Policy options for enhancing Productive Uses of Energy in low-resource settings in the Global South

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Energy-PIECES

Energy Policy Insights from Early Career Events and Secondments

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Executive summary

Every day, thousands of people around the world are migrating from rural areas to cities in search of a better livelihood—putting major strains on urban centres. To overcome this, one solution is to make rural life more attractive by creating greater economic opportunities there. Supporting Productive Uses of Energy (PUE) is one important factor in this.

PUE is a term used to describe (Brüderle et al., 2011, p. 13) "agricultural, commercial and industrial activities involving electricity services as a direct input to the production of goods or provision of services". Examples include irrigation and post-harvest processing. The integration of PUE with other rural sectors is important for realising the economic potential of rural villages and regions, ensuring market integration and fostering economic growth. By creating employment and economic opportunities, PUE can have positive transformative impacts on rural areas, the power to stem migration to cities, and the potential to diminish local poverty levels (e.g. Brady and Burton, 2017).

However, PUE are often not considered in planning off-grid rural electrification developments. There is in particular a lack of uptake of PUE activities in off-grid access projects across the African continent (e.g. Bhattacharyya and Palit, 2016; SVI, 2017b). This can be attributed to, amongst other things: a lack of capital; risky framework conditions; and a lack of clear policy guidelines available on the subject. There is also little understanding of the complexity of the political integration of PUE into wider energy policy. Understanding this is important as many relevant policy decisions are made outside of the energy sector. Practitioners and decision makers working in the energy sector thus reach limits regarding their capacity to encourage PUE through policy.

In this context, this secondment in collaboration with Practical Action (part of the Energy-PIECES project) explored the function of policy, and the limits of energy policy alone, to enhance PUE activities in low-resource settings in the Global South. This first involved a review of Social Sciences & Humanities (SSH) literature. This review of six SSH perspectives highlights the importance of better understanding: (i) the role of energy access for the marginalised (energy justice, energy poverty); (ii) stakeholder decision-making (User-Perceived Values, risk perception); and (iii) the influence of non-energy sectors (Social Practice Theories, 'non-energy' energy policy). Where applicable, examples of practical policy actions related to these six themes were also drawn out. The importance of non-energy energy policy (e.g. environmental policy to promote technologies required for decarbonisation) and relative lack of literature in this empirical context, meant it was chosen for further investigation. To do this, twenty policymakers and development practitioners were consulted by means of an online survey to understand which different government departments outside of energy have a role to play in the uptake of PUE, as well as specific policies that may be needed to enhance PUE effectively.

The findings from this consultation of experts, together with the earlier review, allowed the following actionable recommendations to be made, aimed at organisations working in policy-facing roles in low resource settings in the Global South to achieve the utilisation of PUE:

Actively integrate 'non-energy' energy policy (i.e. from other ministries) and energy policy.

Policy is a powerful tool for shaping the investment environment; for example it can reduce the potential risk for investors and drive systematic change. However energy policy alone is not sufficient to bring about the task of shifting the off-grid energy access landscape to account for PUE. To operationalise the rhetoric of PUE, the energy sector must integrate policy that is commonly located outside the sector, including and most importantly financial policy, agricultural policy and environmental policy. Refer to section 4 for a comprehensive summary on the topic of **non-energy energy policy**; and for relevant departments (and ministries), and policy areas refer to Table 1 (subsection 4.3).

Establish cross-departmental working groups that are not coordinated by a specific sector.

Working in sector silos often results in a failure to see the bigger picture, which is crucial for objectives that cut across many disciplines, such as the mainstreaming of PUE across policy areas. However key challenges of working across sectors are the coordination of action, assigning responsibility of outcomes, the lack of human capacity, and limited financial resources. To overcome this there is a requirement for high level political sponsorship, commitment, and coordination. This may be achieved through the creation of committees or overarching agencies to coordinate different governmental departments to develop a framework for collaborative action (i.e., establish a benchmark of what is required), and to be accountable for progress towards specific objectives. See subsection 4.4 for a review on working cross-departmentally.

Understand end-user decision-making to enable PUE which meet local needs.

The higher cost of PUE developments compared to basic levels of energy access (e.g. household lighting) is clear. Technology solutions which support PUE require additional capital investment relative to those which do

Figure 1: *Illustration of 'Productive Uses of Energy' – energy for the production of goods or services - in a Ghanaian local business.*

not, and projects are further dependent on uptake and utilisation of technology if they are to achieve economic viability. To achieve the necessary change it is essential to work to understand existing, context-specific, local community needs (including e.g. **User-Perceived Value** in subsection 3.3) and socially-carried patterns of behaviours (see subsection 3.5 on Social Practice Theories for literature on the social organisation of energy use). These assessments need to be undertaken in addition to traditional needs assessments.

PUE is not about energy access but about just community and market development.

The objective of rural off-grid energy access projects is to reduce local poverty levels and improve well-being. This requires the delivery of energy access projects that not only facilitate economic opportunities (i.e., PUE) but inclusively benefit all groups (and thus account for inequalities). Developers which better address local injustices and account for changing preferences and demand over time i.e. accommodate market development, are likely to experience higher demand for generated power and thus improve the economic viability of their project. Markets, when well-managed, can be a tool to incentivise the supply of power to the marginalised and thus reduce inequalities. For a more detailed account of **energy poverty** and **energy justice** literature see subsections 3.1 and 3.2 respectively.

Map risks and develop risk mitigation strategies.

To increase private sector participation in off-grid energy access projects, risks that inhibit engagement must be better understood and reduced. This includes actual risks (e.g. the risk of grid extension to project communities which would create stranded assets; or the lack of uptake resulting from low financial capacities of customers); perceived risk (e.g. subjective judgement); but also, the risk perception by other actors (e.g. users' behaviour; practices and measures currently undertaken and accepted; existing knowledge that influences utilisation). This area in relation to PUE needs further exploration. For more details on **risk perception** in general refer to subsection 3.3.

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Abbreviations	
AfDB	African Development Bank
CCREEE	Caribbean Centre for Renewable Energy and Energy Efficiency
CSAP	Centre for Science and Policy
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
Energy-PIECES	Energy Policy Insights from Early Career Events and Secondments
ERA	Electricity Regulatory Authority
ESKOM	Electricity Supply Commission
EWURA	Energy and Water Utilities Regulatory Authority
GIS	Global Sustainability Institute
GIZ	Deutsche Gesellschaft für Internationalle Zusammenarbeit
GSI	Global Subsidies Initiative
IDS	Institute of Development Studies
IPPs	Independent Power Producers
IRENA	International Renewable Energy
PUE	Productive Uses of Energy
RE	Renewable Energy
REA	Rural Electrification Agency
RISE	Regulatory Indicators for Sustainable Energy
RoR	Rate of Return
SDG	Sustainable Development Goals
SPT	Social Practice Theories
SSH	Social Sciences & Humanities
UEDCL	Uganda Electricity Distribution Company Limited
UEGCL	Uganda Electricity Generation Company Limited
UETCL	Uganda Electricity Transmission Company Limited
UNDP	United Nations Development Programme
UPV	User-Perceived Values

1. Introduction

Despite the increased attention drawn to energy poverty by Sustainable Development Goal 7 (SDG7) of achieving universal access by 2030, success in improving energy access for the bottom 15% of the global population (or 1 billion people) remains limited (IEA et al., 2018). Not only is there a basic lack of energy infrastructure, but where this infrastructure is installed it is rarely linked to Productive Uses of Energy (PUE[1]) - goods and services from irrigation, to welding and carpentry - in a systematic fashion. Off-grid energy access projects that facilitate PUE can have transformative impacts on rural villages. They can provide economic opportunities, improve health and education, and stem rural-to-urban migration (Kollanyi et al., 2018). However there has been little to no progress in transforming rural areas in this way—evidenced from the lack of change over the years (SVI, 2017b).

This lack of progress may be attributed to a number of issues, including, for example: a lack of integrated rural development (Urmee and Md, 2016; Energy4Impact and Insensus, 2018; IDS, 2018); the failure to account for project beneficiaries' needs (Hirmer and Guthrie, 2016); risky and unfavourable framework conditions for private developers (SVI, 2017b); and a lack of effective government policies and regulations that support off-grid development (Sovacool, 2015). From this it is clear that energy access in general, or the lack thereof, is often not primarily a technical problem but rather requires the examination of *political*, *social and economic* topics that are commonly investigated as part of Social Sciences & Humanities (SSH)[2]—discussed in detail in section 3.

Further, in the next decade the energy sector is likely to witness a considerable rise in the number of interventions that seek to deliver energy services to the rural poor in the Global South. While this momentum is gathering force, experience suggests that there are several areas in which improved policy might deliver significantly better results. This is exemplified by some progress in a small number of countries (e.g. Tanzania, Nigeria) that have developed specific policy for off-grid energy access projects, more specifically mini-grid developments (e.g. Sakellariou et al., 2016; Bisaga and Parikh, 2018).

1.1. Background to secondment with Practical Action

When formulating energy policy, traditionally the energy debate has had a technical underpinning (e.g. development of technologies for greater energy efficiency). This technical focus means that less energy research from a SSH perspective makes it into policy target and strategy formulation, despite this being a highly social and economic issue. Within this, there are even fewer opportunities and mechanisms for researchers at the start of their careers to engage with policy organisations and their agendas. In this context then, the Energy-PIECES (Energy Policy Insights from Early Career Events and Secondments) project was launched in 2018[3]. The project aimed to provide opportunities for PhD and Early-Career Researchers from energy-related SSH fields to get engaged in the energy policy debate. The project consists of two main activities aimed at this audience: a Masterclass in December 2018[4] and a set of six secondments with energy policy-facing organisations in 2019. This report is the output of one of those secondments[5].

The starting point of this secondment, hosted by Practical Action, was exploring inclusive off-grid energy access, including policy and regulatory options for improving the effectiveness of projects in developing countries. The findings from the Masterclass, where the secondment policy problems were discussed, in particular highlighted that the energy policy debate for off-grid energy access projects must, amongst other things, include: understanding and accounting for the poor; enhancing private sector engagement; and encouraging interlinks between national, regional and local governments. These, together with conversations with the secondment host, guided the identification and investigation of a number SSH perspectives relevant to the policy problem outlined in this report (section 3), including: the role of energy access for the marginalised (energy justice, energy poverty); stakeholder decision-making (User-Perceived Values, risk perception);

1 The following abbreviations for PUE are also in use: PUEN, PRODUSE, PROUSE.

2 Examples of SSH disciplines of relevance include political science (energy justice); psychology (decision-making); and sociology (value-theory).

