DESIGNING SUSTAINABLE SUBSIDIES TO ACCELERATE UNIVERSAL ENERGY ACCESS

A briefing paper on key principles for the design of pro-poor subsidies to meet the goal of sustainable energy for all

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This report was mainly written by Stephen Nash, with Jo Khinmaung-Moore contributing. Jo also commissioned and designed the research for Tearfund.

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Front cover: Lameck Chibago (59) proudly cleans, maintains and positions a solar panel on the roof of his house in Sasajila village, Manyoni district, Tanzania.
Photo: Tom Price – Ecce Opus/Tearfund

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EXECUTIVE SUMMARY

This briefing paper explores how to design subsidies, as a form of public finance, for distributed renewable electricity and clean cooking, and how to deliver them effectively to accelerate universal access to energy. The paper draws on country examples of subsidy schemes and identifies the characteristics of effective subsidies that will catalyse a sustainable energy market delivering energy access for the long term. The paper aims to provide a discussion point for policymakers, particularly for multilateral development banks (MDBs), donors and governments, who are increasingly financing subsidy schemes.

Policymakers and investors need to step up significantly efforts to achieve universal energy access goals if the poorest and most remote communities are to be reached in the next decade. Access to affordable, reliable and clean energy remains one of the greatest development challenges for many countries, especially in sub-Saharan Africa. On current trends it is expected that 620 million people will remain without access to electricity in 2030, and 2.3 billion will have no access to clean cooking solutions. If universal access to energy is to become a reality in the next decade, additional efforts to increase public finance will be required. Making progress on energy access and transitioning to renewable energy should form a central part of countries' recovery from the Covid-19 crisis. This will catalyse economic activity, build resilience and contribute to the climate change agenda by reducing emissions, air pollution and their associated health impacts.

Subsidies are necessary to achieve universal energy access. They are needed to bridge affordability gaps and the higher costs involved in ensuring that the poorest and most remote communities are not left behind. In rural areas especially, many communities cannot afford even the most basic modern energy services, especially if the full cost of those services is passed on to the energy user. The coronavirus pandemic has highlighted the importance of addressing these inequalities: the traditional fuels that many households use, such as firewood and charcoal, are linked with respiratory conditions that could put people at increased risk of serious illness from Covid-19. The private sector-led results achieved by the off-grid electricity sector in recent years have often been made in peri-urban and/or weak grid areas where the cost of serving customers is lower.

Policymakers and investors increasingly recognise that subsidy support from public finance will be required to reach more remote communities and achieve universal energy access. There have been numerous dialogues on the need for effective subsidies in recent years and a growing body of literature supporting this view, building on Tearfund's 2018 paper, *Transforming electricity markets to deliver universal energy access.* The need for support is likely to be increased by the Covid-19 pandemic and the impact on communities. Emerging evidence suggests that renewable energy companies operating in the sector have been particularly badly affected by lockdowns.

There are many levers that can be used to ensure that subsidies are well designed. Once the requirement for a subsidy is identified, there are many complex and interrelated design decisions to make. It is important that a subsidy is tailored towards the specific market failure that it intends to address. For example, is the subsidy intended to address an affordability gap or differences in cost of service? Does it need to target up-front connections costs or ongoing operating costs? Other important considerations and trade-offs include the geographical and technological scope of the subsidy, how the subsidy is funded, and how the funds made available are allocated.

Subsidy schemes should be designed with a focus on sustainability from the start. To date, schemes for distributed renewable energy have often used short-term subsidies to address long-term challenges and so have not been sufficiently sustainable or scalable. This briefing paper reviews the experience of energy subsidy schemes that have been implemented, covering a range of technologies in various low- and middle-income countries.

This review shows that the most successful schemes have been long-lived and/or have been integral to the design and regulation of a country's energy market. It is notable, and concerning, that many of the schemes targeted at the hardest-to-reach communities are tied to short-lived donor programmes. Even the latest wave of results-based financing (RBF) schemes do not appear to take on board the lessons from earlier subsidy schemes that have failed to achieve sustained results. Systems have fallen into disrepair and service providers have exited the market. It is important to define the end goal of a subsidy scheme and consider what subsidies a future sustainable energy market might need.

Lessons from the on-grid electricity sector show how sustainable subsidies and cross-subsidies can be used to achieve progressive policy objectives. There are many examples globally of subsidy and cross-subsidy schemes being used to redistribute resources to achieve access to affordable energy for all. Many of these schemes are in the on-grid electricity sector. This paper cites examples of countries that already redistribute hundreds of millions of dollars every year through applying an energy market design that is focused on achieving equitable and affordable access.

A three-phase approach can be used to transition towards a sustainable market to deliver energy access. In countries where it is not yet politically possible to charge tariffs that fully recover system costs, outright subsidy (in contrast to a self-funding cross-subsidy) will be required initially. This kind of scheme can be funded by donors, with the government taking on a funding role in a second phase, before eventually the scheme is funded through sustainable and customer-funded cross-subsidies. Adopting a subsidy that allows for such a phased transition assuages concerns that donors and/or governments could become locked into funding subsidies. Such a market design, combined with integrated energy planning, should also be blind to the technical mode of delivery and be designed to sustain the benefits of energy access over the long term.

Policy recommendations

Multilateral development banks (MDBs) and donor governments have a critical role to play in developing solutions to achieve universal energy access, given their ability to influence policy and regulation across the energy sector. They can provide technical assistance as national governments develop energy plans, and can support effective enabling environments to crowd in private sector investment in distributed renewable electricity access and clean cooking.

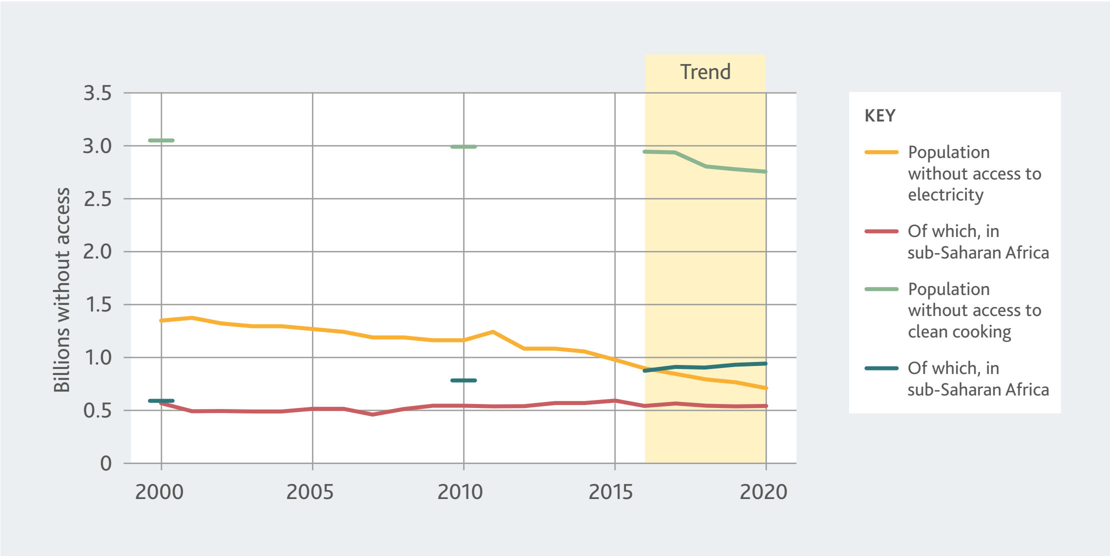
Based on the findings of this briefing paper, the following recommendations are for national governments, MDBs and donor governments.

- **Remember the three 'S's as key principles when designing subsidy schemes for decentralised energy access: systemic, standardised and scalable.** Subsidy schemes require long-term funding in order to reduce persistent affordability gaps and geographical differences in the cost of service. An ongoing subsidy is required that outlives existing short-term donor funding cycles and addresses more than up-front connection costs.
- **Be clear on the problem(s) to address and the likely future trajectory of the funding need.** Where possible, national governments should take the lead and mobilise public finance.
- **Don't reinvent the wheel where there are proven models that work.** We know how to design sustainable and scalable subsidy schemes. Policymakers can apply this knowledge in designing schemes to expand access to renewable electricity and clean cooking.
- **Get the enabling environment right as this is key if subsidies are to be effective in making the energy access sector more investible.** Governments can create an enabling environment to provide a framework for subsidy design and accelerate progress on energy access. This should incorporate sustainable subsidies and integrated energy planning.
- **Avoid implementing policies and regulations that pose a barrier to implementing systemic subsidy support schemes**, especially regulation that might undermine progress towards a more sustainable energy sector.
- **Shift towards focusing on outcomes and involving end users in the design of subsidies and energy services**, rather than concentrating on the technologies deployed, as this promises to yield better results for energy-poor communities. Energy consumers care about the energy service they receive and what they can do with it.

1 CONTEXT

Globally, 790 million people remain without access to electricity, and 2.8 billion people lack access to clean cooking solutions. In sub-Saharan Africa, which has a population of just over 1 billion, nearly 550 million people have no access to electricity and more than 900 million have no access to clean cooking, relying on polluting fuels instead. Figure 1 shows how some progress has been made in improving access to electricity, but progress remains slow in improving access to clean cooking. In the hardest-to-reach areas, such as rural regions of sub-Saharan Africa, the situation is static or in reverse. Sustainable Development Goal 7 (SDG 7) commits to affordable and clean energy for all. The latest analysis of progress towards SDG 7[1] suggests that at the current pace 620 million people will remain without access to electricity in 2030, and 2.2 billion will remain without access to clean cooking solutions.

