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Briefing note

Energy, migration and the 2030 Agenda for Sustainable Development

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Key messages

- Migration can contribute to improving access to reliable, affordable modern energy services (SDG target 7.1) through higher incomes for migrants and the sending of remittances.
- The informal or irregular status of many migrants is a barrier to universal access to modern energy services. Migrants in informal settlements and displaced people often experience a worsening in their access to modern energy services.
- Migrants require knowledge about modern energy services and markets to ensure equitable access to reliable, affordable energy in high-income countries. They may transfer this energy knowledge to their communities of origin.

Migration and the 2030 Agenda for Sustainable Development: a briefing series

Migration is one of the defining features of the 21st century and significantly contributes to economic and social development everywhere. As such, migration will be key to achieving the Sustainable Development Goals (SDGs).

In a series of briefings, ODI, with the support of the Swiss Agency for Development and Cooperation (SDC), explains the relationship between migration and critical development issues that are central to the SDGs. The briefings provide a set of recommendations for governments and policy-makers tasked with delivering the 2030 Agenda.

1 Introduction

International migration is a factor in social and economic development in every region of the world. It can increase investment and development in countries of origin, and reduce poverty among migrants and their families (Foresti and Hagen-Zanker, 2017). Migration within countries, especially from rural to urban areas, can increase migrants' incomes and benefit those remaining in their places of origin. These social and economic gains are only realised with the use of energy, which enables migrants to earn a living and sustain themselves at their destination, as well as to undertake the migration journey itself.

Energy consumption is a prerequisite for social and economic development. High living standards are associated with high per capita energy consumption, and access to modern energy services – electricity and clean fuels and technologies for cooking – is essential for poverty reduction (Pachauri et al., 2013). The services that energy can provide – lighting, cooking, heating, cooling, communications, mobility and motive power – allow people to meet essential consumption needs and to be productive. It is these energy services that contribute to social and economic development rather than the consumption of energy itself. However, the consumption of energy can have detrimental effects on human development, through pollution and the degradation of natural resources.

SDG 7 is to ensure access to affordable, reliable, sustainable and modern energy for all. But based on current trends, this universal access target will not be achieved: by 2030, 674 million people are expected to be living without electricity and 2.3 billion without clean fuels and technologies for cooking (IEA et al., 2018). Almost 97% of the world's urban population already has access to electricity, though for many supplies are unreliable or unaffordable, and most of those without access in 2030 will live in the rural areas of sub-Saharan Africa and South Asia.

SDG 7 also addresses the climate change impacts of energy consumption, which can be reduced by switching to renewable energy sources and reducing energy demand through greater efficiency. Renewable energy is expected to account for 21% of the global energy mix in 2030, a share that neither meets the SDG target nor the ambition of the Paris Agreement on climate change (IEA et al., 2018). Similarly, progress on improving energy efficiency is unlikely to be enough to achieve the SDG target.

Migrants need energy services wherever they are.[1] However, it is difficult to quantify the amount of energy required by a migrant to live a dignified life, free of poverty. There are also differences between countries, and between rural and urban areas, in the basic level of energy services needed to eliminate energy poverty. These are related to geographical and cultural factors, and along with a lack of data and variation in how access is measured, hamper international comparisons.[2]

This briefing focuses on the direct and indirect relationships between migration and energy services in places of origin and destination, and how changes due to migration will affect achievement of the SDGs. The next section discusses the role of energy in migration decisions, followed by an analysis of migration's effects on energy services in countries of origin, transit and destination. Section 3 describes how these relationships will affect achievement of the SDGs, recognising that energy is linked to all the SDGs, and finally we conclude with policy recommendations to enhance migration's contribution to SDG 7.

1 This briefing focuses on international labour migrants, defined by the International Organisation for Migration (IOM) as people who have moved from one country to another for employment purposes (IOM, 2011). Reference to internal migrants and people displaced forcibly will be stated explicitly.

2 The binary (access/no access) measurement of access to electricity does not capture variation in the quantity and quality of electricity consumed. The Multi-Tier Framework (MTF) has been designed to measure energy access in a way that recognises different energy access service levels (Bhatia and Angelou, 2015). The MTF has six tiers of access, ranging from Tier 0, inadequate access for even a basic living standard, to Tier 5 which represents at least 23 hours a day of grid supply. However, statistics about access at different tiers are unavailable, except for a very small number of countries, and are not disaggregated by migration status.

2 The relationship between migration and energy

Decisions to migrate in pursuit of better livelihoods and well-being are closely related to socioeconomic conditions in places of destination and origin. They are also influenced by migrants' social and familial relationships, and by experiences of migration (UNESCO, 2017; Curran et al., 2016; Cummings et al., 2015). Access to and use of energy services is an integral dimension of people's socioeconomic circumstance and well-being (Castán Broto et al., 2017), but is rarely explicitly recognised as a factor in migration decisions. Nor is it considered in current migration debates (except, perhaps, in relation to humanitarian contexts).[3]

2.1 Is energy a driver of migration?

The links between energy services and migration are best understood in terms of energy's contribution to living standards generally. Access to energy services – or the lack of it – may be considered, what van Hear et al. (2012) call, a 'predisposing factor' that can lead to migration.

