Exploring energy justice in rural Bolivia

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Abstract

Great progress has been made in improving energy access in Bolivia during the last four decades. However, rural areas, where grid solutions are not tenable, still pose challenges for the goal of achieving universal energy access. Although decentralized renewable energy solutions (DRES) are being deployed in rural areas, not all the benefits expected from energy access are materializing. In many instances the benefits of DRES are inequitable relative to grid solutions, and in some cases, they bring unwanted social impacts. Research shows that socio-cultural, economic and political issues, as well as the individual values and beliefs of users regarding energy services, nuance and mediate development benefits. Therefore, policies focused on targeting off-grid rural energy access need to reflect on and engage with the specific context and needs of rural communities.

Energy justice offers a valuable conceptual framework to explore energy systems from the perspective of social justice. It encompasses three key tenets: distributive justice, procedural justice and recognition justice. Drawing upon a bespoke conceptual framework based on the two mainstream approaches to studying energy justice, this thesis uses argumentative discourse analysis to explore the discourse underpinning Bolivia's rural energy policy. Five key public policy documents relating to rural energy access in Bolivia were identified and analyzed and eleven in-depth semi-structured interviews were carried out with key stakeholders within the Bolivian energy sector including representatives from the government, academia, private energy suppliers, non-government organizations and international cooperation entities.

Findings show that while Bolivia's national policy framework for off-grid energy access echoes global narratives relating to energy justice, it is underpinned by its own unique discourse framing Bolivia's efforts to achieve universal energy access. This discourse is characterized by three key elements. First, a distributive a principle of universalization to deploy modern energy services across rural areas supported by a meaningful framing strategy. Second, two parallel coalitions built around electricity and clean cooking fuels and technology (CCFT) and other energy requirements position the government at the forefront of the energy access challenge and introduce the environment as a non-human actor within the energy sector. Thirdly, an epistemological approach of development based on the indigenous philosophy *Vivir Bien* that calls for an ecosystemic perspective to conceptualize the instrumental value of modern energy services.

However, several inconsistencies constrain Bolivia's capacity to achieve its goal of universal energy access by 2025. These issues include (1) policy vagueness and an undefined distributive rationale to deploy energy as a basic service and reallocate socio-economic and environmental benefits from energy

access; (2) constraints on meaningful participation and power imbalances within the procedural arrangements of Bolivia's energy policy framework; and (3) lack of recognition of energy requirements across different cultural and socio-economic identities within rural populations related to political strategies stemming from the ideology of the incumbent political regime.

Three groups of possible measures to address these issues are proposed. First, it is argued that the distributive rationale could be strengthened by using qualitative and quantitative benchmarks; standardizing strategies to better engage with the potential reallocation of socio-economic and environmental benefits; and developing broader policy instruments to achieve universal energy access in rural areas. Second, procedural arrangements should focus on sectorial capacity building to establish new sites of argumentation and explore alternatives to broaden the current governance structure. Finally, the rationale of recognition justice within the policy framework could be strengthened by exploring typologies of individual users of energy to design more targeted policies, considering the potential of traditional forms of economic organization and exploring cultural figures related to Community Justice to lead the local governance arrangements around energy access.

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This research is dedicated to the foundations of my family: Costi, Nilda, Juan and Ruy.

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List of Acronyms

ADA	Argumentative Discourse Analysis
ARE	Alliance of Rural Electrification
ATIOC	Autonomía de Territorio indígena originario campesino (Indigenous Autonomous Government)
CPEP	Constitución del Estado Plurinacional de Bolivia (Political Constitution of the Plurinational State of Bolivia)
EEP-AR	Energy and Environment Partnership Andean Region
ENDEV	Energising Development
ESMAP	Energy Sector Management Assistance Programme
FAO	The Food and Agriculture Organization of the United Nations
FASERTE	Fondo de Acceso Sostenible para Energías Renovables y Tecnologías Eficientes (Fund for Sustainable Access to Renewable energy and efficient technology)
FONDESIF	Fondo Nacional de Desarrollo del Sistema Financiero (National Funding Scheme for the Financial System and Productive Development)
HPMG	Hydro-powered mini grids
IBNORCA	Instituto Boliviano de Normalización y Calidad (Bolivian Institute of Standarization and Quality)
IEA	International Energy Agency
INE	Instituto Nacional de Estadísticas (National Institute of Statistics)
IRENA	International Renewable Energy Agency

KgOE	Kilogram of Oil Equivalent
kWh	kilowatt-hour
NyPIOC	Naciones y pueblos indígenas originario-campesino (Indigenous-peasant native nations)
MDRyT	Ministerio de Desarrollo Rural y Tierras (Ministry of Rural Development and Lands)
MEN	Ministerio de Energia (Ministry of Energy)
MHE	Ministerio de Hidrocarburos y Energía (Ministry of Hydrocarbons and Energy)
PDES	Plan de Desarrollo Económico y Social 2016 - 2020 (Social and Economic Development Plan 2016- 2020)
PER	Programa de Electrificacion Rural (Rural Electrification Program)
PEVD	Programa de Electricidad para vivir con Dignidad (Electricity Program for living in dignity)
NyPIOC	Naciones y Pueblos Indígena-Originario Campesinos (Indigenous nations and peoples)
SE4ALL	Sustainable Energy for All
SENAMHI	Servicio Nacional de Metereología e Hidrología (National Service of Meteorology and Hydrology)
SIN	Sistema Interconectado Nacional de Bolivia (National Elecricity Grid)
TIOC	Territorio indígena originario campesino

	(Indigenous-peasant native territories)
UNDP	United Nations Program for Development
USD	United States Dollars
VMEEA	Viceministerio de Electricidad y Energías Alternativas
	[Viceministry of Electricity and Alternative Energies]
WEF	World Economic Forum

Chapter 1 Introduction

Energy plays a critical role in facilitating human development (Carbonnier and Grinevald, 2011). As such, universal access to modern energy services – including both electricity and clean cooking fuels and technologies (CCFT) – is one of the main challenges facing the global community in seeking to achieve the Sustainable Development Goals and implement the Paris Agreement on climate change. In 2018, 789 million people around the world lived without electricity, 85% of them in rural areas. At the same time, nearly three billion people did not have access to clean cooking facilities, almost half of them in rural areas. However, great progress has been achieved through the deployment of decentralized renewable energy solutions (DRES) where grid solutions are not feasible. By 2018, off-grid solutions provided electricity services to approximately 136 million people around the world, mainly through standalone home systems, solar lighting, and mini grids in remote off-grid areas in developing countries, where the universalization challenge is greatest (World Bank, 2018).

Bolivia is one of the developing countries aiming to achieve universal energy access by 2025 (Ministry for Development Planning, 2013). Steady progress towards this goal has been achieved, and 93% of the population now have access to electricity (Ministry of Energy, 2019), while the most recent available statistics estimate that 83% of the population have access to CCFT (World Bank, 2018). Remarkable efforts have been made by the government to deploy on-grid energy solutions for both urban and rural areas. At the same time, DRES, including solar home systems (SHS), solar lanterns, standalone wind systems, micro-hydro mini-grids, improved cookstoves, solar cookstoves and biodigesters, among other technologies, have been deployed to provide modern energy services for more than 400 000 scattered rural households (Ministry of Hydrocarbons and Energy, 2014).

The deployment of these DRES represents a transition away from a traditional rural energy regime based on fossil fuel generators and batteries, kerosene and diesel lamps, candles, and inefficient biomass burning, and their associated socio-economic and environmental impacts. In this context, Bolivia's national energy policy rhetoric echoes global narratives that emphasise the development benefits of energy access for the economy, health, education, communication and gender equality (Ministry of Hydrocarbons and Energy, 2012). However, a growing body of literature highlights that conceptual vagueness of energy policy (Samarakoon, 2018), socio-cultural arrangements (Otte, 2014; Treiber et al., 2015; Padmanathan, 2019), local political issues (Mceachern et al., 2008), and the individual values and beliefs of users regarding energy services (Groves et al., 2017) nuance and mediate the development benefits associated with improved energy access.

By ignoring such issues, even policies that deploy low-carbon energy technologies like DRES can either remain neutral as to creating benefits (Aklin et al., 2017), create inequitable benefits (Azimoh et al.,

2015, Treiber et al., 2015; Munro et al., 2017; Kumar, 2018), or in some cases actually reinforce existing social inequalities (Marshall et al., 2017; Sunikka-Blank et al., 2019). These insights call for a reflexive pause amongst policy makers and academics to: (1) better understand the relationship between energy access and development; and (2) more effectively engage with the values, needs, and socio-political contexts of rural communities being provided with DRES.

