduce flexible tariffs, encourage residential storage alternatives, and implement the possibility of changing supplies.

These measures cover different aspects of *energy poverty* and reflect the understanding that a comprehensive approach is needed to overcome this problem. The combination of policies aimed at improving access, quality, efficiency, and equity in the energy sector can lead to significant advances in reducing *energy poverty* and promoting *energy justice*.

7. Organizational Techniques for Combating Energy Poverty and Promote Energy Justice

In this section, four "organizational techniques"¹⁵ (Bourdieu, 2012, p.49) used by countries to address the issue of *energy poverty* or justice will be presented. The ways in which this issue is dealt with within the institutional structures of the State that use this nomenclature will be highlighted. It is emphasized that the lack of terminology does not imply the absence of actions, but rather their dispersion among agencies, secretariats, and institutional mandates.

The first organizational technique used, and still in effect, is that of Committees composed of members of the Executive branch. This initiative began in England in 1999 with the establishment of an Inter-ministerial Group on Fuel Poverty, composed of 11 ministries or equivalents, with a mandate of approximately two years to establish a strategy to combat fuel poverty. Subsequently, the Fuel Poverty Advisory Group (FPAG) was established in 2001, composed of senior representatives from energy industry organizations, social assistance organizations, and consumer advocacy groups. This model of advisory council, committee, group, or panel is a second relevant technique for understanding and proposing policies on the subject. In the case of England, in 2015, this Group was transformed into the Committee on Fuel Poverty, with a change in its composition, replacing institutional representatives with a smaller group of six independent, paid experts appointed through an open competition process. The role of this committee is to assess the level of fuel poverty, report on progress towards the objectives set for 2030, assess the effectiveness and impact of measures adopted, and propose modifications or additions to fuel poverty alleviation strategies. Partnerships and relations with other policies, such as those related to climate change, are generally proposed. Domestic energy monitoring (connected to the gas network, gas and electricity consumption, on a postcode scale) is carried out by the Department for Energy Security & Net Zero.

In the case of Scotland, there are two government-established groups that work together in the advisory body model, involving minority government actors (representatives of local authorities, energy service regulatory agencies, healthcare systems), and including representatives from the energy industry and electricity and gas distribution companies, as well as various actors from civil society, many of whom focus on providing social assistance to people in poverty. The group advising state ministers on the subject is the Scottish Fuel Poverty Advisory Panel - whose members change every two years, and the second group, the Scottish Fuel Poverty Partnership Forum, brings together an even larger group of non-governmental entities (including business) and serves as support for data production and monitoring analysis and proposition of measures. Nevertheless, before the implementation of the Energy Poverty overcoming Strategy in 2018, there was a public consultation on the subject.

The third technique is that of "Observatories" of *energy poverty*, which gather information on current levels of *energy poverty* and, with equal emphasis, on the various initiatives to combat it. There are observatories conducted exclusively by state apparatuses, with one or several ministries, others by a set of municipal instances. There are also those led by researchers at universities, occasionally involving sector companies. In some cases, NGOs also participate. Examples of countries

¹⁵ The author highlights how these techniques were created at a certain moment, possessing a historicity and symbolic effects in representing the official view on a subject. And defines these organizational inventions as techniques in which people are placed to work together in such a way that they do things they would not do if they were not organized in this specific manner.

with observatories with government participation or coordination include France, created in 2011; Greece, created in 2014; and Romania, created in 2022.

These observatories integrate interest groups, provide practical bases for evaluating *energy poverty*, monitor status and trends, and propose structural and long-term measures. The observatories have a structure to gather information on monitoring and constant work to organize local exchange experiences. Therefore, there is openness to the participation of different actors, becoming a point of connection between different government agencies, companies, civil society (consumer representatives and social assistance groups), with a strong presence of university researchers, combining the proposal of generating academic knowledge, raising awareness among politicians, but also a repository of practical initiatives of national and local governments on ways to overcome *energy poverty* (including presented in the form of maps), aiming at dissemination among local and national technicians. In this sense, the European Union Observatory on Energy Poverty was transformed into the Energy Poverty Advisory Hub, reinforcing its pedagogical and practical character with a view to creating institutional capacity of local governments to eradicate *energy poverty* and accelerate the just transition in European countries¹⁶. Even with this new function, it still maintains the function of monitoring the level of *energy poverty* in countries and offers a range of materials for monitoring at the local level¹⁷.

