Uniting against Poverty

Energy Access and Affordability

OFID background paper

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Introduction:

Universal access to modern energy services is one of the fundamental pillars of economic growth and human welfare and, as such, a critical factor in modern socioeconomic development. In addition, energy poverty is one root cause of migration.

The 7th goal of the Sustainable Development Goals (SDGs) is dedicated to ensuring access to affordable, reliable, sustainable and modern energy for all by 2030. While energy was entirely missing in the Millennium Development Goals (MDGs), the SDGs explicitly recognize the direct linkage between energy access, poverty and development. This evolution of the development agenda is closely related to an expanded understanding of poverty, as it moves beyond a monetary definition, to be seen as a more holistic measure of overall quality of life. Energy has thus become recognized as an important aspect of alleviating extreme poverty.

In addition, most of the SDGs relate in one way or another to the objective of achieving universal energy access, including education for all, decent work opportunities, economic growth and reduced inequalities. Modern and secure energy access is also a critical factor in improving livelihoods for women globally, through its countless positive effects on female health and safety, positively affecting key developmental factors such as maternal health, reduced child deaths, access of girls and women to education and hence significant long-term effects on gender balance and social development overall.

Providing energy access to households only, however, is not enough to ensure economic and social development. Energy needs to be available reliably and affordably not only for households to access meaningful services but also for income generating activities and public services. Improvements and cost declines in decentralized technologies, for example, offer new opportunities for delivering universal electricity access, but many challenges remain, particularly for providing electricity access affordably for remote and poor households.

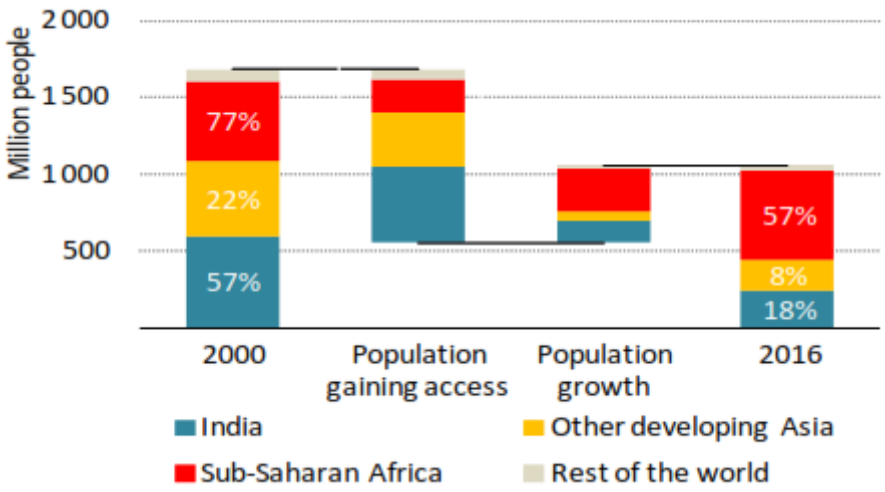
This background paper explores the current status of energy access globally as well as the electrification and clean cooking fuel solutions, and the investment needed to eradicate energy poverty at global level by 2030. Finally, this paper looks at the pioneering role OFID has played as both an advocate and practitioner of energy poverty eradication.

Status of Energy Access

Electricity access

Efforts to promote electricity access are having a positive impact in all regions, and the pace of progress has accelerated. The number of people without access to electricity fell below the 1.1 billion mark for the first time in 2016[1]. Nearly 1.2 billion people have gained access since 2000, but population growth in areas with low access rates has offset some gains, Figure 1.

Figure 1: Change in population without access to electricity between 2000 and 2016



Source: IEA, Energy Access outlook, 2017

Most progress has been made in developing Asia, where 870 million people have gained access since 2000. India accounts for 500 million– one of the largest electrification success stories in history – while universal electrification was announced in China in 2015. This remarkable growth puts India on course to achieving access to electricity for all in the early 2020s – a colossal achievement. Today about 89% of the population in the region has access and the absolute number of people without access has halved in the last ten years despite population growth. Based on current policies and trends, the region is on track to achieving universal access in the early 2030s[2].

In sub-Saharan Africa, there is for the first time a positive trend, where the number of people without access peaked in 2013, led by Cote d'Ivoire, Ethiopia, Ghana, Kenya, Sudan and Tanzania. Since 2012, the pace of electrification has nearly tripled relative to 2000-2012.