Access to energy services might indirectly influence a decision to migrate through its impact on:

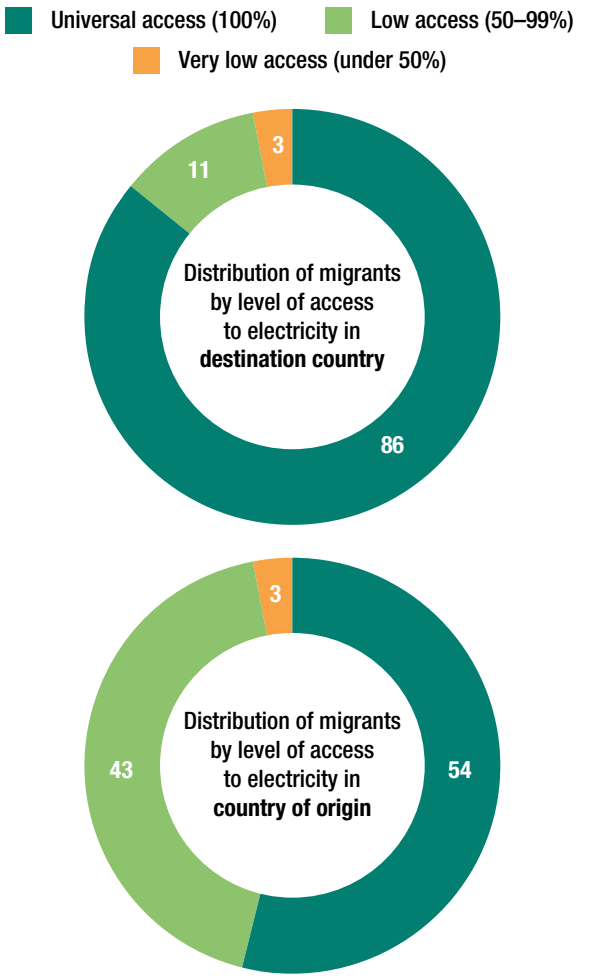
- other established drivers of migration – such as food insecurity, a lack of access to sufficient resources, other basic infrastructure (e.g. roads, water and sanitation), and social services (e.g. healthcare) (Morales, 2017; Wollensack, 2017)
- the livelihoods of farmers and the self-employed: energy poverty can restrict agricultural processing and limit the time available for productive activities, while modern energy services can enable solar-powered water pumps and access to weather information (Morales, 2017)
- social and economic development opportunities, including jobs: energy access can help improve education and skills as well as the productivity of businesses
- resilience to natural disasters: access to easily deployed renewable energy technologies before and after disasters could, for example, allow communities to recover more swiftly (Wollensack, 2017).

There is insufficient evidence to establish causation between energy poverty and migration in general (Morales, 2017). This is partly because energy consumption patterns are highly context specific (e.g. relating to geography and climate) and likely to affect migration in different ways. The relationship between energy and migration also depends on the interpretation of migration.

There appears to be more evidence for a causal relationship between internal, rather than international, migration and access to energy services. Research has found a variety of links between migration and electrification in rural areas and peri-urban slums: out-migration can reduce levels of access to electricity, and electrification in places of origin can reduce migration (Harris et al., 2017; IADB, 2014; Beguy et al., 2010). Improved access to electricity in rural Brazil reversed rural–urban migration in some cases (IADB, 2014).

Although it is difficult to discern a *causal* relationship between energy and migration, they are correlated. Most countries with a high proportion of migrants among the total population have universal access to electricity, while migrants represent a small proportion of the population in countries with a low level of electrification. Figure 1 shows the distribution of international migrants by level of access to electricity in countries of destination and origin, in 2015. The great majority of international migrants (86%) reside in destination countries with universal access to electricity, but only 54% of international migrants are from countries with universal access. Countries of destination and origin with very low levels of access to electricity account for the same small proportion (3%) of international migrants. While this suggests migrants are moving to countries with higher levels of energy access, it does not indicate whether migrants' access to energy improves.

Figure 1 Distribution of migrants by level of electrification



Source: UNDESA, 2015; IEA et al., 2018.

3 The word 'energy', for instance, appears once in the 364-page 2018 *World Migration Report* (IOM, 2017).

2.2 Effects of migration on energy services in places of origin

The effects of migration on energy services in countries, or places, of origin can be felt in three ways: through households' consumption of energy; through remittances; and through the transfer of knowledge about energy technologies and uses.

Household energy consumption

The effect of migration on energy consumption in migrants' places of origin varies. Where fuel needs to be collected by energy-poor households, the reduced availability of labour in households may negatively affect energy access. Women, who bear a disproportionate responsibility for fuel gathering, will be affected most when migrants from the household are female.

Migration can reduce the demand for household energy in places of origin, which may in turn reduce the burden of fuel collection for women and girls at lower tiers of energy access. When the supply of electricity is from, for example, community-owned solar systems with limited capacity, migration could improve access to electricity for those who remain behind. But, when electricity is from the grid or a mini-grid, migration could reduce demand and revenue to the service provider.

Remittances

Existing levels of income and access to electricity affect individuals' ability to migrate and remit. In Mexico, municipalities with low levels of poverty and higher baseline rates of electrification were more likely to benefit from the 3x1 Programme for Migrants (Aparico and Meseguer, 2011).[4] Evidence from Thailand suggests that electrified households were more likely to have migrants, but were less likely to remit (Garip, 2010). This could be explained by the fact that electrified households are also likely to be higher-income households, can afford electricity access and use, and are less reliant on remittances.