The emerging conceptual framework of energy justice aims to promote energy policy frameworks that "fairly distribute both the benefits and burdens of energy services, and… contribute to more representative and inclusive energy decision making" (Sovacool et al., 2017, p. 677). It offers an analytical framework to facilitate the exploration of energy policy from the perspective of social justice (Sovacool and Dworkin, 2015; Jenkins, 2017). There are two main approaches to applying an energy justice conceptual framework (Williams and Doyon, 2019). The first approach offers a set of normative guiding principles, namely: availability, affordability, due process, transparency and accountability, sustainability, intergenerational and intragenerational equity, responsibility, resistance, and intersectionality (Sovacool et al., 2017). The second approach proposes three-tenets of energy justice, namely: distributional justice, procedural justice, and recognition justice (McCauley et al., 2013). Both approaches seek to inform policy and decision making by helping to identify injustices potentially caused by energy systems, as well as normative prescriptions to address them (Jenkins et al., 2016).

1.1 Motivation of the study

Despite the significant progress in improving rural energy access in Bolivia, research shows that development impacts associated with the deployment of DRES do not occur in a straightforward fashion and are not necessarily equal amongst the rural population (Fernandez, 2010; Monroy and Montaño, 2015; Galoppo and Carlo, 2017; Interamerican Development Bank, 2019). Therefore, there is a need to reflect upon the national policy framework for rural energy access and its engagement with rural communities, beyond the techno-economic dimensions of universalization, in order to achieve the national goal of universal energy access 'based on equity' by 2025 (Ministry for Development Planning, 2013).

Researchers using the energy justice framework have exposed inclusionary and exclusionary energy regimes and policy frameworks (Jenkins et al., 2018; Williams and Doyon, 2018; Bartiaux et al., 2018; Dong-Yoon Kim et al., 2019). For example, the energy justice framework has been used to evaluate policy frameworks for rural energy and the feasibility of fairness in Nepal (Islar et al., 2017); understand the implications of energy justice in postcolonial Mozambique (Castan et al., 2018); and critically reflect

on the limitations of the global rhetoric of energy access in the context of Sierra Leona (Munro et al., 2017).

The guiding principles and tenets proposed by the energy justice framework can be used to guide energy practitioners and policy-makers towards providing more equitable and just energy policy outcomes. However, although some authors have discussed challenges associated with rural energy policy in Bolivia (Fernandez, 2010; Guzman, 2010; Gomez, 2017), no research has been conducted to analyse the current national policy framework from the perspective of energy justice, or assess the justice-awareness of energy policy in Bolivia. This study aims to address this gap within the literature, and contribute to the growing body of literature exploring energy justice within developing countries more broadly.

1.2 Research aim and objectives

This research aims to explore the national policy framework for rural energy access in Bolivia by applying the key tenets and guiding principles of the energy justice framework.

To achieve this aim, this research has three objectives:

1. To identify the national policy framework for off-grid rural energy access in Bolivia;
2. To explore the key principles of the energy justice framework within the discourse of the national policy framework for off-grid rural energy access in Bolivia; and
3. To make recommendations to inform future policy development.

1.3 Research approach

This research adopted a constructivist interpretive research paradigm and a qualitative research approach, including the analysis of documentary sources, and a series of semi-structured interviews. In particular, five key public policy documents relating to rural energy access in Bolivia were identified and analysed. Eleven in-depth, semi-structured interviews were carried out with key informants from the Bolivian government, academia, private energy suppliers, non-government organisations and international cooperation agencies. Argumentative discourse analysis (ADA) was then used to analyse the data and explore the discursive structures and dynamics of off-grid rural energy access within the policy documents and stakeholders' responses, and to identify the argumentative dynamics around the three tenets of the energy justice framework.

1.4 Outline

This thesis consists of nine chapters. Chapter 2 introduces Bolivia's natural environment, history, demographic profile, governance system, economy, and rural areas. It then provides key background

information on energy access from both a global and regional perspective. Next, Chapter 3 reviews the literature exploring benefits, technologies, policy instruments and governance models for off-grid energy access in rural areas.

Chapter 4 outlines the energy justice framework, exploring its philosophical intricacies while critically engaging with its tenets and guiding principles, to define the conceptual framework used within this thesis to explore the national policy framework for rural energy in Bolivia. Chapter 5 then describes the research design. It explains the methods used for data collection and analysis, including documentary sources, semi-structured interviews, and argumentative discourse analysis. Limitations of the study are also identified and discussed.

Chapter 6 presents the findings of the first step of the discourse analysis: “the first reading of events”. Chapter 7 then outlines the findings from the remaining steps of the discourse analysis, and Chapter 8 discusses these findings within the context of literature reviewed in Chapter 3 and the energy justice framework developed in Chapter 4. Finally, Chapter 9 concludes this thesis, summarising the findings, making recommendations, and identifying new avenues for research to promote a more justice-aware policy framework for rural energy access in Bolivia.

Chapter 2 Background

This chapter provides a comprehensive overview of key background information about the context in which this research was undertaken. Section 2.1 provides a general introduction to Bolivia, including a description of its climate and natural environment, history, demographic profile, governance system, and rural areas. Section 2.2 then provides an introduction to the global energy regime and an overview of the current state of energy access around the world.

2.1 Bolivia

Bolivia is located in the heart of South America, covering a total area of 1 098 581 km^2. It is a landlocked country, and shares borders with Brazil to the north-east, Paraguay to the east and south-east, Argentina to the south, Chile to the south-west and Peru to the north-west, as illustrated in Figure 2.1 (INE, n.d.a). Due to its unique geographic location, Bolivia hosts a rich array of natural resources, which have shaped the development of its history, economy, culture and national identity.

Figure 2.1 The location of Bolivia in South America. Source: Google maps (2019).

2.1.1 Climate and natural environment

Bolivia contains the widest portion of the Andes, the largest mountain range in South America, which frames a broad array of geographic features unfolding across the country. Stemming from the variation of altitudes, Bolivia has three main geographic regions, as illustrated in Figure 2.2: the Andean region in the south-west; the Sub Andean region in the north and the Llanos region in the north-east (INE, n.d.a). These regions encompass 28%, 13% and 59% of the national territory respectively, and feature significantly different weather and landscapes (SENAMHI, n.d.).

Figure 2.2 Physical map of Bolivia. Source: Mapamundi (n.d.).

Such geographic diversity supports astonishing biodiversity and a significant stock of renewable and non-renewable natural resources. Bolivia's territory encompasses four biomes, 32 ecological regions, and 199 ecosystems. Protected areas constitute 16% of the national territory with 21 natural reserves (Ibisch, 2005). Bolivia's biodiversity relies on the water supply that comes from three basin regions: the Amazon River Basin in the north, the Del Plata River Basin in the south, and the Lacustre Basin in the centre. Bolivia is also very rich in minerals and hydrocarbons, including tin, silver, lithium and the second biggest natural gas reserves in the region (INE, n.d.a; MHE, 2018).

Unfortunately, Bolivian natural treasures are increasingly endangered as a consequence of climate change and other human impacts. Impacts of climate change in Bolivia include melting glaciers, and more frequent extreme weather events including floods, droughts, frosts and mudslides. Other major environmental issues, such as recent water shortages across Bolivia's main cities, forest fires, and declining biodiversity across all ecological regions are linked to unsustainable mining (Perreault, 2015), the unsustainable exploitation of gas and water resources for big scale hydropower (Coaquira, 2010; Solon, 2019a), and the ongoing expansion of agriculture (Jacobi, 2016).

2.1.2 History

It is widely acknowledged that geography plays a crucial role in shaping national identity (Kaplan and Herb, 2011). Bolivia's geographic diversity has contributed to social and cultural diversity that share a common history. Bolivian society is highly complex. It is characterised by the Bolivian philosopher René Zavaleta Mercado (1986) as *"abigarrada"* (mottled) referring to a multi-layered social diversity coexisting within the same country (Tapia, 2002).

