Executive Note
for the
G20 Energy Transition Working Group and the
G20 Climate Sustainability Working Group

Energy Poverty: addressing the intersection of Sustainable Development Goal 7 (SDG7), development and resilience

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University of Birmingham (UK), Economic Commission for Latin America and the Caribbean (ECLAC), European Commission (DG Energy), ESMAP/World Bank, International Energy Agency (IEA), International Renewable Energy Agency (IRENA), International Institute for Applied Systems Analysis (IIASA), Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), OPEC Fund, and UNICEF

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addressing the intersection of Sustainable Development Goal 7 (SDG7), development and resilience

Executive Summary

An important step was taken under the Kingdom of Saudi Arabia's G20 Presidency (2020) to recognize the need to go beyond access and address the complexity of energy systems that can provide affordable, reliable, sustainable and modern services for all. This Executive Note builds on last year's G20 Energy Ministers' communiqué emphasizing "our collective effort to eradicate energy poverty" and provides a more detailed scope of the G20 energy poverty policy agenda.

Energy poverty affects both developing as well as developed countries and, in both cases, represents an obstacle to achieving the SDG7 goal of ensuring access to affordable, reliable, sustainable and modern energy for all. The eradication of energy poverty provides a number of health, economic, and climate co-benefits (Thema et al, 2017) while also building resilience of societies and economies when faced with health or climate emergencies.

The COVID-19 pandemic has clearly illustrated the need for building greater energy resilience in our societies and economies in order to provide households, community services and productive uses with affordable access to uninterrupted and quality energy services. Countries with existing mechanisms for identifying vulnerable populations and the ability to respond to interrupted service provision have been experiencing less disruption at a moment when the pandemic has pushed an additional 150 million more people worldwide into poverty (Lackner et al, 2021).

In this Executive Note, the concept of energy poverty focuses on all energy services required by households (lighting, cooking, heating, cooling, information-communication). However, it should be recognized that for developing country contexts with underperforming energy services markets[1], energy poverty can also negatively impact the effectiveness of public services (e.g., health and education) as well as economic productivity.

Clear differences exist in how energy poverty is manifested in developing versus developed economies as well as the differences within countries. In developing economies, energy poverty can affect entire neighborhoods or rural communities (i.e., entire territorial units) due to the lack of infrastructure or well-functioning energy services markets in addition to individual households located within serviced territorial units. Developed economies, where infrastructure coverage is greater and where there tends to be more equitable access, will also be affected by energy poverty among at-risk households that are vulnerable to issues of affordability, quality of services, or quality of dwellings. Accordingly, approaches to eradicating energy poverty will need to be country-specific and adjusted for different local contexts.

[1] Underperforming energy services markets in this case occurs when service providers of different household energy needs and appliances are unable to meet the needs of the household consumers for affordable, modern energy services. Conversely, well-functioning energy services markets are meeting the needs of household consumers with varying incomes.

This Executive Note aims to provide a more detailed scope of the energy poverty policy agenda by proposing a voluntary action plan that includes the following G20 definition of energy poverty:

> *"Energy poverty occurs when households or territorial units cannot fulfill all of their domestic energy needs (lighting, cooking, heating, cooling, information-communication) as a result of lack of access to energy services, an inability to afford them, or their poor quality or unreliability in order to, at minimum, safeguard their health and provide for opportunities to enhance their well-being. Energy poverty affects, to a greater or lesser extent, every country (both developing and mature economies) and requires addressing constantly changing risks while targeting support to populations most vulnerable to these risks. For developing economies energy poverty should also take into consideration energy services needed by public services and productive uses."*

The proposed voluntary action plan also includes moving towards energy poverty indicators that can be adapted to the needs of national and local decision-makers in both developing country and developed country contexts, as well as integrated policy solutions coordinated across different levels of government. Finally, the voluntary action plan proposes exploring the opportunity for G20 countries to coordinate further energy poverty analytics and lessons with the EU Energy Poverty Observatory & Advisory Hub as a way of encouraging cross-regional learning.

The Energy Poverty Challenge and SDG7

Under the Kingdom of Saudi Arabia's G20 Presidency (2020), the G20 recognized the importance of focusing on the challenges of energy access, and access to clean cooking in particular, through its endorsement of the G20 Initiative on Clean Cooking and Energy Access and the five forward-looking options to scale-up modern energy cooking services. Embedded in the endorsed approach is the goal of going "beyond access" to provide clean cooking solutions that are affordable, reliable, sustainabile and modern. This approach embraces the fact that only after surpassing minimum access thresholds will modern energy cooking systems generate positive impacts to improve health, well-being and productivity of households.

Energy systems have positive impact when they enable the health and well-being of their target populations. When systems break down or target populations are unable to access services (due to lack of affordability, for example) the full positive impact of energy for development is compromised.

The Multi-Tier Framework (MTF) introduced by the World Bank/ESMAP in partnership with SEforALL in 2015 already began unpacking the different levels of energy access and, as a result, their differentiated impacts on health and well-being. While Tier 1 access, the ability for task lighting and phone charging for at least four hours a day (one hour in the evening), is considered access for the purposes of tracking SDG7 progress, it falls well below the potential positive impact of energy services that begin to accrue with Tier 3 which allows for general lighting, phone charging, television, fan, and medium-power appliances over a minimum of eight hours daily (at least three in the evening) (Bhatia and Angelou, 2015). As further documented by the Modern Energy Minimum (Energy for Growth Hub, 2021), "sufficient electricity consumption is a necessary input to economic activity everywhere while its absence is a binding constraint on income and development". The Energy for Growth Hub estimates that a minimum level of 1,000 kWh per person per year (a "modern energy minimum"), inclusive of both household and non-household electricity consumption, is required for development to take place. Both the MTF and the Modern Energy Minimum provide policy makers with evidence and frameworks to understand that not all energy access is the same and that minimum thresholds of service are required for energy systems to have a positive impact for development.