Recipients can use remittances for consumption expenditure or investment for longer-term social and economic benefit (UNDP, 2018). Remittances can affect the level of household energy consumption. For example, analysis in China found a 1% increase in remittances leads to a small (0.09%) reduction in firewood consumption in communities of origin (Gong, 2011). This suggests recipients invested some of their remittances in improved energy services (though the reduction in firewood collection was also influenced by other factors such as income and perception of future poverty status).

Some studies have shown that, at the macroeconomic level, remittances have had a positive impact on human development through increases in household incomes. As energy consumption is closely correlated with income, energy services are likely to have contributed to this (Sanchez-Loor and Zambrano-Monseratte, 2015): in Asia, a long-term causality was established between economic growth, and remittances and electricity consumption (ibid.). However, the effect of remittances on electricity consumption is not necessarily in the same direction, nor is it clear that there is always a direct link between remittances and energy consumption.

In Morocco, Akçay and Demirtaş (2015) found that remittances were used for energy consumption in the short- and long-term, and indirectly influenced economic growth and industrialisation processes. In Tajikistan, remittances are often used to pay for energy services but are at risk – temporarily or permanently – because of difficulties faced by migrants in destination countries (World Bank, 2015). To increase remittance inflows more generally, Akçay and Demirtaş (2015) identify several policies that can help to create a strong enabling environment, which in turn can contribute to energy access. These include formalising remittance flows into the country and lowering the transfer costs and taxes on such transactions; minimising the risks to remittance transfers and increasing transparency; and the promotion of financial inclusion and literacy, as well as improvements in the business environment.

There are also linkages between energy and remittances through global energy prices. Rising oil prices have a small, but significant, positive impact on remittance flows from oil-producing Middle Eastern countries, which are economically important for migrants' countries of origin (Ratha, 2015). Falling oil prices, and higher taxes in the Middle East, reduce remittances, and the number of migrants from South Asia (Karim Byron, 2016; Rahman, 2018).

Fluctuations in global energy prices have the greatest proportional impact on low-income consumers (Mendelson, 2013), who may already be reliant on remittance flows. Evidence suggests that single mothers without access to remittances are particularly vulnerable to energy price increases (World Bank, 2015).

Along with consumer financing mechanisms (e.g. mobile banking), remittances are starting to contribute to the delivery of renewable energy technologies to the off-grid and under-electrified poor in developing countries (Mendelson, 2013). Remittances can be specifically provided to support investment in energy services in migrants' original households and communities, including investments that improve energy access and energy efficiency.

Several initiatives in Latin America direct remittances towards improving energy access. A clean-energy technology deployment programme is aiming to increase rural energy access in Ecuador, linked to a financial remittance mechanism (IFAD, 2009), and EcoBazar has begun selling solar water heaters, having marketed the opportunity among remittance providers in Spain and recipients in Bolivia (NDF et al., 2015). Meanwhile, Mexico's 3x1

4 Under this programme, the amount received in remittances is trebled by the government at municipal, state and federal government levels (Aparicio and Meseguer, 2012).

Programme for Migrants is encouraging investment in local development, including electrification projects.

In Haiti, a pilot scheme to target remittances from the Haitian diaspora to finance solar lanterns and solar home systems reached 30,000 beneficiaries in 2013. The scheme targeted the country's marginalised and energy-poor households, enabling them to displace dirtier fuels (e.g. diesel, candles and kerosene) and reduce household air pollution (Mendelson, 2013; Fomin and ArcFinance, 2014; Fomin, 2015).

Knowledge transfer

Technological progress in developing countries is strongly influenced by their ability to access, adapt and diffuse technological knowledge generated abroad (UNCTAD, 2014). Policies that encourage mobility can also enhance innovation capabilities in developing countries (IRENA, 2013). Migrants' transfer of energy-related knowledge from high-income countries may therefore be important for energy development in countries of origin.

Though research evidence on this link is generally lacking, there are examples of how international mobility has promoted energy-related skills in countries of origin.

Indian expatriates employed in Europe and working in a variety of sectors, including the energy sector, were found to be important mobilisers of knowledge. Of the four channels analysed for their development impact – physical return, financial transfers, social impact and knowledge transfer – the last was found to be the most important. However, physical return of migrants was an important pre-requisite for diaspora knowledge transfer (EPFL et al., 2013).

Knowledge transfer can also occur *before* a migrant has returned to their country of origin. One skilled migrant who was living in the United States transferred solar and wind technology capabilities back to their country of origin, Bangladesh, through a non-profit organisation (Sultana, 2005). The migrant's organisation supported implementing partners in Bangladesh to learn from mature foreign companies and develop local partnerships. Smaller firms developed the capacity to assemble batteries and solar products (excluding the panels themselves), by gaining access to imports and technological know-how (Sultana, 2005).

However, permanent migration of educated people can result in a loss in a country's stock of human capital and reduce its capacity to receive technology transfers (UNCTAD, 2014). Moreover, migrants that develop energy-related skills overseas do not necessarily return to their countries of origin. For example, the European Centre for Nuclear Research Switzerland, found that 55% of fellows take up jobs in a different country to the country in which they obtained their diploma (Nilsen and Anelli, 2015).

2.3 Energy in transit countries

Migrants in transit may be particularly vulnerable to energy poverty, but even less is known about how this group of people access energy services. According to a recent World Bank report:

Box 1 Energy for displaced people

More than 135 million people currently need humanitarian assistance (UNOCHA, 2018), including refugees and displaced people. With most living in informal settlements and rented accommodation (Morales, 2017), they are particularly likely to have a lower level of energy access because of migration. Access to clean energy is especially lacking for displaced people living in camps – 80% have 'absolutely minimal access to energy' (Lahn and Grafham, 2015).