Bolivia's history has been characterised by such societal complexity since Pre-Columbian times. Ancient archaeological remains dating from 10 000 BCE provide insight into the oldest indigenous peoples, the Viscachani in the Andes and the Ñuapua in the Gran Chaco. By the early 14th century, the Inca Empire had conquered much of what is now western Bolivia (INE,n.d.b). The coexistence of indigenous communities was further disrupted by beginning of the Spanish conquest in 1535. Both the conquest and the subsequent colonial institutions undertook a process of ethnic cleansing led by the Catholic Church (Gareis, 2007). Such outrageous practices resulted in a significant decline in indigenous populations, particularly in the Andean Region. However, the Chiriguano peoples located in the eastern region resisted the conquest and settlement in their lands, remaining independent of direct Spanish control (INE,n.d.b).

Almost three centuries of colonization could not completely annihilate the indigenous population living in the territory that is now Bolivia. Moreover, the fusion of natives and Spanish colonialists resulted in a new mixed population known as *mestizos,* increasing the diversity of coexisting cultural identities (Stavenhagen, 2004). Significant efforts to gain independence began from around 1780, led by both indigenous and mestizo leaders. The revolution officially started in 1809, culminating in 1825 with the Independency Proclamation and the foundation of the Republic of Bolivia, named in honour of the Liberator Simón Bolivar. However, the indigenous population remained largely unacknowledged and relegated to certain roles within society (INE, n.d.b).

During the 19th and early 20th centuries, Bolivia faced three conflicts with neighbouring countries and lost its access to the Pacific Coast, significant territory rich in high-valued natural resources. During these conflicts indigenous men were sent as cannon fodder to defend a nation that did not acknowledge them as citizens (INE, n.d.b). However, the 20th century brought crucial historic milestones towards a more inclusive society in Bolivia, including the first attempt to acknowledge indigenous people, the inclusion of ethnically diverse communities in the development discourse, the establishment of the universal right to vote, attempts to return land ownership to indigenous communities in rural areas, and the creation of the Bolivian Working Union (INE, n.d.b).

Indigenous and social movements across the country played a crucial role during the early 21st century, with indigenous communities fighting the privatization of public water supply in Cochabamba during the so-called Water War in 2003 and the potential expansion of the natural gas market to Chile that ignited the so-called Natural Gas War in 2005 (INE, n.d.b). This conjuncture reinforced the inclusion of social movements representing Bolivia's indigenous population and working class within high-level governance structures in Bolivia.

Between 2006 and 2019 a new political regime representing the indigenous and social movements implemented many structural reforms including a new Political Constitution (CPEP for its acronym in Spanish) and the rebirth of the Republic of Bolivia as the Plurinational State of Bolivia (INE,n.d.b). Despite the explicit inclusion of indigenous nations and populations, the incorporation of Autonomous Territories and the novel conceptualization of a plural citizenship (Soruco, 2009), several questions have arisen with regards to the new CPEP, and new social and political conflicts have emerged (Radhuber, 2012). For instance, Rivera (2015) argues that pluri-nationalism is an empty concept and entails an instrumentalist vision of indigenous people ignoring the recurrent migratory movements and new settlements that occur within this population.

2.1.3 Demographics

According to the most recent census, Bolivia had 10 059 856 inhabitants in 2012 as illustrated in Figure 2.3. Based on this data, INE estimates that Bolivia's population was more than 11 million by 2018, with 49.6% female and 50.4% male. The Bolivian population is quite young with an average age of 27 years old (INE, 2018).

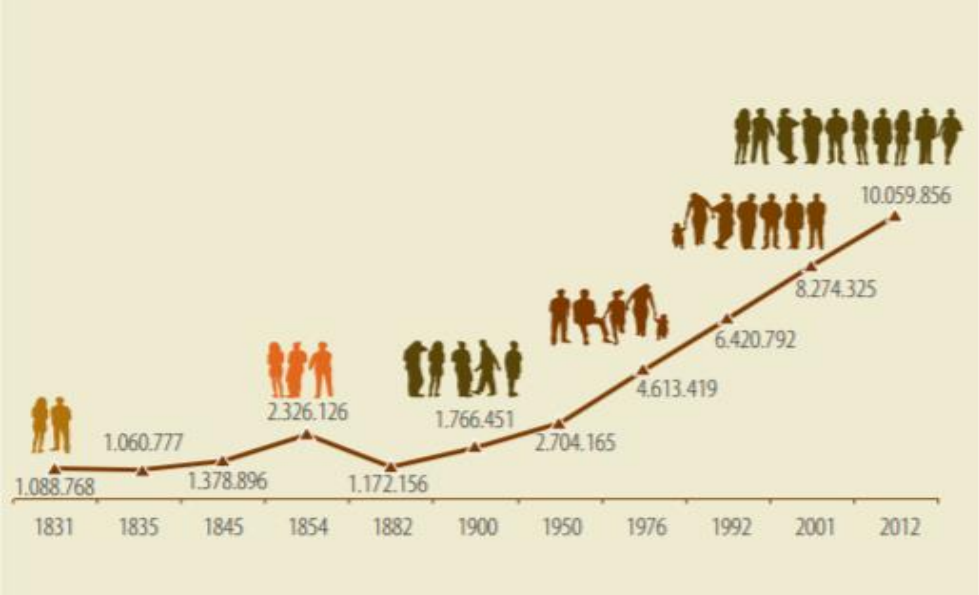


Figure 2.3 The population of Bolivia per census year. Source: INE (2015).

Indigenous people account for 60% of Bolivia's population and many mestizos identify as both mestizo and an indigenous nationality. Although the CPEP does not specifically state which indigenous nations (NyPIOC for its acronym in Spanish) are officially acknowledged within the Plurinational State of Bolivia, the Electoral Regime Law outlines 36 NyPIOC in addition to Quechuas and Aymarás, which are the majority. However, the 2012 census showed a total of 119 NyPIOC, 74 of which are unacknowledged nations, as illustrated in Figure 2.4 (INE, 2015).

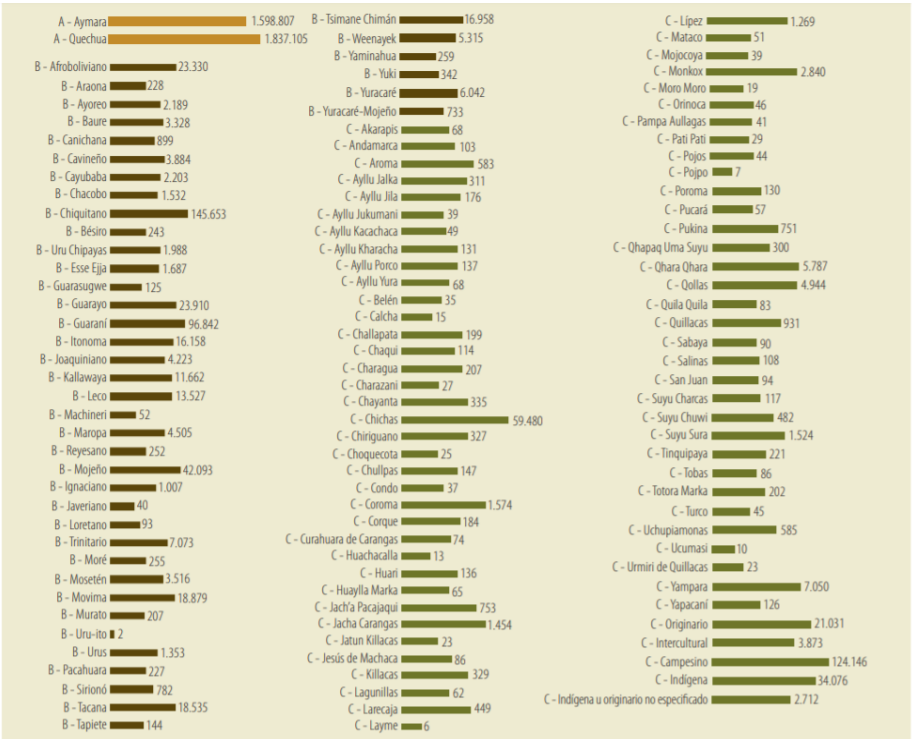


Figure 2.4 The population of NyPIOCs and Afrobolivians. Source: INE (2015).
** A: Majorities; B: Minorities acknowledged in the Electoral Law; C: Unacknowledged nations.*

2.1.4 Governance system

Bolivia is constituted as a unitary social state of Plurinational right: free, independent, sovereign, democratic, intercultural, decentralized, and aiming for equal rights between men and women (CPEP, 2009). The president is the head of state, including the government and the executive branch, which currently has 21 ministries. The heads of these ministries form the cabinet. Legislative power is vested in both the government and the two chambers of parliament. The judiciary branch is independent of the executive and the legislative (INE, n.d.c).