In order to ensure that energy services provide opportunities for health and well-being, both supply side (provision of energy services) and demand side (access and affordability of services) need to be addressed by policy makers. Any number of risks will continuously affect both supply and demand sides causing gaps in service, lack of affordable service, or a lack of equitable service at-scale, as is the case for those populations in countries without universal access to energy. This is well illustrated by the clean cooking challenge. According to the most recent estimates, 2.6 billion people worldwide lack access to modern cooking fuels and technologies (IEA et al, 2021). The latest research indicates that an important part of this challenge requires bringing together many different considerations on both the supply side (stove designers, manufacturers, distributors, retailers) and demand side (affordability, accessibility, convenience, safety) for variety of consumer markets (ESMAP, 2020). There are many opportunities for either supply to break down or demand to be priced out of the market. The forward-looking options endorsed by G20 Energy Ministers last year reflect an explicit recognition of these complex supply- and demand-side relationships.

In addition, COVID-19 provides a clear example of how a health, social and economic crisis has

pushed more people into poverty[2] and increased the number of households unable to afford energy services. The challenge facing all countries will be to address these risks, minimize gaps in service (which also includes populations that still lack basic access to ***all*** of their household energy needs) and improve the resilience[3] of energy services for households, public services and economic productivity needs outside the household[4]. In doing so, countries will increase their resilience in the face of future health, economic or environmental emergencies.

The concept of energy poverty and its eradication is part of the next generation of more targeted policy tools to address SDG7. By qualifying more precisely the quality and reliability of access needed for positive impacts in the health, well-being, and productivity of households and communities, eradicating energy poverty reinforces the SDG7 goal of access to energy that is affordable, reliable, sustainable and modern.

In accordance with the G20 Energy Ministers communiqué (2020) which underlined the importance of continuing "our collective effort to eradicate energy poverty"[5], ***the objective of this Executive Note*** is to provide a more detailed scope to the G20 energy poverty policy agenda and propose a voluntary framework of action that G20 member countries can apply to address energy poverty. These voluntary actions will provide valuable global leadership for addressing chronic gaps in all the energy services required by households (lighting, cooking, heating, cooling, information-communication) in order to improve households' health and well-being as well as build more national resilience to future health and climate emergencies.

Conceptual Framework: the four quadrants of energy poverty. Developing policy measures for the eradication of energy poverty represents a meaningful paradigm shift that requires decision-makers to focus on the intended impacts of energy-use in addition to the supply-side. Because each country will be subjected to different opportunities and resources to develop their energy services as well as socio-economic constraints of their populations, energy poverty will vary across wide ranges determined by equitable access as well as sustainability and resilience of energy services needed by households.[6] In terms of equitable access, poorer communities may have lower power quality which can lead to appliance damage or may have more interrupted service and poorer households may be spending a larger percentage of their income on their energy needs. The affordability of energy services an important parameter for understanding energy poverty and would affect the sustainability of energy services and their resilience to disturbances.

[2] World Bank estimates that 150 million people worldwide have slipped back into poverty as a result of the COVID-19 pandemic (Lackner, C. et al, 2021).

[3] In this Executive Note resilience is considered as the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization and the capacity to adapt to stress and change (IPCC AR4, 2007). In terms of resilient energy services for household needs, these would be services that can absorb disturbances to continue service provision that is affordable to all households.

[4] For the purposes of this Executive Note the focus will be on household energy needs.

[5] G20 Energy Ministers Meeting, Communiqué, September 27-28, 2020, para 12.

[6] The conceptual framework developed by Urquiza and Billi (2020) captures the different realities across Latin America and the Caribbean for water and energy poverty for territorial units. This helpful approach is further adapted to expand a focus on all household energy services as well as differentiating possible scenarios of household energy poverty in addition to a territorial unit's energy poverty.

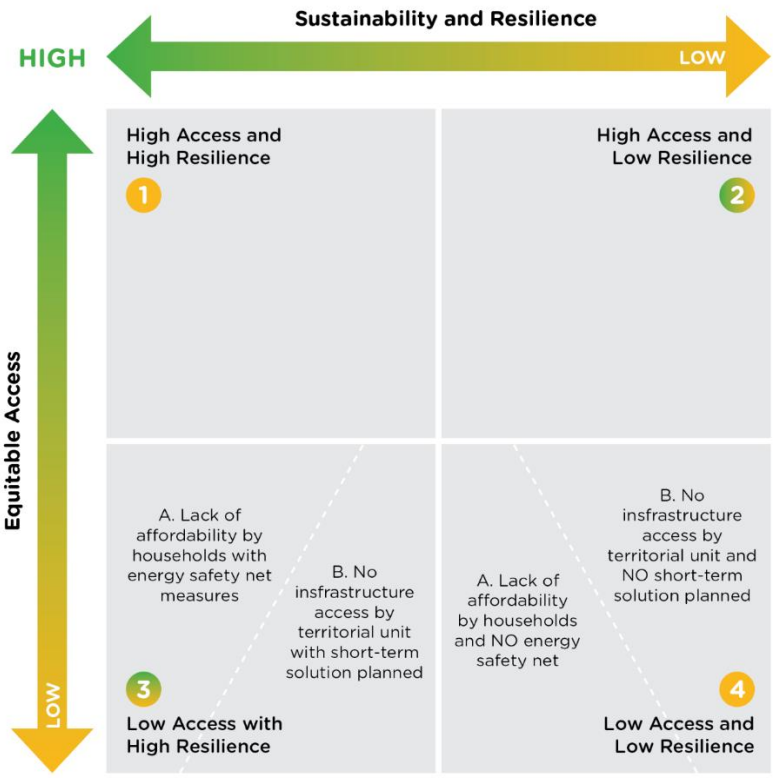

Figure 1: Four quadrants of energy poverty (Adapted from Urquiza and Billi, 2020)

In addition, energy poverty can affect individual households that are more vulnerable or marginalized from the rest of society, or it can affect entire neighborhoods or rural communities (i.e., territorial units[7]) that collectively may not have access to energy services. Figure 1 depicts the four quadrants of energy poverty, from a context where there is high equitable access and a high degree of sustainability and resilience of household consumption (quadrant I) to a context where there is low equitable access and low degree of sustainability and resilience (quadrant II). Quadrants III & IV are further subdivided to reflect the scenario of low equitable access by households or entire territorial units that may not have access to specific energy services (as is the case in many developing countries). Finally, the four quadrants approach also needs to consider that in many cases, there will be different performance levels of the different energy services and needs (e.g., household access to heating and cooling may not be as equitable as lighting).

