5 Reflections from Quantitative Characterisations of Energy Poverty in Mexico

Methods, Energy Justice, and Geographic Differences

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5.1 Introduction

Access to affordable energy services – for cooking, transport, heating, or cooling – is fundamental to the well-being of countries and communities around the world and contributes to collective efforts to overcome existing and/or potential cycles of poverty and underdevelopment (International Energy Agency, 2004; Sorrell et al., 2020). Such narratives linking energy use and access with well-being, mobilised by authors like Reynolds and Hughes (1984) or Nye (1999), have materialised in the United Nations Sustainable Development Goals (SDG7) (UN, 2020).

Within this context, issues related to Energy Poverty (EP) have been explored and analysed extensively over the last decades (Li et al., 2014) since the concept of *fuel poverty* was first coined in the 1980s (Day et al., 2016) in the UK. These concepts emerged in response to concerns about heating standards in British households (Ministry of Fuel and Power, 1946; Morris, 1961) during the oil crisis beginning in 1973 (Owen, 2010). This situation took Boardman (1991) to define a fuel-poor household as one spending >10% of its income on fuel costs. In recent years, fuel poverty evolved into the more widely defined concept of EP, later adopted by organisations like the European Commission and the International Energy Agency (IEA) (European Commission, 2021; IEA, 2020). Although the concepts of EP and fuel poverty are sometimes used as synonyms and descriptors of household energy consumption issues (Li et al., 2014), both concepts are typically used to represent different problems in different geographies. However, EP has become a more global term used to analyse the lack of access to modern energy services, an issue that intensifies in countries from the Global South. On the other hand, fuel poverty is mainly used in the UK to describe the inability to afford adequate heating services in households (Bouzarovski & Petrova, 2015).

Since Energy Justice (EJ) was endowed with its first conceptual frameworks (Jenkins et al., 2014; McCauley et al., 2013; Sovacool & Dworkin, 2015), it has become well-established in the energy literature as a scholarship aiming to have a positive impact on energy policy (Jenkins et al., 2016; Van Veelen et al., 2019). Within this context, there are increasing number of publications using both EP and EJ in combination, with different degrees of analysis of a wide variety of complex energy issues across different geographies. These include domestic energy injustice in the UK (Bouzarovski et al., 2022), issues of affordability in rural West Africa (Gafa et al., 2022), and solar power and EP in India (Akter & Bagchi, 2021).

Nevertheless, recent literature on EP and EJ still highlights the need for further research focusing more on frequently overlooked regions like Latin America to facilitate the development of alternative conceptualisations and methods (Jenkins et al., 2021; Thomson et al., 2022). This chapter contributes to energy research by drawing from the analysis of national characterisations of EP in Mexico (Soriano-Hernández et al., 2022) to further the theoretical, empirical, and

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methodological exploration of EP and EJ, in turn elaborating on the Latin American context. Three distinctive discussion sections outline the main contributions from this chapter after the following section, which describes the methods and results. The first discussion section draws on theoretical contributions in the literature to analyse the conceptual links and tensions that arise between EP and EJ when examining the results of the case study. The second section illustrates how geographic differences influence the lived experiences of Mexican households under EP and how these might differ from the lived experiences of households in the Global North. The third and last discussion section makes a case for developing alternative methods for gathering and analysing data that facilitate a deeper, more robust, and complete understanding of EP. The concluding section of this chapter summarises the main takeaway messages and contributions.

5.2 Methods and results

The chapter draws from two main methodological approaches: accessibility to energy services (García, 2014; García-Ochoa & Graizbord, 2016b) and monetary expenditure in energy services (Boardman, 1991; Sovacool et al., 2017). The relevant data from Mexican households were collected from Mexico's National Household Income and Expenditure Survey (ENIGH) (INEGI, 2015), which is free and publicly accessible. The sample size included 19,124 households, representing a total of 31,128,396 households nationwide. A complete version of the methodology can be accessed in Soriano-Hernández et al. (2022).