Energy consumption in the humanitarian sector is often inefficient, polluting, unsafe for the users and harmful to the surrounding environment (GIZ, 2017). Camp infrastructure is often run on diesel-fuelled generators, at an estimated cost of $100 million annually (Bailey et al., 2017). The Moving Energy Initiative has estimated a one-off investment to provide all displaced households with basic access to energy (clean cooking stoves and solar lanterns) at $355 million – approximately the amount that would be saved annually in fuel costs (Lahn and Grafham, 2015).

The humanitarian sector's slow progress to reduce energy poverty can be explained by: a lack of a formalised or funded mechanisms for international agencies to coordinate energy-related humanitarian assistance (Callaghy and Riddley, 2017); displaced people and refugees being less likely to be a priority for policy-makers (GIZ, 2017); insufficiently long-term funding horizons (Bailey et al., 2017); and a difference in skills and objectives between the development and humanitarian sectors (ibid.).

In Athens, plans to grow the housing stock for refugees and migrants, with the city paying for utilities and basic electrical appliances, provide an example of action being undertaken to address these constraints (WEF, 2017).

Elsewhere, solar powered water pumps have been installed in the Dadaab refugee camp in Kenya to replace diesel generators, and a new solar farm is being built to provide power to both the Azraq refugee camp and nearby villages in Jordan (Morales, 2017). The 'Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement' (GPA) aims to improve coordination and support by humanitarian organisations to address the energy needs of displaced people in camps, urban settings, informal settlements as well as local host communities.

The literature is silent on the impacts of transit migration on the migrants themselves; the families they leave behind; and the origin, transit, and final destination countries' (KNOMAD, 2018).

Migrants in transit may be especially unlikely to be able to access modern energy services because of challenges in securing good-quality accommodation and legal connections to utility services at each point along their journey.

Access to electricity is essential for migrants in transit to power mobile phones, which allow them to maintain contact with their families and connect to the internet, to find accommodation and essential amenities, as well as maps for their route (Cummings et al., 2015; IOM, 2017). The United Nations High Commissioner for Refugees (UNHCR) found that only 46% of Syrian refugees arriving in Europe received adequate assistance to charge their phone. In the absence of support, such as the solar-powered charging stations provided in some camps and along major transit routes (Kellerhals, 2016; Hartocollis, 2015), payments for charging or improvised and irregular connections to electricity may be necessary.

2.4 Effects of migration on energy services in places of destination

The absence of comprehensive data on where migrants settle and what their lives are like in host countries (UNESCO, 2017; WEF, 2017) means there is limited evidence about how migrants use energy services and how migrants' energy consumption affects their destination. Understanding the impact of migration on international migrants' welfare 'largely depend[s] on the level of human development in their home countries' (Esipova et al., 2011), but data comparing migrants' current and previous energy use are scarce. Where energy supplies are already constrained, migrants' demand for energy services could decrease access for established residents.[5] On the other hand, migration and its broad range of benefits could lead to more investment in energy services, which in turn benefits host communities.[6]

While migrants settle predominantly in cities (WEF, 2017), and rural-to-urban migrants (both internal and international) form a significant part of the urban poor (ITDG, 1998; IOM, 2017; Heinrich Böll Stiftung, 2016; Singh et al., 2014), it is important to note that some migrants do not, that not all migrants are poor, and that all the 'urban poor' are not migrants. It is therefore difficult to generalise migrants' experiences with energy (see also Box 2, for example). However, drawing on the evidence that is available – including anecdotal evidence – we can make some links between migration and energy services in destination countries.

The quantity, quality and type of energy consumed

People migrating from rural households that have limited access to modern energy services may consume a smaller quantity of primary energy at their destination, but experience an increase in the quality of energy as well as the efficiency with which they consume it. This shift is attributed to migrants from rural areas reducing the inefficient burning of biomass fuels on open fires in developing countries. In Australia, migration increased migrants' energy efficiency, because the energy infrastructure 'tightly scripted' energy consumption practices (Maller, 2011). International and internal migration in Mexico helped a transition away from the use of wood for cooking, towards gas (Manning and Taylor, 2014). Figure 2 shows that rural-to-urban migrants in China shift away from crop residues and wood towards gas and electricity, and for some migrants towards coal (Ru et al., 2015). The quantity of household energy consumed by migrants (MI in Figure 2) was lower than that of rural households, but higher than that of indigenous urban households (Shen et al., 2017).