There will be differences across developed and developing regions as well as within countries. Whereas most developed countries may have high equitable access (quadrant I & II), they may not have adequate policy measures in place to guarantee a high sustainability and resilience of energy services needed by all households. Consumption of household energy needs ceases to be affordable in situations where costs outstrip consumers' ability to pay or where dwellings lack

[7] For developing country contexts where access to energy services can be include wider collective areas beyond individual households, the concept of territorial units provides a better unit of analysis. The territorial unit is characterized by areas of a collection of households that are subjected to similar service provision due to their shared geographical, technical, or ecosystem parameters.

energy efficiency that result in higher energy costs. For example, in the European Union, energy poverty is caused by low incomes, poor energy performance of buildings, and high energy costs (Kyprianou et al, 2019). The challenge lies in improving the sustained affordability and resilience of energy services for all characterized by quadrant II in order for all households to continue to benefit from uninterrupted energy services.

Developing countries, by contrast, may also have low equitable access in entire territorial units that reflect uneven infrastructure development, ineffective institutions, and insecure enabling environment for private sector investment (quadrant IV). As progress is made toward the goal of providing access, the challenge of ensuring universal access will shift from the question of connections to the question of affordability and sustainable consumption of energy services. People who cannot afford basic levels of electricity consumption or clean cooking or cooling/heating, or where these services are sub-standard (due to poor quality) or unreliable even when they have a connection, will remain at risk of being left behind and in a state of energy poverty.

The usefulness of this conceptual framework of the four quadrants of energy poverty is to provide an overview of the different possibilities of energy poverty that can exist in different contexts. Beyond this conceptual framework, a country-based analysis would be needed to identify the different energy poverty conditions that can occur within a country, within a region and even areas within a city. For these analyses, there is a need to have highly granular data available to understand the multidimensional characteristics of energy poverty.

By adopting an energy poverty framework, policy makers are able to more specifically target policy measures for eradicating energy poverty to ensure that benefits of improved well-being by energy services are accrued. This allows for smarter, better designed responses to improve the functioning of energy markets to maximize their impact on improved well-being.

BOX 1. Selected Efforts to Address Different Elements of Energy Poverty.

Energy for Growth Hub. The Hub is a global solutions connector focused on identifying pathways for a high-energy future for everyone. It has recently proposed a new global electricity consumption threshold based on the electricity needs of households and their communities (including economic activities) to improve their well-being.

EU Energy Poverty Observatory (EPOV). A European Commission project that began to operate in 2018 to measure, monitor and share knowledge on energy poverty. It will transition in 2021 to an action-driven advisory hub to provide training and technical assistance directed at the local level. The new project will continue to develop indicators and to provide guidance on how national, regional and local authorities should use them in policy making and the adoption of concrete measures. It will contribute to the EU Covenant of Mayors' development of an energy poverty pillar, which will formalize their partnership in the field until 2024.

Global Commission to End Energy Poverty. Co-led by the Rockefeller Foundation, African Development Bank, and the former U.S. Secretary of Energy, the Global Commission to End Energy Poverty comprises of utilities, off-grid companies, multilateral development banks, academics, and leaders from across the electricity and development sectors. Its most recent focus has been on access to electricity in developing countries.

International Institute for Applied Systems Analysis (IIASA). Researchers at IIASA (an independent, international research institute with National Member Organizations in Africa, the Americas, Asia, and Europe) have focused on the importance of measuring energy poverty from both supply- and demand-sides. They have proposed an Alternative Framework for measuring energy poverty and SDG7 access targets.

UN Economic Commission for Latin America and the Caribbean (ECLAC). ECLAC has provided a useful analytical framework to understand energy poverty from the perspective of a developing region with a diverse range of development contexts.

World Bank Energy Sector Management Assistance Program (ESMAP) Energy Data and Analytics Hub. To address the limitations of a binary access measurement (yes/no), ESMAP developed a Multi-Tier Framework which has been useful to recognize the different "tiers" of energy access (electricity and clean cooking) that can exist between a basic connection that provides minimal power capacity and service hours (tier 1) to uninterrupted, high power capacity, 23-hour service provision (tier 5). Other relevant tools of ESMAP Energy Data and Analytics Hub include the Regulatory Indicators for Sustainable Energy (RISE), which tracks progress in setting up enabling policy and regulatory frameworks for energy access, renewable energy and energy efficiency and the Global Electrification Platform, which is a tool for integrated least-cost electrification planning.

What should we measure? Several recent initiatives illustrate the related nature of efforts that address or aim to better understand different parts of the energy poverty challenge (see Box 1). Similarly, in terms of measuring energy poverty, a variety of efforts continue to evolve in search of more standardized, practical measures of energy poverty that can inform policymaking.

The following six approaches provide varying perspectives on how to most usefully focus measurement efforts:

- ***SDG7 Tracking Report indicators.*** The indicators included in the *Tracking SDG7: The Energy Progress Report* were developed as part of the multi-stakeholder process to establish official indicators to measure progress on SDG7. These indicators, collected and analyzed annually by the SDG7 Data Custodians (IEA, IRENA, UNSD, World Bank, WHO), provide an important snapshot of access to electricity, access to clean cooking, annual growth rate of improvement in energy intensity, and renewable energy share in total final energy consumption. The two most useful indicators for the purposes of household energy needs are the access to electricity and clean cooking indicators. While this measurement provides an extremely useful parameter for tracking progress over time and across countries and regions, its definition of access does not allow for a more detailed understanding of the quality, affordability, or reliability of energy services provided.