3 The project is coordinated by Anglia Ruskin University's Global Sustainability Institute (GSI) with support from the University of Cambridge's Centre for Science and Policy (CSaP).

4 The masterclass for PhDs and Early-Career Researchers provided an initial understanding of how SSH can better connect with energy policy making and took place on the Monday 10 December 2018 in Cambridge.

5 Secondment #6, reported on in this report, was hosted by Practical Action with the aim of informing their strategic position on how to address energy policy to enhance PUE in low-income settings.

and the influence of and being influenced by non-energy sectors (Social Practice Theories, non-energy energy policy). Further, the preliminary discussions with the secondment host and energy practitioners helped to further refine the original topic to focus on Productive Uses of Energy in low-income settings in the Global South.

1.2. Structure of the report

This report is divided into four main chapters. **Section 2** provides the background context for this report and includes: off-grid energy from the perspective of Practical Action (subsection 2.1); a review of the importance of Productive Uses of Energy (subsection 2.2); the importance and role of the private sector (subsection 2.3); and an introduction to energy policy in the Global South (subsection 2.4). The section concludes with a brief outline on the policy problem of interest to us (subsection 2.5). **Section 3** then examines six different SSH perspectives relevant to the policy project investigated in this report, including: energy justice (subsection 3.1); energy poverty (subsection 3.2); User-Perceived Value (subsection 3.3); risk perception (subsection 3.4); Social Practice Theories (subsection 3.5); and non-energy energy policy (subsection 3.6). This chapter is complemented by an annotated bibliography which is included in Appendix I (**section 8**) for those wishing to explore the research literature in more detail. In **section 4**, the topic of non-energy energy policy for PUE is further investigated through consultation with experts; this helped identify the status quo of energy policy for off-grid energy (subsection 4.1), its limitations (subsection 4.2) and the relevance of non-energy energy policy for PUE (subsection 4.3). The benefits and hindrances of working cross-departmentally were also touched upon (subsection 4.4). **Section 5** has conclusions on the work including practical recommendations relevant to the policy problem.

2. Background context

2.1. Off-grid energy from the perspective of Practical Action

Within the Energy-PIECES project, this project was undertaken through a secondment with the organisation Practical Action[6]. Energy has been at the heart of Practical Action's work for 50 years. Their goal is to deliver sustainable energy access for poor people in developing countries. To shine a light on energy access from the perspectives of the poor, in 2010 Practical Action has launched the Poor People's Energy Outlook series (PPEO). Topics covered to date include: energy access for households (PPEO, 2010); energy for livelihoods (PPEO, 2012); energy for community facilities (PPEO, 2013); total energy access (PPEO, 2014); poor people's energy access priorities (PPEO, 2016); the energy access financing gap (PPEO, 2017); and scaling up inclusive energy access: levers of change (PPEO, 2018).

Practical Action manage complex, multi-disciplinary international projects across Africa, Asia, Latin America with a focus on decentralized and off-grid energy. This experience has shown that to develop sustainable energy solutions it is necessary to work across the areas of business, market development, technology, community, capacity, environment, enterprise and policy. Practical Action recognise that if there is a hope of achieving SDG7, the energy access community needs to reach beyond the standard 'siloed' solutions and to take a more nuanced and creative approach to the problem.

Practical Action was therefore keen to utilise this project to generate a preliminary evidence base around the limitations of the standard approaches to policy evident in most countries. In line with the objectives of Practical Action, this report provides actionable recommendations aimed at organisations working in policy-facing roles in low resource settings in the Global South to achieve the utilisation of PUE and thus make a meaningful contribution to human and economic conditions.

6 See secondment host website for details of their activites: https://practicalaction.org/

2.2. Importance of Productive Uses of Energy

It is widely acknowledged that Productive Uses of Energy (PUE) can generate employment, create opportunities, and subsequently reduce poverty (Scott et al., 2014; SVI, 2017b). Figure 2 offers a commonly adopted definition of PUE including three key PUE activities.

As highlighted by Arntsen and Flatlandsmo (2013, p. 5), "rural electrification projects, as a general rule, should not be taken forward if productive uses cannot be included". In addition to associated socio-economic benefits, PUE are commonly seen as a necessity for the long-term success of off-grid electrification installations (Carr, 2014). Evidence from Nepal (e.g. Brüderle et al., 2017) and Kenya (e.g. Best, 2016) suggests that projects that facilitate PUE are more likely to withstand project-related difficulties. One study investigating the impacts of small-scale electrification projects in India and Nepal via household and business surveys (Rao et al., 2016) found that "the more these systems can be encouraged to support a broader set of services, particularly productive uses, the greater the potential for off-grid systems to serve as a mechanism for rural development" (*ibid*, p. 6).

PUE can be defined as (Brüderle et al., 2011): "agricultural, commercial and industrial activities involving electricity services as a direct input to the production of goods or provision of services".

It can broken up into the following three activities including (Kollanyi et al., 2018):

- primary industries (e.g. agriculture, fishing, meat and dairy livestock, timber);
- light manufacturing (e.g. carpentry, welding, tailoring, ice making); and
- commercial and retail enterprises (e.g. phone charging businesses, groceries, hair salons, restaurants).

Figure 2: *Definition of productive uses of energy adopted in this report.*

Despite the aforementioned benefits, PUE are not sufficiently accounted for in most mini-grid developments (Bhattacharyya and Palit, 2016). One reason for this is that PUE come at additional cost and add complexity (Brüderle et al., 2017). Communities that would benefit from activities relating to PUE the most (i.e. the rural poor) are also those that lack the necessary hard and soft infrastructures (e.g. roads and business skills respectively), which thus makes development even harder. Therefore, it is not necessarily surprising that PUE have not received the required attention by governmental agencies and developers alike, and that projects for the rural poor aim for a lower level of energy access tier[7] (consisting mainly of lighting and mobile phone charging).

2.3. The role of the private sector

Globally, the cost of achieving universal access to electricity by 2030 is estimated to be around US$ 1,058–1,266 billion per year (UNDP and UN Environment, 2018). Nationally, this translates into an enormous effort for developing nations. Taking the example of Rwanda, the budget needed by its government to achieve its 2025 targets is US$ 3.1 billion in six years—the total annual governmental budget is US$ 2.8 billion (Yandereye, 2019). A more severe example of lack of funding can be seen in the case of Liberia. Here the funding required to implement their rural electrification strategy is US$935 million which dwarves the annual budget of US$189 million budget, resulting in a funding gap of US$ 746 million (SVI, 2017a). Not only are public funds insufficient, the conditions in which this extension of the electricity grid to rural areas need to take place - e.g. remoteness, low population densities, low economic activity and uncertain demand - are unfavourable (Safdar, 2017). Therefore, it is no surprise that government agencies focus on low-hanging fruits, such as grid extensions to semi/peri-urban areas.

In light of this, there is arguably a need to increase private sector engagement and to secure private funding. One way of achieving this is by creating an environment that makes investing attractive to the private sector by means of policy (which will include both energy policy and non-energy energy, e.g. fiscal, policy). Many potential mechanisms exist - including subsidies, taxation etc. - but also clear rules and regulations are essential so that investors can calculate the rate of return (RoR) of investments with a reasonable degree of confidence, for example. In this report therefore, our SSH review included consideration of research which may help inform strategies for encouraging private sector engagement. Examining, for example, risk perception (subsection 3.3) or how social structures influence uptake (subsection 3.5: Social Practice Theories) may help policy makers create the right conditions for private development.

7 The multi-tier framework captures energy access across four tiers that define the level of energy access (ESMAP et al., 2013).

2.4. Energy policy context of the Global South

To better understand the overall context, energy policy in the Global South is discussed generally in subsection 2.4.1. Focussing in, a review of off-grid energy policy follows this in subsection 2.4.2.

2.4.1. Energy policy

There is a considerable amount of literature that focuses on energy policy in the Global South (e.g. Sovacool and Dworkin, 2015; Dornan and Shah, 2016; Surroop et al., 2018), whereby energy access is predominantly seen through a national energy lens. This literature often reflects how electricity generation and distribution (e.g. grid extension), energy efficiency, GHG emission reduction, and renewable energy are at the core of the policy discussion (e.g. Javadi et al., 2013). This policy focus on technological (rather than e.g. social) aspects is often not surprising given the way funding and evaluation frameworks are constructed. Renewable Energy (RE) for example has received the largest bulk of development assistance funding in the energy sector, and policy advice and reform are commonly part of this funding 'package' (Dornan and Shah, 2016). The Regulatory Indicators for Sustainable Energy (RISE) framework, which measures country specific progress, has three key areas: modern energy, Energy Efficiency (EE), and RE (World Bank Group, 2017). As just one example, Nepalese energy policy discussion thus centres around the size, quality, and physical conditions of solar panels and hydro turbines (e.g. Islar et al., 2017).

Common foci for national and regional targets relate to licensing, tariff regulation, risks related to main-grid arrival, and access to finance (IRENA, 2016). These targets are commonly implemented and overseen by Ministries of Energy[8] and their regional/local counterparts. This work may also be guided by regional institutions, such as the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) in West Africa or the equivalent in the Caribbean (known as CCREEE), and International Renewable Energy Agency (IRENA) (e.g. Sakellariou et al., 2016). They help set targets for the region which are then translated into national policies.

8 The name of the ministries that deal with energy varies by country. The ministry is the top governmental department managing a specific sector and may have multiple sector institutions. For example, in the case of Uganda there are seven different institutions that oversee different aspects of the energy sector including ERA, UEGCL, ESKOM, UETCL, UEDCL, Umeme Ltd. and REA.

2.4.2. Off-grid energy policy

Shifting the focus now from national energy policy to off-grid energy specifically, we note that according to the African Development Bank there are five essential elements needed to create an enabling environment which is attractive to potential private developers (SEforALL, 2017): (1) clear regulations, such as simple licensing procedures; (2) detailed national grid expansion strategies; (3) laws for cost-reflective tariffs; (4) integrated energy planning; and (5) local capacity in the sector. However, these elements are often not present. For example, in respect to the third of these, national tariff structures are not always appropriate for decentralised energy access as seen in the case of Cape Verde. Here, the national grid tariff structure was simply transferred to mini-grid developments which failed to cover the capital investment (SVI, 2017a). To overcome this, the government may look to put cross-subsidies in place where the tariffs are not able to cover the electricity production cost of the mini-grid operator (*ibid*). In addition to the five elements, to make private sector investment more attractive, the institutional settings, energy markets and pricing policies may need to be improved (Rao et al., 2016).