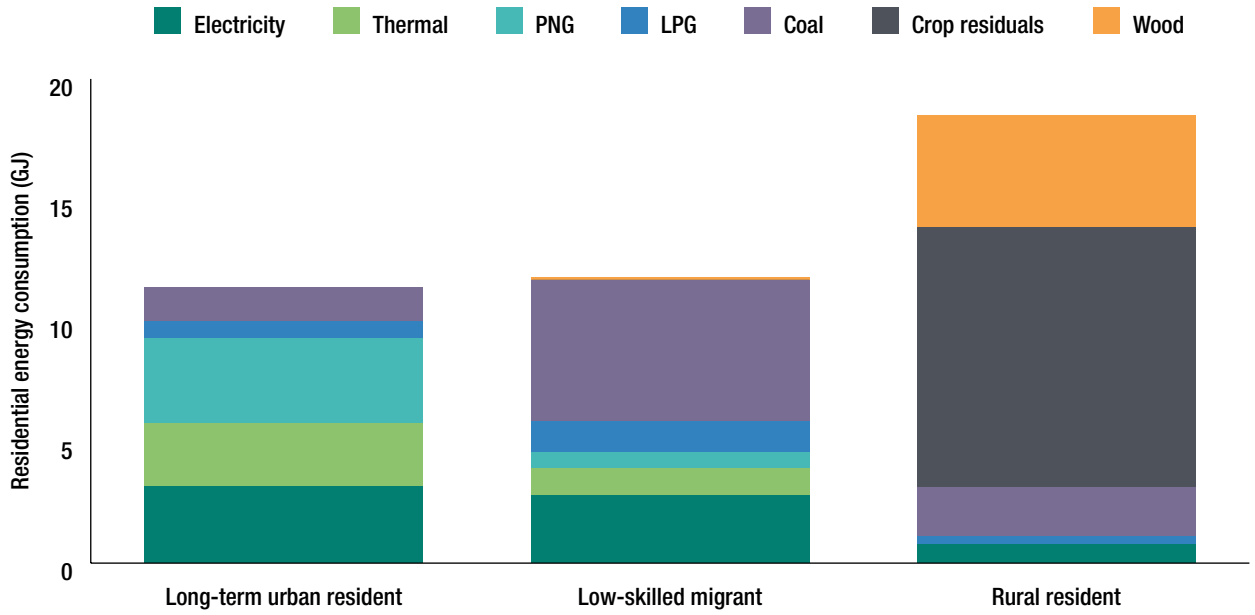
Box 2 Migrants have different energy experiences

In 2015, migrants from the Kyrgyz Republic, Tajikistan and Uzbekistan represented approximately one-third of registered migrants in Russia, but the profile of migrants from each country is markedly different. A majority from the Kyrgyz Republic came from industrialised cities but migrants from Tajikistan and Uzbekistan tended to emigrate from rural households. While migrants from these three countries were most likely to be male, young, and working in construction (UNDP, 2015) – which suggests their current energy consumption patterns may be similar – different conditions in their places of origin mean that the impact of migration on their energy consumption is likely to vary. Moreover, this profile of a migrant contrasts with the global picture, which shows that almost half of the world's migrants are women, and is not even representative for migrants in Russia, where only one-quarter of migrants are employed in the construction sector for their first job (UNDP, 2015).

5 In Ghana, the Mayor of Kumasi blamed migration for putting pressure on the city's housing supply and the resulting creation of slums which had poor access to electricity (IOM, 2017). In Eastern Africa, wood fuel supply near refugee camps is severely depleted for the indigenous population (Morales, 2017).

6 In Davao, Philippines the migrant demand for electricity was cited as a reason for the local government to invest in a new coal-fired power plant (WEF, 2017). Support for energy services in refugee camps may be extended to the indigent population (Morales, 2017).

Figure 2 Energy sources used by urban migrants in China



Source: Ru et al., 2015.

Studies of migrants from developing countries living in rich destination countries suggest significant positive changes in migrants' access to modern energy services because of the higher standard of energy infrastructure in the destination country (Kadundu et al., 2016; Maller, 2011). Migrants from Democratic Republic of Congo living in France were impressed, not only by the reliability of access, but also the improved quality – for example, being able to use multiple electric appliances simultaneously (Kadundu et al., 2016). But migration alone does not always result in better access to modern energy services.

Comparisons between migrants' access to energy and that of the indigenous population show mixed findings. In Spain, migrant women were found to be particularly vulnerable to energy poverty (Gonzalez-Pijuan, 2018). Across Europe, non-EU migrants were found to 'experience systematically higher levels of energy poverty' than intra-EU migrants and EU citizens residing in their home country (Bollino and Botti, 2017). But in China, the share of internal migrants using clean cooking fuels was higher than that of the general urban population (Aunan and Wang, 2014).

Energy access is affected by a range of non-technical factors that must be considered alongside whether a reliable electricity or gas connection is available (Bhatia and Angelou, 2015; Castán Broto et al., 2017). Although relative prices are key, households may continue to use lower quality fuels, because they perceive them to be cheaper, cannot afford large upfront costs for appliances, or prefer to buy fuels in the smaller quantities in which inferior fuels are sold (Heinrich Böll Stiftung, 2016; Phillimore, 2014; Taylor et al., 2011). The need for behavioural change can also constrain a household's transition to improved energy services (ITDG, 1998; Kadundu et al., 2016). Knowledge from other contexts can increase migrants' resilience to energy access barriers or shocks (Maller, 2011).

Migrants' familiarity with how the energy system works in the host context is also important. Research in Australia, France and the UK has shown that migrants are less likely than the general population to be aware of welfare measures to secure energy access, and less likely to be 'energy literate' – that, to have an understanding of the energy market, tariffs and affordability measures such as energy efficiency drives (ECC, 2016; Barnes et al., 2014; Kadundu et al., 2016; South Seeds, 2016).

The effect of insecurity and informality

The quality of migrants' accommodation at their destination affects the pattern and quantity of their energy usage. In South African cities that have experienced considerable levels of in-migration, poor households living in older, low-quality housing were found to be less likely to have access to reliable electricity and modern cooking fuels (Heinrich Böll Stiftung, 2016). Migrants in Europe face challenges related to poor quality housing (Phillimore, 2014), and low-quality housing and inefficient appliances can lead to energy poverty for both the income and non-income poor (Bollino and Botti, 2017).