- ***Multi-tier Framework (MTF).*** At the same time that the SDG7 access indicator was being developed, a Multi-tier Framework for access to electricity was developed by ESMAP in partnership with SEforALL in recognition that access alone did not guarantee the development impacts being sought. The MTF categorizes the five different levels (or tiers) of access to energy (electricity) and its link to potential impact on health and well-being of the household. A more recent effort was undertaken (ESMAP 2020) to identify the different tiers (from zero to five) of six cooking attributes that provide a multi-dimensional characterization of modern energy cooking services (tiers four and five). Additional MTFs have been developed for community services and productive uses (Bhatia, M. et al, 2015). While these approaches have been helpful to begin to identify threshold levels of energy services for development impact, more empirical work will further our understanding of specific needs for different contexts

- ***Alternative Framework.*** Developed by researchers at IIASA (2020), the Alternative Framework seeks to re-think how we measure SDG7 along an energy poverty framework that specifies two distinct aspects of energy access: energy supply conditions and the status of household energy poverty (Pachauri and Rao 2020). This alternative approach addresses the multi-dimensionality of energy access (reliability, affordability, quality); explicitly recognizes different household energy uses (lighting, cooking, cooling, heating, information connectivity); and the need to go beyond minimal provision in order to ensure that energy can be useful to meet a variety of energy service needs.

- ***Affordability as a percentage of household income.*** This approach has been used by many European governments to determine the affordability of energy services by households. It has established the threshold of the percentage of household income that should be allocated to all energy services consumed by a household (lighting, cooking, heating, cooling, information-communication) to identify when households are at risk of energy poverty (i.e., when energy services are no longer affordable or become de-prioritized in favor of other human needs). However, in England this approach has been replaced by the “Low Income Low Energy Efficiency” fuel poverty metric (UK BEIS, 2020) and Scotland uses a two part fuel poverty metric taking into account income, fuel bills and

an acceptable standard of living (Scottish Government, 2019). Canada establishes an affordability threshold for energy services at 6%[8].

- ***Modern Energy Minimum.*** The Energy for Growth Hub (2021) has also begun to question the threshold for modern energy access by recognizing that consumption of energy is a necessary input to economic development. When consumption of energy does not occur at sufficient levels, under situations of energy poverty for example, development processes are limited. This concept recognizes the importance not only of household energy needs (lighting, cooking, cooling, heating, communication access) but also the needs of activities outside the home where the majority of electricity is used.[9] The Energy for Growth Hub proposes to recognize these needs with a new Modern Energy Minimum of 1,000 kWh per person per year (with at least 300 kWh at home and 700 kWh consumed in the wider economy). This re-think may be needed considering that current definitions of minimal access thresholds identify an extreme energy poverty line rather than promoting an international energy target for development and greater prosperity[10]. (See https://www.energyforgrowth.org/wp-content/uploads/2019/01/FULL-Modern-Energy-Minimum-final-Jan2021.pdf)

- ***IEA Methodology.*** According to the IEA, minimum requirements for having electricity access are an electricity supply connection and a minimum level of consumption of 250 kilowatt-hours (kWh) per year for a rural household and 500 kWh for an urban household, which increases over time to reach the national average (IEA, 2020).

- ***Other Multi-dimensional indices.*** Several approaches have taken into consideration energy poverty as a multi-dimensional issue. For instance, the European Energy Poverty Index (EEPI) is a composite indicator which scores and ranks Member States' progress in alleviating domestic and transport energy poverty as well as their nexus. The EEPI is composed of two sub-indexes, the European Domestic Energy Poverty sub-index (EDEPI) and the European Transport Energy Poverty sub-index (ETEPI). An earlier Multi Dimensional Energy Poverty Index (MEPI) was also developed to capture five dimensions of basic energy services (cooking, lighting, services provided by household appliances, entertainment, communication) and six indicators of these dimensions (Nussbaumer et al, 2013).

G20 Definition of Energy Poverty

The challenge in developing a useful G20 definition lies in the multi-faceted nature of energy poverty, as depicted in Figure 1 above. Nevertheless, the usefulness of an agreed definition lies in establishing some parameters for understanding the scope of the challenge, within which different elements can be emphasized to capture localized contexts.

Many OECD countries may have achieved equitable access for lighting and cooking but may still have populations with less equitable access to heating/cooling and information-communication.

[8] For most Canadians, this value is below 3 per cent: the median Canadian household spends less than 3 per cent of its after-tax income meeting its home energy needs.
[9] IEA World Energy Balances (2019) estimates that 70% of global electricity consumption is for non-household uses.
[10] Current definition of energy access as set by the IEA (2019) establishes a threshold of 100 kWh for urban households and 50 kWh for rural households.

For all energy services, sustainable access by households will continue to be an on-going and evolving challenge. For OECD countries, a more useful unit of measure will be the energy poor household that has either a permanent or temporary inability to access some or all of the energy services it needs.

Non-OECD countries, on the other hand, may have both energy poor households amidst well-serviced areas of their country as well as entire communities, often times urban poor, rural poor, and isolated communities, that do not have access to energy services. For these countries, both household and territorial units of measure are needed to identify which populations are at risk of not meeting their basic health and developmental needs.

Examples of existing definitions

According to the EU Energy Poverty Observatory (EPOV), energy poverty is often understood as a situation where a household cannot meet its domestic energy needs (EU Directive 2019/944, 2019). A common European definition does not exist, but many Member States acknowledge the scale of this socio-economic situation and how energy poverty can lead to severe health issues and social isolation.

For example, in France the term "energy poverty" is described as the "inability to keep homes adequately warm."[11] In France this approach has been officially adopted in the *Grenelle II Act* which defines energy poverty as a situation in which a person has difficulty obtaining the necessary energy in their home to meet their basic needs because of inadequate resources or living conditions.

In Canada, energy poverty is referred to as 'the experience of households or communities that struggle to heat and cool their homes and power their lights and appliances'. Energy poverty is seen as a complex issue that includes climate emergency, increasing disparity and poverty, and the housing crisis. These issues are interrelated, and intervention strategies for one impacts the others.