Policy frameworks help ensure that the private sector can effectively complement government and development organisation initiatives (SVI, 2017b). If adequate policies are not in place developers are able to "just get on with it", as was seen in the case of Kenya (Best, 2016, p. 9) with little consideration of what is important or needed. While many governments advocate decentralised energy, they have not put in place the necessary policies, regulations, and initiatives to deliver it (Taylor et al., 2015) and offer "few positive incentives that support standalone energy access projects" (Best, 2016, p. 9).

2.5. Policy problem of interest

The limitations of off-grid energy policy, together with the limitations of energy policy more generally, as discussed above means that PUE are very often not incorporated, or not incorporated successfully, into projects. Our 'policy problem' for this report is thus how to address the current lack of adequate policy for off-grid energy projects that enhance PUE in a manner that improves human and economic conditions within complex, resource-constrained settings.

3. Social Sciences and Humanities perspectives on off-grid energy access

This section of the report explores SSH literature of relevance to the policy problem outlined above. This is not to say that non-SSH disciplines - such as natural and physical sciences, health sciences or technology - are unimportant but that in order to better understand the policy problem at hand, a cross-discipline assessment of the available literature has to be taken, and to date SSH has often been neglected. This is particularly important for complex societal issues such as the one studied here (EC, 2018). An annotated bibliography complementing this section is included in Appendix I.

From the Masterclass conducted in December 2018 - which formed the starting point for this secondment with Practical Action - a number of topics emerged which can be organised in the following three themes: (1) understanding and accounting for the poor; (2) enhancing private sector engagement; and (3) encouraging interlinks between national, regional and local governments. These guided the selection of a number of areas of SSH research relevant to the policy problem outlined in this report which are summarised in Figure 3 and are then discussed in detail in each subsection. Note these SSH perspectives do not present a comprehensive list, there are others (e.g. behavioural economics; systems thinking; memory structures; transformation management) which may be relevant. However these areas were prioritised through both the Masterclass and conversations with the secondment host and aim to give readers who might want to know more about a diversity of relevant SSH research approaches a number of 'starting points'.

At the end of each SSH subsection practical policy actions that are relevant for providing an enabling environment to enhance private sector engagement, and are based on the research reviewed, are clearly stated[9]. An exception is 'non-energy energy policy' (subsection 3.6), which is explored in more detail in section 4 through a new study which aimed to address the lack of knowledge of the topic in this specific context.

Key Social Science and Humanities (SSH) perspectives on 'Policy options for enhancing Productive Uses of Energy in low-resource settings in the Global South', that emerged from the Energy-PIECES masterclass with SSH early career researchers and discussions with Practical Action:

The role of energy access for the marginalised

3.1. **Energy justice**: to understand existing imbalances of marginalised groups in energy related decision-making.

3.2. **Energy poverty**: to understand the link between energy and socio-economic development, wellbeing and quality of life.

Stakeholder decision-making

3.3. **User-Perceived Values**: to understand what drives and motivates rural communities and its integration into project planning.

3.4. **Risk perception**: to understand the subjective judgement that people make about the characteristics and severity of risk.

The influence of and being influenced by non-energy sectors

3.5. **Social Practice Theories**: to understand how infrastructures, meanings and knowledges combine to influence socially accepted ways of doing things.

3.6. **Non-energy energy policy**: to understand the relevance of policies outside of the energy sector on energy policy.

Figure 3: *Key SSH perspectives for achieving inclusive rural electrification by means of mini-grids in developing countries.*

9 The practical policy examples given at the end of each SSH perspective are not exclusive to one perspective; they may appear in more than one section.

3.1. Energy justice

Energy justice emerged as a distinct research field around 2013[10] and aims to address existing imbalances of marginalised groups in energy related decision-making (Jenkins et al., 2018). A comprehensive definition of energy justice has been given by Joroff (2017, p. 27):

> "*Energy justice is based on the principle that all people should have a reliable, safe, and affordable source of energy; protection from a disproportionate share of costs or negative impacts or externalities associated with building, operating, and maintaining electric power generation, transmission, and distribution systems; and equitable distribution of and access to benefits from such systems.*"

The idea of a just society through an equal distribution of resources is, of course, not a new one. In the 1860s Mill (1871) advocated for decision makers to build communities and programs based on common goods that would benefit all. Over time, the ideas of a just society, as advocated by Mill, have evolved and been applied to fields such as environmental justice[11], which energy justice is commonly seen to build on. Energy justice is often viewed through the lens of three philosophical groundings: distributional (where are the injustices?), recognition-based (who is ignored?) and procedural justice (is there fair process?) (Jenkins et al., 2016). Sovacool and Dworkin (2015) offer additionally eight guiding principles important to the promotion of energy justice (listed in order of the increasing complexity or controversy of each application): availability, affordability, due process, good governance, sustainability, intragenerational equity, intergenerational equity and responsibility.

As a burgeoning field, energy justice is still undergoing discussion, but it is clear that energy justice is relevant to energy access for PUE in rural areas in the Global South. To date, 45% of the global population is rural and 70% of these live in poverty[12] (United Nations, Department of Economic and Social Affairs, 2014). Marginalised groups, such as women or the rural poor, are impacted the most by a lack of energy access (van Gevelt et al., 2018). Poor households spend as much as 14-22% of their income on energy (Westphal et al., 2017). Proponents of energy justice argue that in order to have a just society, the capabilities of varying user groups need to be accounted for and energy sources fairly distributed. Taking account of some of the different principles of energy justice outlined above, a number of key practical policy actions applicable to the policy problem discussed in this report, together with specific policy examples, were identified as follows:

- **Remove the burden of energy cost on low-income households.** This could be achieved by use of an appropriate tariff structure. An example of a tariff structure that is particularly favourable for poorer households that cannot pay cost-reflectively is a lifeline tariff. Here, richer consumers cross subsidise the tariffs for poorer households (Tenenbaum et al., 2014).

- **Avoid disproportionate distribution of access and costs.** This could be achieved through better power planning (i.e. planning for future demand). Such planning needs to be mindful of the needs of different socio-economic groups and this is discussed below further as part of 3.3: User-Perceived Values. It can help to identify future electricity demand, allowing a country to better understand least-cost supply options for an area, including time of procurement and construction and finance requirements (Ondraczek, 2014).

3.2. Energy poverty

Energy access is believed to be an essential need or right that should be provided for (e.g. Owoeye, 2016). It is seen as crucial to the development and wellbeing of communities (SVI, 2017b). The lack of this can, therefore, be considered a form of deprivation that must be addressed (e.g. Owoeye, 2016). **Energy poverty**[13] may be defined as a lack of access to modern energy services (Sovacool, 2012). Those who don't have access to modern energy services consume dirtier and polluted fuels. They also spend more time collecting said fuels. Energy poverty research is thus concerned with the link between energy and socio-economic development, wellbeing and quality of life (Day et al., 2016). There are many different ways in which energy poverty can be measured—e.g. Pachauri and Spreng (2011) give a detailed account of different ways on measuring and monitoring energy poverty. However, most commonly, energy poverty is taken as being measured via *access to modern energy sources* (e.g. electricity, energy-efficient cookstoves, etc.). This approach assumes that with increased access to modern fuels, as portrayed in the 'energy ladder'[14], there will be a knock on effect of higher levels of consumption, reduced exposure to dirty fumes and less time spent collecting fuels (e.g. firewood). However, Day et al. (2016, p. 256) raise concerns over this simplistic view of energy poverty:

> "*energy poverty in more developed regions can be seen as serving to sustain if not increase levels of energy consumption, thereby conflicting with the global need for a reduction in energy use and associated carbon emissions; whilst global objectives for restricting energy consumption can, in parallel, be*

10 It was a term coined by McCauley et al. (2013) in their inaugural paper—although the concept appears earlier under terms such as 'energy and justice' (Cowell et al., 2012).

11 Environmental justice was formally acknowledged as a distinct field in the 1980s (Gonzalez, 2013). It builds on the ideas put forward by people such as Carson (Carson, 1962).

12 Poverty is defined as living on US$ 2.5 a day or under; extreme poverty as US$ 1.25/day (Sumner, 2012).

13 Energy poverty should not be confused with fuel poverty which refers solely to affordability (Okushima, 2017).

14 The energy ladder describes the linear move 'up' the ladder to a higher level of consumption based on the economic status of a household (van der Kroon et al., 2013).

seen as in conflict with the needs of much of the Global South to extend energy infrastructures and access to energy services".

Therefore, they propose viewing energy poverty via a **capabilities approach**[15]. The capabilities approach is a concept or framework which is used in economics and management science that is concerned with economic welfare and more specifically what individuals are capable of doing (Sen, 1986; Nussbaum, 2003). Sen (1986), in particular, recognised that people have different capacities to utilise resources, depending on their social, personal and locational arrangements. By using the capabilities approach, instead of measuring energy poverty by means of access to modern energy sources or the amount of energy produced, energy poverty can be viewed in terms of what is actually usefully delivered to households (Day et al., 2016). Therefore, the capabilities approach can help to better understand the relationship between energy consumption, energy services and what energy services enable or produce (*ibid*).

Currently, a billion people do not have access to modern forms of energy and three billion cook on dirty stoves (van Gevelt et al., 2018); the majority of these people live in rural areas (*ibid*). In order to change the circumstances of people living in rural areas when implementing off-grid projects, addressing energy poverty is crucial. Energy poverty considerations can go beyond mere energy access to include the level of consumption, fuel-cleanliness and time spent on sourcing fuel (Day et al., 2016). Taking account of this, the following practical policy actions were identified from literature:

- **Reliable delivery of a service or the function of a service.** This could be achieved by means of quality assurance of energy products. As described by Bugatti (ECREEE), "the market is filled with all sorts of different products, many of which are sub-quality and prone to failure, which destroys the reputation of the market" (SVI, 2017a, p. 30).

- **Better management of subsidies across different energy sources.** *Subsidies* for fossil fuels, such as those used for powering generators or kerosene lanterns, can act as an impediment for the use or consideration of modern energy sources which remain largely unsubsidised today. Therefore, to create an equal playing field, subsidies on fossil fuels should be removed or subsidies for the use of modern energy sources (e.g. solar, energy-efficient stoves, etc.) should be introduced (Bridle et al., 2018)[16].