Figure 1 Population without access to energy, 2000–2018 (trend shown to 2020)



Source: IEA, IRENA, UNSD, WBG, WHO (2020) *Tracking SDG 7: The Energy Progress Report 2020*

A step change in the rate of deployment of energy access solutions is required if Sustainable Development Goal 7 (SDG 7) is to be met. As illustrated by Figure 2, the acceleration required is substantial. New electricity connections need to increase by 50 per cent; the rate of deployment of clean cooking solutions needs to more than triple. The case for making this step change is clear. The Sustainable Development Goals were based on the moral imperative to 'leave no one behind'. Improving access to renewable energy and displacing traditional biomass fuels and kerosene will also contribute to the climate change agenda and national plans to reduce emissions. Analysis by the Overseas Development Institute (ODI)[2] makes the case that access to energy is also an important factor in improving resilience, which is increasingly important as the worst impacts of climate change are felt by the poorest communities. The Covid-19 crisis further highlights the importance of energy access. The household air pollution associated with traditional fuels can cause respiratory illnesses that could put people at increased risk of severe illness from Covid-19. Furthermore, electricity access is a key enabler of quality health care.[3]

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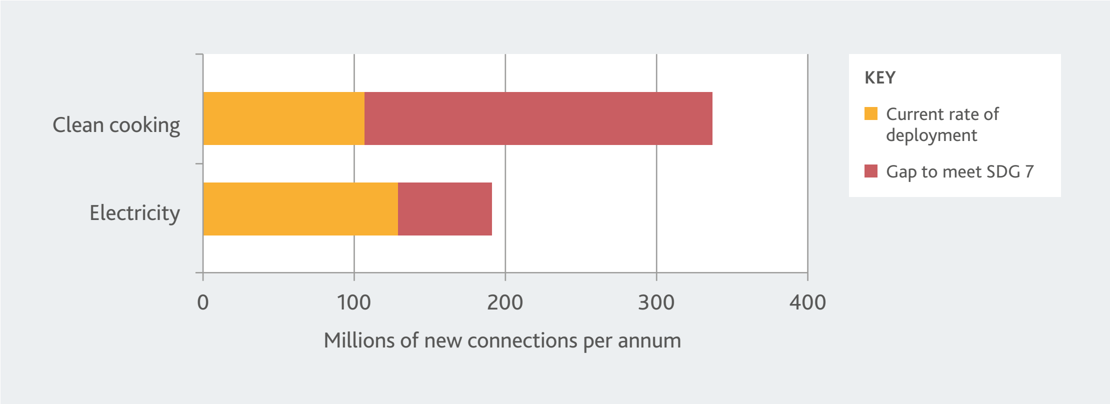
1 IEA, IRENA, UNSD, WBG, WHO (2020) *Tracking SDG 7: The Energy Progress Report* 2020: www.irena.org/publications/2020/May/Tracking-SDG7-The-Energy-Progress-Report-2020

2 ODI (2017) *How solar household systems contribute to resilience*: www.odi.org/publications/11003-how-solar-household-systems-contribute-resilience

3 Castán Broto V C and Kirshner J (2020) 'Energy access is needed to maintain health during pandemics', *Nature Energy* 5, 419–421: www.nature.com/articles/s41560-020-0625-6

Figure 2 Step-up in new connections required to meet SDG 7



Source: Kuungana Advisory analysis, based on IEA, IRENA, UNSD, WBG, WHO (2020)

The Covid-19 pandemic increases the challenge of meeting SDG 7. In the short term, lockdowns have severely impacted the operations of the companies key to the delivery of clean energy access solutions. An SEforALL survey[4] of solar home systems (SHS) and mini-grid companies highlighted a range of concerns linked to personnel, operations and cash flow. Forty-nine per cent of SHS companies reported disruption to customer payments, and mini-grid companies reported that they expect to lose 40 per cent of their revenues as a result of the crisis. The pandemic highlights vulnerabilities in companies' business models: almost a third of SHS companies and more than a third of mini-grid companies report cash reserves equivalent to one month or less of operating expenditure. This is likely to dampen financiers' appetite for investment: in a survey for the Clean Cooking Alliance, 60 per cent of investors stated that they were less likely to invest in clean cooking companies as a result of the crisis.[5]

There is a clear case for deploying subsidies and cross-subsidies[6] to improve the viability of energy access investments for remote communities.[7] Most, if not all, high-income countries have used subsidies and/or cross-subsidies to achieve universal access. Carefully designed and targeted subsidies can be used more widely in accelerating progress towards meeting SDG 7. Such subsidies can be affordable, especially where funds currently used to subsidise the use of polluting fossil fuels are redeployed.[8] Other authors have also explored this theme, for example through research on 'subsidy swaps'[9] that suggests the redeployment of funds for fossil fuel subsidies towards clean energy access. Well designed and targeted subsidies are sometimes referred to as 'smart' subsidies; this paper aims to define some of the characteristics that a 'smart' subsidy scheme might adopt.

4 SEforALL (2020) *Identifying options for supporting the off-grid sector during Covid-19 crisis*: www.seforall.org/system/files/2020-04/SEforALL-survey-findings-20200417.pdf

5 Clean Cooking Alliance (2020) *Covid-19 impacts on clean cooking: results from a sector survey*: www.cleancookingalliance.org/resources/590.html

6 Subsidies refer to additional financial resources, normally funded by a donor or a national government, that is exogenous to the market design. Cross-subsidies are a redistribution of existing financial resources, this redistribution often being endogenous to the market design.

7 Tearfund (2018) *Transforming electricity markets to deliver universal energy access*: https://learn.tearfund.org/~/media/files/tilz/climate_and_energy/2018-tearfund-transforming-electricity-markets-en.pdf?la=en

8 Ibid

9 IISD (2019) *Fossil fuel to clean energy subsidy swaps: how to pay for an energy revolution*: www.iisd.org/sites/default/files/publications/fossil-fuel-clean-energy-subsidy-swap.pdf

Misconceptions about subsidies

'It's the private sector's role to invest in renewable energy, not the government's role, and the private sector is more efficient in this area.'

Private sector companies can be more efficient at operational delivery in this area than governments. Private sector companies also require the projects that they invest in to be commercially viable. Delivering energy access solutions to many of the hardest-to-reach and poorest communities is not yet commercially viable. Moreover, the poorest communities often cannot afford solar home systems or clean cooking. Well designed subsidies, funded by donors' public finance or national budgets, can be an important market catalyst within an enabling environment that allows efficient private sector delivery to reach these communities.

The principle of redeploying existing subsidy funds to achieve sustainable energy access goals is now being put into practice. For example, the World Bank ESMAP's[10] Energy Subsidy Reform Facility recently worked with the Rwandan government[11] to restructure on-grid electricity subsidies so that they are now better targeted at the poorest communities. These reforms resulted in an increase in average tariffs, while introducing a lower-cost lifeline tariff for the least well-off energy consumers of grid electricity.

Increasingly, the important role that well designed subsidies can play is being recognised. At the time of publishing Tearfund's last paper in 2018, there was often a knee-jerk reaction against the suggestion that subsidies might be required to extend energy access to last-mile communities. That conversation has changed. Over the past two years, there has been a marked increase in dialogues and publications making similar arguments and recognising the role that carefully designed subsidies can play in meeting SDG 7. SEforALL has recently launched a series of publications on energy safety nets, building a comprehensive evidence base that uses case studies to explore how government-led social assistance programmes can improve access to energy.[12] The Covid-19 crisis has emphasised the importance of such programmes.[13] Many actors are starting to see energy subsidies as a form of social protection that is needed long term to bridge the affordability gap, in a similar way to how safety nets are needed for food security or health.

Misconceptions about subsidies

'Subsidies will distort the market, which the government should avoid.'

Governments and regulators should minimise, and avoid where possible, distorting the market. Admittedly, poorly designed subsidies can sometimes result in market distortion and unintended consequences. However, intelligently designed subsidies can enhance the outcomes enabled by the market. Well designed subsidies can help the market to deliver energy access for the poorest people.

Most subsidy schemes for decentralised energy access implemented to date have been supply-side subsidies, rather than demand-side subsidies,[14] although the latter are starting to receive more attention. In most sectors, demand-side subsidies are preferred as it is generally believed that they have a lower risk of market distortion.

10 ESMAP is the World Bank Group's Energy Sector Management Assistance Programme.

11 World Bank ESMAP (2019) *Rwanda country brief: lifting the burden of electricity subsidies, while expanding access*: www.esmap.org/node/181504

12 SEforALL (2020) *Energy safety nets: using social assistance mechanisms to close affordability gaps for the poor*: www.seforall.org/publications/esn

13 Damilola Ogunbiyi (the Special Representative of the UN Secretary-General for SEforALL) and Riccardo Puliti (the World Bank Group's Energy Director and Regional Director for Infrastructure in Africa) highlighted the importance of energy safety nets for the poorest communities in a recent statement: www.seforall.org/news/energy-access-takes-center-stage-in-covid-19-fight

14 Demand-side subsidies are typically aimed at increasing the purchasing power of consumers, whereas supply-side subsidies intervene upstream of the consumer, reducing the apparent cost of a good or service.