[1] IEA and World Bank (2017), "Global Tracking Framework: Progress Towards Sustainable Energy".
[2] IEA (International Energy Agency) (2017), Energy Access Outlook: World Energy Outlook Special Report, OECD/IEA, Paris.

Some 80% of the 590 million people who remain without access live in rural areas, where the average electrification rate is less than 25%[3]. Despite positive developments, population growth and uneven progress means that on the basis of current efforts, the IEA estimates some 600 million will remain without access in 2030[4].

Even in countries where access is universal, unplanned service disruptions and power outages can be common, there is no guarantee that supply is affordable, and many rural mini-grid systems can supply only a few hours of electricity services per day. According to the IEA's scenarios, a household initially gains access to enough electricity sufficient to power a basic level of energy services, growing over time so that by 2030, the average household has electricity to power four lightbulbs operating at five hours per day, one refrigerator, a fan operating 6 hours per day, a mobile phone charger and a television operating 4 hours per day.

Clean cooking fuel and technology access

Despite increasing awareness of the health and environmental risks, and decades of programmes targeting access to modern cooking, one third of the global population – 2.5 billion people - uses solid biomass as their primary cooking fuel; around 120 million people use kerosene, and 170 million people use coal. Most of those without clean cooking are living in developing Asia (1.9 billion), followed by sub-Saharan Africa (850 million).

Yet, there has been some progress: since 2000, the number of people in developing countries with access to clean cooking – principally liquefied petroleum gas (LPG), natural gas and electricity, has grown by 60%, and the number of people cooking with coal and kerosene has more than halved. In this regard, there are some notable success stories, especially in China and Indonesia as urbanization and increased policy efforts are prompting a switch to LPG, natural gas and electricity. China has seen a reduction in the share of people relying on solid fuels for cooking to 33% in 2015, from 52% in 2000.

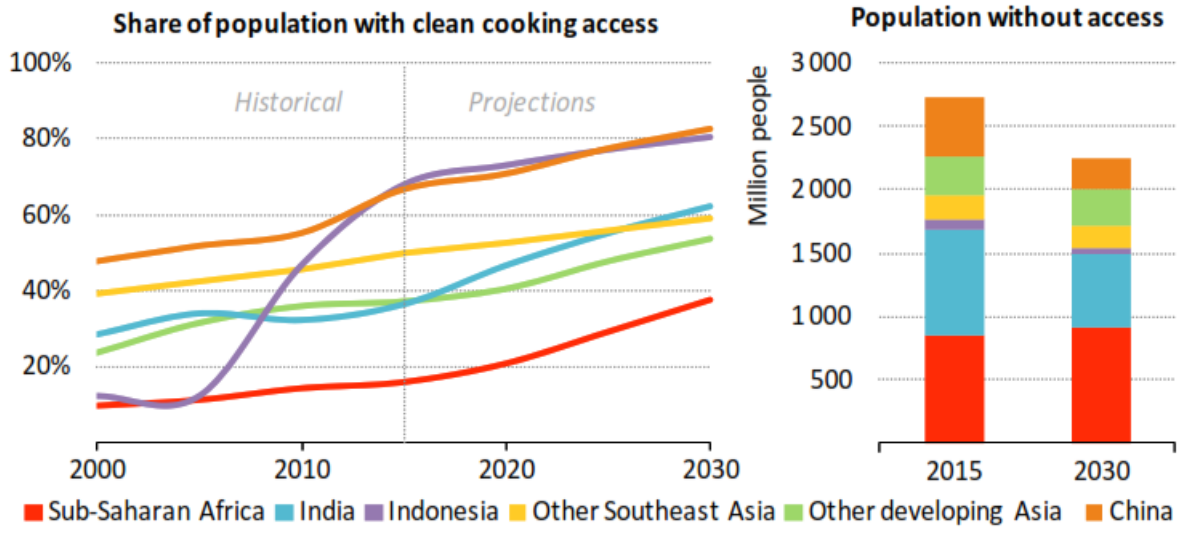
But this progress was outstripped by strong population growth, leaving at least 400 million more people without clean cooking today than in 2000[5&6]. Furthermore, even households that report primary reliance on clean fuels and technologies for cooking may supplement with biomass, coal and kerosene – the well-known reality of fuel-stacking.