In the case of the French National Observatory for Energy Precarity¹⁸, it is noteworthy that the map produced to identify families having difficulty paying energy bills serves for preventive social assistance actions before winter arrives. It was one of the first to include the theme of transportation and its costs in the work carried out by the observatory. Another opening refers to the sources of data in its reports, which include official, business, but also some sample data produced by NGOs. And among the series of research conducted, some has a sociological approach, seeking to portray how *energy poverty* is experienced and the interaction with government aid devices for families, generating analyses from the citizens' point of view and contributing to solutions based on qualitative methods¹⁹ (something similar was done in Scotland more recently²⁰).

Finally, the fourth organizational technique was identified in the United States, where the Office of Energy Justice Policy and Analysis was established, linked to the Department of Energy, which analyzes federal energy policies and programs focusing on energy and environmental justice issues. Its activities include providing technical assistance, making recommendations, and promoting equity for racial and ethnic minorities, as well as other disadvantaged communities and individuals. This technique differs significantly from those adopted in European countries. By addressing the issue as *energy justice* and not just *energy poverty*, this Office broadens the scope of the issues addressed beyond the cost of energy for low-income families or the difficulties of living without access to energy services. This expansion of the scope of the set of problems to be solved simultaneously allows for the consideration of inequalities in the impacts of pollution in general, not just from energy generation, and is linked to monitoring of investments in energy transition - locating whether the installation of solar panels, the impact of clean energy jobs, among others, is occurring in socially or environmentally more vulnerable communities. It is noteworthy that the focus is not so much on families, referring to

¹⁶ https://energy-poverty.ec.europa.eu/about-us_en. Accessed on 05/19/2023.

¹⁷ https://energy-poverty.ec.europa.eu/observing-energy-poverty_en. Accessed on 05/19/2023.

¹⁸ <https://onpe.org/>. Accessed on 05/19/2023.

¹⁹ https://onpe.org/sites/default/files/onpe_-_etude_longitudinale_-_analyse_transversale_.pdf Accessed on 01/05/2023.

²⁰ <https://www.gov.scot/publications/research-lived-experience-fuel-poverty-scotland/tag>. Accessed on 07/06/2023.

"communities" as the unit of analysis in which these dimensions are considered together. Another difference is the fact that the Office is exclusively linked to the Department of Energy, without institutionalizing relationships with other ministries, companies, academia, or NGOs.

One of the public tools made available by this Office is the Energy Justice Dashboard²¹. This platform portrays not only the cost of energy for low-income families but also addresses the "legacy of environmental racism that has resulted in low-income, Black, Brown, and Indigenous communities in the United States being disproportionately impacted by air and water pollution, as well as becoming more vulnerable to extreme weather events." (US Department of Energy website). For this, it uses, in the same mapping tool, the Environmental Justice Screening and Mapping Tool²², with environmental and demographic data and the map of the cost of energy for low-income families²³. A third layer of information refers to new clean energy solutions in terms of electricity, transportation, among many other initiatives related to the fair energy transition of the Justice40 program. In this way, it is possible to visualize and analyze whether the most vulnerable communities, according to criteria of the environmental justice²⁴ concept, are being served by new energy policies.

²¹ <https://www.energy.gov/diversity/energy-justice-dashboard-beta>. Accessed on 05/18/2023.

²² <https://ejscreen.epa.gov/mapper/>. Accessed on 05/18/2023.

²³ <https://www.energy.gov/scep/slsc/lead-tool>. Accessed on 05/18/2023.

²⁴ As early as 1992 the George H.W. Bush administration had established the *Office of Environmental Equity*, now known as the *Office of Environmental Justice*, within the U.S. Environmental Protection Agency (EPA).

8. Final Thoughts

At EPE, the process of structuring a database and socio-environmental information systems applied to energy planning raised reflection on the importance of incorporating analyses of *energy justice* and *energy poverty* into planning instruments. In this way, it is hoped that the experiences observed in other countries and consolidated in this document present elements that can support and contribute to the construction of the path to be taken in Brazil.

As discussed in this Technical Note, defining a concept to be applied in Brazil, considering its particularities, including intra-regional ones, is a fundamental step for the subsequent choice of indicators and for the establishment of state goals and actions. Identifying the most vulnerable families and communities helps to more effectively direct governmental interventions, producing practical results for citizens.

In other countries, the use of the concept of *energy poverty* or *energy justice* and its corresponding indicators is linked to other political agendas, providing different perspectives on the problem. For example, with the climate agenda (Poland), social agenda (Romania), or as part of broader populist narratives (Hungary), as shown by Jigla et al. (2020). We can also highlight the relationship with the health issues of the lower classes in winter (United Kingdom), the relationship with energy market models (European Union), the precariousness of living conditions of the lower classes (France), or a conception of the energy sector focused on human development (Chile). Finally, in the United States, the merging of energy cost indicators for the low-income class was articulated with the concept of environmental justice, in the wake of struggles for civil rights of racial minorities (Rosenthal, V. et al., 2023). These international experiences demonstrate how *energy poverty* and *energy justice* should be treated with care, considering the reality of each country.