3.3. User-Perceived Values

The concept of **User-Perceived Values** (UPV) emerged as a distinct theory in 2014 in direct response to the need for delivering energy services that create value to the rural poor who are hampered by limited financial means (Hirmer and Cruickshank, 2014). Understanding UPV is important as the aforementioned lack of financial means makes the rural poor particularly good at assessing risk and value, and this subsequently affects the uptake and utilisation of products or services (Hirji, 2015). UPV may be defined as: "the benefits, concerns, feelings and underlying drivers that vary in importance and act as the main motivators in the lives of the people—as perceived and defined by the beneficiaries themselves at a given time" (Hirmer, 2017, p. 45). Hirmer and Guthrie (2016) propose UPV as an approach complementary to traditional needs assessments to assess the values and needs of beneficiaries and integrate this into policy decision-making and planning processes.

Value-theory, on which UPV builds, is not a new concept (Baudrillard, 1998; Graeber, 2001; Woodall, 2003; Hitlin and Piliavin, 2004). It is a theory with common application in marketing and product design in the West and with recent, but limited, application to energy products for low-resource settings in the Global South, such as solar lantern design and biomass stoves (e.g. Schlag and Zuzarte, 2008; Cordes, 2011). According to Baudrillard (1998) and later Woodall (Woodall, 2003) there are four common value strands that influence the decision-making of consumers: value in use (determined from practical use); value in experience (perceived by customers); value in exchange (the perceived worth); value in sign (prestige or social status).

Integrating decision-making factors (by means of understanding UPV) into planning processes is important, as to date developments are often criticised for a lack of engagement and integration with local communities (e.g. Burnside-Lawry and Carvalho, 2015). Despite recent emphasis on bottom-up planning as key to success, the views of benefiting communities are rarely accounted for (e.g. Brand-Correa et al., 2018)—design takes place from the top-down. Therefore, to ensure that project developers better account for what is important to communities in project design there is a need to integrate mechanisms to elicit and incorporate community viewpoints into policies.

- We are not aware of any existing policy in the energy sector that would achieve this. Therefore, there is a need to look at other sectors for guidance. An example may be in the case of natural resource extraction where prior informed consent from varying stakeholder groups is required and there are relevant policies to ensure enforcement.

15 Inaugurated by Sen (1986) and later further developed by Nussbaum (2003). Although, some aspects of the capability approach can be traced back even further to Aristotle, Adam Smith, and Karl for example (Byskov, 2017).

16 For resources and information on subsidies refer to the Global Subsidies Initiative (GSI).

3.4. Risk perception

From subsection 2.3, it is clear that increasing private sector engagement is an important part of achieving SDG7. Governments have not managed to catalyse on private sector investment for off-grid energy access in the Global South to date. There are many reasons for this, and risk factors for investment include: high capital costs of projects (Rønneberg, 2018); the threat posed by national grid extension (Ahlborg and Hammar, 2014); and low financial capacities of customers (Yaqoot et al., 2016). These make RoR difficult or impossible to predict with accuracy. Therefore, in order to engage the private sector more effectively in off-grid energy access, **risk perception** must be better understood and risks reduced.

In recent years, risk perception has been identified as an important influencer on the decision making of key stakeholder groups (e.g. experts, politicians or beneficiaries, investors), particularly in complex environments (e.g. low-resources settings)—as is the subject of this report. According to Sjöberg and Moen (2004), risk perception emerged in policy as an important concept in the 1960s. Risk perception may be defined as "the subjective judgement that people make about the characteristics and severity of a risk" (Brighetti et al., 2010, p. 133). It is complementary to traditional risk assessments, which only considers likelihood and impact, whereas risk perception considers different levels of risks as perceived on the individual level. Some relevant factors that may influence or mediate risk perception include: voluntariness of the exposure; control over exposure or remedy; experience with the risk; and the cultural background, professional background or world view a person has. It is, therefore, not surprising that each person will perceive risk differently, and risk is difficult to measure or aggregate (Renn and Rohrmann, 2000).

This can be illustrated through the practical example of a drought. Modelling of the extent and likelihood of a drought will provide hard information regarding the environment and likely future events, e.g. intensity, duration, severity and spatial extent (Mishra and Singh, 2011). In contrast, risk perception provides a deeper insight into people's behaviour, for example: the villagers' existing knowledge of drought management; practices and measures currently undertaken and accepted; and relevance of drought risk in comparison to other risks. This provides valuable insight to project developers as to how beneficiaries may react to certain events that can impact a project[17].

The diversity in perceptions between different stakeholder groups brings about a challenge to the design of infrastructure projects. In the case of energy access this may include the promotion of alternative technological approaches, for example. Such new approaches have to be supported by a wide range of actors. Infrastructure projects are characterised by path dependencies; thus, different inhibiting factors must be overcome in order to transform projects, or as Kerber et al. (2016) phrased it, are inhibited through certain 'transformation risks'. These include market insecurity, economic uncertainty, cost risks, missing institutional arrangements, financial constraints, organisational rigidity, regulatory risks and acceptance risks. In order to promote change, financial support must be enabled, but far more important is adequate cooperation between stakeholders, in particular government policy makers and the private sector.

In light of this, there are a number of actions that governments can take by means of policy to reduce the perceived risk of the private sector in making off-grid energy access investment decisions. Three key practical policy actions found in literature are given below:

- **Reduce the threat posed by national grid developments.** Establish *dedicated mini-grid zones* that are explicitly allocated to mini-grid developers in order to lower the perceived risk of possible grid extensions in the area where developments take place and compromising investment (SVI, 2017a).

- **Reduce the costs for rural developments** and ergo reduce investment risk. Introduce import duty exemption on equipment and machinery for renewable energy generation. There has been some practical progress on this in Ghana by the Ministry of Trade and Industry, for example. There, with the aim of increasing private sector engagement, the Ministry of Trade and Industry introduced an import duty exemption for solar panels and reduced or zero-rated import tariffs for equipment and machinery for renewable energy generation (SVI, 2017a).

- **Reduce the level of bureaucracy, improve current unstructured processes and address the lack of guidelines.** The lack of inadequate policy is a problem that was observed over a decade ago and has not changed significantly since. As stated by Gratwick and Eberhard (2008, p. 3958): "the power sector of most developing countries is a confused and contested policy and institutional space". This makes investment difficult and risky (Taylor et al., 2015) and discourages investments for rural off-grid developments in the volumes required. To address this, there is a need for increasing *the quality of regulatory authority*. While many countries have started to have a regulatory authority (e.g. the Electricity Regulatory Authority in Uganda) to ease processes, Eberhard et al. (2017, p. 393) point out that "merely having a regulator is [...] not sufficient; rather, it is the quality of regulation produced [...] that is critical for attracting private investment". However, even high quality regulation amounts to little if implementation is not effective and transparency weak.

17 Albeit briefly mentioned here, beneficiaries' risk perception is not the main subject of this SSH review. For research on the topic, refer to, for example: Oltedal et al. (2004); Brown (2014); Barclay et al. (2016); Paek and Hove (2017); Stewart et al. (2017).

3.5. Social Practice Theories

Social Practice Theories (SPT) developed broadly from the field of sociology and have been particularly applied in recent years to efforts to achieve a sustainable, just and equitable future through the rapid transformation of production and consumption systems by means of understanding social action (Stephenson, 2018). They build on social theory which emphasises the role of people and social structure within (e.g. energy) systems and that neither the social or the technical element can be considered in isolation, as they have intertwined objectives and trajectories and instead must be considered as one. Given its diversity, it is very difficult to accurately define social theory especially given it is a constantly evolving field.

SPT (or practice theories) however diverge from some other social theories as they shift the focus away from individual people/actions (individual motivations, drivers and capabilities: i.e., micro-economic level) and commodities (macro-economic level). They instead consider the make-up and evolution of practices themselves (routinized sets of behaviours undertaken across segments of society, such as cooking or washing practices), looking at micro-/macro-economic factors together as influencers to practice (Hooloham et al., 2018). Practices are sometimes described as 'meso-level', the "relationship(s) that obtain between human action, on the one hand, and some global entity which we call 'the system' on the other" (Ortner, 1984, p. 148). Further, individuals are considered as 'carriers' of a practice, thus explicitly shifting central focus from individuals to practices. According to Hess et al. (2018) there are three key elements that influence practice: (i) the meaning element of practice (norms, values and wants); (ii) the competence element of practice (knowledge of how to do the practice and self-efficacy); and (iii) the material element of practice (the infrastructure the practice requires to perform). Galvin (2017) identifies four different streams of SPT (hence common reference to their being several 'theories'): critical realism; scientific realism; morphogenic realism; and Schatzkian practice theory. The latter has been most commonly applied to energy use and defines social practices as a habitual form of behaviour (Galvin and Sunikka-Blank, 2016). For a detailed account on the origin of SPT refer to Wilhite (2014) for example.

In the past, application of SPT to energy use has mostly been limited to industrialised societies and sustainable levels of resource consumption, including, for example, problematic peak electricity demand patterns (e.g. Strengers, 2012); the uptake of energy efficiency measures (e.g. Hess et al., 2018); and electricity use through 'homely' household practices in middle income households in Pakistan (Khalid and Sunikka-Blank, 2017).

Another closely linked theory is that of **sustainability cultures**. Instead of focusing on practices as the main unit of analysis, its focus is on cultural formations and their relations to sustainability outcomes (Stephenson, 2018). It seeks to understand "the beliefs and values of social groups, but also their language, forms of knowledge, and common sense, as well as the material products, interactional practices and ways of life established by these" (*ibid*, p.246). Sustainability cultures builds on cultural theory which seeks to explain and understand actions through symbolic and cognitive structures of meaning (*ibid*).

Learning from the above, policy resulting from SPT needs to consider all elements of a practice as it is enacted in society, rather than just focussing on e.g. changing the material elements and expecting change to follow. This includes for example, considering what practices are enabling and thus the meanings they hold (e.g. family relations), the know-how people in those communities develop and the wider economic structures by which they are bound. Spurling et al. (2013, p. 46) put forward the notion that in order to change practice, infrastructure or technology can help to "make new practices possible" (i.e., change existing practices). However, the authors also highlight that technological interventions alone are not sufficient to change trajectories of practice, particularly in the case of one-off interventions that try to completely subvert trajectories of practice.