2 DESIGNING SUSTAINABLE AND SCALABLE SUBSIDIES FOR AFFORDABLE ENERGY ACCESS

The idea that subsidies are needed is gaining support, but what should those subsidies look like? The debate over the role of subsidies is not a binary one; there are many detailed design decisions that need to be made if a subsidy is to be introduced. These include deciding how a subsidy is funded, how it is allocated, and what technologies are eligible. Subsidies can be funded externally, by direct government or donor funding, or the cost can be internalised through a surcharge on other energy consumers. While a well designed subsidy might be effective in achieving an important policy goal – such as universal access to energy – a poorly designed subsidy might have unintended consequences or undermine parts of the market that are working well.

Subsidy schemes should be systemic, standardised and scalable if they are to increase the deployment of energy access solutions. Tearfund's paper[15] on this topic introduced these three requirements:

- **SYSTEMIC:** A clear process is defined by which projects and companies can apply for or obtain funds – moving away from a piecemeal, project-by-project approach.
- **STANDARDISED:** Funds are allocated with terms that are consistently applied across similar projects, technologies and companies.
- **SCALABLE:** The scheme is designed so that it can be scaled up and replicated more widely.

To meet these requirements, subsidies need to be thought of as integral to market design, rather than as a gap to be filled by a short-lived donor programme. Ensuring that companies deploying energy access solutions can operate in a market that offers long-term economic and financial viability will have a further positive effect as a wider range of lower-cost capital types invest in the sector. SEforALL's recent paper on energy safety nets[16] notes that it is important to distinguish between subsidies that target connections and subsidies that reduce the ongoing costs of energy consumption.

Misconceptions about subsidies

'The lack of subsidies is not the constraint; there are not enough projects to invest in.'

A common complaint of development finance institutions (DFIs) is that there is an insufficient pipeline of 'bankable' projects. This is indeed often true. However, the sector is often held back from scaling up by the lack of a suitable enabling environment. Implementation of a market design that includes systemic and scalable subsidies could allow businesses and projects that would otherwise depend on piecemeal and localised donor interventions to truly scale up.

It is also important to note that subsidies have always been used to deliver energy access. In that sense, the arguments put forward in this paper are not new. For example, in the US funding was channelled through rural electricity cooperatives to extend electricity access under the 1936 Rural Electrification Act. Rural electrification subsidies in the US exceeded USD 500 million each year as recently as 1984.[17]

15 Tearfund (2018) *Transforming electricity markets to deliver universal energy access*: https://learn.tearfund.org/~/media/files/tilz/climate_and_energy/2018-tearfund-transforming-electricity-markets-en.pdf?la=en

16 SEforALL (2020) *Energy safety nets: using social assistance mechanisms to close affordability gaps for the poor*: www.seforall.org/publications/esn

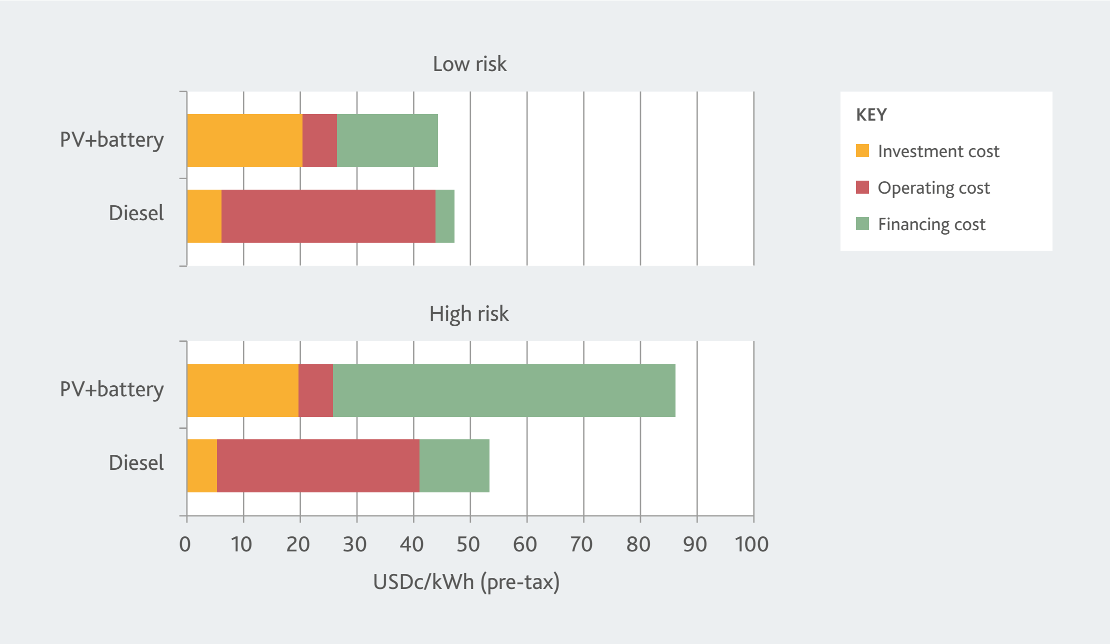
17 Schmidt W E (1984) 'Rural electric co-ops fight to keep subsidy', *New York Times*, 19 April 1984

Other components of a strong enabling environment need to be in place for subsidies to have the desired effect. Other elements of fiscal policy might reduce or reverse the impact of a subsidy. For example, high import duties or exposure to VAT or sales taxes can mean that decentralised energy access solutions do not always operate on a level playing field with centralised solutions such as grid-based electricity. Furthermore, externalities such as greenhouse gas emissions and household air pollution are often not reflected in the cost of traditional sources of energy, such as charcoal and kerosene. Taxation to reflect these externalities could help to level the playing field and could also help to fund subsidies for modern energy access. It is, however, acknowledged that this would be difficult to implement in the informal markets where the use of these fuels is prevalent.

A recent paper from UNDP and ETH Zürich[18] highlighted the importance of the enabling environment for renewable energy technologies, compared to traditional and fossil fuel-based technologies. The greater role of capital expenditure as a portion of total project costs means that reductions in the cost of capital have a disproportionate impact on renewable energy projects. This in turn means that these projects can be more sensitive to market risk. The research suggests that this means the cost of a renewable energy mini-grid can be materially impacted by improving (or de-risking) the enabling environment, as shown in Figure 3.

The analysis shown in the figure involves many assumptions,[19] and clearly the absolute numbers shown could vary depending on the size of system and technologies deployed. However, the renewable energy solution becomes more cost-effective and fundamentally more attractive as a result of the improved enabling environment, which reduces risk, leading to lower financing costs.

Figure 3 Impact of financing costs on mini-grid generation costs



Source: UNDP and ETH Zürich (2018) *Derisking renewable energy investment: off-grid electrification*

18 UNDP and ETH Zürich (2018) *Derisking renewable energy investment: off-grid electrification*: www.undp.org/content/undp/en/home/librarypage/environment-energy/low_emission_climateresilientdevelopment/derisking-renewable-energy-investment/drei--off-grid-electrification--2018-.html

19 The UNDP and ETH Zürich analysis assumes a small mini-grid with 15kWp of solar PV and a 41kWh lithium-ion battery. The lifetime of these assets is assumed to be ten years, while the lifetime of the diesel system comparator is assumed to be 20 years.

Designing subsidies involves many complex and interrelated design decisions. A recent World Bank ESMAP report[20] on mini-grids identifies four main types of subsidy:

1. Pre-investment subsidies, which essentially covers technical assistance to governments and developers.
2. Supply-side capital subsidies, which might be predefined or might be determined through an auction.
3. Connection cost subsidies, which might be paid to developers (eg as supply-side subsidies through an RBF scheme) or to customers (as a demand-side subsidy).
4. Usage subsidies, which would be another form of demand-side subsidy, for example through the structure of tariffs for end consumers.

Once the type (or types) of subsidies to be used has been decided, there are further trade-offs in subsidy design that need to be considered. Some of the most important trade-offs are highlighted in Figure 4 on page 10. Most of these trade-offs are not binary decisions; rather, they describe a menu of options to be considered in designing subsidies.

Many of the trade-offs in subsidy design are ideological and political in their nature. There is often not a correct or incorrect answer, but a judgement is required based on the political economy and other contextual factors. For example, a universalist approach might argue for a subsidy scheme that all energy consumers can benefit from. This approach might help to build support for the scheme across energy consumers, which could be important if they are to be asked to pay for the scheme over the long term. However, others might argue for a more targeted subsidy scheme, which might be easier to withdraw in future if the subsidy is no longer required. The choices made in relation to each of these trade-offs will also depend on the context in which the subsidy is to be applied, the actors involved in its implementation, and the capacity of those actors.

In designing a subsidy scheme to accelerate deployment, the scheme's objectives need to be clear. There are two main drivers for energy subsidies:

1. **Cost of service**, which is higher in sparsely populated rural areas. The least-cost energy access solution in a rural area is more likely to be a distributed solution, which is likely to have a higher cost of service in USDc/kWh terms, when compared to an on-grid solution in an urban area. For any given technology (whether on-grid or off-grid), distribution costs will be higher in sparsely populated areas.
2. **Affordability gaps**, where the poor are unable to meet the cost of basic energy service provision.

In low-income countries there is often a high level of coincidence between areas with high cost of service and those with larger affordability gaps. However, it is important to note that the problem that a subsidy is trying to solve will impact its design.

Defining the end goal of a subsidy scheme will help to improve the sustainability of its design. Affordability gaps may narrow over time, as a country becomes more developed and as the cost of distributed renewable energy and clean cooking technologies continues to decline. However, the cost of service will continue to vary by region.