5.2.1 Accessibility of energy services: meeting absolute energy needs

For García (2014), the lack of energy leading to the deprivation of households' needs and satisfiers implies one is living in EP. The Meeting of Absolute Energy Needs (MAEN) method operates this idea by building on Sen's (1981) theorisations which differentiate between categories of absolute needs (e.g., subsistence, entertainment, and freedom) from existential needs (e.g., being, doing, and interacting) and satisfiers (e.g., shelter, work, and privacy) (Max-neef et al., 1992). As these fundamental human needs are considered to be shared across human cultures, they are considered finite and, therefore, classifiable. Thus, it is possible to develop a Household EP (HEP) Index to measure the lack of economic goods, like appliances, in households (Table 5.1), causing the deprivation of energy services and absolute needs (García, 2014; García-Ochoa & Graizbord, 2016a; García-Ochoa & Graizbord, 2016b).

The HEP identifies six basic energy end-uses, listed in the third column of Table 5.1, linked to economic goods necessary for different final energy uses. Therefore, if a household does

Table 5.1 Selected six key energy services for the household EP index (HEP)

Energy Service	*Economic Good*	*Absolute Need*
Cooking	Stoves (gas or electric)	Subsistence
Refrigeration	Refrigerator (models later than 1998)	Subsistence and protection
Entertainment	TV or computer (with internet access)	Entertainment, leisure and creation
Lighting	One incandescent bulb or fluorescent lamp per room	Protection, entertainment, pleasure and creation
Water Heating	Water heater or electric/gas stove	Subsistence and protection
Air conditioning or ventilation	One fan (for every three people in a household) or air conditioning	Subsistence and protection

Source: Summary elaborated by the authors based on García-Ochoa and Graizbord (2016a).

Table 5.2 Estimated Mexican households in EP in areas where climatic conditions do not require thermal comfort, segmented according to HEP score

HEP Index	*Households*	*Percentage (%)*
0	37,516	0.3
0.2	162,962	1.1
0.4	367,557	2.5
0.6	455,911	3.1
0.8	2,842,711	19.6
1	10,646,465	73.4

Source: Modified from Soriano-Hernández et al. (2022).

not have access to economic goods or appliances, it cannot satisfy its human needs through an energy service, which can be considered in EP (García-Ochoa & Graizbord, 2016b). It is essential to highlight that air-conditioning or ventilation is added as an extra energy end-use for households in geographic locations where the average annual temperature is above 26°C.

Once the final energy uses, economic goods, and absolute needs have been defined, the HEP index can be constructed, assuming a household is living in EP if:

$$HEP(x_i) < 1 \tag{5.1}$$

where:

$$HEP(x_i) = \frac{1}{n}\sum_{i=1}^{n} x_i \tag{5.2}$$

Where xi corresponds to the different selected economic goods from Table 5.1. If a household has the selected economic good, then xi=1; otherwise, xi=0. Thus, lacking an economic good leads to HEP (xi)<1. Therefore, the household faces more severe degrees of EP the more HEP approximates 0. Tables 5.3 and 5.4 illustrate the results of access to or deprivation of the economic goods described in Table 5.1.

Under the MAEN method, an estimated 11,613,578 households suffer different degrees of EP in Mexico (38.84%). These results are close to those from García-Ochoa and Graizbord (2016a; 2016b), with only a slight increase of around 2% from the 2012 figures.

Table 5.3 Estimated Mexican households in EP in areas where climatic conditions need thermal comfort, segmented according to HEP score

HEP Index	*Households*	*Percentage (%)*
0	57,526	0.4
0.17	456,055	3.0
0.33	662,488	4.3
0.5	766,663	5.0
0.67	1,315,700	8.5
0.83	4,488,489	29.2
1	7,641,888	49.7

Source: Modified from Soriano-Hernández et al. (2022).

5.2.2 Approximation of household energy consumption based on monetary expenditure

The second method is based on Boardman's (1991) definition embedded in the EJ principle of affordability (Sovacool et al., 2017), stating that any household spending 10% or more of its income on energy and fuel services is considered to be energy poor. However, Boardman's initial approach was built for the UK and focused on heating to keep houses at 21°C. Building on earlier critiques of EP, notably those conceptualisations and methods traditionally limited to heating, this work embraces approaches like that of Sovacool et al. (2012), which include expenditure for mobility, specifically gasoline, given the high number of vehicles registered in Mexico. This work also provides an approximation of energy consumption based on work by Jiang and O'Neil (2004). Such an approach allows the transformation of monetary expenditure on fuels and services into energy values, considering unit prices and heat values of fuels and services (see Table 5.4).