When thinking about the evolution of rural-to-urban migration from an SPT perspective, one might therefore consider the meanings associated with such migration, such as a promotion of migration as entrepreneurial, a need for status and expectations around jobs. By putting the opportunities in place in rural areas (e.g. through PUE) focus of the practice is shifting slightly, this in turn may lead to a major change in behaviour.

We are not aware of any examples whereby SPT is applied to energy access in low resource settings in the Global South. An example of a practical policy action that would draw on such theories and is relevant to the policy problem studied in this report is given below:

- When designing policy initiatives for PUE in rural settings, **consider carefully the diverse set of *practices* that energy provision may interlink with**. Consider what other non-technological measures may be needed (changes in meanings of staying in rural setting through e.g. community leadership, upskilling of know-how to develop jobs locally) for this to relate to (or potentially compete with) the practices enabled by urban infrastructures. Simply increasing energy access is unlikely to have a direct, linear impact on rural-to-urban migration levels.

3.6. Non-energy energy policy

Conventionally, policy discussion takes place within a specific sector, such as energy, water and sanitation, or transport (Selby and Royston, 2017). A number of researchers now contend that rather than looking at energy developments through an energy sector lens alone, it might be more useful to look at it through the lens of other sectors outside of energy (Maulidia et al., 2019). This may be referred to as **non-energy energy**

policy[18]. This is important as an assessment of more than 22,000 'energy' publications highlighted the interdisciplinary nature of energy literature, which appears in over 25 academic fields (Marra et al., 2018). The authors state that "[by] looking at energy policies designed and implemented throughout the world, it is clear that energy challenges today and in the coming years will require the adoption of efforts across a range of different fields, approaches and technologies" (*ibid*, p. 242). This is not surprising as energy is central to growth, economic activity and wellbeing more generally, and therefore departmental overlaps are inevitable (SVI, 2017b).

There have been a number of recent studies that focused on the role of policy that traditionally might not be characterised as energy policy. Cox et al. (2016), for example, undertook a sector-by-sector review on the impact of non-energy policies on the energy system by looking at policy across thirteen non-energy sectors, including international trade policy, economic policy and health policy[19]. Others, in contrast, examined non-energy policy's impact on energy demand patterns in the UK (Selby and Royston, 2017; Butler et al., 2018) and energy efficiency measures (Cagno et al., 2019).

The importance of energy to other sectors - and therefore the interlinks that exist - has been acknowledged by researchers focusing on off-grid energy access in low-resource settings in the Global South. A number of recent studies highlighted the importance of integrating SDG7 with other sectors and goals (e.g. Fuso Nerini et al., 2018; McCollum et al., 2018). Despite this recent interest in sectoral integration, this thinking has not yet explicitly extended to policy—a gap further discussed in section 4. The consideration of other sectors is particularly important as "policymakers and development practitioners working on off-grid energy access reach a limit regarding how to incentivise economic activities in the sector"[20].

Although research is limited, there have been some studies that implicitly link energy policy to market development[21]. Bhattacharyya and Palit (2016), for example, in their assessment of off-grid electrification, offer goal-oriented policy recommendations for an enabling policy environment. Their recommendations include financing, pricing, technology use, transfer, labour and land use. Another study on the renewable energy policy in Indonesia looked at the wider need for coordination amongst governmental departments to encourage private sector finance (Maulidia et al., 2019). The following national governmental departments and policy guidelines outside of, but relevant for, the energy sector in Indonesia were identified by the authors: Ministry of Finance (subsidies, loans and government equity); Ministry of National Development Planning (development planning); Ministry of Home Affairs (coordination, guidance and oversight).

- Due to the preliminary nature of research in the area, and its relevance to the practical policy recommendations resulting from other SSH perspectives, this topic of non-energy energy policy was chosen to be explored in more detail in section 4.

3.7. Summary SSH perspective

The review of six SSH perspectives highlights the importance of better understanding: the role of energy access for the marginalised (energy justice, energy poverty); stakeholder decision-making (User-Perceived Values, risk perception); and the influence of and being influenced by non-energy sectors (Social Practice Theories, non-energy energy policy). Additionally, most of the SSH perspectives were accompanied by examples of practical policy actions. This further enunciated that research on the impacts of non-energy energy policy are somewhat cross-cutting in the sense that practical policy resulting from the other SSH perspectives may include non-energy sector specific elements. To better understand this, non-energy energy policy is further investigated next through a small-scale study.

18 Synonyms for non-energy policy may also include invisible energy policy or beyond energy policy.

19 Other sectors included communications and media policy; culture and sport policy; defence, military and foreign policy; education policy; international development and overseas aid policy; industrial, business and innovation policy; non-energy-related environmental policy (e.g. air pollution, water and forestry); planning, building and construction policy; and work, welfare, population and equality policy (Cox et al., 2016).

20 Renewable Energy Expert at GIZ, personal communication, 28-Jan-19.

21 To elaborate on how the enabling policy environment is linked to market development: in the real world (as distinct from notions of 'free markets' which in practice do not exist) the functioning of markets is multi-dimensional.

4. Understanding non-energy energy policy

In the case of this study, policy is taken as referring to "a course or principle of action adopted or proposed by an organisation or individual" (OED, n. d., 'policy') and includes frameworks, guidelines, incentives legislation, policy and other public policy techniques. Government policies may thus cover: regulations for health and safety; codes of practice and tax impositions; financial measures and incentives for capital grants, operating grants, soft loans, tax credits and private sector investment; guidance for technology transfer and capacity building; and specialist training, promotion and education (Safdar and Heap, 2016).

Non-energy energy policy is particularly important for off-grid energy access that seeks to cater for productive activities in low-resource settings in the Global South. To capture a range of views on which departments (e.g. agriculture, industry, trade, etc.) and, importantly, specific policies are most relevant to enhance PUE, an online survey with experts was conducted (see Appendix II for the survey). The survey was informed by the research need (section 2), an identified gap in the research literature (subsection 3.6) as well as the importance of non-energy policy for policy relevant to other SSH perspectives (section 3).

The survey centred around four key research questions, shown in Figure 4.

Aim: to better understand 'the limits of energy policy and the opportunities of non-energy policy to enhance productive uses of energy', a topic that emerged from the analysis of the different SSH perspectives.

To close the knowledge gap, the following questions were further investigated by means of expert surveys:

1. What energy policy can enhance PUE?
2. What are the current limitations within energy policy that prohibit the enhancement of PUE?
3. Which non-energy governemental departments and policies can enhance PUE?
4. What is the biggest hinderance to working across different governamental departments to enhance PUE through policy?

***Figure 4**: Topics of investigation by means of expert surveys.*

The following selection criteria were applied. The experts needed: a minimum of two years of work experience in low-resource settings in the Global South; to have been exposed to or worked on energy policy; be an energy project developer, policymaker or practitioner; and work in an area related to the Sustainable Development Goals. Initial expert selection was from the personal contacts of the researchers and the secondment host (Practical Action) as well as through targeted outreach to experts that meet the specified criteria—these experts primarily consisted of academics and experts identified during the literature review but also included experts from the researchers' LinkedIn network. During March and April 2019, a total of 20 experts took part in the online survey.

The results for each of the research questions were coded and a number of key themes emerged. The findings from the survey are discussed with reference to the research questions (Figure 4).

4.1. Energy policy

Initially experts were asked to identify **policies that can be introduced within the energy sector in order to enhance PUE** (Figure 4: research question 1). Ten key themes emerged and are listed below in alphabetical order. Note, many of the themes discussed in conjunction with energy policy, such as capacity building, empowerment of end-user, and incentives, are not exclusive to the energy sector and are also discussed across other sectors, such as education, rural development and finance, in subsection 4.3 (non-energy energy policy).

- **Deregulation:** the introduction of policies that deregulate sale and purchase of electricity. Deregulation is of particular importance to independent power producers (IPPs) and distributed generation companies as they have a disproportionate interest to deregulate to make market access easier (at least in the short run). A possible but not guaranteed outcome may allow market players to meet demand (including suppressed demand), ensure service quality and unlock business models around captive power (embedded generation), peer to peer trading, and storage.

- **Energy-user empowerment:** the introduction of policies and measures that encourage energy

consumers[22] to engage more actively in the energy/electricity market through activities like using electricity for productive uses, participating in the generation of energy (e.g. for self-consumption), providing services (e.g. electrical installations, monitoring and upkeep of energy assets), and even adopting simple forms of demand response (e.g. turning off appliances when necessary). The need for this, and lack of, was also mentioned in subsection 3.3: User-Perceived Value.

- **Energy planning procedures:** the adoption of clear energy planning procedures at national, regional and local level in order to accommodate off-grid energy access projects alongside projects relating to the national grid. Also important here is the need to plan for future changes in demand (i.e. decreases[23] or increases) and account for this in planning processes by building systems that can be easily adapted to said future changes.

- **Incentives:** the introduction of policies that incentivise the connection or specific use of larger or multiple loads (appliances, machinery) to off-grid systems. Incentives can be financial or non-financial (e.g. recognition, food vouchers, gift cards).

- **Licensing:** the introduction of clear licensing policies. This is particularly important to foster private developers such as IPPs and to help bring the private sector into remote areas and guarantee investments. The importance of this was discussed as part of subsection 3.4: risk perception.

- **Mandate PUE:** the introduction of policies that regulate rural service delivery for PUE and mandate local governments to include the promotion of PUE as part of the electricity code or renewable energy law. This will foster the inclusion of PUE at the beginning of project planning (also see minimum standard of service discussed as part of 3.1: energy justice).

- **Piloting of technologies & business models:** the introduction of policies and programmes to encourage and accommodate field testing in the form of piloting of technologies and business models. At present there is a lack of evidence needed to make a compelling business case to end-users, NGOs, aid agencies and governments for public investment, scale-up and adoption. Piloting will foster a better understanding of the economics of adoption (end-user behaviour) and other related dynamics (relevant here 3.5: Social Practice Theories).

- **Quality assurance:** the provision of policies for quality assurance (see also subsection 3.2: energy poverty). Minimum quality standard can be set for specific technologies (including machinery and equipment) and/or projects as well as their operation and performance.

- **Tariffs:** the introduction of regulations on setting, review, and coverage of tariffs for electricity or energy services more broadly. (see also subsection 3.1: energy justice). Tariff regulations can give the private sector clarity on potential returns from projects and help in their decision-making on whether or not to enter the market. Tariffs should be set in a way that encourages PUE.