When designing a subsidy, it is important to consider what subsidies (if any) a future sustainable energy market might need. For example, a time-limited subsidy that is designed to tackle a market characteristic that is not time-limited fails the sustainability test. World Bank ESMAP states[21] that 'it is important that any subsidy scheme has an exit/taper policy'. This is understandable given prior experience of energy sector subsidies: for example, fossil fuel subsidies, which have proven difficult to unwind. However, while subsidy schemes should be reviewed regularly to ensure that they remain targeted and have an impact on the need that they were established to address, an exit policy is not always necessary.

To be sustainable, subsidies should be designed with an end state in mind where they are self-funding (ie an outright subsidy over time becomes a cross-subsidy). For example, energy markets in developed countries have many sustainable (cross-)subsidies that are designed to meet legitimate redistributive aims. These reflect the view that energy should be viewed as a public good, especially for those who could not afford to pay for it under pure cost-reflective tariffs.

20 World Bank ESMAP (2019) *Mini grids for half a billion people*: www.esmap.org/mini_grids_for_half_a_billion_people
21 Ibid

Figure 4 Selected trade-offs in subsidy design

Targeting subsidies at specific groups of energy users most in need could lead to more efficient use of resources…	Targeting	…but it might be easier to build support for a more **universal** subsidy scheme, which could be important if in the long term cross-subsidies are to be funded by energy consumers
Funding from **national government** or, even better, from **energy tariffs** might result in a more sustainable and scalable scheme…	Funding source	… but in many developing countries tariffs do not achieve basic cost recovery, so the reality is that **donor funds** will be required to fund subsidies
Subsidies that are **technology-specific** might be more confident of delivering reliable technical solutions…	Technological scope	… but a scheme that is **blind to the mode of delivery** might encourage innovation and be more focused on outcomes than inputs
Results-based finance is already being used to allocate subsidy based on new connections achieved, rather than cost incurred…	Inputs vs outputs	… but some risks are outside of service providers' control, arguing for **input-based subsidies**
Tightly defined geographical scope may help ensure the subsidy is targeted at those who need it most…	Geographical scope	… but a **broader geographical scope** might build wider support for the subsidy and increase the political acceptability of eventually funding it through tariffs
Paying subsidies to **service providers** means that the funder can be sure it is spent on quality energy services…	Immediate beneficiary	… but paying the subsidy to **end consumers** could increase customer empowerment and builds awareness of the real cost of energy
Exclusivity (eg through a regional concession) might be required to improve the business case for companies entering more sparsely populated areas…	Exclusivity	… but **competition** within a region increases consumer choice and might be expected to lead to better quality of service over time
Auction-based allocation of subsidies can improve value for money and encourage innovation to drive down costs…	Allocation mechanism	… but **first-come-first-served** allocation can sometimes lead to faster deployment and open the market to a wider range of actors

CASE STUDY 1

Renewable energy subsidy support in Nepal

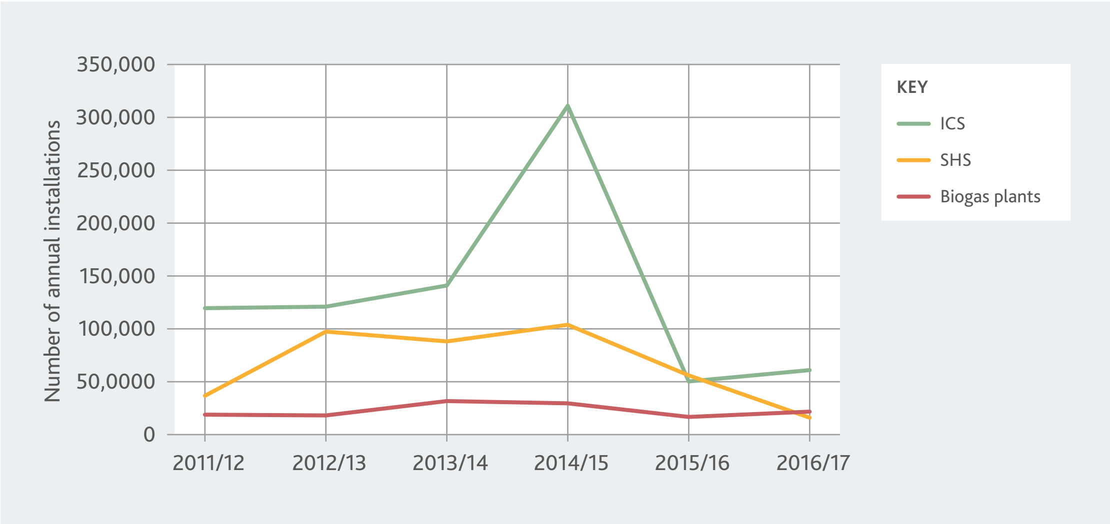
Nepal introduced its Renewable Energy Subsidy Policy (RESP) in 2012. The RESP is wide-ranging and covers many technologies, although it is mostly focused on small-scale installations. For example, subsidies for wind energy are for installations up to 100kW. The technologies covered under RESP include SHS and clean cooking technologies. Subsidies for SHS range from 4,500 to 10,000 Rs (~USD 39–87) depending on the size of system and the region in which the system is installed. (More remote regions, where affordability is more challenging, attract a higher subsidy.)

Subsidies for clean cooking cover domestic biogas plants (16,000–35,000 Rs) and improved cooking stoves (ICS) with biomass (up to 50 per cent, but not exceeding a cap of 3,000–4,000 Rs, which depends on the type of stove).

RESP is implemented by Nepal's Alternative Energy Promotion Centre (AEPC), which manages a Central Renewable Energy Fund (CREF), the source of the subsidy funds. CREF's budget for 2012–2017 was USD 116 million, of which USD 64 million was funded by the government of Nepal, with the remaining funds being sourced from donors.

Figure 5 below shows annual installations of selected technologies under the policy. Installations gradually increased during the early years of implementation, peaking in 2015, just before the earthquake that struck Nepal in that year. The substantial reduction in installations since that date has been largely attributed to the reallocation of donor funds to earthquake recovery efforts. The Nepalese experience illustrates the risk of relying on donor funds for subsidy schemes, rather than having a self-sustaining financing mechanism.

Figure 5 Annual installations of selected technologies



Source: Alternative Energy Promotion Centre

3 LESSONS FROM PAST AND CURRENT SUBSIDY SCHEMES

Subsidies and cross-subsidies are used widely to achieve desired energy sector outcomes. The Appendix presents an analysis of the key characteristics of a range of energy subsidy schemes for on-grid, off-grid, mini-grid energy and clean cooking. Table 1 lists a summary of the schemes included in the Appendix. This list is not a comprehensive list of all schemes, but the selected schemes cover a wide range of geographies and technologies, illustrating how widely subsidies are used.

The case study boxes in this paper present further detail on three of the schemes presented in the table: subsidy support for clean cooking and SHS in Nepal, the World Bank Group's new Nigeria Electrification Project, and Thailand's Uniform Tariff Policy. Some of the subsidies presented in the table date back many years; the use of subsidies to promote energy access is not a new idea.

Table 1 Overview of selected energy access subsidy schemes

Geographical scope	Subsidy scheme	Technological scope	Nature of support	Funding source
Kenya – focused on 14 underserved counties covering ~20% of the country's population	Kenya Off-grid Solar Access Project (KOSAP)	Mini-grids (open to a range of technologies), SHS, solar water pumps, improved cookstoves	Tariff cross-subsidies RBF to suppliers	World Bank Group
Kenya, but limited to ~1m households within 600m of selected LV transformers	Last Mile Connectivity Programme (LMCP)	Grid connections	Subsidised connection cost	Government of Kenya, African Development Bank, World Bank Group, EU, Agence Française Développement
Nigeria	Nigeria Electrification Project	Mini-grids, SHS	Subsidised cost to consumer RBF to suppliers	World Bank Group
Tanzania – Lake Zone and Central Zone	Results-Based Financing Fund	SHS – Lighting Global-approved products	RBF to suppliers	DFID
Morocco – rural areas	Global Rural Electrification Programme (PERG) – decentralised component	Solar systems (note this is focused on the decentralised component of PERG, which is only ~9% of the total programme)	Subsidised cost to consumer	KFW, Agence Française Développement, French Fund for World Environment
Bangladesh	Infrastructure Development Company Limited (IDCOL)	SHS, mini-grids, biogas, other renewable energy technologies	Soft loans to suppliers	Grants and soft loans from a wide range of international financial institutions

Geographical scope	Subsidy scheme	Technological scope	Nature of support	Funding source
India	Pradhan Mantri Ujjwala Yojana (PMUY) LPG subsidy	LPG	Subsidised connection cost	Government of India
Indonesia, China, Lao PDR, Mongolia	Clean stove initiative	Certified clean stoves meeting agreed quality standards	RBF to suppliers	Varies by country, but supported by World Bank Group and AusAID
Nepal	Renewable Energy Subsidy Policy (RESP)	Cookstove technologies eligible determined by Nepal's Alternative Energy Promotion Centre (AEPC), which administers the Central Renewable Energy Fund (CREF)	Subsidised connection cost	Government of Nepal, various development partners
Thailand	Free Electricity Policy, Uniform Tariff Policy	Grid-based electricity	Tariff cross-subsidies	Tariff redistributions
Nicaragua	Off-grid Rural Electrification (PERZA) Project	Mini-grids, solar battery charging stations, SHS	RBF to suppliers	World Bank Group, Central American Bank for Economic Integration, UNDP
Peru	Peru Rural Electrification Project	Grid extension, SHS	Subsidised connection cost Tariff cross-subsidies	World Bank Group, tariff redistributions

It is notable that subsidy schemes for decentralised technologies have, to date, had mixed results. There are many results-based finance (RBF) schemes that are currently being implemented, some of which are included in the table and others that are not. Large, multi-country RBF schemes are also being developed, such as the proposed Universal Electrification Facility (UEF) being developed by SEforALL, with support from UN Energy and the World Bank Group.[22] It is too early to tell whether these RBF initiatives will achieve more sustainable results than earlier schemes. There is not yet consensus on how subsidies for off-grid electrification or clean cooking solutions should be designed to achieve scalable and long-lasting results.