Bolivia is divided into nine departments as illustrated in Figure 2.5. The capital city of the Chuquisaca, Sucre, is the official and judicial capital of Bolivia, while La Paz is the headquarters of the executive and legislative branches of the government. Departments are divided into provinces, municipalities and indigenous territories (TIOC for its acronym in Spanish) (INE, n.d.c).

Figure 2.5 Map of Bolivia's nine departments. Source: Mapamundi (n.d.).

Bolivia's nine departments gained autonomy under the Administrative Decentralization Law in 1995 and they are currently governed by elected governors and Departmental Legislative Assemblies. Similarly, cities and towns are governed by mayors and councils, operating with resources provided under the

Popular Participation Law of 1994. Finally, TIOCs are ancestral territories representing the collective or community native lands and constitutionally enabled to constitute indigenous autonomous government (CPEP, 2009).

2.1.5 Economy

The foundation of the Plurinational State of Bolivia involved the adoption a new paradigmatic vision known in aymará as Suma Qamaña (V*ivir Bien* in Spanish), which can be loosely translated into "good living" or "living well" although neither of these captures the full philosophical meaning of the term (Gudynas and Acosta, 2011). According to *Vivir Bien*, the subject of development is not isolated individuals, but individuals as part of a culturally diverse community living in harmony and balance with the environment (CPEP, 2009).

Vivir Bien encompasses a new logic to organize the economic and social relationships defined as the Plural Economy. According to the CPEP (Art 306), this consists of four forms of economic organization: community-based, state, private and social cooperative, harmoniously coexisting to generate wealth that will be distributed equally for the achievement of *good living*.

Drawing on the cosmovision of ancient indigenous cultures, the *Vivir Bien* approach aims to provide an alternative development model to neo-liberal capitalism that deepened the social and environmental degradation stemming from the primarily extractive model implemented since the Spanish conquest (Arce, 2011). Bolivia was a great world producer of gold and silver, with large reserves plundered by the colonial regime and in the first half of the 20th century, Bolivia became the world's leading producer of tin. Today, the Bolivian economy still depends on primary production, particularly natural gas, mining and soy (INE,2019a).

Since the implementation of the plural economy model, real GPD in Bolivia's economy has grown 78% between 2006 and 2017, becoming the second fastest growing economy in the region, with an average annual growth rate of 4.9% (INE,2019b). Among the many elements which have contributed to such strong economic performance, the boom of international oil prices was paramount, increasing the income stemming from natural gas exports, and proving that, after 14 years of the new economic regime, Bolivia has not overcome the extractive economy model (Tockman and Cameron, 2014). However, the nationalization of hydrocarbons in 2006 provided the conditions to generate more income and the main social indicators during this period have significantly improved as an outcome of redistribution policies. By 2018, extreme poverty had reduced from 45.2% to 17.1% (Ministry of Economy and Finance, 2018) and the Gini index decreased from 0.60 in 2005 to 0.47 in 2015 (INE, 2016).

In this context, the energy sector is currently pursuing a goal to generate new income sources, aiming to transform Bolivia into the "energy heart of South America". In line with this vision, the government is pushing the introduction of large-scale hydropower in the energy mix in order to export power to neighbouring countries (MHE, 2014). However, such initiatives are arguably antagonist to the loudly preached principles of *Vivir Bien* due to the significant social and environmental costs incurred (Solón, 2019a, 2019b). Consequently, some argue that the challenge for a real consolidation of the Plural Economy and *Vivir Bien* lies in its implementation rather than its conceptualization (Gutierrez, 2014).

2.1.6 Rural areas

In Bolivia, rural areas are defined as geographic locations with less than 2000 inhabitants (INE, 2015). It is estimated that in 2018 30.6% of the national population and 45% of Bolivia's indigenous population lived in rural areas (INE, 2018). Figure 2.6 shows that these percentages are at their lowest point in history. According to data collected through five censuses carried out from 1950 to 2012, the percentage of rural inhabitants reduced from 75% to 32.5% during this period (INE, 2015).

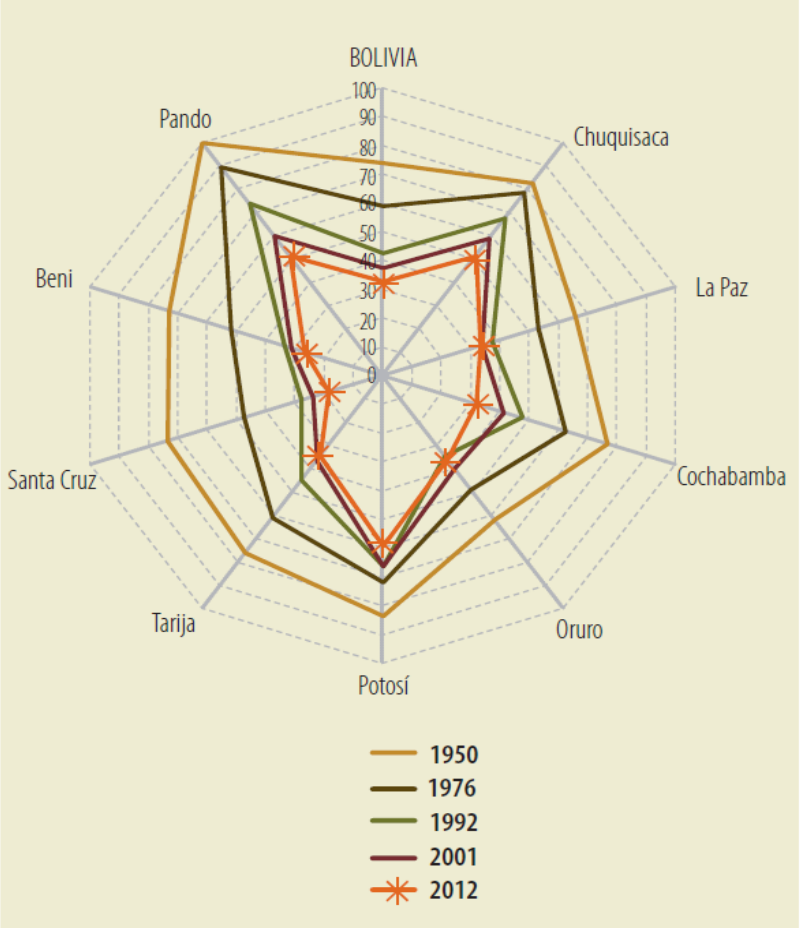


Figure 2.6 The percentage of Bolivia's population living in rural areas. Source: INE (2015).

However, although the proportion of Bolivia's population living in rural areas has decreased, population growth has resulted in the total number of rural inhabitants increasing from 1 995 597 in 1950 to 3 270 894 in 2012 (INE, 2015). Agriculture represents the most significant sector of the rural economy, contributing on average 60% of rural incomes (MDRyT, 2017). Great progress was achieved between 2007 and 2018 with extreme poverty in rural areas reducing by 30.5% (Jubileo, 2018). However, urban-rural disparities persist across regions, gender, indigenous and non-indigenous citizens, and even between indigenous populations. Ninety percent of Bolivia's rural population continue to live in precarious households and lack access to basic services, with education and health facilities often non-existent (MDRyT, 2017).

2.2 Energy access

The concept of energy refers to the physical capacity of matter to do work (Coelho, 2009). In modern society, different forms of energy, namely heat, light, mechanical power, electricity and so forth, are crucial to meet basic human needs and provide services for households and communities. In this context, Yergin and Gross (2012, p. 6) characterise energy as "the lifeblood of the global economy – a crucial input to nearly all of the goods and services of the modern world".

Quantifications related to energy access and performance are used as inputs to measure development levels across countries through metrics such as the Human Development Index [1] (UNDP, n.d.). There is a widespread agreement within policy and academic literature regarding the close and positive connection between energy and development. As such, the international community shares a common goal to provide energy for all (SE4All, n.d.; Toman and Jemelkova, 2003; Constantini and Monni, 2008; Ghouri, 2006; International Energy Agency-IEA, 2019; McLean et al., 2019; Urban, 2020).

2.2.1 Global energy regime

In 1983, the World Bank and the United Nations Development Programme (UNDP) established the Energy Sector Management Assistance Programme (ESMAP), a global technical assistance program focused on the role of energy in economic development and its relationship with poverty alleviation, economic progress, improvement of living conditions, and preserving the environment in developing and transition economies. Indeed, ESMAP was created to address what until then, was a non-mainstream approach to international energy politics (World Bank, 1999).