- **Training & capacity building:** the introduction of incentives, programmes and policies to encourage and accommodate capacity building of various stakeholder groups (e.g. governmental officials, project developers, local entrepreneurs and end-users). This includes building capacities of electricity consumers (end-users and enterprises); providing advisory services for both local entrepreneurs and project developers; and devising policies to support the broader entrepreneurship in off-grid areas (e.g. training, linkages to funding, markets, etc.).

4.2. Limitations of energy policy

Experts were then asked to identify the **limits of energy policy to enhance PUE** (Figure 4: research question 2). From the survey two key themes emerged, and these are detailed below:

- **PUE is not primarily about energy access but about market development:** while the basic level of electricity access is important (tier 1 and tier 2), it is not sufficient for PUE activities to thrive, as one expert commented "productive use is about people using energy, not energy itself". PUE must be linked to market development which is not considered in current policies. This may be attributed to the fact that the sector is focused on energy provision (supply side) and not on the end-user (demand side). However, as another expert comprehensively outlines: "whether or not economic activities emerge is dependent on the level of education, exposure to markets, quality of roads, communication infrastructure, level of purchasing power of the local population, level of bureaucratic hurdles to be overcome by private entrepreneurs, etc." This requires a clear shift in mindset of practitioners (e.g. project funders, developers, etc.) away from taking energy access as the goal and focusing on rural economic development. This was also highlighted under SSH perspective energy poverty (subsection 3.2).

- **Fostering holistic planning approaches:** The benefits of working across sectors are clear. Energy policy can push activities (e.g. agricultural, industrial etc.) but cannot always provide pull-factors (e.g. market demand and access etc.). This requires

22 Note that some energy literature uses the term energy citizen, rather than energy consumer etc. (see Haf and Robison (2019) for more details on this).

23 Some rural areas lose population and lead to stranded assets.

working across different sectors (e.g. energy, water, agriculture, climate change, health, transport) and undertaking cross-sectoral planning, including shared actions and priorities across said sectors together with energy. For example, combining energy with transport can provide access to markets, and combining energy with finance can help overcome affordability barriers by means of subsidies.

4.3. Non-energy policy which interlinks with energy policy

Here we outline the key non-energy sectors, including departments or line ministries and policies (**non-energy energy policy**), that were identified from the expert surveys as **relevant to enhance PUE in low-resource settings in the Global South** (Figure 4: research question 3). Table 1 (including department or line ministries and policies) summarises these, and includes (in alphabetical order): agricultural; educational; environmental; financial; foreign affairs and coordination; health; industry and trade; land user/rights; rural planning; and standards bureau.

Table 1: *Non-energy departments and policies for energy seen as of relevance to enhancing PUE.*

Sector (incl. governmental department example based on Uganda for purpose of illustration)	Relevant policies (incl. frameworks, guidelines, incentives legislation, policy and other public policy techniques)
Agricultural (e.g. Ministry of Agriculture)	**Awareness raising:** establish outreach programmes that create awareness of electricity use for agriculture. **Build capacities:** provide educational programmes on the uses of electricity for agricultural activities along the value chain. **Public investment:** provide public investment accessible to projects that benefit agriculture. **Subsidies:** provide subsidies for PUE technology for agricultural activities.
Educational (e.g. Ministry of Education & Sports)	**Building capacities:** provide programmes (e.g. vocational training programmes) that build the capacities of people working and wanting to work in the energy sector. **Minimum energy standards:** mandate regional authorities to prioritise and introduce EE measures into public spaces (e.g. schools).
Environmental (e.g. Ministry of Water & Environment)	**Conservation:** provide guidance on integrated resource management for natural conservation relevant for the energy sector. **Decarbonise:** provide policies that mandate the reduction of GHG emissions by discouraging the use of fossil fuels. **Environmental Impact Assessment (EIA) mandates:** provide concise and clear requirements and to mandate EIA for specific projects. **Incentivise:** provide policies that incentivise low carbon technologies and innovation for RE and EE technologies.
Financial (e.g. Ministry of Finance, Planning & Economic Development)	**Guarantees:** provide guarantees and government investment protection for developers of energy access projects. **Import duties, taxation & VAT:** provide tax waivers (e.g. import) on quality RE and EE products to cover the extra costs of RE. **Public funds:** provide government loans or subsidies (e.g. in the forms of concessional financing) for energy access projects. **Pricing distortions:** phase out fossil fuel subsidies or fairly distribute fuel subsidies across different energy sources. **R&D funds:** establish funds for research and development (R&D) for field testing (piloting) and energy product innovation. **Smart subsidies:** provide price subsidies for electricity from RE that will not distort the market.

Foreign affairs and cooperation (e.g. Ministry of Foreign Affairs)	**Business visa:** provide business/entrepreneurship visas for international actors in order to enable them to work in the country on energy access projects.
Health (e.g. Ministry for Health)	**Minimum energy standards:** mandate regional authorities to prioritise and introduce EE measures into public spaces (e.g. health clinics).
Industry and trade (e.g. Ministry of Trade & Industry)	**Industry redistribution:** implement industrial projects in areas close to rural electrification projects. **Planning:** facilitate creation of enterprise to manage/develop mini-grid.
Land use/rights (e.g. Ministry for Lands, Housing & Urban Development)	**Land ownership:** provide guidance to communities in the project.
Other(*)	**Integration:** provide guidance on integrating energy access with other development priorities (e.g. roads: distance to markets/quality of roads has a big effect on the possibility to sell products that are produced with modern energy). **Needs assessment:** provide clear and concise requirements and to mandate needs assessments for energy access projects. **Engagement:** provide guidance on effective communication and involvement of local project communities. **Stakeholder analysis:** provide clear and concise requirements and to mandate accounting the needs of the various project stakeholder for energy access projects by means of stakeholder analysis. **Sustainability assessment:** to provide clear and concise requirements and to mandate sustainability assessments for energy access projects. This is important for better understanding the different sustainability dimensions and its influences on rural development.
Standards Bureaus (*)	**Norms and standards:** to provide guidance on norms and standards crucial to ensuring quality of energy technology. **Conformity assessment:** to provide clear and concise requirements and to mandate conformity assessments of technology.

**no dedicated department for this exists in Uganda. Other Ministries that may be relevant but have not been mentioned include Ministry for Communication & Information Communication Technology; Ministry of Public Service; Ministry for Local Governments; Ministry for Information & National Guidance; Ministry for Gender, Labour & Social Affairs).*

The top three, identified as most relevant from the expert surveys are next discussed in greater detail (based on the total number of times a sector/department was mentioned by experts). Namely (in order of relevance): financial policy, agricultural policy and environmental policy.

4.3.1. Financial Policy

Policies (as per Table 1): import duties, taxation & VAT, smart subsidies, R&D funds, guarantees, and distortions.

The higher cost of PUE developments is clear. Machinery and equipment require more significant upfront capital and end-users are expected to consume more to make projects feasible—making projects more expensive for developers as well as end-users. Thus, finance, or the lack thereof, as identified by experts, is a key hindrance for the inclusion of PUE in off-grid energy access projects and makes developments high risk—the importance of the latter was discussed in subsection 3.4: risk perception. Financial policy can help to overcome said financing barriers and lower investment risks for private investors. For example, financial policy can be used to lower/remove **import duties** on products or **subsidise** electricity use (see Table 1 for a comprehensive list). Subsidised purchasing for the end-user, in turn, may stimulate demand for electricity use. The importance of end-user focus was highlighted by one expert: "the focus of productive use stimulation should be on the end-customer as they face the most barriers in accessing and using electricity productively. The main barrier is financing of productive use machinery and appliances". End-user focus in project design was comprehensively discussed in subsection 3.3: User-Perceived Value. While initiatives such as microfinance exist and can enable rural agriculturalists to access funds for productive means, that are not always accessible and affordable.

Another financial aspect worth mentioning is that of financial guidelines. Experts critiqued governments for their failure to provide guidance on how private

developers can access **public funding** such as loans, in particular outside of the energy sector. This especially relevant to developers seeking to enhance PUE in projects that encompass multiple sectors (e.g. water, agriculture, etc.), not just that of energy (as was described in subsection 4.2). Further, **guarantees** and government investment protection can be used to help the private sector to access loans. This is particularly important for the energy sector, where many young entrepreneurs, that lack working capital, enter the market. Financial policy can also help to reduce market entry barriers for appliances/machinery in rural areas through **import duties** and **VAT** reduction on efficient end-user equipment for PUE. This will make the equipment for both production and consumption cheaper and more affordable for both producers and end-users. However, when introducing financial mechanisms/policies[24] care must be taken to not distort the market (as is commonly observed in the case of fossil-fuel pricing **distortions**) and be sensitive to distributional consequences (Robinson et al., 2017) and the country-specific conditions (Baldacci et al., 2003). An example of the engagement of the Ministry of Finance can be seen in the case of Indonesia. Here the Ministry identified policy reforms in three key engagement areas to support RE and EE, including: project economics; access to finance; and political economy (Ward et al., 2015).

4.3.2. Agricultural policy

Policies (as per Table 1): subsidise, raise awareness, capacity build and invest.

The majority of people living in rural areas are subsistence farmers (Heap et al., 2017). PUE can play an important role for farmers as it can be used for irrigation and post-harvest processing for example. Utilising electricity along the agricultural value chain can create a market niche for PUE products and services. Agricultural policies should be used to: incentivise by means of subsidy the use of PUE along the agricultural value chain (production, conservation and processing); sensitise and raise the awareness of farmers regarding the opportunities resulting from electricity in the agricultural sector; and build the capacities of farmers to utilise such energy technology for agriculture[25]. The latter is in line with the policy advice on training and capacity building discussed in subsection 4.1. Furthermore, public investment available within the agriculture–energy space for PUE projects should be made available or be jointly coordinated across the sectors and better guidance on how to access such funds must be made available. This will ensure that the relevant stakeholders are engaged and ensure the efficient use of public funding, unlocking private capital for example.

4.3.3. Environmental policy

Policies (as per Table 1): decarbonise, incentivise, mandate EIA, conserve.