[3] Id.
[4] Ibid, IEA 2017
[5] Ibid, IEA and World Bank (2017)
[6] WHO (2016), Burning Opportunity: Clean Household Energy for Health, Sustainable Development, and Wellbeing of Women and Children. Geneva.

Looking forward, the world is far from being on track to achieving universal access to clean and modern cooking fuels and technologies by 2030: The IEA's projections estimate that 2.3 billion people will still remain without access to clean cooking facilities in 2030 under current policy and population trends, Figure 2. Strong population growth hides some substantial, though uneven, progress: 900 million people are projected to gain access to clean cooking over this period, mainly in urban areas[7].

The greatest progress is seen in developing Asia, where the share of biomass used in buildings for overall energy demand declines from 50% today to 33% in 2030, largely replaced by LPG and electricity for cooking. Countries with dedicated policy initiatives, such as China, India, and Indonesia, see significant reductions in the population without access to clean cooking. In sub-Saharan Africa, over 300 million people will gain access to clean cooking by 2030, an estimated 100 million of them from clean cooking pledges in countries' Nationally Determined Contributions. However, clean cooking efforts do not keep pace with the population, leaving 820 million people or 56% of the population reliant on biomass as their main cooking fuel, an increase relative to today's number.

Figure 2: Population with and without access to clean cooking by region in the New Policies Scenario (IEA 2017)



Source: IEA, Energy Access outlook, 2017

[7] Ibid, IEA 2017

Electricity access: the solutions

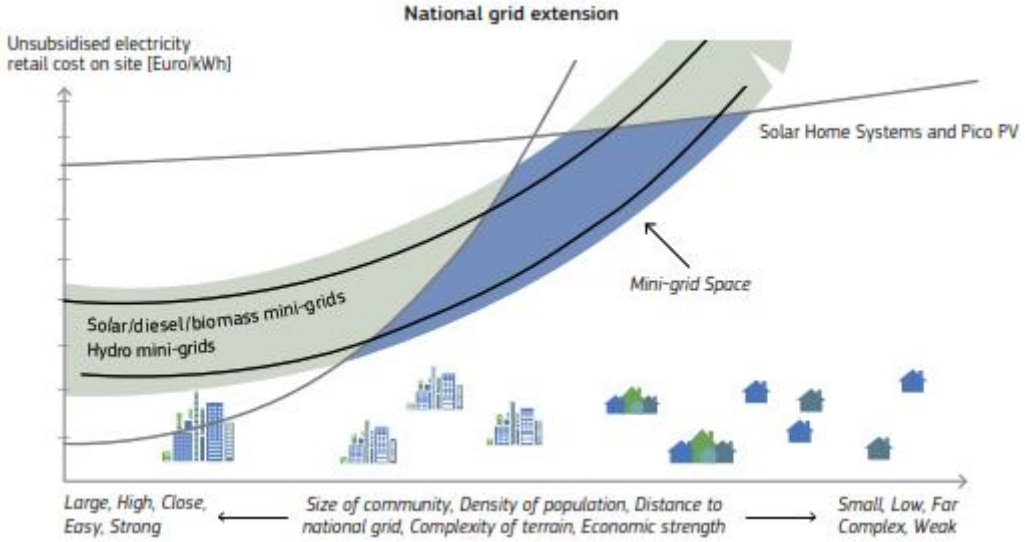
Grid extension of the electricity backbones and additional on-grid distribution are crucial actions for increasing access to modern energy, enabling regional integration of power markets, and allowing transboundary energy trade, connecting resources with demand hot spots, optimizing return on investments, achieving system efficiencies and balancing consumption and production from variable sources like renewables as well as reinforcing security of power supply.

Of the 1.2 billion people who have gained access since 2000, nearly 97% of them have gained access via connection to the main grid and from a system perspective offers the lowest-cost path to household electrification when the option exists. Given the economies of scale associated with centralized power generation, grid extension and connection will likely remain the most favorable electrification option for many households, particularly those in more densely populated areas. The IEA analysis suggests that to deliver universal access by 2030, grid extension is the lowest cost option for around 40% of households that do not currently have access.

However, granting universal access to electricity in a vast continent like Africa cannot realistically be achieved only by extending the electricity grid. The cost of connecting remote villages and sparsely populated areas to the national grid is disproportionally high, while low consumption from village households would yield very little revenue for utilities. Such an option would be too expensive and seriously jeopardize the financial health of utilities in the mid-long term. The planning for electrification should take into account financial and technical realities. As a consequence, populations in remote areas risk being left behind without basic energy services while waiting for the grid to arrive.