[1] There is no single universal definition of development. Rather, there is a myriad of conceptual and quantification approaches to the topic stemming from different ideologies, academic disciplines, cultures and philosophies (Urban, 2020). Although the Human Development Index was created to provide criteria for assessing the development of a country by considering populations' capabilities and economic growth, it does not reflect on inequalities, poverty, human security and empowerment, among other issues (UNDP, n.d.).

Two decades later, the importance of energy services gained more attention within the global development agenda. Although energy was not explicitly part of the Millennium Development Goals, many practitioners, policy makers and scholars reflected on the crucial role of energy in achieving these goals (Modi et al., 2005). For example, during the Johannesburg World Summit on Sustainable Development in 2002, the international community was called upon to work together towards the deployment of reliable and affordable energy in order to achieve the Millennium Development Goals, acknowledging that modern energy enhances poverty eradication (ESMAP, 2002).

In 2011, the Secretariat of the United Nations and United Nations Energy, established a global initiative called Sustainable Energy for All (SE4All), aiming to engage governments, the private sector and civil society, to ensure universal access to modern energy services, reduce global energy intensity by 40%, and increase renewable energy use globally to 30% by 2030. In support of these goals, the UN General Assembly declared 2012 the International Year of Sustainable Energy for All (SE4ALL, n.d.). The initial work of SE4ALL was crucial to ensure that energy was included in the Agenda 2030 for Sustainable Development which was adopted by UN member countries in 2015. The seventh Sustainable Development Goal (SDG7) aims to ensure access to affordable, reliable, sustainable and modern energy for all, adopting the three initial objectives of SE4ALL as its initial targets.

In tandem, the global climate change regime, through the Paris Agreement adopted in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC), called for ambitious efforts to mitigate and adapt to climate change through Nationally Determined Contributions, and highlighted the paramount role of the clean energy. In this context, by agreeing to the 17 SDGs and the Paris Agreement, world leaders agreed to working towards achieving affordable, reliable, and sustainable energy for all (SE4ALL, n.d).

2.2.3 Global state of energy access

A joint effort between the World Bank, the International Energy Agency, the International Renewable Energy Agency (IRENA), the UN Statistics Division and the World Health Organization annually presents the Global Tracking Framework for SDG7 in order to assess the progress towards universal energy access. Their most recent report shows that significant improvement has been made towards achieving universal modern energy access and provides further insights encompassing electricity and clean cooking fuels and technology (World Bank, 2020).

2.2.3.1 Electricity

In recent years, the proportion of the world's population that has access to electricity has increased from 83% in 2010 to 89% in 2017 (an average annual growth rate of 0.80%). This progress benefited

more than 920 million people. By 2017 97% of people living in urban areas and 79% of people of living in rural areas had some level of access to electricity. The process of electrification accelerated between 2015 and 2017, with 153 million additional people gaining access yearly. In total, the number of people without access to electricity decreased from 1.2 billion to approximately 840 million during this period (World Bank, 2019).

At regional scales, progress was led by Latin America, the Caribbean and Eastern and South-east Asia which achieved access rates of 98% by 2017, followed by Central and Southern Asia, which reached 91%. In contrast, Sub-Saharan Africa still faces an electricity deficit of 44% of the population equivalent to approximately 530 million people, with 15 of the 20 countries with the lowest electricity access rates in Sub-Saharan Africa, as illustrated in Figure 2.7.

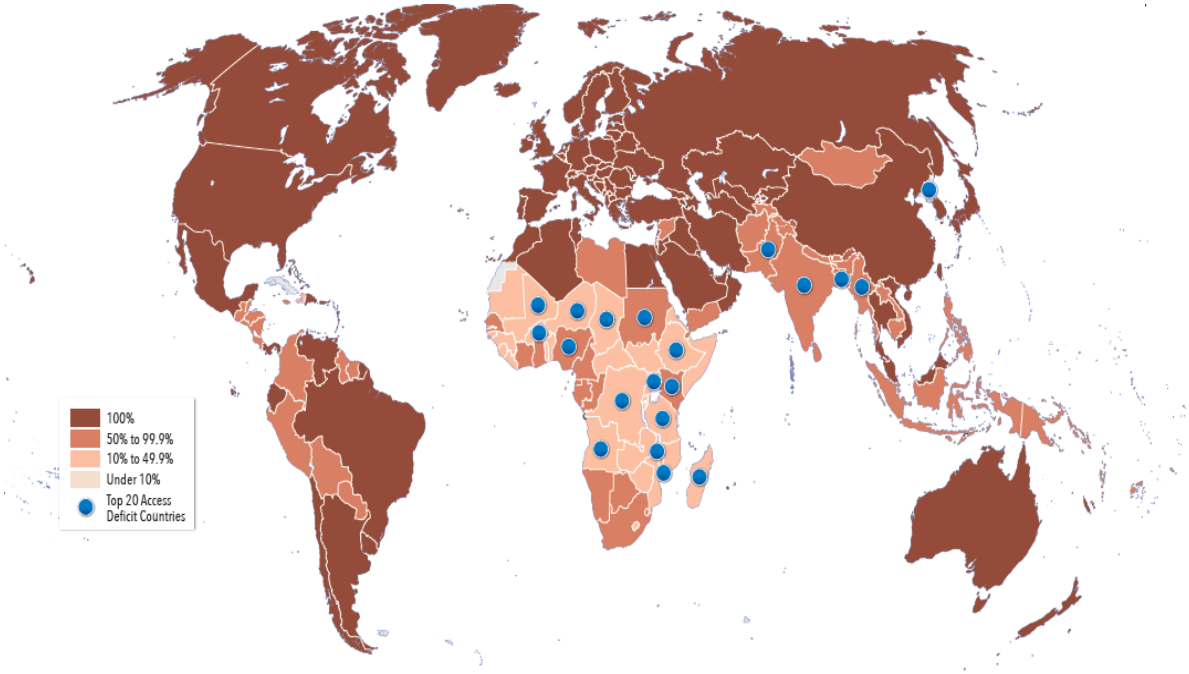


Figure 2.7 The proportion of the population with access to electricity in 2017. Source: IEA (2019).

In terms of affordability, the World Bank estimates that basic subsistence level consumption (defined as 30 kWh per month) costs more than 5% of monthly household incomes for the poorest 40% of the population across half of the countries with the lowest electrification rate, equivalent to 285 million people. Based on the Regulatory Indicators for Sustainable Energy (RISE), World Bank also made observations regarding the reliability of supply revealing that households in one out of three of the highest deficit countries are challenged by more than one supply disruption each week (World Bank, 2019).

2.2.3.2 Clean cooking fuels and technologies

Meanwhile, the population with access to clean cooking solutions increased from between 51-62% to between 54-67% from 2010 to 2017. This included around 83% of urban populations and 34% of rural populations respectively, with an average annual growth rate of 0.5% which slowed down after 2008. Taking population growth into account, the access deficit has remained around three billion since 2016.

Currently, Asia and Sub-Saharan Africa account for the most access-deficit populations as shown in Figure 2.8. Indeed, the population without access to clean cooking fuels and technology in Sub-Saharan Africa increased from 750 million in 2010 to 900 million in 2017. In Latin America, access grew at an average annual rate of 0.4% between 2010 and 2017 but remained stable at the rate of 88% between 2016 and 2017 (IEA, 2019).