A key challenge of environmental policy in this space is to balance trade-offs among competing goals between environmental policies and energy access, or work to align them (Lacey-Barnacle et al., no date). This is particularly relevant in the face of climate change and the need to reduce Greenhouse Gas (GHG) emissions (**decarbonise**), and make not only energy accessible to all, but ensuring sustainable energy. Environmental policy can be used to create **incentives** for low carbon technologies by providing incentives on low carbon technologies (RE and EE). Another option is to mandate a reduction of GHG emissions by creating clear guidelines on acceptable levels, albeit that in the past this has arguably had limited success. Further, it is the role of environmental policy to maintain natural resources (e.g. land and water)—particularly important for increasing biodiversity. Here, clear and concise guidelines and requirements of **environmental impact assessments** (EIA) are necessary. These are also relevant to the energy projects that utilise and construct on natural resources. EIAs should be mandated to provide an efficient process to achieve environmental compliance on a project. Another key component raised by one of the experts regards policies for **nature conservation**. An approach commonly used is that of integrated resource management (IRM). This is important as environmental problems are typically complex, interconnected, associated with uncertainty, multidisciplinary, and broad in spatial and temporal scale (Marti-Costa and Serrano-Garcia, 2001).

4.4. Working cross-departmentally

The above sections have shown the importance of various governmental departments and line ministries in enhancing PUE. To enable this requires decision makers to come together and collectively decide on policies that can support this. To better understand collective decision-making, experts were asked to comment on (a) **existing cross-departmental working groups for PUE**; and (b) **hindrances to working cross-departmentally** (as per Figure 4: research question 4). This is summarised below.

24 For a detailed account on the role of financial policy refer to Ward et al., (2015) and Robinson et al., (2017).

25 In the agricultural sector matters related to capacity building and awareness raising among farmers is often referred to as agricultural extension services.

4.4.1. Cross-departmental working groups

Cross-departmental working groups related to energy are not new and have been established in many countries as early as the early/mid 2000s. These have discussed issues related to energy statistics or energy and development, for example. However, these are mainly to facilitate donor coordination, especially relating to grid investments. Some countries have 'taskforces' to better coordinate public and private sector involvement in the distributed renewable energy sector, for example Sierra Leone and Nigeria. However, as one expert commented "PUE markets are so small that companies are largely under the radar and not well-represented in national or international industry associations". A number of experts gave examples to countries with cross-departmental working groups: in Nepal there are nodal agencies; South Africa has seen collaborations between energy, finance and treasury departments; and in India the Clean Energy Access Network (CLEAN) was formed to provide, amongst other things, guidance on cross-departmental policy.

4.4.2. Hindrances to work cross-departmentally

Working in sector silos results in a failure to see the bigger picture. However working cross-departmentally is not always easy. We asked experts **what the challenges are to work across departments and what can be done to improve the coordination across departments**. The findings of which can be summarised under the following four key areas:

- **Accountability/Responsibility:** there is, in particular, a lack of accountability/responsibility for outcomes related to work across different departments. Here, Key Performance Indicators (KPIs) could be incorporated to create a sense of accountability/responsibility in each department.

- **Capacity:** human capacity to work on issues outside of respective governmental departments is limited. To overcome come this, funders could budget for undertaking awareness raising and build the capacities of staff to work cross-departmentally.

- **Coordination:** coordination takes place within a sector. Creating a joint committee or an overarching agency could bring different governmental departments together. Examples were given above (subsection 4.4.1). However, in order to achieve this pressure will have to come from the top down (e.g. funders).

- **Finance:** departments have limited resources, and budgets are clearly allocated. This hinders cross-departmental efforts. Similarly, to 'coordination', joint committees or agencies could coordinate and allocate joint budgets.

5. Conclusions and recommendations

The basic premise of this report was to understand the role of Social Sciences and Humanities (SSH) perspectives to enhance Productive Uses of Energy (PUE) in low-income settings in the Global South. The key takeaways are summarised below (subsection 5.1) and actionable recommendations are given (subsection 5.2).

5.1. Conclusions

The importance of Productive Uses of Energy (PUE) in low-resource settings in the Global South is clear. PUE can enhance rural areas by providing economic opportunities and bring about the change needed to reduce economic migration (rural-to-urban). Despite its importance, government agencies focus on low-hanging fruits (such as grid extensions to semi/peri-urban areas). Grid extensions, however, will not reach rural areas in time for the Sustainable Development Goals target year of 2030, so the energy sector has to attract private investment. This requires a favourable enabling environment to deploy off-grid energy projects which enhance PUE, and PUE require more than a technical solution. External factors such as access to markets have a huge effect on the success of PUE i.e. the same intervention can have a low or high impact depending on market constraints (e.g. production, finance, technology, training, etc.). Ergo one role of policy is to create an environment that fosters this and makes investing less risky and more attractive for the private sector. To achieve this, the sector has to go beyond the technical understanding and consider *political, social and economic drivers and systems*.

For this report, we drew on six SSH perspectives. This enabled us to better understand: the role of energy access for the marginalised (energy justice, energy poverty); stakeholder decision-making (User-Perceived Values, risk perception); and the influence of and being influenced by non-energy sectors (Social Practice Theories, non-energy energy policy). The latter was then further investigated by means of surveys with 20 experts with experience of PUE in low resource settings in the Global South.

From this survey and the review of SSH literature, we have come to the conclusion that there is little current understanding of the complexity on the political integration of PUE into wider energy policy (i.e. including non-energy policy). The current energy policy landscape has to change and account for a lack of capital; risky framework conditions; and a lack of clear policy guidelines available on the subject. This report demonstrates that SSH disciplines offer several key insights on the policy problem and how it can be addressed.

5.2. Recommendations

In light of this, here we offer actionable recommendations aimed at organisations working in policy-facing roles in low resource settings in the Global South to achieve the utilisation of PUE:

Actively integrate 'non-energy' energy policy (i.e. from other ministries) and energy policy.

Policy is a powerful tool for shaping the investment environment; for example it can reduce the potential risk for investors and drive systematic change. However energy policy alone is not sufficient to bring about the task of shifting the off-grid energy access landscape to account for Productive Uses of Energy (PUE). To operationalise the rhetoric of PUE, the energy sector must integrate policy that is commonly located outside the sector, including and most importantly financial policy, agricultural policy and environmental policy. Refer to section 4 for a comprehensive summary on the topic of **non-energy energy policy**; and for relevant departments (and ministries), and policy areas refer to Table 1 (subsection 4.3).

Establish cross-departmental working groups that are not coordinated by a specific sector.

Working in sector silos often results in a failure to see the bigger picture, which is crucial for objectives that cut across many disciplines, such as the mainstreaming of PUE across policy areas. However key challenges of working across sectors are the coordination of action, assigning responsibility of outcomes, the lack of human capacity, and limited financial resources. To overcome this there is a requirement for high level political sponsorship, commitment, and coordination. This may be achieved through the creation of committees or overarching agencies to coordinate different governmental departments to develop a framework for collaborative action (i.e., establish a benchmark of what is required), and to be accountable for progress towards specific objectives. See subsection 4.4 for a review on working cross-departmentally.

Understand end-user decision-making to enable PUE which meet local needs.

The higher cost of PUE developments compared to basic levels of energy access (e.g. household lighting) is clear. Technology solutions which support PUE require additional capital investment relative to those which do not, and projects are further dependent on uptake and utilisation of technology if they are to achieve economic viability. To achieve the necessary change it is essential

to work to understand existing, context-specific, local community needs (including e.g. **User-Perceived Value** in subsection 3.3) and socially-carried patterns of behaviours (see subsection 3.5 on **Social Practice Theories** for literature on the social organisation of energy use). These assessments need to be undertaken in addition to traditional needs assessments.

PUE is not about energy access but about just community and market development.

The objective of rural off-grid energy access projects is to reduce local poverty levels and improve well-being. This requires the delivery of energy access projects that not only facilitate economic opportunities (i.e., PUE) but inclusively benefit all groups (and thus account for inequalities). Developers which better address local injustices and account for changing preferences and demand over time i.e. accommodate market development, are likely to experience higher demand for generated power and thus improve the economic viability of their project. Markets, when well-managed, can be a tool to incentivise the supply of power to the marginalised and thus reduce inequalities. For more a detailed account of **energy poverty** and **energy justice** literature see subsections 3.1 and 3.2 respectively.

Map risks and develop risk mitigation strategies.

To increase private sector participation in off-grid energy access projects, risks that inhibit engagement must be better understood and reduced. This includes actual risks (e.g. the risk of grid extension to project communities which would create stranded assets; or the lack of uptake resulting from low financial capacities of customers); perceived risk (e.g. subjective judgement); but also, the risk perception by other actors (e.g. users' behaviour; practices and measures currently undertaken and accepted; existing knowledge that influences utilisation). This area in relation to PUE needs further exploration. For more details on **risk perception** in general refer to subsection 3.3.

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8. Appendix I: Annotated bibliography of useful resources

The annotated bibliography presents a summary snapshot of relevant literature on the six SSH perspectives explored in this report. This is not an exclusive list and only offers a starting point of the literature available on the subject for those wishing to explore this further.

Energy justice (subsection 3.1)

- **Jenkins, K., McCauley, D. and Forman, A. (2017). Energy justice: A policy approach. *Energy Policy*, 105(February), pp.631–634.**

  In this editorial piece, an overview of energy justice literature and different methodologies are presented. Five challenges for academics as well as practitioners to reflect upon are given. These can be summarised under: (1) use concepts from ethics, morality and justice to think about energy dilemmas, and (2) continue to develop, and increasingly implement energy justice concepts in the policy sector.

- **Joroff, A. (2017). Energy Justice: *What It Means and How to Integrate It Into State: Regulation of Electricity Markets*. Washington DC: Environmental Law Institute.**

  In this practical review energy justice is used as an analytical tool to assess the regulation of the energy market based on a number of criteria to meet social goals of justice and fairness. The following practical steps are discussed: who has authority to address energy justice objectives; in what context are equitable impacts measured; who is protected by energy justice goals; and finally, what information is necessary to evaluate energy justice impacts.

Energy poverty (subsection 3.2)

- **Energypedia.info: energy poverty (**https://energypedia.info/wiki/Energy_Poverty**)**

  The website provides a comprehensive overview of the topic of energy poverty. This includes an introduction to the topic, a review of different approaches for defining energy poverty, and exemplary definitions of energy poverty.

- **Pachauri, S. and Spreng, D. (2011). Measuring and monitoring energy poverty. *Energy Policy*, 39(12), pp.7497–7504.**

  Based on the assessment of indicators on national and international scales, this article presents different ways of measuring and monitoring energy poverty. The review goes beyond basic measurements of energy access and seeks to understand energy access for underlying mechanisms of energy poverty. The paper reviews a variety of different energy poverty indicators, including: energy indicators relating to sustainability; energy poverty indicators for national reporting and policy and programme design; and indicators for monitoring and evaluating individual projects to reduce energy poverty.