In developing countries, energy poverty is primarily experienced as lack of access to basic energy services. ECLAC has provided one of the few definitions of energy poverty from a developing region with an explicit intent of covering the wide-ranging diversity of realities in Latin America and the Caribbean. ECLAC define energy poverty as "the insufficient fulfillment of energy needs that are considered necessary, as understood within a particular territory and in relation to certain standards" (Urquiza and Billi 2020).

A proposed G20 definition of energy poverty

The G20 has the opportunity to move the energy poverty policy debate forward by establishing an agreed definition of energy poverty to capture the parameters of the challenge:

"Energy poverty occurs when households or territorial units cannot fulfill all of their domestic energy needs (lighting, cooking, heating, cooling, information-

[11] Est en situation de précarité énergétique une personne qui éprouve dans son logement des difficultés particulières à disposer de la fourniture d'énergie nécessaire à la satisfaction de ses besoins élémentaires en raison de l'inadaptation de ses ressources ou de ses conditions d'habitat. Loi n° 90-449 du 31 mai 1990 visant à la mise en oeuvre du droit au logement, https://www.legifrance.gouv.fr/loda/article_lc/LEGIARTI000028777868/

communication) as a result of lack of access to energy services, an inability to afford them, or their poor quality or unreliability in order to, at minimum, safeguard their health and provide for opportunities to enhance their well-being. Energy poverty affects, to a greater or lesser extent, every country (both developing and mature economies) and requires addressing constantly changing risks while targeting support to populations most vulnerable to these risks. For developing economies energy poverty should also take into consideration energy services needed by public services and productive uses."

This proposed definition includes the key elements of energy poverty by addressing:

- The consumption of energy services that can be used by households to improve health and well-being;
- The inclusion of all household energy needs (lighting, cooking, heating, cooling, information-communication);
- The importance of resilience over time to identify vulnerable populations and those that may become energy poor in the future;
- The importance of equitable access; and
- The always present risks that can impact different types of populations (from individual households to territorial units).

The case for improving policy options to address energy poverty

Addressing energy poverty will help G20 governments (1) achieve SDG7 without leaving anyone behind, (2) accurately include all basic household energy needs (lighting, cooking, heating, cooling, communications) for improved health and well-being, and (3) enhance resilience to shocks and emergencies, such as COVID-19 pandemic, that expose existing vulnerabilities to risks that can increase the rates of energy poverty.

(1) An energy poverty focus achieves SDG7 without leaving anyone behind. For countries that still have large access deficits (Figure 1, quadrants III & IV), the challenge for addressing SDG7 focuses providing access to territorial units. However, even for countries with high equitable access, the introduction of energy poverty policies will avoid leaving anyone behind. Nearly all governments provide some form of support to citizens who are vulnerable, or living in conditions of poverty, in the effort to ensure their basic needs are met. This assistance, or 'social safety nets', offers support for such things as nutrition, education and housing. Similarly, *Energy Safety Nets* (SEforALL, 2020) is an umbrella term for government-led approaches to support very poor and vulnerable people to access essential modern energy services by closing the affordability gap between market prices and what poor customers can afford to pay.

Prioritizing a gender lens in efforts to address energy poverty will help ensure sustainable energy for all while recognizing the different risks experienced by women and children. For women managing households, using traditional fuels for cooking and heating[12],

[12] WHO estimates that nearly four million people, disproportionately affecting women and children, die prematurely each year from illness attributable to the household air pollution caused by lack of access to clean cooking (https://www.who.int/news-room/q-a-detail/indoor-air-pollution).

maintaining subsistence farms for their families, and operating informal businesses, addressing the gender dimensions of energy poverty would offer significant benefits. Evidence from Italy suggests that women-led households are more prone to energy deprivation compared to those led by men. This disparity increases as the size of the households increases (ENEA 2020a). However, a paucity of sex-disaggregated data on how a lack of energy access is distributed, what this means for education/health/economic outcomes, and how energy decisions are made within households complicates efforts to address this challenge. The experience of Brazil's energy safety net illustrates how specific programs can reach the most disadvantaged communities from access to sustained service provision (see Box 2).

BOX 2. Gender and Energy Safety Nets in Brazil

Brazil's electricity access programs have been broadly successful in their goals of providing electricity connections and supporting basic levels of consumption for a large population.

Luz para Todos was launched in 2003 to extend access to electricity connections in rural and remote areas of Brazil. The program has focused on connecting households and communities to ensure the most disadvantaged communities are connected to electricity first. Since its inception, it has invested more than USD 7.1 billion (BRL 26 billion, 2018 prices) to reach over 16 million people, putting Brazil on track to achieve universal access to electricity well before 2030.

Tarifa Social was launched in 2010 to complement universal access to electricity connections. The program was built on previous experience with subsidizing electricity consumption to increase affordability for poor and vulnerable households. It has expanded rapidly and currently supports nearly 9 million households. While some analysis has shown that this program has insulated low energy-consuming households from economic downturns, the program also faces some challenges to fully support households using minimal levels of electricity.

Finally, "More Light to the Amazon" was launched in February 2020 with the purpose of providing electricity to the Brazilian population living in remote regions of the Amazon to promote social and economic development of these communities, encouraging activities that increase family income and the sustainable use of the natural resources of the Amazon Rain Forest.

(From Energy Safety Nets case study on social assistance mechanisms in Brazil, developed by researchers at the Centre for Energy and Environmental Economics (Cenergia Lab), COPPE, Universidad Federal do Rio de Janeiro and Antonella Mazzone, from the Oxford University Centre for the Environment.)

(2) An energy poverty approach includes all basic household energy needs. By including all household energy needs that are required for improved health and well-being, the energy poverty approach recognizes the reality that different energy services are required by households. While SDG7 focuses on access to electricity and clean cooking, equally as important to maintain basic health is the ability to control indoor temperature (heating and cooling) especially under extreme temperature cases. More recently, the COVID-19

pandemic has illustrated the importance of access to information-communication for on-line education of school-aged children as well as the importance of cooling systems to preserve vaccine cold chains.