Subsidy schemes targeting energy access in the last mile have often been time-limited and funded by donors. Many of the schemes that have achieved sustainable and long-lasting impact have been integrated into the regulation of electricity markets; for example, the electricity cross-subsidies in Thailand and Peru. Donor-backed schemes that have received sustained support over many years have also achieved impressive results. For example, IDCOL in Bangladesh has supported the installation of more than 4 million SHS. However, even IDCOL has not yet been successful in achieving sustainable energy access outcomes; IDCOL's original intention was to withdraw from the SHS market as it became more commercially viable, but in practice this withdrawal has been limited.

22 Implementing partners engaged in the UEF programme include Rockefeller Foundation, Shell Foundation, AMDA, Power Africa, Good Energies, UK AID and the Carbon Trust.

CASE STUDY 2
Nigeria Electrification Project

The Nigeria Electrification Project is a World Bank Group (WBG)-funded programme that was approved by the WBG in 2018, and which is scheduled to run to 2023. While this programme is still at an early stage of implementation, it is an interesting example of a more holistic approach to tackling the electricity access challenge in a country where there are systemic challenges with the financial viability of on-grid utilities.

The total programme cost is expected to be USD 765 million, of which USD 350 million is from the International Development Association (IDA), a WBG fund for the poorest countries. Most of the remaining funds are expected to be leveraged from the private sector through the use of IDA funds to catalyse investment in energy access initiatives. The three main components of the programme that are relevant to this paper are as follows:

- A minimum subsidy tender for mini-grids is being administered by Nigeria's Rural Electrification Agency (REA). It is unclear how the tender is being structured and what the resulting tariffs for end consumers will be. USD 70 million of the IDA funds will be used to fund the subsidies and the objective of the tender is to fund 250 mini-grid projects, providing 110,000 new connections.
- A further USD 80 million of IDA funds are allocated to providing performance-based grants to the developers of a further 580 mini-grids, delivering 230,000 new connections. The grants will again be administered by REA and will be awarded on a USD/connection basis.
- USD 60 million of IDA funds are being allocated to performance-based grants to SHS companies. The grant amount is to be fixed for each system size or level of service category, and the WBG aims to leverage USD 230 million of private sector investment through this activity.

The programme is still at an early stage of implementation, so it is not yet possible to draw clear conclusions and lessons from it. However, 400 mini-grids are already being worked on by nine companies under the performance-based grant scheme, and nine companies have qualified under the SHS programme, with 130,000 systems expected to be deployed during 2020.

A lack of foresight in addressing long-term maintenance requirements has undermined many schemes. This is evident in many of the schemes highlighted in Table 1. Concerns were raised over sustainability in the World Bank Group's own evaluation of off-grid electrification activities in both Nicaragua[23] and Peru.[24] Specifically, it was noted that provision for ongoing maintenance was weak. Similar issues are apparent in more recent schemes: two service providers benefiting from a DFID-funded RBF scheme in Tanzania have left the market, and institutional systems installed under the same programme have suffered from multiple technical system failures, with poor maintenance provision again highlighted as a challenge.[25] It is too early to tell whether the same sustainability challenges will affect the performance of result-based schemes under the Nigeria Electrification Project or the Kenya Off-Grid Solar Access Project (KOSAP), both of which are backed by the World Bank Group.

The sustainability of subsidy schemes is often undermined if long-term affordability gaps are not addressed. It is clear from the review of subsidy schemes in Table 1 that many schemes deploy only capital subsidies, even though they are being used in an environment where there are long-term affordability gaps. These schemes ignore the recommendation made above that subsidy schemes should have a clearly defined objective that is accurately reflected in the design of the scheme. India's Pradhan Mantri Ujjwala Yojana (PMUY) scheme has resulted in 80 million new LPG connections, but there is evidence that many of these new connections are not used because households cannot afford the LPG to use with their new stove.[26] Ensuring that subsidy schemes draw on sustainable funding sources is particularly pertinent as countries plan for recovery from Covid-19. Over a

23 World Bank Group IEG (2018) *Offgrid Rural Electrification (PERZA): project performance assessment report*: http://ieg.worldbank.org/sites/default/files/Data/reports/ppar_nicaraguaperza.pdf

24 World Bank Group IEG (2017) *Rural Electrification Project: project performance assessment report*: https://ieg.worldbankgroup.org/sites/default/files/Data/reports/ppar-perururalelectrification-09012017.pdf

25 Hankins M, Kaijage E, Barja A, Hindrich F (2017) *Technical assistance to the Rural Energy Agency of Tanzania*: www.gov.uk/dfid-research-outputs/technical-assistance-to-the-rural-energy-agency-of-tanzania-final-report

26 SEforALL (2020) *Energy safety nets: India case study*: www.seforall.org/publications/esn/india

third of donors responding to a Clean Cooking Alliance survey said that they were less likely to fund clean cooking projects as a result of the pandemic.[27]

It is concerning that many of the current generation of RBF schemes appear to ignore the experience described above. Some proponents of RBF schemes suggest that kickstarting the market will be sufficient to bring down costs to the point where everyone can afford energy access. It is unclear whether RBF will achieve this. Parallels are sometimes drawn with the experience of subsidising renewables, where many countries have removed feed-in tariff and similar schemes as the cost of renewable energy technologies has been driven down. Indeed, this experience is instructive. While feed-in tariffs have been removed, in most countries renewables are still supported, with support being allocated through more market-based mechanisms. The cost of this subsidy or support is normally spread across all energy consumers.

On-grid electricity access schemes show that we already know how to design systemic, standardised and scalable subsidies. Cross-subsidies are integrated into on-grid electricity market regulation in most countries – including high-income countries – to even out differences in cost of service and to address affordability gaps. Thailand's Uniform Tariff Policy and Free Electricity Policy redistributes ~USD 350 million every year.[28] This is self-funded through the electricity tariff. In the UK, electricity consumers pay more than GBP 60 million every year to subsidise the high cost of service in more remote parts of Scotland.[29] This scheme is again self-funding. Of course, there are plenty of badly designed subsidies for on-grid electricity as well. For example, many utilities in low- and middle-income countries charge tariffs well below a level that fully recovers system costs, resulting in large quasi-fiscal deficits[30] and undermining the sustainability of the energy sector. Unsustainable tariffs and subsidies in India have meant that the government has been required to bail out the distribution companies.[31] The push to achieve universal access to electricity (primarily using grid connections) through India's Saubhagya scheme is likely to increase the financial stress on India's utilities unless these underlying issues of tariff sustainability are also tackled.

Misconceptions about subsidies

'People should pay more for off-grid technologies because they cost more.'

It may be true that off-grid renewable technologies are more expensive when evaluating the cost per kWh delivered, but the IEA estimates that grid expansion is the least-cost option for only 45 per cent of households without electricity access.[32] Regardless of the cost differences, it does not necessarily follow that these costs should not be redistributed. Consumer energy markets across the world involve the redistribution of costs: for example, from rural to urban consumers. The principles integrated into existing energy markets should be extended to communities that do not yet benefit from energy access.

On-grid subsidy designs from more developed countries cannot simply be replicated in the off-grid sector in low- and middle-income countries. But the principles can be leveraged. In countries where it is not yet politically possible to charge tariffs that allow full cost recovery for on-grid electricity, outright subsidy will be required. Yet, over time, as electricity sectors mature, cross-subsidies can be incorporated into a market design that is blind to the technical mode of delivery.