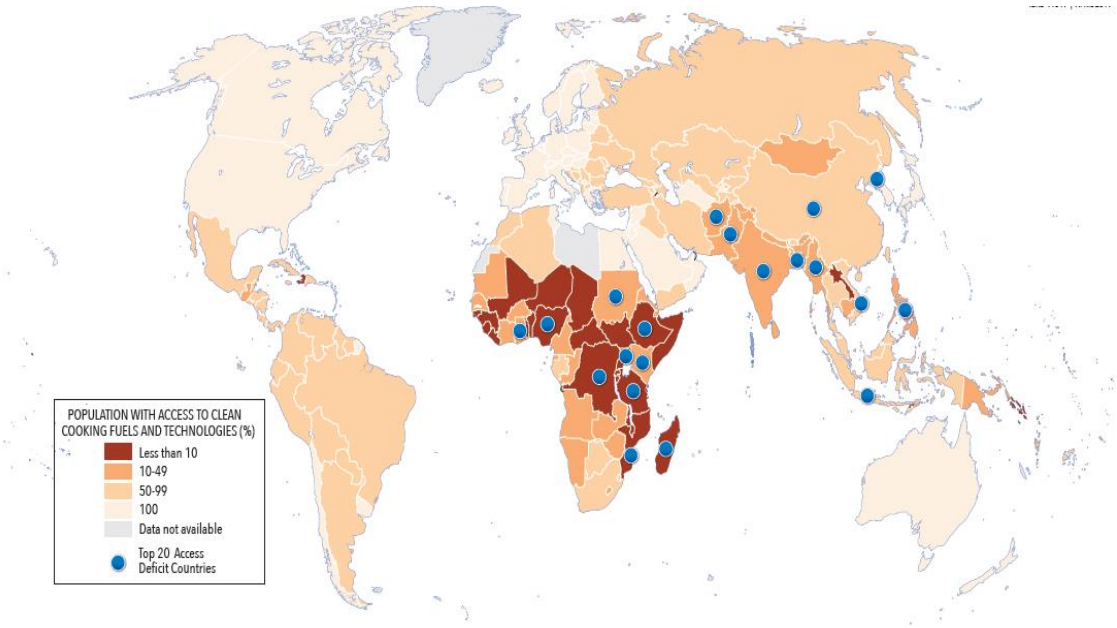


Figure 2.8 The proportion of the population with access to clean cooking fuels and technologies in 2017. Source: IEA (2019)

2.2.4 Outlook

While acknowledging the progress that the global community has made towards achieving modern energy access for all, it is important to note the challenge ahead. In particular, 80% of people without electricity live in developing countries and around 87% in rural areas, which, due to their low population-density and dispersed populations, present the most challenging stage for electrification (Practical Action, 2010).

In order to achieve universal energy access, current growth rates of both electricity and clean cooking fuels and technology access need to increase from 0.8 to 0.86 and from 0.5 to 3.0 respectively. It is estimated that an average annual investment of approximately $55 billion USD will be required between

2018 and 2030. Indeed, it is projected that 650 million people are likely to remain without access to electricity and 2.2 billion without access to clean cooking fuels and technologies in 2030, unless major efforts are undertaken by the international community (IEA, 2019).

Chapter 3 Literature Review

This chapter explores the literature about policies to promote off-grid energy access in rural areas, with a particular emphasis on the social dimensions of these policies and processes. First, Section 3.1 introduces the concept of energy poverty. Section 3.2 then explores the benefits of energy access. Next, Section 3.3 considers the range of technologies which can be deployed to provide off-grid energy access and Section 3.4 reflects on governance frameworks promoting energy access for households and communities. Finally, Section 3.4 briefly outlines policy instruments that can be used to promote off-grid energy solutions.

3.1 Energy poverty

Historically, rural communities have relied on traditional energy sources, particularly biomass fuels such as wood, agricultural residue, and dung, burned in inefficient stoves (Khakder, 2010). However, other fuels including kerosene, diesel and batteries have also become increasingly prevalent within the traditional rural energy regime (Practical Action, 2014; Morrisey, 2017; World Bank, 2018). These energy sources contribute to both social and environmental depletion in rural areas particularly across the Global South (Sovacool, 2012) detrimentally impacting on income generation, education, health, gender equality and vulnerable groups, whilst contributing to global deforestation and climate change (Goldemberg,2000; Sovacool and Drupady, 2012).

In this context, the concept of energy poverty has emerged, although "there is no single, universally-accepted understanding of what it is to be below the energy poverty line" (Culver, 2017, p. 1). However, Pachauri and Spreng (2011) have reviewed the most widely used approaches to assess energy poverty within the literature, identifying three main approaches based on technological, physical and economic thresholds.

The technological threshold perspective frames energy poverty as the absence of modern energy services including electricity and clean cooking fuels and technologies (CCFT). This approach is used by the United Nations (2018) and scholars such as Khanna et al. (2019) who propose that three main causes of energy poverty need to be considered to provide a comprehensive perspective of the topic: availability, accessibility and affordability.

The physical threshold approach focuses on the minimum quantity of energy needed to meet basic requirements. However, there is no universal definition of what this threshold is, with proposed quantities varying widely. For example, Goldemberg (1990) argued that a minimum of 32.1 KgOE[2] per

[2] KgOE (kilograms of oil equivalent) is the unit used as a common metric to quantify energy supplied using a variety of sources by converting them into oil equivalent units.

capita per month is needed to meet essential direct energy needs. More recently, Modi et al. (2005) calculated it at 50 KgOE per household per year. Differentiating electricity consumption from other fuels, Chakravarty and Tavoni (as cited by González-Eguino, 2015) set the threshold at 100 kWh[3] and 150 litres of gasoline consumed per capita per year for basic needs, and 750 kWh of electricity and 220 litres of gasoline per capita per year for productive uses. Khandker et al. (2010) explain that the significant differences between such estimates are the result of significantly different underlying assumptions.

Finally, the economic threshold approach defines energy poverty in terms of the percentage of income spent on energy services. As explained by Morrisey (2017), this approach frames energy poverty in terms of "the energy consumption habits of populations who are deemed poor by other measures" (p. 15). It highlights that poor people spend a much greater share of their income on meeting their energy requirements than wealthier people do, despite consuming significantly less energy. However, again there is no agreement on the value of this threshold within the literature. Khandker et al. (2010) assert that in general, it is defined as within a range of 5 to 20%, being 10% the most common value used.

Culver (2018) argues that it is important to consider that physical and economic thresholds are based on assumptions about the size and efficiency of the technologies used. Therefore, these thresholds need to be adjusted over time as these evolve. Likewise, Bhattacharyya (2012) states that both approaches to energy poverty are context specific, since in different circumstances people need different amounts of energy to meet their basic needs. In addition, defining what constitutes "basic needs" is subjective. These arguments are also discussed by Barnes et al. (2017) who argue that most approaches to energy poverty focus on outputs rather than outcomes and suggest the concept of energy poverty lacks a solid theoretical foundation. Furthermore, the IEA (2019) claims that, due to data constraints, metrics proposed by approaches such as the physical and economic thresholds are difficult to measure. In this context, high-level global initiatives and academic debates on energy access generally define the policy problem from a technological threshold perspective, namely the lack of access to modern energy services, including electricity and CCFT as outlined in Chapter 2.

3.2 Benefits of energy access

The benefits of energy access are widely recognised by academics (Table 3.1) and practitioners (Figure 3.1), supported by a vast body of empirical evidence and literature, with a particular focus on the Global South (Gautama, 2009; Laufer and Schafer, 2011; Sovacool and Drupardy, 2012; Barman, 2017; Barnes and Samad, 2017; Thomas et al., 2018; Dihman et al., 2019; Garcia et al., 2019; Nwozor et al., 2019;Hamburger et al., 2019). Authors like Sokona et al. (2012) and Ugwoke et al. (2020) argue that

[3] kWh (kilowatt hour) measures the electrical energy equivalent to a power consumption of 1000 watts for one hour.

energy access is an essential tool to achieve great strides in human development, strengthen the economy and enable sustainable development in rural areas. Sovacool and Drupardy (2014) identify a wide range of benefits associated with different types of energy, including mitigation benefits, adaptation benefits and social and economic benefits (as outlined in Table 3.1). Similarly, Practical Action (2014) highlight the various ways improved energy access can benefit households, businesses and the wider community (as illustrated in Figure 3.1).

Table 3.1 Benefits from energy access. Source: Sovacool and Drupardy (2014)

Type	Application	Mitigation benefits	Adaptation benefits	Social and economic development benefits
ICS	Electricity generation and heat.	Reduced use of charcoal and fuelwood, less pressure on natural resources.	Reduces the likelihood of deforestation and desertification.	Creation of jobs and livelihood opportunities, reduced drudgery, reduction of incidents related to indoor air pollution and respiratory infections.
Wind	Crop processing, irrigation, and water pumping.	Decreased dependence on wood and biomass, avoidance of carbon dioxide emissions.	Greater resilience through reduced vulnerability to water scarcity, more adaptation choices through irrigated agriculture.	Greater prospects for income generation, improved quality of life, reduced risks of vector born diseases, improved water supply and food security, reduced migratory fluxes, improved school attendance (especially for girls).
Biogas	Production of sludge for fertilizer.	Reduced use of pesticides and fertilizers.	Adapting to soil erosion, aridity, and environmental degradation.	Better prospects for agricultural productivity and income generation.
SHS	Cooking, lighting, and water heating.	Reduced consumption of fuelwood, kerosene, and batteries, improved local air quality.	Improved education through illuminated studying and access to information and communication technology.	Improved quality of life as well as better health and sanitation through streetlights and boiled water.
Microhydro	Lighting, agricultural processing.	Reduced greenhouse gases, protection of land cover.	Improved social resilience.	Improved health, greater school attendance.