Innovative decentralized solutions now cover most of the electricity needs of remote villages in a sustainable and autonomous way, Figure 3. These solutions range from independent local mini and micro grids, to community managed systems, and stand-alone solar home systems (SHS) combined with portable photovoltaic appliances for light. These systems overcome the distance barrier as they utilize local renewable resources such as hydropower, wind, renewable biogas and in most instances solar power. They can become the main energy source or can be used to hybridize existing power sources (such as diesel generators). Community involvement is important to handle demand side management as well as maintenance, production and distribution aspects.

Figure 3: A growing role for mini grids and distributed renewable energy systems



Source: Mini-grid Policy Toolkit, EU Energy Initiative Partnership Dialogue Facility

The IEA estimates that to deliver universal electricity access by 2030, decentralized solutions are the least-cost option for 60% of people lacking access, with the role of grid expansion expected to increase with increasing power demand and economic activity. Currently, decentralized access solutions are small but accelerating: according to the IEA only 33 million people have access to electricity with decentralized renewables (excluding pico solar, which IRENA estimate benefit 114 million users). Decentralized electricity systems can also have co-benefits for local job creation and economic growth.

Accelerating decentralised options in rural areas

Several trends are converging to transform the energy access landscape in rural areas with decentralised options. Notably, these trends include the declining cost of renewables and storage (historically, most decentralised capacity has been oil based), the emergence of new technologies enabling smart metering and mobile payments, the liberalisation of energy markets enabling more actors, including the private sector, to participate, as well as focus from international initiatives. Affordable financing models have been instrumental, two in particular.

- The ***pay-as-you-go (PAYG) model*** has emerged in recent years with considerable momentum: consumers use their phones to pay a fixed up-front cost for the device – usually a solar panel bundled with battery storage and appliances – and then pay for its use in instalments. Critically, the daily payments can be less than a household pays for poor quality energy alternatives, such as kerosene for lighting. The model is well-established in East Africa, where mobile money is widely used, and has

expanded to more than 30 countries, serving an estimated 700,000 households[8]. The PAYG model is scalable with private sector capital; however, so far PAYG businesses have been almost exclusively reliant on international investors, exposing businesses to the risk of transaction costs and currency fluctuations, which can lead to price increases for consumers.

- **Micro-credit model:** a successful Micro-credit model has been in operation for more than a decade in Bangladesh. There, the state-owned Infrastructure Development Company (IDCOL) channels international funding to micro-credit groups and installers, sets technical specifications and loan terms and certifies products and components for quality control purposes. While affordability has been key, household loan terms have moved from concessional towards commercial. A cumulative 4.1 million solar home systems have been installed and more than 100,000 jobs have been generated[9]. Replicable lessons include adaptation of equipment to local needs, enforcement of product standards, and workforce training. A designated "national champion" like IDCOL can be tasked with establishing an overall policy framework within which financing, product certification and other activities unfold.

The role of mini-grids, currently limited, is expected to increase, especially when access initiatives aim to provide electricity for productive and commercial activities as well as households. For sustainable mini-grid development and operation, an enabling environment is needed that covers dedicated policies and regulations, tailored financing mechanisms, enabling institutional frameworks, a focus on capacity building and adapted technology. Within such an enabling environment, suitable policies and regulations for mini-grids cover: a clear rural electrification strategy, a tailored licensing and permitting framework, a mechanism to address compensation/integration of mini-grids when the main grid arrives, clear rules for setting tariffs which incentivizes investment and enables sustainable operation, and measures to facilitate access to finance for both developers and end users. Anchoring mini-grid development to productive sectors, such as telecoms towers, agriculture (irrigation/processing) can provide important revenue to the supplier and increase the financial viability of the mini grid (as well as having benefits to the local economy). It is therefore important to promote productive uses sooner rather than later. OFID supported 18 business models for mini-grids spread over 16 countries in order to accelerate the scaling up of energy access projects for residential as well as productive use.

[8] REN21, Renewables Global Status Report, 2017

[9] IDCOL, "IDCOL SHS Installation under RE Program," 2017, available online at http://www.idcol.org/old/bd-map/bangladesh_map/

Affordability

Affordability in particular remains a critical barrier to scaling up decentralize solutions. Even though people without electricity access often pay a lot for their energy sources, such as kerosene and candles – sometimes more than they would pay for the same service if they had electricity access – the upfront costs for off-grid systems may still be higher than most consumers are willing or able to pay.