User-perceived values (subsection 3.3)

- **Hirmer, S. and Guthrie, P. (2016). Identifying the needs of communities in rural Uganda: A method for determining the 'User-Perceived Value' of rural electrification initiatives. Renewable and Sustainable Energy Reviews, 66, pp.476–486.**

  In this research paper a detailed account of User-Perceived Value is given including the difference between needs, values and wants. For this, the authors draw primarily on marketing and product design literature; a detailed account of five consumer research methods is also given. The paper concludes with a demonstration of the UPV approach in seven case-study villages across rural Uganda.

- **Hitlin, S. and Piliavin, J.A., 2004. Values: Reviving a Dormant Concept. Annual Review of Sociology, 30(1), pp.359–393.**

  In this review paper, the authors give a detailed account of the role of value including linking values to culture, social structure, and individual behaviour cultural. The paper is organised around three main questions which are comprehensively discussed by the authors, namely: what are values? where do values come from? and what do values do?

Risk perception (subsection 3.4)

- **Brown, V.J. (2014) Risk Perception: It's Personal. *Environmental Health Perspectives*, 122(10), pp.276–279.**

  This short article presents the topic of risk perception as a phenomenon of decision making. Risk perception is based on a person's frame of reference which is developed over a lifetime, for example. The main topics covered in this short articled include the risk perception gap resulting from ignorance and difference between the thinking of experts and the public about risk.

- **Paek, H.-J. and Hove, T. (2017) Risk Perceptions and Risk Characteristics. *Oxford Research Encyclopaedia of Communication*, 1(April), pp.1–16.**

  This article focuses on risk perception as an important tool for risk communication. The assessment is based on the health sector. The authors frame risk within two main dimensions: the cognitive dimension, which relates to how much people know about and understand risks, and the emotional dimension, which relates to how they feel about them. Initially the article gives an introduction of definitions and dimensions of risk and risk perception; this is followed by a review of risk models including risk characteristics. A number of different theoretical perspectives of risk perception are also presented.

- **Sjöberg, L. and Moen, B.-E., 2004. Explaining risk perception. *An evaluation of the psychometric paradigm in risk perception research.* Trondheim: Rotunde publikasjoner.**

  This report presents different risk perception research. Initially different definitions of risks are presented. This is followed by review of different theories including cultural theory and psychometric paradigm. The latter of which is then reviewed in detail.

Social practices theories (subsection 3.5)

- **Strengers, Y. (2012) Peak electricity demand and social practice theories: Reframing the role of change agents in the energy sector. *Energy Policy*, 44, pp.226–234.**

  In this article the problem of peak electricity demand is investigated by means of theories of social practices. Based on these, practical solutions for managing energy demand are given, including: enabling co-management relationships with consumers; working beyond their siloed roles with a broader range of human and non-human actors; and promoting new practice 'needs' and expectations. The roles of different stakeholders as change agents are also discussed.

- **Galvin, R. and Sunikka-Blank, M. (2016) Schatzkian practice theory and energy consumption research: Time for some philosophical spring cleaning? *Energy Research and Social Science*, 22, pp.63–68.**

  This paper focuses on Schatzkian practice theory, which is most commonly applied to energy consumption research. The paper identifies three areas that require further three areas where practice theory appears to need more in-depth development: a fuller account of the ontological status of 'practices' and what this implies for research models; more clarity on lines of causality; and the place of socio-economic issues within practices and their descriptions.

Non-energy energy poverty (subsection 3.6)

- **Cox, E., Royston, S. and Selby, J. (2016) *The impacts of non-energy policies on the energy system: a scoping paper*. Brighton: UK Energy Research Centre (UKERC).**

  In this paper a sector-by-sector review on the impact of non-energy policies on the energy system is conducted. The paper presents an investigation of policy across thirteen non-energy sectors, including international trade policy, economic policy and health policy. The paper concludes by proposing a future research agenda on the topic.

- **Bhattacharyya, S.C. and Palit, D. (2016) Mini-grid based off-grid electrification to enhance electricity access in developing countries: What policies may be required? *Energy Policy*, 94, pp.166–178.**

  This paper offers goal-oriented policy recommendations for an enabling policy environment. Said policy recommendations go beyond the energy sector and include policy related to financing, pricing, technology use, transfer, labour and land use. These findings are based on the study of four off-grid energy access demonstration activities across India.

9. Appendix II: Expert survey

Survey on: "What are the limits of energy policy to enhance productive uses of energy in low-resource settings in the Global South?"

Block: Background

Q.1 What sector do you work in? (you may select multiple]

NGO (1)	Research Institution (4)
Private Sector (2)	Social Enterprise (5)
Public Sector (3)	International Development Organisation (7)
Other (6): _____	

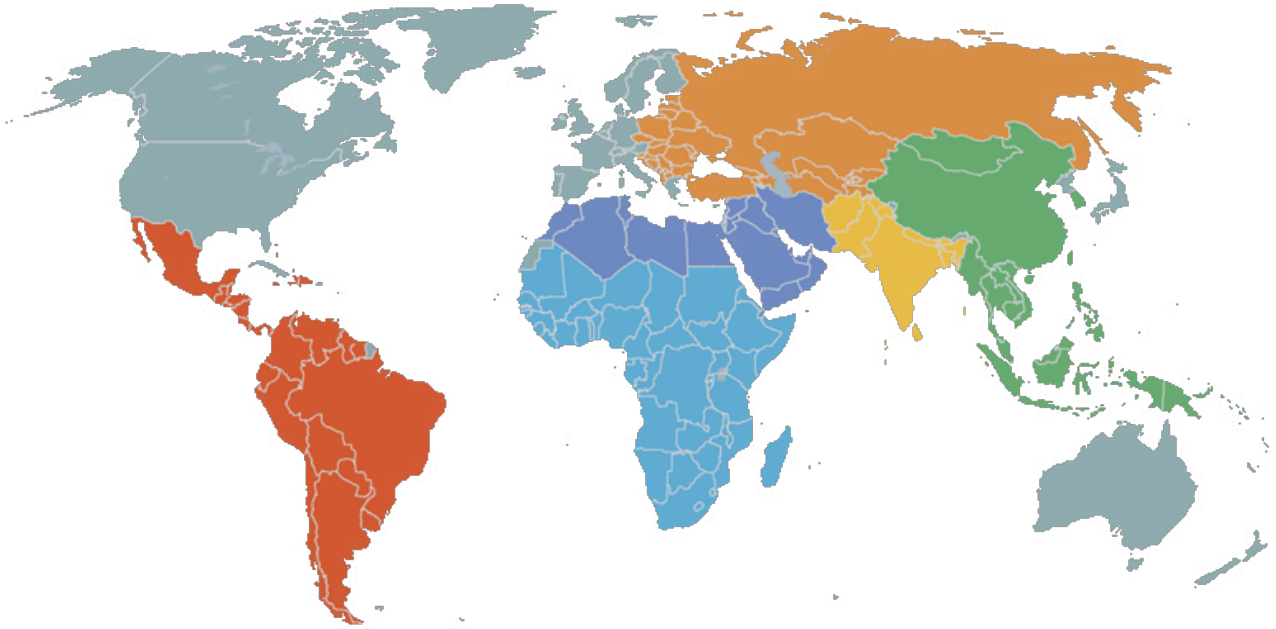
Q.2 Which of the following best describes the work you do? (you may select multiple)

Development practitioner (1)	Policymaker/ policyworker (4)
Consultant (2)	Project developer (5)
Researcher (3)	Other (6): _____

Q.3 With which of the 17 Sustainable Development Goals does your current field of work align with the most?

Q.6 How many years of experience do you have in this field of work in the Global South?

Q.5 In which region of the Global South have you worked (max 5)?



Block: Energy policy to enhance economic activities through Productive Uses of Energy (off-grid) in low-resource settings in the Global South.

This section investigates energy policy and its limits to enhance productive uses of energy (PUE) in low-resource settings in the Global South. Productive Uses of Energy is defined as: 'agricultural, commercial and industrial activities involving electricity services as a direct input to the production of goods or provision of services'. Policy refers to 'a course or principle of action adopted or proposed by an organisation or individual'. It may include legislation, incentives, guidelines and other public policy techniques. Energy policy refers to the policy within the energy sector and relating to energy.

Q.6.1 What specific energy policies do you feel need to be in place to incentivise / enhance / encourage PUE? (list max. 6)?

Policy suggestions:

a)	
b)	
c)	
d)	
e)	
f)	

Q.6.2 In your opinion, which of these policy suggestions achieve the quickest results? (drag and drop from highest to lowest)

➤ Carry Forward Entered Choices - Entered Text from "What specific energy policies do you feel need to be in place to incentivise / enhance / encourage PUE? (list max. 6)?"

Q.6.3 ...and why?

Q.7 In your own words, what are the limits of energy policy to enhance activities relating to PUE (i.e. what may require other policy sectors or non-policy actors to achieve)?

Block: Non-energy energy policy to enhance PUE in low resource settings in the Global South.

Going beyond energy policy, this section seeks to identify which other departments have a role to play in pushing PUE activities and the specific policies that can help to enhance it.

Q.8.1 What other specific governmental departments / ministries, aside from energy, need to be engaged to incentivise / enhance / encourage PUE (list departments, policies and state why)? (list max. 6)

	Department (1)	Policy (2)	Why (optional) (3)
i)			
ii)			
iii)			
iv)			
v)			
vi)			

Q.8.2 In your opinion, which of the above policies achieve the quickest results? (drag and drop from highest to lowest)

➤ Carry Forward All Choices - Displayed & Hidden from "What other specific governmental departments / ministries, aside from energy, need to be engaged to incentivise / enhance / encourage PUE (list departments, policies and state why)?"

Q.8.3 ... and why?

Block: Further feedback (optional)

While this section is optional, we would still love to hear and learn from your expertise.

Q.9.1 What do you see as the biggest hindrance or challenge working across the different governmental departments? (We're particularly interested in examples or learning related to energy)

Q.9.2 What could practically be done to overcoming this?

Q.9.3 Do you have knowledge of cross-departmental working groups or similar formalised mechanisms for coordination in this space?

Q.10 If you would like me to share the final publication with you, please provide your email address.

Energy-PIECES

Policy options for enhancing Productive Uses of Energy
in low-resource settings in the Global South

April 2020