Making the best use of energy services requires an additional ability by households over time to (a) afford energy-efficient appliances and (b) maintain and improve the energy-efficient integrity of their housing structures or dwellings.

Households require the ability to purchase appliances (e.g., non-polluting cookstoves, refrigerators for safe food preservation, cooling appliances, heating appliances, communication devices) which correspond to minimal energy performance standards (MEPS). A market that does not provide affordable appliances or a market that is not regulated by clear and enforceable MEPS represents an important risk for triggering increased energy poverty among a vulnerable population.

Similarly, dwellings that are not sufficiently modern and may have unfinished floors that accumulate humidity and mold, or walls, windows and roofs with air leakages or lack of insulation (depending on climate conditions) will also present a risk to increasing energy poverty. In many cases real health risks emerge when living in energy poor dwellings including serious mental, psychological, and physical stresses, especially for children, and overall result in measurably worse health consequences including high blood pressure, mood swings, overheating, smoking, stroke, chronic bronchitis, allergies, diabetes, and overweight (Abbas et al, 2021). Because so many of these driving factors are related to poverty, critical policy responses are needed that can address cross-sector factors, such as *Bolsa Família* and *Vale Gás* in Brasil that help poor families purchase subsidized LPG to address malnutrition risks (SEforALL 2020).

(3) Addressing energy poverty enhances resilience to shocks and emergencies. As demonstrated by the COVID-19 pandemic, the ability to access uninterrupted energy services has been pivotal for many countries' ability to respond to the challenges of the pandemic. Those countries that already had energy safety net policies in place were able to surge their efforts more easily and build more resilience of their communities and economies. To prepare for a future emergency, either another public health pandemic or a climate-related emergency, governments need to put in place programs that can target populations that will be vulnerable to risks. Three key areas for building greater energy resilience that can address energy poverty include:

- **Smart grids, renewable energy and battery storage.** As discussed during the First Energy Transition Working Group Meeting (March 2021), energy systems are becoming more decentralized and interconnected. This will enhance the ability to generate more renewable energy in different locations while allowing for integrated energy systems to move renewable energy across different parts of interconnected systems to where it is most needed. The increased use of solar home system and micro-grid technologies will also contribute to significantly improve resilience during shocks as well as expand access to households without grid access. The capacity of the energy system's infrastructure to provide this flexibility will be enhanced by the introduction of improved technologies, such as battery storage, and when it can be combined with policy measures that target more carefully energy poor populations.

While the smart grids will be able to more accurately provide the necessary services needed by a system, an energy poverty framework will be able to provide guidance on where energy services are needed in order to leave no one behind.

- **Buildings.** As mentioned above, the ability to retrofit existing buildings and dwellings that are not energy efficient, as well as ensure greater energy efficiency of the new global building stock will be very important for improving energy resilience. In addition to many efforts focused on the climate benefits of more energy efficient building (e.g., the Building Efficiency Accelerator and the Global Alliance for Buildings and Construction), the European Portal for Energy Efficiency in Buildings (www.buildup.eu) recognizes the importance of addressing building integrity as part of the strategy to eradicate energy poverty. In addition, evidence is emerging regarding additional climate mitigation and health co-benefits of addressing energy efficiency improvements in dwellings, such as increases in employment, GDP, productivity and energy security, positive impacts on health, ecosystem and crops, and reduction of green-house gases (Thema et al, 2017).

- **Role of Energy Communities.** Efforts to implement new strategies that address energy poverty are being introduced by the European Union through its Clean Energy Package to create a new legal entity, the "energy community". Through legally established energy communities, barriers of entry are lifted for vulnerable communities to access more easily decentralized generation. Energy cooperatives are one of the more common representations of energy communities (see Box 3). Many EU countries are providing national enabling frameworks to encourage increased participation of community interests in the energy system. This innovative approach helps to both involve more communities in addressing their energy needs as well as plug gaps of energy poverty. The European Commission estimates that by 2030, energy communities could represent 17% of installed wind capacity and 21% of solar capacity and by 2050, 37% of energy produced could come from energy communities (European Commission, 2016).

BOX 3. Emerging energy communities in France and Africa.

In rural southwestern France, a local agricultural cooperative, Farms of Figeac, created its own energy community, the company SAS Segala Agriculture et Energie Solaire, to carry out the installation of solar PV on the agricultural buildings of its members that produced needed energy for to improve the agricultural productivity of the entire cooperative. Through this energy community, Farms of Figeac became a new player in renewable energy development while contributing to the revitalization of rural areas where agricultural activities are on the decline. (Adapted from JSR Science for Policy Report, 2020. For more information: www.fermesdefigeac.coop)

Likewise, the Green People's Energy for Africa program, launched by the German government in 2017, also focuses on building energy communities across nine countries in Africa. By focusing on SMEs, municipalities, public associations and energy cooperatives, co-ownership and co-operation of new decentralized renewable energy resources has expanded productive activities in communities where barriers to access renewable energy technology still exist. (For more information: www.gruene-buergerenergie.org)

Policy Options that address equity and sustainable access to energy services

As reflected in Figure 1 above, energy poverty will continue to challenge countries to varying degrees, especially when considering the full complement of household energy needs (i.e., not just lighting). In developing countries, the energy poverty challenges that are prioritized are those that focus on basic access, although this must quickly evolve into a focus on sustained service provision once access is achieved and progressively towards regional averages that can contribute to increased well-being and development. The energy poverty approach, therefore, will help countries address their challenges regardless of where among the four quadrants of energy poverty they may find themselves.

The policy options pursued by countries that have already begun to directly address energy poverty can be classified into three different categories: temporary/short term measures, structural/long-term measures and cross-cutting measures. Table 1 provides a sample of policy measures that have addressed each of these categories from both a developing country and a developed country perspective.