One of the primary business models that has emerged which provides solutions focuses on areas covered by mobile networks but not electricity grids. In the PAYG payment model, consumers use their phones to pay a fixed up-front cost for the device – usually a solar panel bundled with battery storage and appliances (which can include lights, radio, mobile phone chargers, and in larger systems a fan, television and refrigerator) – and then pay for its use in instalments.

The economics of this off-grid business model rely on what it provides being affordable to poor households, as well as offering an improvement on the energy services they currently have (often kerosene or candle lighting, plus payments to local businesses for charging mobile phones) at a lower cost. The affordability of these systems hinges on three main factors: the PAYG model (these companies are essentially micro-financing households), the bundling of ultra-efficient appliances (to keep the solar panel small), and the falling cost of solar panels and batteries.

Efficient appliances can play an important role in delivering electricity access. Using more efficient appliances lowers the amount of electricity needed for the same bundle of energy services. In turn, this reduces the investment cost in the supply of electricity required to deliver universal energy access, making off-grid renewable solutions more affordable to households.

Governments can also help by lowering the cost for decentralized solutions by creating sound policies and institutions. Governments may need to subsidies decentralized connections to ensure equity between rural and urban households, as well as affordability. Targeted subsidies and financing could be aimed at lowering connection fees, or the upfront costs of equipment and appliances.

Clean cooking fuel: the solutions

A number of international development organizations have promoted improved cookstoves as a pathway to clean cooking, including Sustainable Energy for All (SEforAll) and the Global Alliance for Clean Cookstoves, both of which have been instrumental in researching, designing and rolling out programmes for improved cookstoves. As understanding of the health risks has grown, programmes have tended to broaden and to add the provision of other fuels like liquid petroleum gas (LPG). For example, the World LPG Association has launched "Cooking for Life", a long-term program to demonstrate the health benefits of switching communities from biomass and other traditional fuels to LPG for cooking. It also encourages decision-makers to recognize the need to ensure that LPG markets develop in a safe, managed way.

In addition, the Global LPG Partnership (GLPGP) is working to accelerate the transition to LPG for cooking for 50 million people by 2018. Via it grant program, OFID supported the GLPGP to promote the adoption and utilization of LPG for clean cooking across the 15 Economic Community of West African States (ECOWAS), through the creation of an enabling environment for impactful investments and interventions to scale up the LPG ecosystems.

Indeed, LPG is a common path to access clean cooking options, especially in urban areas. In 2015, an estimated 2.5 billion people, 43% of the population in developing countries, cooked with LPG. Its use varies by region. Only 7% of people in sub-Saharan Africa have access to LPG, mainly in Sudan, Nigeria, Angola and Ghana. Access to LPG is widespread in North Africa and parts of Latin America, and is increasingly being used in Asia. China and India are taking a strong stance on clean cooking through government-led policies. In China, residential biomass use has been declining 6% per year since 2010, largely replaced by natural gas, LPG and electricity demand especially in urban areas driven by policy efforts targeting clean cooking.

In India, though the number of people without clean cooking access has plateaued around 780 million since 2010, there are clear indications however that government policy efforts targeting LPG have begun to take hold. The Government's Pradhan Mantri Ujjwala Yojana Programme is set to provide LPG connections to 50 million households living below the poverty line by 2019, with a target reaching 80 million households by 2020[10]. By 2030, the

[10] WHO (2017), Household energy database+

promotion of LPG and improved biomass cookstoves by the government means that more than 300 million people gain access to clean cooking facilities, but still more than one-in-three people remain without.

Affordability

There are a variety of reasons why it has proved difficult to make progress in access to clean cooking. When taking into account the opportunity cost of gathering fuelwood, clean cooking facilities may present an overall saving compared with cooking with traditional stoves. However, even the cheapest improved cookstoves can cost a poor household several weeks of income, and they may prioritize more urgent needs such as food. Furthermore, families may not take into account the opportunity cost of time spent gathering fuelwood, especially when fuelwood is a free resource and economic opportunities are scarce.

Affordability is a major barrier with the upfront cost of the stove beyond reach for some households, and the need to buy fuel in relatively large amounts is another affordability constraint. There are signs that private enterprises are beginning to use PAYG business models to overcome these barriers. Subsidies are another approach to help overcome the cost barriers.