Once the information on prices and calorific values is obtained, energy consumption in households can be calculated from their expenditure on these fuels or services using the following equation.[1]

$$HEC = \sum_{i=1}^{n} \frac{AFE_i}{AFP_i} \times CVF_i \tag{5.3}$$

where:

HEC = Total Household Energy Consumption in Joules.
AFE = expenditure on the ith fuel in monetary values.
AFP = price of the ith fuel in monetary values per unit ($/Kg or $/liter).
CVF = Heat value of the ith fuel in Joules/Kg or Joules/liter.

To compare the MAEN method and the monetary expenditure method, a filter was applied to use data from household reporting, comprising 1) quarterly expenditure on energy services; 2) responses to questions about the goods considered in the MAEN method; and 3) quarterly income. This filter was meant to reduce the sample to 18,102 households, representing 29,901,931 households in Mexico (96.15%). Using the criterion of 10% or more of the income spent on the energy services and fuels listed above, this work found that 10,164,200 (34%) Mexican households are living in EP based on expenditure. Additionally, the average energy consumption at each level of deprivation was approximated using Jiang and O'Neil's methodology

Table 5.4 Average price in Mexican Pesos and heat values per fuel or energy service in Mexico in 2014

Fuel/Energy Vector	*2014 Average Price (US$ per unit)*	*Heat Value*
Electricity	0.0036 per GJ	–
Petroleum Liquefied Gas (PLG)	13.762 per kg	0.046 GJ/kg
Natural Gas (NG)	13.94 per GJ	–
Coal	9.8 per kg	0.03 GJ/kg
Firewood	3.2 per kg	0.015 GJ/kg
Oil	13.94 per litre	0.038 GJ/litre
87 Octane gasoline	13.31 per litre	0.0311 GJ/litre
92 Octane gasoline	14.11 per litre	0.0314 GJ/litre

Source: Elaborated by the authors based on estimations based on Castillo et al. (2012), CFE (2014), CONAFOR (2013), and SENER (2014).

Table 5.5 Key indicators of households that do not require thermal comfort by deprivation level for households in temperate climate regions (not requiring thermal comfort)

HEP Index	*0*	*0.2*	*0.4*	*0.6*	*0.8*	*1*
Households	37,516	162,962	367,557	455,911	2,842,711	10,646,465
Households spending in energy poverty (spend >10% of income on energy services)	12,572	33,125	60,767	108,460	922,447	3,341,658
Average expenditure (% of total income)	10.52%	10.01%	16.31%	9.02%	9.40%	9.51%
Average quarterly energy consumption (GJ)	2.81	1.34	2.38	4.04	5.58	8.53
Total Households	14,513,122					

Source: Modified from Soriano-Hernández et al. (2022).

(see Tables 5.5 and 5.6). These results show that around 3,449,280 (11.54%) of Mexican households face EP through both accessibility and expenditure pressures.

5.3 Discussions

The discussions presented here build on the results reported by Soriano-Hernández et al. (2022), summarised in the previous section. The following sections provide deeper discussions within three main areas (geographic difference, energy justice, and alternative methods) where the chapter makes its contribution. Section 3.1 discusses essential differences emerging from geographic context that determine how EP is lived and experienced in Mexico, contrasting with traditional notions in EP developed mainly in the Global North. This section also explores intranational divides of EP lived experiences across regions with different urbanisation rates and climates. Such geographic differences are explored through the lenses of justice as distribution and recognition to explore the tensions between conceptualisations of EP in Mexico and EJ conceptual frameworks. Section 3.2 elaborates on the results and previous discussions to reflect on the need for alternative methods to measure and understand EP, calling for using qualitative and mixed methods to explore EP effectively.