Among the challenges mapped in the Brazilian case, one of them refers to the databases to compose *energy poverty* indicators. For indicators that relate electricity to the characteristics of families and residences, there are consistent, reliable, and regionalized databases, but, on the other hand, they are scattered across different institutions and the data are collected for different purposes. Regarding indicators related to LPG (Liquefied Petroleum Gas), there is difficulty in mapping consumption since the cylinder has less traceability compared to piped gas. Concerning environmental and health indicators, there were difficulties in finding data similar to those existing in the Energy Justice Dashboard Beta (USA).

A relevant issue rarely mentioned in the accessed documents and academic literature on the topic of *energy poverty* and justice concerns community energy uses. Community energy uses have significant impacts on well-being, covering health, education, and productive activities. The availability of reliable and affordable energy is essential for the functioning of health services, ensuring adequate lighting, refrigeration of medicines, and operation of medical equipment. In education, energy enables suitable learning conditions through energy services such as lighting and access to technological resources. Moreover, energy can make feasible and drive productive activities, generating income and improving the socio-economic conditions of communities.

Among the approaches observed in international contexts, some experiences stand out for their potential:

1. Official establishment of a definition of *energy poverty* and/or *energy justice*, aiming to provide a solid legal basis for assessing and planning energy policy.

2. Formulation of indicators capable of measuring and monitoring lack of access, quality, and efficient use of energy, in order to identify vulnerable groups and direct appropriate interventions.
3. Setting goals and policies aimed at reducing *energy poverty* and promoting *energy justice*, with the aim of ensuring that people have access to reliable, safe, and affordable energy services in the context of the energy transition.
4. Implementation of initiatives that promote energy citizenship, involving active participation of the population, awareness of responsible energy use, and capacity building to adopt effective energy efficiency measures.
5. Creation of a panel with geolocated information, providing data on energy access, consumption, socioeconomic and demographic indicators, enabling comprehensive and accurate analysis of the energy situation in different geographic areas.
6. Establishment of governance with governmental and/or non-governmental actors responsible for assessing the degree of *energy poverty* and/or supervising *energy justice*, reporting progress towards established goals, analyzing the effectiveness and impact of adopted measures, proposing modifications or additions to existing strategies, and conducting specific research on various dimensions of the problem. Additionally, it can serve as a hub for sharing local experiences and developing institutional capacity at various levels to address the issue.

The adoption of these approaches in Brazil can significantly contribute to understanding, monitoring, and addressing *energy poverty*, promoting *energy justice*, and improving the well-being of the population.

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11. Appendix – Goals Identified in Plans, Programs and Strategies

	Goals	Countries
1	Prioritize investment and financing initiatives targeting indigenous peoples for access to energy services and promote their development.	Chile
2	Reduce the use of polluting energy sources in homes (especially for heating) and the use of devices that harm human health by switching to clean energy options.	Chile
3	Improve the efficiency of the energy devices and equipment they use in the home.	Chile e Portugal
4	Ensure safe and quality physical access to the energy services needed to meet the basic energy needs of all households and households.	Chile, Uruguay and Colombia
5	Users of integrated systems and isolated systems with the same quality of access to energy.	Chile, Uruguay and Colombia
6	Affirm a right to access energy for all without excessive costs in relation to household resources.	France
7	Increase the efficiency of existing measures (electricity and gas bonuses).	Italy
8	Prioritize the energy efficiency of buildings (in some cases with a focus on the residential sector).	Italy, Chile, Portugal and the United Kingdom
9	Tackling energy poverty (reducing the burden of energy expenditure on the vulnerable) – with or without targets for the proportion of the population in energy poverty at the end of the horizon.	Italy, France, Spain, Ireland and Scotland
10	There is no variation in fuel prices and domestic electricity tariffs in relation to the national consumer price index.	Mexico
11	Encourage self-consumption projects and renewable energy communities that integrate families in energy poverty.	Portugal
12	Ensure that all energy programmers, policies, and initiatives, including infrastructure and large-scale energy investments, are non-discriminatory, gender-inclusive and geared towards reducing inequalities.	Togo (West Africa)
13	Access to adequate information (comparison of sources, equipment, costs, short- and medium-term projections, etc.) must be guaranteed to all citizens, which must enable them to make appropriate energy decisions, both at the domestic and production levels.	Uruguay