Migrants who belong to the category of urban poor are likely to live in informal accommodation or slums, and therefore experience unsafe housing conditions and a lack of basic infrastructure (IOM, 2017). The out-of-city location of peri-urban slums can also increase transport needs, with associated energy impacts (IOM, 2017; Heinrich Böll Stiftung, 2016). A recent study found that 'most rural-urban migrants residing in illegal settlements and urban slum areas are poor and have

limited access to affordable, reliable electricity' (Singh et al., 2014). Insecure land tenure and being forced to rent accommodation have been linked to energy poverty in Europe (Bollino and Botti, 2017).

Informality can also prevent modern energy services reaching migrant households, for the Roma population in new EU member states, for example (World Bank, 2015). In Beijing, millions of undocumented internal migrants live in shanties where piped natural gas or centralised heating are rarely available (Ru et al., 2015; Shen et al., 2017). And attempts to substitute coal with electricity for space heating in Beijing were initially targeted only at officially registered households (Ru et al., 2015). Households that have indirect, sometimes illegal, connections to electricity grids through neighbouring properties often pay more per unit and are also excluded from receiving consumer energy subsidies to which they would otherwise be entitled (Heinrich Böll Stiftung, 2016).

However, poor living conditions are not always an indicator of energy poverty. For example, a report by Human Rights Watch – which lamented the cramped, dirty, and dark living conditions of migrant workers in Qatar – suggested that they did have electricity connections and gas stoves (Human Rights Watch, 2015). Outside cities, information about housing for migrant farm workers in the US suggested access to modern energy services (Hamilton and Dudley, 2010).

Migrants' housing can be temporary as well as informal. In Moscow, 40% of labour migrants were found to be living in 'abandoned factories, basements, and trailers' (Centre for Migration Research, 2014). The inherently insecure accommodation in these situations is unlikely to provide high quality access to modern energy sources.

Support for access to modern energy services is available in some countries for low-income urban households – including migrants. In Thailand, low-cost housing schemes for slum dwellers explicitly included electricity connections, and temporary household registration allowed more households to be connected directly, and legally, to the grid (Shrestha et al., 2008). In brownfield areas of Brussels, Re-Vive are building low-energy and passive housing for these groups (WEF, 2017), while in Glasgow, South Seeds help migrants navigate the energy market and provide them with technical support to improve household energy efficiency (South Seeds, 2016).

However, many municipal governments are unable to respond to the challenges posed by the rate of in-migration (IOM, 2017; Heinrich Böll Stiftung, 2016), and government policy may not consider electricity a basic need for the urban poor (Singh et al., 2014; Castán Broto et al., 2017). National policies for migrant inclusion and energy access do not necessarily translate to the integration of migrants and provision of access to modern energy services at city level (IOM, 2017; WEF, 2017; Singh et al., 2014). These policy issues can be especially acute for peri-urban settlements, which can fall beyond the purview of municipal authorities (Castán Broto, et al., 2017).

Environmental impacts

There has been little research on the impact of international migration on energy-related greenhouse gas and particle emissions. The effect depends on the absolute number of migrants in destination countries, their proportion of the total population, and their energy consumption patterns – factors which vary significantly between countries. Although the US, for example, hosts the largest number of migrants, they comprise a much smaller proportion of the population than in the United Arab Emirates, Kuwait and Qatar, where migrants account for 80% to 90% of the resident population (KNOMAD, 2018). In these countries, migrants seem less likely to consume as much energy as the indigenous population. However, urbanisation tends to increase per capita primary energy consumption in higher income countries while decreasing it in lower income countries (Belloumi and Alshehry, 2016).

Although urbanisation has been linked to increased greenhouse gas emissions (Belloumi and Alshehry, 2016), the relationship between migration and emissions, and other air pollutants, remains unclear, involves competing factors and appears to vary by context. For example, if migration leads to an increase in income or a move to a less hospitable climate, migrants may be more likely to consume more energy services, which, other things being equal, would increase emissions. But migration often changes the *types* of energy available and thus changes the types of fuel used to provide the energy services and the resulting pollutants produced. In their place of destination, migrants may have access to different appliances and combustion technologies – potentially increasing the energy efficiency and decreasing the emissions per unit of energy consumed – but actual impacts vary, depending on the migrants themselves.

Research in Viet Nam found that internal migrants from rural areas were likely to produce fewer emissions per capita than migrants from urban areas and indigenous residents (Komatsu et al., 2013). The boundaries of the analysis are also important because although fuels like electricity and natural gas may be 'cleaner' at the household level, the greenhouse gas implications associated with their use must also account for upstream emissions (e.g. those released by coal-fired power stations or during the production and processing of methane).

Finally, while the impact of greenhouse gases like CO_2 is global, fuel use produces many other local air pollutants (some of which also have climate impacts). In terms of assessing the harm from air pollution, driven by internal and international migration, urbanisation has relocated and concentrated both emissions and populations in cities, particularly in informal settlements where ambient air quality may already be impacted by other emission sources (e.g. transport), therefore yielding greater harm (Shen et al., 2017). Thus, while urbanisation may decrease particulate emissions at the household level, migrants and non-migrants may be subject to higher concentrations of air pollutants because of the general housing density and other pollutant sources in informal and urban settlements that many migrants inhabit.