Table 5.6 Key indicators of households that require thermal comfort by deprivation level for households in hot climate regions (requiring thermal comfort)

HEP Index	*0*	*0.17*	*0.33*	*0.5*	*0.67*	*0.83*	*1*
Households	57,526	456,055	662,488	766,663	1,315,700	4,488,489	7,641,888
Households spending in energy poverty (spend >10% of income on energy services)	12,258	68,027	99,880	151,273	388,727	1,591,744	3,373,262
Average expenditure (% of total income)	7.87%	6.28%	6.47%	7.92%	8.28%	10.26%	12.11%
Average quarterly energy consumption (GJ)	1.45	1.32	1.62	2.61	4.26	6.73	11.08
Total Households	15,388,809						

Source: Modified from Soriano-Hernández et al. (2022).

5.3.1 Reflections on geographic difference and energy justice implications

The existing conceptual frameworks on EJ comprise helpful analytical tools to conceptualise EP beyond a condition of material energy deprivation, enabling energy researchers to frame such conditions in terms of different justice tenets or principles. For instance, the three core tenets framework (distributive, procedural, and recognition) proposed by McCauley et al. (2013) aims to address social justice concerns within energy systems. Whilst distributive justice calls for the equitable distribution of costs and benefits coming from energy systems among all members of society (Jenkins et al., 2016), justice as recognition draws attention to the specific needs, conditions, and characteristics of particular social groups, avoiding forms of cultural domination, degradation, and devaluation (McCauley et al., 2013). Finally, procedural justice is concerned with fair access to decision-making processes involving all members of society in a participatory, impartial, and non-discriminatory manner to pursue social goals (Jenkins et al., 2016). Such an analytical approach has been mobilised to explore energy issues related to climate change (Newell & Mulvaney, 2013), energy resilience in Nepal (Underwood et al., 2020), or energy vulnerability within transitions to smart technologies (Sovacool et al., 2021). However, this research highlights important limitations of EJ conceptual frameworks for an in-depth analysis of EP in Mexico.

One of the main limitations lies in the ambiguity of some definitions and elements present in conceptual frameworks, with authors like Monyei et al. (2019) arguing that EJ frameworks are not yet complete and fail to provide ample exploration or tangible definitions for concepts like "sufficient" energy access. Indeed, such ambiguity is present in conceptual frameworks like the energy principles (Sovacool et al., 2017), which use loose terms such as "sufficient" and "high-quality" to describe energy resources in relation to the principle of availability. Within this context, these facilitate meaningful discussions about what is considered "sufficient" or "high-quality" energy resources. In this case, "sufficient" or "high-quality" energy resources are understood as specific economic goods (Table 5.1) or energy consumption levels, by households with different incomes, located in different climatic regions (Tables 5.5 and 5.6). Moreover, these same results enable discussions about the impacts of socio-economic disparity among households on accessing what they could consider "sufficient" energy resources. In this respect, it is necessary to recognise that frameworks like the EJ principles (Sovacool & Dworkin, 2015) have been modified over time by adding, replacing, or modifying different principles in later versions (Sovacool et al., 2017). Therefore, we call for energy researchers, especially those developing empirical research on EP and EJ in countries of the Global South, to engage in conceptual work that allows refining, expanding, or replacing EJ conceptual frameworks.

Concerning the three EJ tenets framework, the results show households suffering different degrees and combinations of EP due to accessibility or expenditure, highlighting the need to interlink justice through distribution and recognition (McCauley et al., 2013). Following a distributive approach to justice allows for differentiation among tiers or levels of households living under different degrees of EP. These households can be categorised into tiers of EP across geographies (temperate and hot regions) and social classes (income deciles). Therefore, the results help to identify the most vulnerable groups of households in distributive and geographic terms, particularly those living with hidden EP and experiencing issues of expenditure in combination with the lowest level of accessibility (HEP = 0). This means that households in this state of hidden energy poverty are locked into high rates of expenditure in relation to paying for energy services, whilst at the same time do not have all the necessary satisfiers to meet their energy needs. The double or hidden EP state experienced by these households can only be identified by combining the two methods. Therefore, even if

the distributive results of EP from applying both methodologies individually lead to similar figures for Mexico, in isolation, they miss-recognise slightly more than one in ten Mexican households that live in this situation of double or hidden EP.