Financing Universal Energy Access

Estimates of the investment needed for universal energy access range from $12bn to $279bn per annum from 2010 to 2030, indicating a significant degree of uncertainty. The amount of required investment is highly dependent on the assumption of technical solutions, financing methods, and subsidies, among other country-specific attributes. However, the estimate most widely used is that given recently by the IEA Energy Access Outlook 2017. It assesses the annual investment required to achieve universal energy access by 2030 at $56bn (equal to 3.4% of average annual global energy investment) including both access to electricity ($52 billion per annum) and clean cooking facilities (around $4.0bn per year).

However, according to the IEA new Policies Scenario, if all announced investment commitments and policies are realized, an average of $24bn yearly will be invested annually in electricity access through 2030. Again, this is far below the $52bn annual requirement for universal electricity access.

Regardless of the precise figure of the required investment, the financing requirements are bound to be large, and various ways of raising additional capital need to be considered. In addition, there are other important factors to consider: the wide variety of technology

solutions; the multitude of different actors and stakeholders; and the board diversity of regional/country circumstances.

To bridge the investment gap, all available types and sources of funding will need to be tapped: international funds, public-private partnerships, bank finance at multilateral, bilateral and local levels. However, the availability of funds alone is not the critical issue. For example, the total volume of assets held by global public investors (central banks, sovereign funds and public pension funds) is close to $29.7 trillion. Nevertheless, financing for energy supply might be challenging due to competition among various sectors of the economy over the amount of capital available, despite the growth in liquidity in financial markets over the course of time.

Furthermore, the enormous investment requirements confirm the need for more innovative financing vehicles, cost-effective technology solutions, and consistent and credible policies.

With regard to attracting financing, one of the biggest obstacles is the perceived risk element, since energy access projects are predominantly small-scale and target poor communities. Several options are available to mitigate this risk, including the following two examples.

Aggregation solutions are financial clustering mechanisms that convert a broad range of small projects into pools large enough to reduce transaction costs and meet investors' requirements for diversification, scale and liquidity.

Convertible grants are provided by dedicated funds at an early stage of the project life as a means of attracting private and commercial financing. The grant covers first losses; otherwise it is paid back to the contributor. An example is provided by the "OFID-REEEP Revolving Capital Pool", set up recently as a cooperation facility between OFID and the Renewable Energy and Energy Efficiency Network (REEEP). The Pool offers repayable grants at zero interest to start-up businesses to help them provide affordable modern energy services and unlock their potential for scale up.

In providing energy access, an important stakeholder group is small- and medium-sized energy enterprises. Due to their size, small and medium-sized enterprises (SMEs) have little access to traditional finance. Here, multilateral development banks and Development Finance Institutions (DFIs) play a prominent role in bridging the financing gap, together with other public and private resources. OFID is an equity partner in The Energy Access Fund (EAF), an impact investment fund sponsored by Schneider Electric. The EAF supports energy-related SMEs through the provision of equity investments of €2.5m–€5m.

It is local banks, however, that are better equipped to offer loans to the local private sector and small credits to consumers. The role of international aid agencies can be at the level of providing assistance to the local financial sector, including credit enhancement and risk mitigation, in addition to capacity building. For OFID, this worked successfully in the case of its US$10m loan to Armenia's Ardshinbank, which is using the financing to fund local SMEs involved in the construction and operation of small-scale hydropower plants (SHPPs).

The examples of innovative financing solutions are numerous, but what will underpin financing for universal access to modern energy services is the creation of an investment-enabling environment. This environment must be politically, institutionally and economically stable at the macro-level and have a regulatory framework at the micro-level.

Governments also need to elucidate their long-term choices concerning energy access pathways. This is a clear requirement, for instance, in the case of mini-grids. For mini-grids projects, given the long-term investment perspective needed to develop them, private investors' involvement may be deterred if they are not assured that schemes will not be superseded by connection to the national grid.

Of critical importance is the role of the private sector. With its efficiency and flexibility, the private sector is vital in ensuring universal energy access. A wide investor base comprising the private and public sectors together with DFIs can combine their different strengths. However, existing experience indicates that it is often difficult to prove the business case for the private sector participation in energy access projects. Therefore, governments need to create the policy environment and the regulatory frameworks that are conducive to the participation of private investors and to the encouragement of public and private partnerships and initiatives. For example, a key element in the successful financing of power projects is the commitment of Governments to power purchasing agreements (PPAs).