However, a growing body of literature posits that development impacts stemming from energy access projects are not simple nor straightforward (Kumar, 2018). Rather, they are nuanced and mediated by a wide range of social, cultural and political factors that can hinder anticipated benefits (Bhattacharyya, 2012; Otte, 2014; Treiber et al., 2015; Groves et al., 2017; Kumar, 2018; Padmanathan, 2019; Dihman et al., 2019; Mceachern et al., 2008; Sovacool, 2014). For example, Aklin et al. (2017) found no evidence for systematic changes in savings, spending, business creation, time spent working or studying, or other broader indicators of socioeconomic development across 1281 households in rural India.

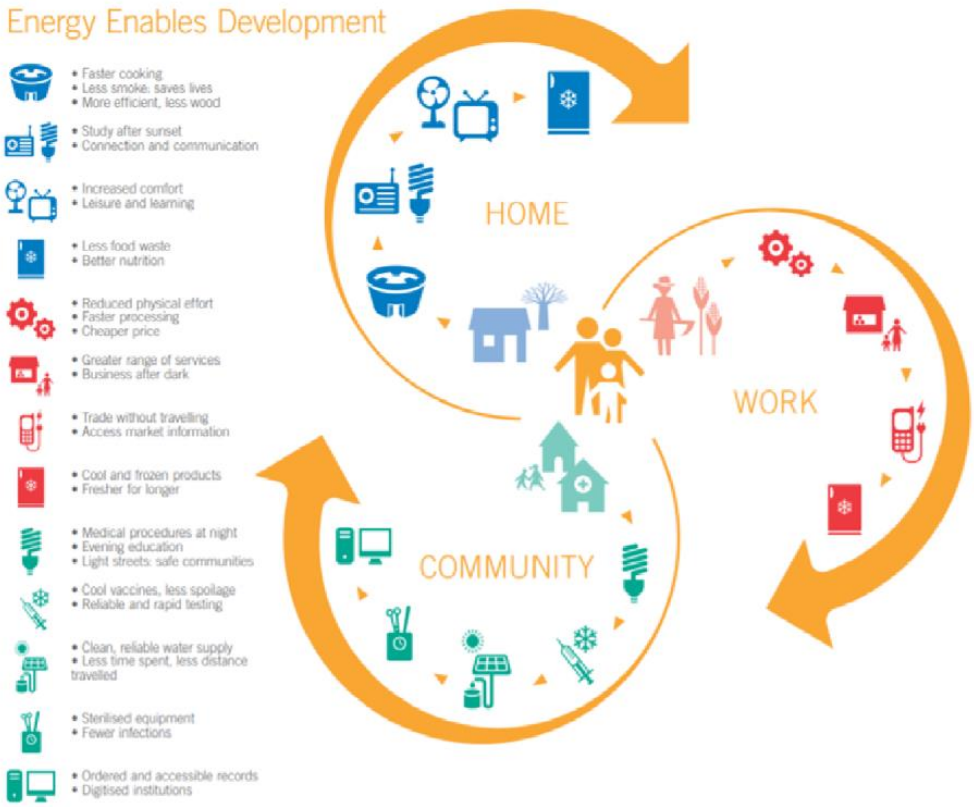


Figure 3.1 Benefits from energy access. Source: Practical Action (2014)

Research by Kooijman-van Dijk (2012) and Barman (2017) found noticeable benefits associated with the adoption of SHS including savings from a reduction in kerosene consumption, extended working hours of small businesses and income generation through mobile phone charging. However, when Monyei et al. (2018) compared on-grid and SHS policies in South Africa they found that the different supply tiers these DRES provide have increased the disparity between on-grid and off-grid services, resulting in increased final costs for off-grid families. Furthermore, while household savings can result from DRES displacing another energy source, this is not always a straightforward process as traditional and modern energy systems and practices are often used concurrently (Sokona et al., 2012). In this context, Ulsrud et al. (2018) argue that important qualities of potential energy systems such as the relevance of the available electricity services for end-users, the system's operational and economic sustainability and the potential for replication must be taken into account in order to ensure that an appropriate and affordable solution is developed and implemented.

It is also crucial that relevant cultural factors are considered and addressed. For example, Sovacool (2016) show that beliefs of protection related to Buddhism in rural India and community values over individual welfare known as "toki" within an indigenous tribe in Papua New Guinea have resulted in sub-optimal technical operation of SHS, resulting in non-beneficial expenditures. Likewise, despite evidence

of the positive effects of electricity on local productivity (Das, 2006; Rao,2013), Kumar (2018) found that in India's Bihar state, electricity alone was not enough to enhance local supply chains. In this regard, Cabraal et al. (2005) offer that programs focused on productive uses of energy for rural development in Indonesia were successful due to: (1) stimulating rural entrepreneurship through price incentives, information about opportunities and constraints for small rural businesses and marketing interventions; and (2) strengthening and formalizing productive associations to improve the contribution of energy access to productive activities.

Similar evidence from across the literature supports the catalytic potential of DRES to address concerns related to indoor air pollution, physical injury during fuelwood collection, lack of refrigeration facilities and limited medical care in areas that currently lack modern energy services (Aines et al.,2007; Sovacool and Drupardy, 2012; Baquié and Urpelainen, 2017; McLean et al., 2019). However, it is important to note that DRES do not necessarily address all of these concerns. For example, Jüriso et al. (2019) and Treiber et al. (2015) showed that indoor pollution persisted following the introduction of DRES in Zambia. and Kenya, due to the intricacies of fuel choice dynamics. They note that the adoption of clean cooking technologies is highly complex and implies fuel diversification including "modern and traditional, and devices to secure a continuous energy supply and counteract potential access and availability issues" (Treiber et al., 2015, p. 55). Therefore, they advocate for policies that explore strategies to enhance the adoption of heathier fuel mixes in rural households.

Sovacool (2016) found that maintaining the flavour in traditional dishes in Bangladesh was more highly valued than reducing indoor pollution, while cultural beliefs regarding the divinity of the sun affected the uptake of solar cookers in Kenya. To address these kinds of issues, Dziedzic et al. (2019) and Lambe et al. (2020) show that behavioural economic theory can be useful for mapping individuals' experiences of a new technology or service and, based on this, identifying key parameters to support the design and delivery of more robust development-oriented interventions focused on health and other services. Given the many benefits of energy access for healthcare facilities, Franco et al. (2017) argued that projects must explore the most appropriate technology design to enhance the delivery of such services according to the facility size. To achieve this, they recommend mini-grids exclusively designed for health facilities.

DRES can significantly reduce the drudgery of hours spent collecting biomass by girls thereby contributing to increasing the number of hours they can study (Barman, 2017). However, in India amongst. Moreover, Daka and Ballet (2011) argue that policies targeting energy access and education must focus on *when* electricity access happens since it may be, for many children, after school was abandoned like he observed in Madagascar. As for education and telecommunication community

facilities, Nandi et al. (2016) assert that decentralized energy systems are crucial, yet not always sufficient to enable rural empowerment through ICT.

Finally, DRES are expected to empower woman (Masud et al., 2007; Joshi et al., 2019; Lieu, 2020). Some of the benefits of improved energy access for women are summarised in Table 3.2. However, research shows that energy access can sometimes merely reinforce existing gender power imbalances as Marshall et al. (2017) and Sunikka-Blank et al. (2019) note by reflecting on the transfer and uptake of DRES in Kenya and India respectively. Therefore, Osunmuyiwa and Ahlborg's (2019) proposes a planning model for a "gender sensitive electrification project, where the provision of decentralised electricity is understood as a cyclical and dynamic process with multiple possibilities to introduce strategies and components to overcome gender-specific barriers, achieve equal opportunity, access and use."(p. 154). For example, Conway et al. (2019) draw upon well-established social processes and women-led savings groups' strong organisational capacity and accountability within the community. This approach establishes a robust social contract and a resilient mechanism for technical delivery and grass-roots information flow.

Table 3.2 Benefits of modern energy services for women. Source: Masud et al. (2007).