3 Energy, migration and the SDGs

The enabling role of energy in social and economic development means there are direct and indirect links between SDG 7 and the other 16 SDGs (Nerini et al., 2018; McCollum et al., 2018; ICSU, 2017). Detailed analysis of these links suggests that the positive links outweigh the negative (McCollum et al., 2018), but that change in energy systems will be required to achieve almost two-thirds of the 169 SDG targets (Nerini et al., 2018), including targets related to migration (8.8, 16.2 and 17.18). Table 1 summarises the migration links to the energy targets (SDG 7). Table 2 summarises the energy links to the targets relating to migration.

Migration can contribute to achieving SDG target 7.1, universal access to affordable, reliable and modern energy services. The level of energy access is often greater at migrants' destinations than at their places of origin. The urban destinations of rural-to-urban migrants have higher levels of access than rural areas. Migrants in countries where average income levels are higher are likely to have improved access to energy services and to consume more energy. This is not to say that migration always contributes to target 7.1: in urban slums, access may be no better than in rural areas, while migrants in countries with the same level of development as their origin country may have similar levels of access. Many people who are forcibly displaced have worse access. Income levels are likely to be a stronger determinant of access to modern energy services than migrant status.

In terms of numbers, the energy access deficit is primarily a rural experience. The challenge of achieving universal access to affordable and reliable modern energy services (target 7.1) is in rural areas, where people migrate from rather than to. Migration can contribute to improving access in rural areas through remittances, although the extent to which this is occurring is unknown.

The target to increase the share of renewable energy in the global energy mix (target 7.2) requires switching electricity generation and fuel consumption for transport and industry to renewable energy sources. While many migrants do switch energy sources at their place of destination, the contribution of migration to target 7.2 cannot be determined from the evidence available.

Migrants experiencing improved access to modern energy services are likely to be consuming energy more efficiently, contributing to target 7.3. For example, a switch to kerosene or liquefied petroleum gas (LPG) for cooking energy is more efficient than using a traditional wood fuel stove. The infrastructure and use of energy-efficient appliances in rich destination countries, can also improve migrants' energy efficiency. However, the greatest gains for achieving target 7.3 are to be had in industry (where migrants may be employed), transport (including during migration) and buildings (where migrants live and work).

Table 1 Migration links to SDG 7 targets

Relevant SDG target	Link to migration
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	Migration can help improve access to affordable, reliable modern energy services. The general level of access (absolutely and in terms of tiers of access) may be higher in destination countries, and access in towns and cities is higher than in rural areas. Cash and in-kind remittances may be used to enhance access to modern energy services in migrants' places of origin.
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	Migration presents an opportunity to switch from fossil fuel energy to renewable energy. Migrants in urban areas are likely to reduce their use of kerosene and use electricity for lighting. However, electricity may be from the grid, with no opportunity for migrants, except in high income countries, to choose the energy source for its generated. Switching to LPG or natural gas for cooking in places of destination may reduce greenhouse gas emissions, but would not increase the share of renewables in the energy mix.
7.3 By 2030, double the global rate of improvement in energy efficiency	Migrants are likely to adopt more efficient energy uses in destination countries and cities (e.g. electricity, clean fuels for cooking).
7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	International cooperation on energy access, renewable energy and energy efficiency does not explicitly include the needs of migrants. International cooperation on migration does not explicitly consider migrants' energy needs, except in humanitarian contexts. A 'Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement' is being developed.
7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, and small island developing states	Investment in infrastructure and clean energy technologies in least developed countries, small island developing states and other developing countries can benefit migrants in these countries. Remittances from international migrants can support this investment.

Source: UN, 2015b; Foresti and Hagen-Zanker, 2017.

Migration has been directly linked to five SDG targets that are not energy-related (see Table 2; and Foresti and Hagen-Zanker, 2017). Achievement of three of these (8.8, 16.2 and 17.18) requires action within energy systems – to address labour rights and working conditions in the production and supply of energy services, and to support appropriate development of energy systems in developing countries (Nerini et al., 2018). There are also synergies between action to achieve SDG 7 and targets 8.8 and 17.18. For example, employment, innovation and sustainable economic growth are closely linked to the expansion of modern energy services (ICSU, 2017).

Links have been identified between migration and 30 targets, across 13 goals, in addition to the targets that mention migration issues (McCollum et al., 2018; Nerini et al., 2018; ICSU, 2017). Each of these targets has an energy dimension, with a uni-directional or bi-directional link to energy (i.e. SDG 7). These energy and migration links are summarised in the online Annex.

4 Conclusions and recommendations

Progress towards achieving the SDG 7 targets will determine achievement of all the SDGs. This progress will be affected by the international and internal movement of people in pursuit of better livelihoods. As with other development processes, migration is itself enabled by using energy services – to feed and sustain people during their journeys and transport them to their destinations.

The benefits of migration, in terms of higher incomes, improved standards of living and the remittance of resources to home communities are made possible by energy services. Although there are clearly direct and indirect relationships between migration and energy consumption, these links have rarely been explained and there is little empirical evidence about them. However, we can draw some conclusions from the evidence that is available.