27 Clean Cooking Alliance (2020) *Covid-19 impacts on clean cooking: results from a sector survey*: www.cleancookingalliance.org/resources/590.html

28 ERC (2014) 'Thailand's electricity tariffs and cross subsidy between urban and rural supply' [presentation]: https://pubs.naruc.org/pub.cfm?id=538EC127-2354-D714-51A4-37854F6F28FC

29 Ofgem (2019) 'Charging statement – Assistance for Areas with High Electricity Distribution Costs scheme'

30 World Bank Group (2016) *Making power affordable for Africa and viable for its utilities*: www.worldbank.org/en/topic/energy/publication/making-power-work-for-africa

31 IISD (2018) *India's energy transition – subsidies for fossil fuels and renewable energy, 2018 update*: www.iisd.org/sites/default/files/publications/india-energy-transition-2018update.pdf

32 IEA (2019) *Africa Energy Outlook 2019* (www.iea.org/africa2019)

CASE STUDY 3

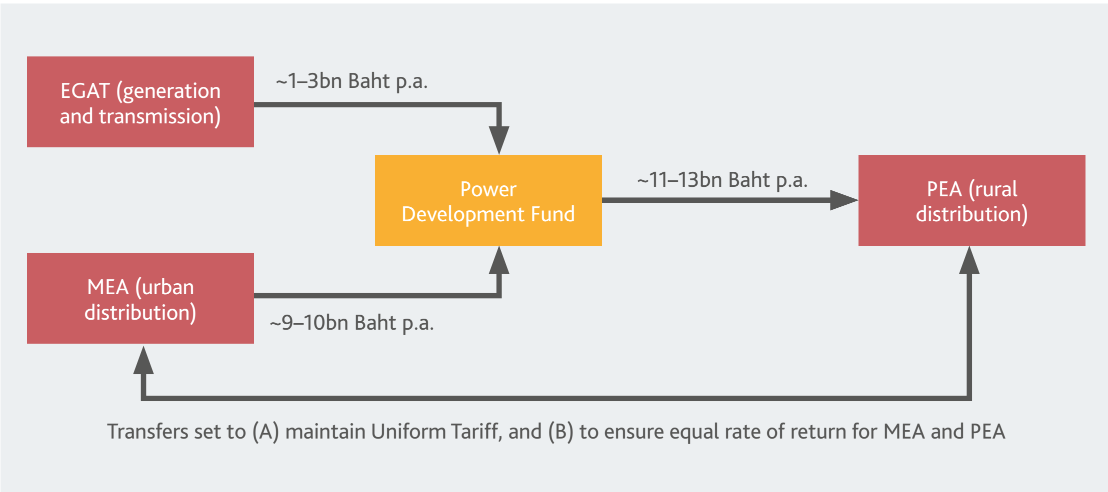
Thailand: electricity tariff cross-subsidies

Thailand is at a more advanced stage in tackling energy access compared to the other country case studies presented in this paper. One hundred per cent of the population has had access to electricity since 2013 and 78 per cent have access to clean cooking.

Thailand has two main state-owned distribution companies: the Metropolitan Electricity Authority (MEA) covers the Bangkok metropolitan area, including Nontaburi and Samut Prakan, while the Provincial Electricity Authority (PEA) covers the rest of the country. PEA has a much higher cost of service because it covers less densely populated areas. In the absence of any further action, less affluent rural consumers would pay higher tariffs than their relatively well-off peers in urban areas. However, the Energy Regulatory Commission is tasked with defining a cross-subsidy between the two distributors and EGAT (the state-owned generation and transmission utility), which facilitates the application of a Uniform Tariff Policy while maintaining an equal regulated rate of return between the two utilities.

Furthermore, Thailand has a Free Electricity Policy which applies to any households with electricity consumption below 50kWh/month. While the merits of this policy are debatable (resulting in consumption clustering around the 50kWh/month threshold, for example), this policy is also sustainably funded through Thailand's market design, through a surcharge on the bills of other customer categories.

Figure 6 Thailand: electricity tariff cross-subsidies



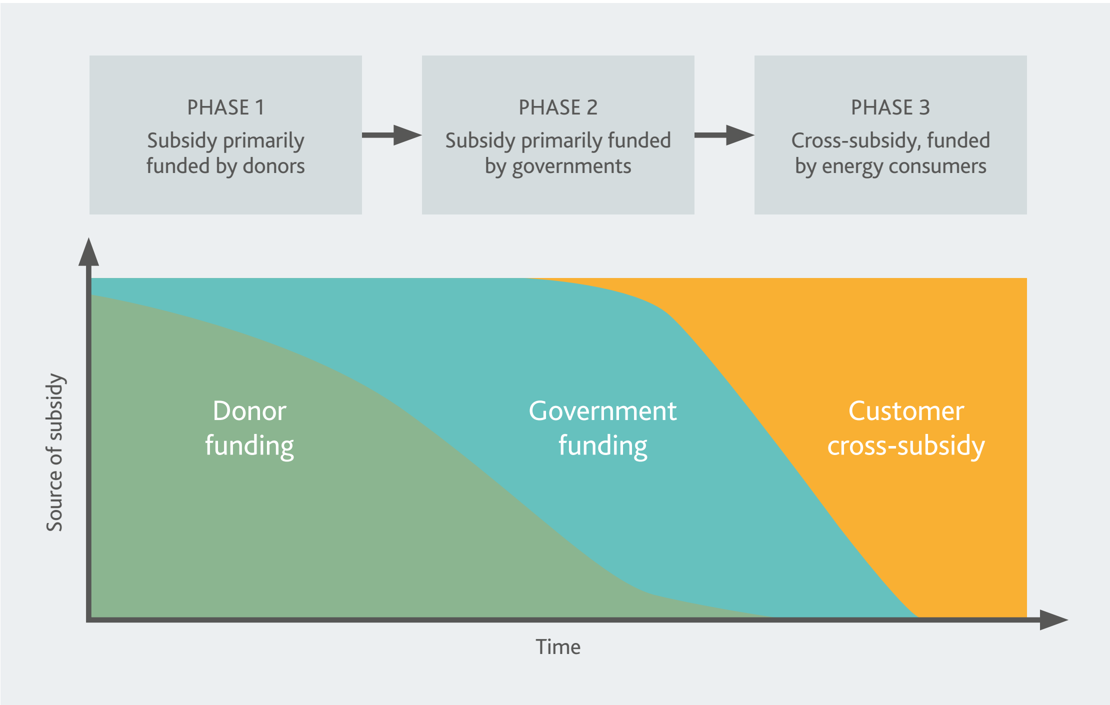
Source: Energy Regulatory Commission of Thailand

Cross-subsidies that reflect the higher cost of service of connecting rural consumers are not unique to Thailand; they are baked into almost any viable grid-based electricity system. The example of Thailand clearly distinguishes between cost recovery (which is critical to financial viability) and a purist and regressive approach to cost reflectivity, which has dominated most off-grid electricity access programmes to date.

4 A LONG-TERM APPROACH: BUILDING A SUSTAINABLE MARKET FOR ENERGY ACCESS

A three-phase approach can be used to transition towards a sustainable market to deliver energy access, as shown in Figure 7. Initially a scheme can be funded by donors, with the government then taking on a funding role, before eventually the scheme is funded through sustainable cross-subsidies. In practice, as is indicated by the figure, the transition between phases is gradual and funding might originate from multiple sources: for example, partly from donors and partly from the host government. Aiming for an end state where support is self-sustaining through customer-funded cross-subsidy addresses concerns that donors and/or governments could get locked into funding subsidies over the long term. Ultimately, this becomes a question of market design, rather than subsidy design, although it is acknowledged that in many countries with a large energy access deficit this endpoint will be many years off.

Figure 7 Transition to a sustainable market to deliver energy access



A shift towards focusing on outcomes, rather than on the technologies deployed, promises to yield better results for energy-poor communities. The progress made in the deployment of SHS in recent years demonstrates that energy consumers care about the energy service they receive and what they can do with it, rather than the mode by which they receive that electricity. This is increasingly being reflected in the growth of business models that span multiple technologies. For example, the company BBOXX is offering weak-grid and grid-control solutions in addition to its SHS offering in Africa and Asia, while the company Konexa is taking on a sub-concession in Nigeria that will span a range of on-grid and off-grid technologies and will allow for some cross-subsidy between them.

5 KEY FINDINGS

There is increasing recognition that subsidy is not a dirty word; indeed, subsidies are a necessary ingredient to achieve SDG 7.

Subsidies can be used to address affordability gaps and the high cost of service in reaching remote, rural and often poor communities. Ensuring that these communities have access to energy is particularly important in catalysing economic activity and building resilience as countries plan their recovery from the Covid-19 crisis.

There are lots of examples of subsidies being deployed successfully without undermining private sector investment.

The review of country examples of subsidy schemes in Table 1 and the Appendix shows that subsidies have been used widely with the aim of ensuring sustainable and affordable access to energy. They are still used, and are integrated into the design of on-grid energy markets, in many of the most advanced countries.

But there are not yet examples of truly systemic subsidy schemes targeting the deployment of decentralised energy access technologies.

Many of the lessons from the subsidy schemes targeted at decentralised technologies have been ignored when designing new schemes. In particular, many such schemes have failed to achieve sustainable results as new off-grid connections or clean cooking solutions have fallen into disrepair or have not been properly maintained over the long term. It is a matter of concern that the current wave of results-based finance schemes risk repeating many of the same mistakes.

6 POLICY RECOMMENDATIONS

Multilateral development banks (MDBs) and donor governments have a critical role to play in developing solutions to achieve universal energy access, given their ability to influence policy and regulation across the energy sector. They can provide technical assistance as governments develop energy plans and can support effective enabling environments to crowd in private sector investment in distributed renewable electricity access and clean cooking.

The following recommendations, based on the findings of this paper, are for national governments, MDBs and donor governments.