Moreover, the results from this research highlight how, in the Mexican case, EP by expenditure permeates all the tiers of EP by deprivation of energy services. Not only do these results highlight the relevance of an EJ approach that seeks to combine different EJ principles to analyse the multicausal nature of EP in Mexico, but they also raise important questions related to how different groups of people experience EP in the country. Based on the results in Table 5.5, it is possible to calculate the share of households (in temperate regions) living in EP according to expenditure across different tiers of EP by deprivation (different HEPs). Between 16.5% and 23.8% of the households suffering stronger deprivation (HEP = 0.2 and 0.4) also experienced poverty by expenditure. In contrast, households with moderated or no deprivation (HEP = 0.6, 0.8, and 1) presented higher shares of EP by expenditure (between 31.4% and 32.4%). On the other hand, data in Table 5.6 for hot climate regions also suggest differences between households living under intense situations of EP by deprivation (HEPs = 0, 0.17, and 0.33) and lower/non-existent (HEPs = 0.5, 0.67, 0.83, and 1). For hot regions, the share of households experiencing EP by expenditure decreases as HEP increases in the lowest tiers of HEP, going from 21.3% (at HEP = 0) to around 14.9-15.1% (at HEP = 0.17 and 0.33). Nevertheless, higher HEPs see a direct relationship, with the share of households in EP by expenditure consistently escalating from 19.7% at HEP = 0.5 to 44.1% at HEP = 1.

The last paragraph illustrates how, in Mexico, EP seems to evolve from an issue of accessibility/deprivation to modern energy services to an issue of affordability/expenditure for such services, with most households (61%) suffering either or both of these two types of EP in 2014. It could be argued that this is driven by the change in consumption habits when households access additional energy services or economic goods to satisfy previously unsatisfied energy needs, such as mobility (Sovacool et al., 2012). This new satisfier generates a new consumption habit. Examples include the use of gasoline for motor vehicles or the acquisition of home cooling systems in hot climate regions. This compromises the economic stability of households, as their income may not be sufficient to maintain the new levels of consumption they have acquired. As a consequence, they fall into EP for expenditure. However, the results of this research reveal how the progression of EP by accessibility to affordability unfolds differently depending on the geographic conditions (e.g., weather and average temperatures) that lead households to satisfy different energy needs through different economic goods.

On the other hand, the EJ tenet of recognition enables the exploration of the challenges faced by the "most vulnerable" households, allowing us to understand their lived experiences of EP from an analysis grounded in terms of their specific geographic locations and contexts. For instance, it is essential to recognise that two out of three households experiencing double or hidden EP are located in regions with hot climates. Within this context, our study recognises and differentiates the need for thermal comfort (in this case, cooling). However, our methodology fails to differentiate effectively and therefore recognises other faces of EP in the country, such as the lack of heating for households in cold regions. According to Ortiz Álvarez and Vidal Zepeda (2006), 69% of the national population was exposed to cold winters (12°C-cold and 5°C-very cold). This represents a critical gap in justice as recognition, hindering a deeper understanding of EP issues in countries like Mexico, where thermal comfort is approached from a hot climate perspective. Within this context, mobilising a tenet of justice as recognition in EP for Mexico would allow us to better analyse households by their geographical and socio-economic contexts, or by their consumption habits, to then design and implement concrete strategies targeted to minimise their vulnerability towards EP.

The above discussions around justice as recognition lead us to wonder how EP emerged as a concept mainly from countries in the Global North, notably the United Kingdom. A consequence of which has been that studies have traditionally been framed by issues of affordability of fuel and heating services (Li et al., 2014; Sovacool, 2015). Against this background, it is essential to recognise the need for contextual understandings of EP, as studies focusing on countries from the Global South may require different approaches or interpretations of EP based on more locally specific contexts or grounded understandings of justice (Castán Broto et al., 2018; Monyei et al., 2019). Here it is important to highlight that, according to Thomson et al. (2022), the study of EP in Latin American countries remains a persistent gap in academic literature. For Mexico, Garcia's works (García, 2014; García-Ochoa & Graizbord, 2016b) that other studies (six including the work of Garcia-Ochoa) have begun to address this gap.