Noticeably, the policy options draw on efforts that involve different sectors as well as across different levels of government. Not surprisingly, according to the EU Energy Poverty Observatory, one of the more important bottlenecks to energy poverty policy implementation over the next several years will be the coordination challenges across energy, social, housing, and health sectors (EPOV, 2020).

Investment Mechanisms

Investment mechanisms will be a mix of public, private, international finance and household investment. Beyond the normative and regulatory role of government, different public sector investments and subsidies will be needed especially in consideration of supporting the last mile, marginalized and hard-to-reach populations, including women and children, continue to avail of the energy services they need. In developing countries with significant access deficits, major

public investment and concessional finance will be needed in order to build new infrastructure along with blended finance combining concessional and private investment that mitigates perceived risks in order to reach some of the hardest to reach populations. Blended finance instruments for distributed renewable energy systems will help to close the access deficit while increasing energy security through use of energy efficient technologies and renewable sources.

To improve energy efficiency of buildings and dwellings, private sector investment, the motor behind our economies, cities, and the built environment, will be instrumental in terms of developing energy appliances, innovating business models and services as well as creating local long-term value chains that can drive market transformation. Innovations are required in different markets that are both energy efficient and affordable. Where up-front costs may be too expensive for consumer groups, targeted public support or innovative business models (pay-as-you-go) may be needed. This is even more important when considering that the world's total buildings space (floor area) is expected to more than double by 2070, which is the equivalent to adding a new city the size of Paris every week (IEA 2021).

Finally, private household investment and consumer behavior/choices will also be needed in order for appliances needed to maximize the benefits of energy services, devices for accessing information-communication technology, and improvements to housing structures to lower the risk of energy poverty. For households that are not able to afford energy efficient appliances and

Type	Description	Country	Policy measure
Temporary/short term measures			
Consumer Protection	Special tariffs, disconnection protection	Spain	Prohibition of disconnection for medical reasons
		Lithuania	Reduced VAT for district heating and hot water for households (from 21% to 9%)
Financial Interventions	Short-term solutions through payments	Bulgaria	Targeted financial aid for heating for five months for specific groups of vulnerable populations
		Spain	Emergency financial support to households in case of disconnection risk (administered by local government)
Structural/long-term measures			
Energy Savings Measures (including EE and RES)	Subsidised schemes for promotion of energy savings and renewable energy solutions technologies	Portugal	Improvement of the housing comfort of vulnerable households (especially in inland areas with elderly populations)
		Cyprus	Saving energy by upgrading households, energy upgrades and RES with enhanced grants for vulnerable consumers
Building Renovation Measures	Tax deduction schemes for promotion of energy efficiency in buildings	Italy	Tax deductions of the expense incurred for energy efficiency improvement and renewable energy implementation works in dwellings, for social housing also (ENEA 2020b)
Integrated energy planning	Adoption of comprehensive national energy strategies and integrated plans	Nepal	Reaching the last mile through integrated electrification planning

Regulatory framework for utilities	Adoption of regulatory frameworks to promote financial sustainability of utilities to drive sustainable grid expansion	Ethiopia Nigeria Tanziania	Policy on consumer affordability and utility transparency
Regulatory framework for decentralized RES, such as mini grids and solar home systems	Adoption of regulatory frameworks to attract investments in decentralized renewable energy systems	Nigeria	Solar Power Naija programme: increase energy access through 5M new solar connections
Standards for EE	Adoption for policies for EE in heating and cooling sector	Chad and Ecuador	HVAC energy performance standards and labelling measures
Cross-cutting measures			
Information Provision	Awareness campaigns, energy savings tips	Spain	Municipal Energy Advice Points offer advice to households on energy service issues such as how to improve their energy efficiency.
		Italy	Italia in Classe A (Italy in A class) - National information campaign aimed to promote energy efficiency behaviours and provide the appropriate tools (ENEA,2021), addressed to vulnerable segments of the population also.

Table 1. Sample of Energy Poverty Policy Measures from Europe and Developing Countries.
(Kyprianou et al, 2019; Regulatory Indicators for Sustainable Energy – RISE platform, 2021; ENEA)

devices, addressing the affordability of consumer products will be important in order to maximize the up-take of energy efficient efforts. Informative measures aim at improving awareness of existing energy efficiency incentives or long-term energy costs of appliances (i.e. energy labels) and to influence consumer behavior.

An important element in many of these policies is the incentives included for responses to energy poverty to shift towards cleaner energy sources while protecting populations that are the most vulnerable, thus aiming to both reduce inequality and emissions. In many developed countries, a shift towards cleaner and more sustainable energy can be done through incentives such as tax subsidies or through consumers that can afford to install solar panels or buy energy-efficient appliances. Tax subsidies might not be financially appealing for low-income households, and the dependence from fossil fuels and low efficiency appliances might expose low-income households to increased energy prices (McGee and Greiner 2019).

Thus a very important role could be played in these contexts by energy communities as mentioned above. Energy communities can help consumers collectively participate in and benefit from distributed renewable energy generation projects, independently of their income and access to capital (Caramizaru and Uihlein 2020).

Recommendations

Six years after the launch of the Sustainable Development Agenda, many additional concepts have emerged recognizing that binary access indicators do not tell the whole story of energy use or what is needed for energy to contribute to peoples' health, well-being and survival. When there is no sustained minimal threshold use of energy services, energy poverty emerges and begins to negatively impact both basic health and productivity as well as community services. Energy poverty is a challenge for developing countries that still struggle with universal basic access (i.e., equitable access) as well as for developed countries that face issues of affordability and reliability (i.e., sustainability and resilience). In both cases, the endemic nature of energy poverty represents an obstacle to affordable, reliable, sustainable and modern energy for all. Without a better understanding of who does not have sustained use of *all* energy services needed by households, what are the least-cost options and what measures are needed to fill that gap, there will always be a percentage of the population left behind in the achievement of SDG7.