- **Remember the three 'S's as key principles when designing subsidy schemes: systemic, standardised and scalable.** Many subsidy schemes for decentralised energy access technologies have failed the sustainability test. They have been successful in deploying connections, but systems have fallen into disrepair, service providers have exited the market, and maintenance provision has been inadequate. Subsidy schemes that address more than up-front connection costs and that recognise persistent affordability gaps and geographical differences in the cost of service will require ongoing subsidy that outlives existing short-term donor funding cycles.
- **Be clear on the problem(s) they are trying to address and the likely future trajectory of the funding need.** Where possible, national governments should take the lead and, where appropriate, should mobilise sources of public finance to achieve energy access goals. As a country's energy institutions mature and as its energy sector becomes financially viable, the objective should be for subsidies to be reduced where possible, with a transition in the long term towards sustainable customer-funded cross-subsidies where support is still required. This will take time in many countries with the largest energy access gaps.
- **Don't reinvent the wheel where there are proven models that work.** Affordability gaps and cost-of-service differences have always existed in the energy sector. Countries around the world redistribute large sums every year to address these challenges, even in the most developed countries. We know how to design sustainable and scalable subsidy schemes. Policymakers can apply this knowledge in designing future schemes to expand access to renewable electricity and clean cooking.
- **Get the enabling environment right as this is also key if subsidies are to be effective in making the decentralised energy access sector more investible.** Governments can create an enabling environment to accelerate progress on energy access, incorporating sustainable subsidies for energy access. Integrated energy planning is another important component of such an enabling environment, which can help governments and companies to understand the relative role of different energy access solutions in different parts of a country. It can also provide a framework for subsidy design, to ensure that the support implemented is appropriate to the energy access solutions to be deployed in a given country or region. Appropriate fiscal policy, such as on import duties, can help to ensure that off-grid technologies participate in the market on a level playing field.
- **Avoid implementing policies and regulations that pose a barrier to implementing systemic subsidy support schemes.** It is particularly important to avoid regulation that might undermine progress towards a more sustainable energy sector. For example, purist cost-reflective tariff regulations have been implemented in some jurisdictions, which might be difficult to reverse if future governments want to implement regulations that allow for more progressive cross-subsidies to even out differences in cost of service.
- **Shift towards focusing on outcomes and involving end users in the design of subsidies and energy services**, rather than concentrating on the technologies deployed, as this promises to yield better results for energy-poor communities. The progress made in the deployment of SHS in recent years demonstrates that energy consumers care about the energy service they receive and what they can do with it, rather than the mode by which they receive that electricity. Designing energy markets that are blind to the mode of delivery could better reflect the needs of the hardest-to-reach energy consumers.

APPENDIX: OVERVIEW OF SELECTED ENERGY ACCESS SUBSIDY SCHEMES

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
Bangladesh	Infrastructure Development Company Limited (IDCOL)[33,34,35]	SHS, mini-grids, biogas, other renewable energy technologies	**Soft loans to suppliers** Soft local-currency loans and grants for partner organisations delivering a range of technologies: SHS, biogas, solar mini-grids etc	Grant and soft-term loans from a range of IFIs: WBG, ADB, JICA, DFID, KFW, USAID etc. To date, USD 696m deployed under SHS programme	SHS programme started in January 2003, still operational	Partner organisations selected by an independent selection committee, but then deal with end consumers on their own terms	4.13m SHS, 49,150 biogas plants, 1,429 solar irrigation pumps, and 27 solar mini-grids financed to January 2019	Quality issues with some early installations, highlighting the importance of good quality control IDCOL's intention was to gradually exit the market as the SHS market became more commercially viable, but in reality it has been difficult to reduce the level of support materially

33 www.idcol.org

34 Bangladesh Institute of Development Studies (2013) *Power from the sun: an evaluation of institutional effectiveness and impact of solar home systems in Bangladesh*: www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/Bangladesh_Idcol_Assessment.pdf

35 World Bank Group (2018) *Project paper – Bangladesh – Rural Electrification and Renewable Energy Development II Project*

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
India	Pradhan Mantri Ujjwala Yojana (PMUY) LPG subsidy[36,37,38,39]	LPG	**Subsidised connection cost** Direct benefit transfer of 1,600 Rs per household for LPG connections (~50% of the cost of an LPG connection). An interest-free loan is provided to cover the remaining cost	Indian government: USD 1.8bn invested in PMUY connections	Started in May 2016, for three years	Paid to women in below-the-poverty-line households, identified using census data	80m new LPG connections	Little increase in LPG consumption suggesting that households with new LPG connections are unable to afford replacement fuel (and/or highlighting issues with fuel distribution). This is exacerbated by beneficiary households being required to pay full market prices for LPG until they have repaid their PMUY loan
Indonesia, China, Laos, Mongolia	Clean stove initiative[40,41]	Certified clean stoves meeting agreed quality standards	**RBF to suppliers** Results-based finance with subsidies paid to stove suppliers based on monitoring and verification results	Varies by country, but supported by WBG, AusAID. USD 6.4m deployed to Laos programme in 2019	Individual programmes being established by country eg WBG RBF programme in Laos runs to 2025	RBF paid for verified sales of qualifying stoves	Pilots resulted in sales of several hundred stoves. No further results reported yet	WBG has noted high-level support as being critical to successful scale-up of the scheme Clean stove standards that are market-appropriate are also needed to complement the availability of well targeted subsidies

36 https://pmuy.gov.in

37 IISD (2018) *India's energy transition: subsidies for fossil fuels and renewable energy*: www.iisd.org/library/indias-energy-transition-subsidies-fossil-fuels-and-renewable-energy-2018-update

38 SEforALL (2020) *Energy safety nets: using social assistance mechanisms to close affordability gaps for the poor*: www.seforall.org/publications/esn

39 SEforALL (2020) *Energy safety nets: India case study*: www.seforall.org/publications/esn/india

40 World Bank Group LiveWire (2016) *Toward universal access to clean cooking and heating: early lessons from the East Asia and Pacific clean stove initiative*: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/530991467991919783/toward-universal-access-to-clean-cooking-and-heating-early-lessons-from-the-east-asia-and-pacific-clean-stove-initiative

41 World Bank Group (2019) *Project information document: Lao PDR Clean Cook Stove Initiative*: http://documents1.worldbank.org/curated/en/380611550108853118/pdf/Concept-Project-Information-Document-PID-Lao-PDR-Clean-Cook-Stove-Initiative-P169538.pdf

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
Kenya – focused on 14 underserved counties covering ~20% of the country's population	Kenya Off-grid Solar Access Project (KOSAP)[42,43,44,45]	Mini-grids (open to a range of technologies), SHS, solar water pumps, improved cookstoves	**Tariff cross-subsidies** USD 40m committed to develop 151 mini-grids using Public-Private Partnership (PPP) model, with consumers paying a uniform national tariff. KPLC customers will pay ~0.3 USDc/kWh to cross-subsidise the mini-grids **RBF to suppliers** USD 15m RBF facility for enterprises supplying SHS in the counties targeted by KOSAP. This is complemented by a debt facility that companies can access RBF facility for clean cookstoves also established, with ex ante awards also available for awareness-raising and inventory acquisition Further components of KOSAP are targeted at community solar facilities (such as water pumps), implementation support and capacity building	USD 150m loan from WB	Programme implemented in 2018–2024	Support directed towards implementing companies in the first instance (other than the proposed cross-subsidy for the KOSAP mini-grids). Minimum criteria are set for the SHS and clean cookstove facilities, but evaluation and allocation criteria are unclear. Evaluation criteria for the mini-grid PPPs are unclear	No outputs from this programme as per WBG December 2019 status update; too early to evaluate	Too early for there to be clear lessons learnt

42 SEforALL (2020) *Energy safety nets: Kenya case study*: www.seforall.org/publications/esn/kenya

43 World Bank Group (2017) *Project appraisal document (PAD) for an Off-grid Solar Access Project For Underserved Counties*: http://documents1.worldbank.org/curated/en/212451501293669530/pdf/Kenya-off-grid-PAD-07072017.pdf

44 World Bank Group (2019) *Kenya – Off-grid Solar Access Project for Underserved Counties – Implementation status and results report*: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/692301593485974857/disclosable-version-of-the-isr-kenya-off-grid-solar-access-project-for-underserved-counties-p160009-sequence-no-06

45 https://kosap-fm.org/facilities

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
Kenya, but limited to ~1m households within 600m of selected LV transformers	Last Mile Connectivity Programme (LMCP)[46,47]	Grid connections	**Subsidised connection cost** Connection to extended low-voltage lines within 600m of 17,967 selected transformers. Households charged a subsidised connection fee of USD 150, compared to an actual cost of connection of ~USD 1,000. USD 150 fee can be paid in instalments over three years	Government of Kenya, AfDB, WBG and EU. AFD facility to support consumer loans. USD 670m committed across Phases 1–4	Originally tied to a 2020 universal access target, but AFD and EU agreed a further ~USD 200m of funding in late 2019, which appears to fund a further three-year period	Consumer self-selection, but subject to proximity to selected substations	Currently connecting ~1.2m customer p.a. ~750,000 connections targeted under LMCP to date, with a further ~300,000 targeted under the latest phase. KPLC website suggests that ~110,000 new connections to date can be attributed to LMCP	Still out of reach of the poorest consumers, but LMCP can be a useful tool in connecting under-grid households
Morocco – rural areas	Global Rural Electrification Programme (PERG) – decentralised component[48,49]	Solar systems (note this is focused on the decentralised component of PERG, which is only ~9% of the total programme)	**Subsidised cost to consumer** Decentralised solar solutions provided to rural households at a reduced rate. The subsidy from the national utility, ONE, was equivalent to ~40% of the system cost. Equipment owned by ONE once installed, with energy consumers paying a connection fee and a monthly service fee to cover the balance of the cost	Grants from KFW and French Fund for World Environment (FFEM), with a soft loan from AFD, totalling USD 35.5m	Systems installed during 2002–2007	Tender issued in 2002, with a second tender in 2004. Both awarded to TEMASOL, who installed and maintained the equipment on behalf of ONE	53,000 systems installed	Payment records suggest that the monthly fees are affordable and customer satisfaction is high