The results based on EP by expenditure from our case study enable the identification of gasoline, electricity, and liquefied petroleum gas (LPG) as the most significant sources for expenditure in Mexican households vulnerable to EP, due to affordability. According to official figures, in 2014, Mexico had a vehicle fleet of more than 25 million cars (INEGI, 2021), almost one per household. Therefore, our work illustrates the relevance of contextual understandings of EP, arguing that, for Mexico, fuels used in private transportation have a critical role for in driving EP by monetary expenditure. Therefore, Mexican understandings and lived experiences of EP, seems to be fundamentally different from those depicted on literature from European or North American case studies, where energy services like thermal comfort seem to have the leading role (Kelly et al. 2020; Middlemiss, 2022). These results support Sovacool et al. (2012) in suggesting services like mobility to be included in the understanding of EP. Essential energy services must be provided in an affordable, reliable, adequate, quality-assured, safe and environmentally benign manner (Parajuli, 2011). Therefore, as our definition of household EP follows that of other authors like Robinson and Mattioli (2020) and Martiskainen et al. (2021) – by considering household expenditure on gasoline for private transport – this chapter calls for developing empirical research for other countries in the Global South, especially where heating (or thermal comfort) does not hold a central role in household energy services. This will further our understanding of EP and contribute to decolonising the concept. Such a process of decolonisation implies deconstructing EP research and understandings from all potential assumptions and biases generated as a result of its epistemic foundations in the Global North. Facilitating greater research in the Global South will complement, expand, refine or replace the way we conceptualise and work with energy-related concepts like EP or EJ (Tornel, 2022; Walker, 2022). This chapter makes a small contribution by briefly exploring how, in the Mexican case, access to and affordability of services like mobility or cooling have a prevalent role in driving households into different degrees of EP, in contrast to other energy services (e.g., heating) traditionally mentioned in academic literature.

5.3.2 Reflections on methodological diversity

The discussions above highlight how the situation in Mexico serves to reflect conceptual and empirical gaps within the existing EP literature. Within this context, Thomson et al. (2022) also call for greater methodological diversity, identifying only two publications in Latin America using qualitative methods to explore EP. Whilst methodological approaches like the one by Jiang and O'Neil (2004) and García-Ochoa and Graizbord (2016a, 2016b), both used in this work, illustrate an effective combination in studying this phenomenon, such methods continue in the main to be quantitative in approach. Since EP is such a complex societal phenomenon

(influenced by age, geography, income, level of education, etc.), this chapter recognises the need for using qualitative and/or mixed methodologies under an interdisciplinary approach to facilitate more effective and robust analyses of EP complexities (Sovacool et al., 2017). Within this context, some noteworthy examples of the use of qualitative methods in examining EP in Latin America can be found, including Ricalde et al. (2021) and Brand-Correa et al. (2018) with both using participatory workshops in Mexico and Colombia, respectively.

An outstanding share of Mexico's household energy services focus on cooking and water heating either with electricity or with some fossil fuel like liquefied petroleum gas (García-Ochoa & Graizbord, 2016a). However, some households use some form of biomass (e.g., firewood) for the same purposes. This research illustrates that up to 33.5% of households in temperate regions suffering the worst deprivation issues (HEP = 0) also suffer from EP due to expenditure or affordability (higher than those with HEP = 0.2 or 0.4). Indeed, firewood and gasoline represented the most significant expenditure for these households, even without considering costs associated with working hours or risks related to recollecting wood, etc. (Santos González et al., 2012). Although official figures for the use of this type of fuel are debatable (Sánchez-Peña, 2012), the National Forestry Commission in Mexico (CONAFOR, 2013) argues that firewood satisfies around 80% of some rural households' energy needs. Nevertheless, official figures reported in the ENIGH appear to only include purchased firewood, which might underestimate the fact that much of the firewood is collected rather than purchased (Santos González et al., 2012; Silva Aparicio et al., 2018). The work from Pérez et al. (2022) estimates that around 26% of the Mexican population uses firewood, with 75% of wood users located in population centres with less than 2,500 inhabitants and 68% of the users not paying for the acquisition of firewood.

Consequently, although this work relies on the statistics from ENIGH on purchased firewood, it calls for the development of surveys that consider quantifying energy sources like recollected firewood. Such alternative methodologies could facilitate the assessment of collected firewood for satisfying energy needs in countries in the Global South and the Global North. Moreover, these alternative methods could open opportunities for EP researchers to collaborate with colleagues working on areas like forest management, conservation, and international development.