While we are still in the midst of the COVID-19 pandemic, one clear lesson points to the importance of building a resilient energy system that can help our populations cope and thrive amidst adverse phenomena. Building resilience needs to address both supply- and demand-side. **By providing a more detailed scope to the energy poverty policy agenda, G20 members can provide an important signal in favor of greater equitable and sustained access *and* affordability for all energy needs of households.** By pursuing a voluntary action plan to eradicate energy poverty among G20 countries, G20 members can provide important global leadership for increasing countries' resilience in anticipation of the next health or climate emergency.

Proposed Voluntary Action Plan:

Because of the inherent risks involved in providing responsive energy services to the ever-evolving energy needs of a growing society, shifting climate patterns, and availability of resources, a voluntary action plan framework will be helpful for all G20 countries to continuously monitor, diagnose, and target public policies that address emerging risks in their energy systems.

This voluntary Energy Poverty Action Plan would consist of four recommendations:

- Recommendation #1: Based on the latest concepts and perspectives documented in global energy poverty literature the G20 recommends adopting a definition of energy poverty that is inclusive of developed and developing country challenges. In the absence of a universally accepted definition, a G20 definition of energy poverty will help build consensus around the importance of energy poverty in order to better target public policies that build resilience of economies and societies. The proposed G20 definition of energy poverty provided above is an important step in outlining the parameters of the challenge to help clarify future policy objectives.

- Recommendation #2: Move towards a minimum set of standard energy poverty indicators that can be adapted for the use of national and local decision-makers which embody the main dimensions of households most at risk of energy poverty in developed and developing countries, including systematic gender disaggregation in recognition of the higher exposure to energy poverty experienced by women and

households led by women. This move towards a minimum standard set of energy poverty indicators would need to be adjusted, disaggregated or expanded to meet the specific needs of different local contexts.

For example, in developing economies, in recognition of lack of physical infrastructure or availability of different energy markets, the minimum set of standard energy poverty indicators would be centered around the availability of supply and the affordability of the service for each of the household energy needs[13]:

Energy Supply Poverty (for lighting, for clean cooking, for cooing, …)

- Availability, Reliability, Quality
- Cost of Supply

Energy Service Poverty (for lighting, for clean cooking, for cooling, …)

- Service Level
- Affordability (budget share)

For developed economies, the movement towards a minimum set of standard energy poverty indicators would focus on the different dimensions of household energy services as well as socio-economic parameters to better identify vulnerable households and energy efficiency of dwellings:

Dimension of household energy[14]	Indicator
Cooking	Modern cooking fuel
	Indoor pollution
Lighting	Electricity access
Services provided by means of household appliances	Household appliance ownership (e.g., refrigerator, space cooling)
Entertainment/education	Entertainment/education appliance ownership
Information communication	Communication means (internet)

Socio-economic and dwelling parameters[15] (all gender disaggregated)
• Household income and expenses
• Household composition

[13] Pachauri and Rao (2020) provide more detail of their Alternative Framework Measurement of Household Access to Electric Services. This alternative framework could be expanded to include other household energy services and needs.

[14] See Nussbaumer et al (2013) for additional insights of the Multidimensional Energy Poverty Index (MEPI).

[15] Parameters suggested by ENEA (2019).

• Employment status
• Tenancy
• Social relations
• Structural condition of dwelling
• Energy technologies and devices
• Residential location

Measurement of energy poverty and identification of vulnerable households would need to be adapted to local needs and would be an essential pre-condition for the development of sound and effective policy measures.

Data collection for a set of energy poverty indicators would aim to be as practical as possible, making use of current data and existing efforts such as the Demographic and Health Surveys (DHS), Household Budget Surveys (HBS), Living Standards and Measurement Studies (LSMS) and available administrative data from electric utilities and other energy players (i.e. industry associations, private companies).

- Recommendation #3: Identify integrated policy solutions as part of energy and social policy as well as coordinate between all levels of government. These should include social policy measures and energy efficiency improvements that reinforce each other, especially in housing, and often require local government implementation. Where there is a poverty issue specifically associated with energy – that is, one not arising solely out of general poverty – it is necessary to add structural measures to the existing social policy measures designed to mitigate the social consequences of energy poverty. Structural measures may be regulatory, designed to improve the functioning of the markets; or infrastructure-related, designed to cut energy costs through renovations to improve the energy performance of buildings.

Five specific policy areas should be addressed:

i. An integrated approach to housing, environmental, economic and social welfare policy and planning;
ii. Forward plans to enable the lowest income groups to benefit from the gradually increased minimum energy performance standards – across all sectors;
iii. Integration of building energy performance into mandatory housing quality standards;
iv. Ensure that vulnerable lower income households are protected against financial risk, particularly in the context of the liberalisation of energy markets, and capable of prioritizing the use of renewable energy sources where possible;
v. Monitor and evaluate the impact of renovations on lower income households, including actual comfort conditions and energy cost savings.

- Recommendation #4: Explore the opportunity for G20 countries to develop on the findings of the just transition initiatives, notably EU Energy Poverty Advisory Hub, and establish future collaboration. Every effort should be made to make best use of existing platforms and initiatives. As reflected in Box 1 above, many of the current initiatives focus on a sub-set of energy poverty challenges (e.g., Global Commission on Eradicating Energy Poverty focuses on expanding access to electricity), are limited to analytical programs (e.g., ECLAC, ESMAP's Analytics Hub, IIASA), or advocate one approach to energy poverty (e.g., Energy for Growth Hub). The Energy Poverty Advisory Hub offers a broader set of tools through its repository for energy poverty metrics and academic research, an indicator dashboard, policy best practices and will soon offer technical assistance to municipal actors aimed at improving local governments' energy poverty strategies. The EU Energy Poverty Advisory Hub would be amenable to become a focal point for G20 members' access to best practices and lessons learned. Ideally, stronger coordination links across regions of G20 countries will contribute to facilitate lesson sharing that will be helpful to policy makers as they address the eradication of energy poverty in their own country contexts.

To provide further details to recommendations two and three, the G20 Energy Transition Working Group should request a small task force of International Organizations to develop more concrete proposals to identify the pathway forward for the second and third recommendations, that the ETWG can consider on a no-objection basis.

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