46 SEforALL (2020) *Energy safety nets: Kenya case study*: www.seforall.org/publications/esn/kenya
47 www.kplc.co.ke/content/item/1095/connectivity-performance
48 ECA (2018) *Fiscal policy options for solar home systems*
49 UNDP (2012) *Morocco solar power case study*

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
Nepal	Renewable Energy Subsidy Policy (RESP)[50,51,52]	Cookstove technologies eligible determined by Nepal's Alternative Energy Promotion Centre (AEPC), which administers the Central Renewable Energy Fund (CREF)	**Subsidised connection cost** Capital subsidies for a range of improved cookstoves. Subsidy available ranges from ~USD 30–300, depending on the technology being used. RESP also covers renewable electricity technologies, not just cookstoves	Government of Nepal and various development partner contributions. USD 116m commitments to CREF over the period 2012–2017	Updated RESP published in 2016. No specific end date set, but allowance for subsidies to be reviewed every two years	Customer self-selection but limited to (a wide range of) approved technologies	High uptake of cookstoves increasing to a peak of >300,000 p.a. in 2015. After 2015, the earthquake in Nepal resulted in donor funds being diverted to recovery. Improved cookstove uptake in 2016 and 2017 fell to ~50,000 p.a.	LPG supply chain needs to be well developed, both to ensure consumers can source LPG and to reduce price volatility

50 SEforALL (2019) *Energizing finance: understanding the landscape*: www.seforall.org/publications/energizing-finance-understanding-the-landscape-2019

51 Government of Nepal (2016) *Renewable Energy Subsidy Policy, 2073 BS*: www.aepc.gov.np/uploads/docs/2018-06-19_RE%20Subsidy%20Policy,%202073%20(English).pdf

52 AEPC (2013) *CREF Financial Intermediation Mechanism*: https://policy.asiapacificenergy.org/sites/default/files/CREF%20%20%28Central%20Renewable%20Energy%20Fund%29%20Financial%20Intermediation%20Mechanism_0.pdf

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
Nicaragua	Off-grid Rural Electrification (PERZA) Project[53,54,55]	Mini-grids, solar battery-charging stations (SBCS), SHS	**RBF to suppliers** Output-based subsidies awarded to suppliers for mini-grids, SBCS and SHS. Most of the subsidy (70–80%) is paid on installation, with some of the mini-grid subsidies held back to incentivise individual connections	WBG, Central American Bank for Economic Integration (CABEI), UNDP, totalling USD 26m	PERZA initially ran from 2003–2008, and was then extended to 2011	Bidding for mini-grid concessions; unclear how SHS subsidies were allocated	19,312 connections as of February 2018, with 6,464 of those from SHS	3 of 5 mini-grid concessions are operating, but there were installation issues with the others. SHS and SBCS initially were successful in increasing connections, but Hurricane Felix reduced incomes for maintenance and the maintenance network was poor in rural, sparsely populated areas. SBCS were abandoned and there are serious concerns over sustainability of SHS. WBG IEG suggests 80% of SHS are still operational (8,080 were installed), but other sources suggest this might be as low as 25%

53 World Bank Group (2003) *Off-grid Electrification (PERZA) Project: project appraisal document*

54 World Bank Group IEG (2018) *Offgrid Rural Electrification (PERZA): project performance assessment report*: http://ieg.worldbank.org/sites/default/files/Data/reports/ppar_nicaraguaperza.pdf

55 ECA (2018) *Fiscal policy options for solar home systems*

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
Nigeria	Nigeria Electrification Project[56,57,58]	Mini-grids, SHS	**Subsidised cost to consumer** Minimum-subsidy tender for preselected mini-grid sites – this sub-component is ongoing **RBF to suppliers** Output-based grant of USD 350 per connection for develop-selected sites Output-based grants of ~20% of system cost for SHS suppliers	WBG IDA grants: USD 70m for minimum subsidy tender, USD 80m for mini-grid output-based grants, and USD 60m for SHS output-based grants	Programme is set to run to 2023	Competitive bidding for minimum subsidy tender; qualification criteria set for output-based grants	Early stage, but progress being made across all components RFP for mini-grid tender awaiting WBG approval, 9 companies working on 400 mini-grids under output-based grants, 9 companies qualified under SHS component with 130,000 projected systems in place during 2020	Too early for there to be clear lessons learnt

56 World Bank Group ESMAP (2019) *Mini grids for half a billion people*: www.esmap.org/mini_grids_for_half_a_billion_people

57 World Bank Group (2018) *Nigeria Electrification Project: project appraisal document*: http://documents1.worldbank.org/curated/en/367411530329645409/pdf/Nigeria-Electrification-PAD2524-06052018.pdf

58 World Bank Group (2019) *Nigeria Electrification Project: implementation status and results report*: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/827181588877847390/disclosable-version-of-the-isr-nigeria-electrification-project-p161885-sequence-no-04

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
Peru	Peru Rural Electrification Project[59,60,61,62]	Grid extension, SHS	**Subsidised connection cost Tariff cross-subsidies** 2006 Electrification Act resulted in connection costs being borne by distribution companies, and cross-subsidies from higher- to lower-consuming customers WBG Rural Electrification Project provided a subsidy for connections, using the distribution network and individual SHS Regulated tariff set for SHS, which is set separately from the grid tariff	Distribution companies (through tariff revenues), but mostly WBG. Total project cost of USD 132m	Initial REP ran from 2005, and extension to 2017 approved in 2011	Projects identified and selected by Electricity Distribution Companies (EDCs). This was the case for both on-grid and off-grid components of the project	Electricity connections brought to 105,000 households. The project raised the electrification rate in the targeted provinces from 75% in 2005 to 80% in 2011 7,100 households benefiting from SHS	Electricity connections achieved compared to target because the connection cost was higher than expected (USD 1,100, compared to USD 715) Concerns have been raised by the WBG evaluation team over maintenance provision and the sustainability of the SHS installations
Tanzania – Lake Zone and Central Zone	Results-Based Financing Fund[63,64]	SHS – Lighting Global-approved products	**RBF to suppliers** Output-based subsidy paid to suppliers for SHS sales based on lumen-hours per solar day	~EUR 4m from DFID	Initial phase 2014–2018, stage 2 launched for 2019–2020	Open to all suppliers, subject to passing certain qualification checks. Supplier limit of EUR 500k	80,000 verified solar product sales by the end of 2018	At least 2 beneficiary suppliers have left the Tanzanian market, highlighting the challenge of achieving sustainable results

59 Practical Action (2019) *Poor People's Energy Outlook*: https://practicalaction.org/poor-peoples-energy-outlook/?gclid=Cj0KCQjwgo_5BRDuARIsADDEntTv33r1TDAGgSClndfv28erABKkU5L2jsyRy2TN8bGf6waaCLvhn6IaAt_AEALw_wcB

60 World Bank Group (2006) *Rural Electrification Project: project appraisal document*

61 World Bank Group IEG (2017) *Rural Electrification Project: project performance assessment report*: https://ieg.worldbankgroup.org/sites/default/files/Data/reports/ppar-perururalelectrification-09012017.pdf

62 Tariff information from www.osinergmin.gob.pe/SitePages/default.aspx

63 Hankins M, Kaijage E, Barja A, Hindrich F (2017) *Technical assistance to the Rural Energy Agency of Tanzania*: www.gov.uk/dfid-research-outputs/technical-assistance-to-the-rural-energy-agency-of-tanzania-final-report

64 SNV (2019) *RBF Fund Stage 2: operational guideline*: https://snv.org/cms/sites/default/files/explore/download/iii.rbf2_is_opguide_feb2019_final_0.pdf

Geographical scope	Subsidy scheme	Technological scope	Nature and quantum of support	Funding source and amount	Funding tenor	Allocation mechanism	Households reached or systems installed	Lessons learnt
Thailand	Free Electricity Policy, Uniform Tariff Policy[65,66]	Grid-based electricity	**Tariff cross-subsidies** Since 2011 residential customers using <90kWh per month received free electricity; this threshold was reduced to 50kWh in 2012 Uniform tariff across the company results in a cross-subsidy from MEA (the distributor covering Bangkok, Nontaburi, and Samut Prakan) to PEA (the distributor covering the rest of Thailand). This cross-subsidy adds ~0.7 USDc/kWh to MEA customer bills and reduces PEA customer bills by ~0.4 USDc/kWh compared to cost-reflective levels	Tariff charged to other consumers. Transfers ~USD 350m every year	Self-sustaining / ongoing	Cross-subsidy is determined such that PEA and MEA achieve the same return on their regulated asset base	Free Electricity Policy benefits ~4.5m households	High level of electricity access in Thailand, meaning that these subsidy schemes do not exclude the poor. Some bunching of electricity consumption around thresholds for free electricity

65 ERC (2014) 'Thailand's electricity tariffs and cross subsidy between urban and rural supply' [presentation]: https://pubs.naruc.org/pub.cfm?id=538EC127-2354-D714-51A4-37854F6F28FC

66 Wibulpolprasert et al (2018) *Evaluating Thailand's Free Basic Electricity subsidy program*: www.pier.or.th/wp-content/uploads/2018/06/pier_dp_087.pdf

Paulina Dustan Chima (38), a 'solar entrepreneur', increased the working hours of her restaurant and cafe thanks to the extra light provided by the solar panels in Makutupora village, Manyoni district, Tanzania. Photo: Tom Price – Ecce Opus/Tearfund

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