Finally, a key barrier limiting wider access to modern energy services by the poor is their lack of ability to pay for services. Pro-poor "smart" subsidies can extend energy access for rural and poor people. Such subsidies should be transparent, well oriented and should reach low-income households. Cross-sector tax/subsidy can be a self-sustained finance approach to the benefit of small-scale energy access projects. For example, the tariff paid by grid-connected customers could be adjusted slightly upward in order to provide subsidies to mini-grid projects in remote areas.

OFID and the fighting against energy poverty

OFID's main objective as a multilateral development finance institution is to spur sustainable development in its 134 partner countries. To this end, we have committed a cumulative US$20bn over the past 42 years. That said, we are widely recognized in the international development community for our pioneering Energy for the Poor Initiative and our lead role in helping to secure a prominent position for energy access in the 2030 Global Development Agenda.

Despite the achievements of the MDGs, one of the most prominent shortcomings was the absence of energy as a distinct development goal. To highlight this omission, OFID initiated the campaign in international fora to advocate for the inclusion of universal energy access on the global development agenda. This campaign stems from a direct mandate from the heads of state of our Member Countries in 2007. Since then, our institution remains committed to using all resources at its disposal and pursuing every viable solution in a bid to make modern energy universally available.

OFID was pleased when energy access had finally gained the recognition it deserves. Embedded as SDG7 in the 2030 Agenda for Sustainable Development, access to modern energy services is now universally accepted as one of the most powerful catalysts for both human and economic advancement. Without energy, it is impossible to provide healthcare and education, end hunger, supply clean water, or, more broadly, eradicate poverty. The enabling power of energy access is strengthened by its direct links to the 16 other SDGs. This is well documented in "The 2030 development agenda: Energy access a keystone" (OFID Pamphlet Series 40, 2016, https://goo.gl/YfuYC4).

At operational level, OFID has taken concerted action to work with its partner countries to prioritize universal access to sustainable modern energy services. Its activity in fighting energy poverty extends to all regions of the world, finances all types of cleaner and efficient technologies, and boosts cooperation with all kinds of financial partners, without imposing any conditionality. OFID projects include a new power plant in Egypt, for example, and rural electrification schemes in Morocco, Mozambique and Uganda.

At the same time, OFID supports innovative solutions that provide additional benefits, such as protection of the environment and climate change mitigation. OFID loans and grants have contributed to the financing of renewable energy projects in countries like Cambodia, Cuba, India, Kenya and Tanzania, as well as the distribution of solar lanterns in Kenya and Tanzania and modern cookstoves in Ethiopia, Honduras, Malawi, Uganda and Zambia.

In order to meet the wide variety of needs, OFID deploys all of its financing windows in the battle against energy poverty. So, in addition to public sector infrastructure projects, resources are also channeled through OFID's private sector window. This facility is financing large-scale wind energy installations in Honduras, Jordan, Kenya and Pakistan, among other interventions. It is also co-funding an energy access fund that offers stable financing to SMEs engaged in providing electricity to off-grid communities in sub-Saharan Africa. Also aimed at SMEs is a project in Armenia to support the development of small-scale hydropower plants.

In many developing countries, not having access to energy is a major barrier to trade and can restrict companies to small domestic markets. Through its trade finance facility, OFID extends finance to developing country companies who need to access energy products in order to run their manufacturing, trade or service operations. Guarantees can provide credit enhancements for local borrowers, increasing their ability to obtain finance for their energy needs. Since 2008, OFID's private sector facility alone has committed more than US$848m to energy operations. This amount leverages more than 45 operations worldwide, leveraging total value of over US$18bn.

Via its dedicated grant program for energy poverty alleviation, OFID funds projects that aim at improving access to modern energy services in poor communities. It also helps small energy businesses with the aim of improving economic conditions in such communities. And it supports scholars and students from developing countries who are pursuing energy research lines and studies.

The strategic framework for these activities is OFID's Energy for the Poor Initiative, now in its 10th year of implementation, which is funded through a revolving endowment of US$1bn pledged by the institution's supreme body, the Ministerial Council, in its June 2012 Declaration on Energy Poverty.

Since 2008, OFID has committed more than US$3.5bn to energy operations, representing around 27% of the total value of all our commitments for the period. This amount leverages more than 200 operations worldwide, leveraging total value of over US$35bn.