Table 2 Energy links to migration targets

Relevant SDG target	Link to migration
8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	Target may require action to be taken on labour rights and working conditions in relation to energy systems (e.g. in fuel supply chains and power plants). Safe and secure working environments can be supported by modern energy services.
10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies	Access to modern energy services for migrants is necessary to ensure safe and responsible migration. Energy is essential for lighting, cooking and communications during migration, as well as for mobility. Migration policies should consider migrants' needs for energy services in transit.
10.c By 2030, reduce to less than 3% the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5%	Energy prices are unlikely to affect the transaction costs of sending remittances. Remittances can be used to improve recipients' access to energy.
16.2 End abuse, exploitation, trafficking and all forms of violence against and torture of children	Target requires action to be taken in relation to forced labour, slavery, trafficking, etc. in energy systems. For instance, this requires the immediate end of child labour in energy systems.
17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	Target includes capacity-building activities relating to energy systems (e.g. for solar, wind power and efficient cook stoves). The development of sustainable energy systems depends on capacity building efforts; and underpinning data to monitor the energy access/sustainability challenges (e.g. World Bank's Global Tracking Framework).

Source: Foresti and Hagen-Zanker, 2017; McCollum et al., 2018; Nerini et al., 2017.

Conclusion 1 Regular migration can contribute to improving access to modern energy services

Migrants tend to move to places and countries where the level of access to electricity and clean fuels and technologies for cooking is higher. They live predominantly in urban settlements. However, the great majority of people without any access to modern energy services live in rural areas. Achieving universal access, and thus the eradication of poverty, require investment in energy services for populations in rural areas that have not migrated. Remittances can be used to contribute to improving access to reliable and sustainable energy services in migrants' places of origin.

Recommendations

Governments in countries with significant out-migration should:

- introduce finance mechanisms for the use of remittances to provide access to modern energy services in rural areas, through electrification projects or household electrical products such as solar home systems. Mexico's 3x1 programme is an example.
- adopt appropriate fiscal incentives (e.g. duty-free import and zero-rated value added tax on solar products) that would encourage the wider development of affordable modern energy services.
- develop and implement plans to ensure universal access – including migrants and displaced people – is achieved by 2030, in line with SDG 7
- facilitate registration of temporary migrants and citizenship for long-term migrants, to enable them to secure access to modern energy services.

Relevant SDG targets

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular, least developed countries and small island developing states

Conclusion 2 The informal or irregular status of many migrants is a barrier to universal access to modern energy services

Migrants in informal settlements or with irregular migration status, may be prevented from connecting to services provided by utilities, and receiving support (including subsidies) intended to enable access to modern energy services. When they do have access, they may pay more per unit of energy than registered households.

Recommendations

Governments should regard access to modern energy services (electricity and clean fuels and cooking technology) as an essential basic service. They should:

Relevant SDG targets

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

Conclusion 3 Migrants to high-income countries gain energy-related skills and knowledge which can be transferred to their places of origin

The transfer of knowledge about solar home systems, electrical appliances, or energy-use behaviour, may occur while migrants remain in their place of destination or, more significantly, when they return. There is some evidence that return migration is the more effective vehicle for the transfer of skills and knowledge.

Recommendations

Developing country governments should consider migration an avenue to gaining energy-related knowledge and skills, to enhance low levels of domestic innovation. They should:

- promote knowledge and skills transfer from migrants through bilateral or regional trade agreements which include, for example, provisions on the movement of people for skills development
- provide incentives for migrants to return to their places of origin to facilitate the transfer of knowledge about energy technologies and uses.

Relevant SDG targets

4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development

10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

Conclusion 4 Migrants in high-income countries often encounter energy services and energy markets that are very different to those in their place of origin

Migrants from developing countries may need help to use the more sophisticated energy services and markets found in high-income countries (e.g. reliable grid electricity, piped gas distribution, multiple suppliers and tariffs). This would help reduce inequalities in access and inefficient use of energy, and avoid unnecessarily high energy costs for migrants.

Recommendations

Governments of high-income countries should:

- support advisory and information services for migrants from developing countries that increase energy literacy and facilitate migrants' effective use of energy services
- ensure support through subsidies and tariff concessions is available to eligible migrants.

Relevant SDG targets

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

Conclusion 5 Policies and regulations in countries of both destination and origin shape the relationships between migration, energy and progress towards the SDGs

Policy frameworks can enhance the positive effects of migration on energy access (e.g. by facilitating remittances for this purpose) or constrain them (e.g. by limiting people's mobility and the transfer of knowledge). The wide range of inter-linkages between energy and the SDG targets, across all SDGs, calls for greater coordination across sectors, while planners and decision-makers in the energy sector need to take migration into account in their decision-making.

Recommendations

Energy sector decision-makers and planners, at national and local level, should:

- include migrants' need for access to affordable and reliable modern energy services when formulating plans and programmes to deliver universal access by 2030
- in high-income countries, focus on equitable access to energy services, by ensuring affordability and providing public information about energy services
- develop plans to deliver universal access to reliable and affordable energy services in developing countries that include unserved populations in both rural and urban areas.

Relevant SDG targets

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

11.3 By 2030, enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

11.3 By 2030, enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels

Conclusion 6 Knowledge about migrants' use of energy and how this affects their welfare and livelihood is limited

When available, household energy statistics are not usually disaggregated by migration status. Migrants' energy needs may be overlooked in the planning and provision of basic services because of lack of knowledge. This gap is beginning to be addressed in humanitarian contexts, with the launch of a Global Plan of Action, but appears to be rarely explicitly considered for international migrants.

Recommendations

Governments and international organisations should:

- support research to enhance understanding of the way access and use of energy affects the welfare and income opportunities of migrants
- ensure household energy statistics are collected in a way that allows disaggregation by migratory status. This includes data about tiers of access, as defined in the Multi-Tier Framework.

Relevant SDG targets

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services.

11.3 By 2030, enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.

16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels.

17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts.

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