On the other hand, this research also limits its analysis to household expenditure on fuel for private vehicles. However, expenditure in relation to public transport has been highlighted as a relevant statistic for future research into understanding EP (Lowans et al., 2021; Sareen et al., 2022). Within this context, it is relevant to highlight that in Mexico, the level of data aggregation of the ENEIGH survey does not allow us to identify relevant information related to the type of transport, fuel, or the percentage of the fare that is directly used in fuel consumption necessary for a critical analysis of public transport. Solving such a lack of data aggregation represents a methodological challenge beyond the scope of this work. However, it highlights an opportunity to improve the statistical tools currently used by institutions like INEGI (the National Institute of Statistics and Geography) in Mexico as well as those in other countries.

5.4 Conclusions

This chapter illustrates the different ways in which Mexican households live and experience EP due to issues of accessibility, affordability, or both. According to our results, in 2014, approximately six out of ten Mexican households (61.3%) faced EP. In addition, this chapter discusses how 38.84% of Mexican households suffered from accessibility issues impeding them from meeting their absolute energy needs, whilst 34% faced a high economic burden purchasing

energy services and fuels. This work also recognises that 11.54% of Mexican households live in both situations of EP, arguably comprising the most vulnerable groups. These results demonstrate and illustrate the multicausal origin of EP in Mexico. From the discussion of the results above, this chapter makes a triple contribution to the topic.

Conceptually, this chapter discusses issues of EP in Mexico in relation to conceptual frameworks relating to EJ. This chapter discusses the ambiguity present in some of the definitions and elements within those conceptual frameworks and calls for energy researchers – especially those developing empirical research on EP in the Global South – to engage with EJ to refine, expand, and/or replace these existing conceptual frameworks. Having said that, this chapter also demonstrates the usefulness of EJ frameworks to analyse the distributive justice dimension of the multicausal nature of EP in Mexico (by expenditure or deprivation). It also identifies a fundamental gap in EP literature by recognising that the most vulnerable groups live under two different kinds of EP. Finally, this chapter discusses the lack of recognition for people experiencing cold winters in countries that are traditionally labelled as having hot climates and in which thermal comfort is approached only through cooling. Therefore, addressing EP within an approach that involves EJ frameworks that facilitate identifying and potentially further remediating energy injustices across different geographies and income groups.

Empirically, this study illustrates how Mexican households have a significant burden of expenditure for gasoline for private transportation instead of heating, as is normally the case for countries in Europe or North America. Such recognition of transport in the Mexican EP experience also calls for future research that challenges traditional conceptualisations of household energy needs to advance the understanding of EP in overlooked regions like Latin America. A further complicating factor in Mexico involves the evolution of EP from issues of accessibility to modern energy services to affordability due to newly acquired energy services. However, this process seems to evolve differently depending on climate conditions (e.g., hot and temperate regions). Therefore, this chapter calls for analytic approaches that facilitate recognition and reflection on the relevance of geographic difference to understanding how EP arises and how it is experienced within households across different countries and regions. Such an understanding of the lived experiences of EP is especially relevant in countries frequently overseen and regions like Latin America, which can effectively contribute to decolonising our understanding of EP.

Methodologically, this quantitative research facilitates the recognition of the complexity and multifaceted nature of the EP problem in Mexico. However, the recognition of such complexity also leads to a call for an interdisciplinary approach based on the deployment of qualitative and/or mixed methods that facilitate a complete analysis and discussion of EP complexities. Finally, this chapter discusses the challenges related to the existing methods for capturing and analysing data related to variables like the recollection of wood or public transport, which apparently play a determinant role in measuring and understanding household EP in countries like Mexico. These alternative methods could open opportunities for EP researchers to develop collaborative work in areas like forest management, conservation, and international development, as well as provide helpful feedback to improve the statistical tools used by institutions like INEGI in Mexico as well as those in other countries.

Note

1 Energy values do not consider losses due to the efficiency of appliances or losses due to the storage, distribution, or transmission of energy. Therefore, the energy per household obtained represents an approximation of the actual energy consumption.

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