Energy source	**Benefits**		
	Practical	*Productive*	*Strategic*
Electricity	Pumping water, reduced need to haul and carry mills for grinding, improved conditions at home through lighting.	Increased possibility of activities during evening hours, refrigeration for food production and sale, power for specialized enterprises and small businesses.	Safer streets, participation in evening classes, access to radio, television, and the Internet.
Biomass (improved cookstoves)	Improved health, less time and effort gathering fuelwood, more time for childcare.	More time for productive activities, lower cost of space and process heating.	Improved management of natural forests.
Mechanical	Milling and grinding, transport and portering of water and crops.	Increased variety of enterprises.	Access to commercial, social, and political opportunities.

Such insights are paramount to designing and implementing public policies to ensure socially empowering energy transitions, recognising that even low-carbon energy transitions can create social vulnerability and reinforce existing social inequalities caused by traditional energy sources (Sovacool et

al., 2019). Focusing on mini-grids Eales et al (2018) asserts that existing studies tend to focus more on measuring technical and economic performance of installed systems rather than their impact on the general well-being or social development of the communities they serve. To address this, Eales et al. (2018) assert that "such social impact focussed data would provide a critical evidence base for supporting claims of the beneficial effects of mini-grids on the communities they serve" (p. 355). As such, there is a critical need for multidisciplinary research into the opportunities and constraints for realising the full potential of decentralised renewable energy systems (Van Ruijven et al., 2008; Thomas et al., 2018; Broto et al., 2020).

3.3 Decentralized Renewable Energy Solutions (DRES)

Energy access policies can promote centralized and/or decentralized approaches (Morrison, 2017; ESMAP,2009). Considering the demographic, socio-economic and geographic features in rural areas, most current energy access planning schemes encompass a mix of both rather than considering them as mutually exclusive and they are often implemented in a parallel or sequenced fashion (World Bank, 2012). However, grid connections are prone to grid capacity failures for consumers at the end of the grid who face low-voltage and power shortages issues (World Bank, 2012; Bhattacharyya, 2012).

Furthermore, most rural population who currently lack access to modern energy services are poor and located in isolated and dispersed areas, for which centralized energy solutions are often not technically nor financially tenable (Moner-Girona et al., 2012; Lee et al., 2015; Barnes et al., 2018). Given persisting poverty and inequality in rural areas of developing countries, as well as their vulnerability to the effects of climate change, there are high expectations of decentralized renewable energy solutions (DRES) as crucial instruments to harness local resources and produce cleaner electricity. In this context, DRES are viewed as a means of transitioning to a more sustainable rural development paradigm (Boliko and Ialnazov, 2019) and are at the forefront of energy planning schemes across developing countries (Mainali and Silveira, 2013; Banal-Estañol, Calzada and Jordana, 2017; Khan et al., 2018; Vezzoli et al., 2018). Table 3.3 shows examples of the transitions from traditional off-grid to modern energy sources to provide energy services in rural areas.

Table 3.3 Transitions to grid-based and renewable energy in developing countries. Source: Barnes, Samad and Rivas (2018).

Energy service	Traditional off-grid rural energy sources	Examples of modern energy sources
Lighting and other small-scale electricity needs (homes, schools, street lighting, telecom, hand tools, and vaccine storage)	Candles, kerosene, batteries, and central battery recharging by carting batteries to grid	• Hydropower (pico-, micro-, and small-scale) • Biogas from household-scale digester • Small-scale biomass gasifier with gas engine • Village-scale mini-grids and solar/wind hybrid systems • Solar home systems • Traditional grid electricity systems
Communication (televisions, radios, and cell phones)	Dry-cell batteries and central battery recharging by carting batteries to grid	• Hydropower (pico-, micro-, and small-scale) • Biogas from household-scale digester • Small-scale biomass gasifier with gas engine • Village-scale mini-grids and solar/wind hybrid systems • Solar home systems • Traditional grid electricity systems
Cooking (homes, commercial stoves and ovens)	Burning wood, dung, or straw in open fire at about 15 percent efficiency	• Improved cooking stoves (fuelwood, crop wastes) with efficiencies above 25 percent • Biogas from household-scale digester • Solar cookers • LPG stoves • Electric stoves and appliances
Heating and cooling (crop drying, other agricultural processing, and hot water)	Mostly open fire from wood, dung, and straw	• Improved heating stoves • Biogas from small- and medium-scale digesters • Solar crop dryers • Solar water heaters • Ice-making for food preservation • Fans from small-grid renewable system
Process motive power (small industry)	Diesel engines and generators	• Small-grid systems from micro-hydro, gasifiers, direct combustion, and large biodigesters
Water pumping (agriculture and drinking water)	Diesel pumps and generators	• Mechanical wind pumps • Solar PV pumps • Small-grid systems from micro-hydro, gasifiers, direct combustion, and large biodigesters • Grid electricity systems

However, there are two spatial considerations to account for. First, it is important to understand that whether a resource is renewable or not depends on its regeneration capability relative to the consumption rate and local management conditions. Vezzoli et al. (2018) explain that:

> wood represents a typical case where renewability depends on this. The same type of wood could be renewable or not depending on how its growth is being planned and controlled… we cannot define a renewable resource without mentioning the context in which it is produced and consumed. What can be 'renewable' on one side of the world, with given natural sources, culture even political situation, could be considered 'non-renewable' in other locations (Vezzoli et al., 2018, p. 27).

Secondly, the availability of wind, solar and hydro resources varies widely geographically and can be intermittent (Wiemann, 2014).

In line with the lack of a general definition of energy poverty, there is also a lack of conceptual consensus regarding energy access (Van Ruijven et al., 2008; Pachauri, 2012). In this context, different actors within the global energy regime introduced in Chapter 2, propose different approaches for defining energy access, beyond just electricity and CCFT. For instance, a joint initiative between the ESMAP and SE4ALL has developed the Multi-tier Framework to monitor and evaluate energy access. It uses a multi-dimensional definition, defining energy access as "the ability to avail energy that is adequate, available when needed, reliable, of good quality, convenient, affordable, legal, healthy and safe for all required

energy services". Energy access is therefore measured from a tiered approach, from Tier 0 (almost no access) to Tier 5 or the highest level of access as illustrated in Table 3.4 (ESMAP, n.d., n.p).

Table 3.4 Simplified multi-tier matrix of energy access. Source: World Bank (2014, p. 3)

Attributes of energy supply		Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Capacity	Household electricity	No electricity[a]	Very low power	Low power	Medium power	High power	
	Household cooking	Inadequate capacity of the primary cooking solution				Adequate capacity of the primary cooking solution	
Duration and availability	Household electricity	<4 hours	4–8 hours		8–16 hours	16–22 hours	>22 hours
	Household cooking	Inadequate availability of the primary cooking solution				Adequate availability of the primary cooking solution	
Reliability	Household electricity	Unreliable energy supply				Reliable energy supply	
Quality	Household electricity/cooking	Poor quality of energy supply			Good quality of energy supply		
Affordability	Household electricity	Unaffordable energy supply		Affordable energy supply			
	Household cooking	Unaffordable energy supply				Affordable energy supply	
Legality	Household electricity	Illegal energy supply			Legal energy supply		
Convenience	Household cooking	Time and effort spent sourcing energy cause inconvenience			Time and effort spent sourcing energy do not cause inconvenience		
Health and safety	Household electricity	Unhealthy and unsafe energy system				Healthy and safe energy system	
	Household cooking[b]	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5

Similarly, the Total Energy Access Index proposed by the international NGO Practical Action, establishes a minimum level of energy required for each of the following energy services: lighting, cooking and water heating, space heating, cooling, information and communications, and earning a living, as illustrated in Table 3.5 (Practical Action, 2010). This approach focuses on the benefits derived from the provision of energy providing insight into how energy access enhances the wellbeing rural populations. This supports Samarakoon's (2019) observation that people demand energy services, not energy itself. In this context, energy access is not just about electricity and CCFT, but rather the energy services that these enable for households as well as "for community facilities as well as enterprises and other productive spaces to enable energy-poor people to lift themselves out of poverty" (Practical Action, 2020, p. 5).

Table 3.5 The Total Energy Access Minimum Standards for a household. Source: Practical Action (2010).

Energy service		Minimum standard
Lighting	**1.1**	300 lm for a minimum of 4 hours per night at household level
Cooking and water heating	**2.1**	1 kg woodfuel or 0.3 kg charcoal or 0.04 kg LPG or 0.2 litres of kerosene or ethanol per person per day, taking less than 30 minutes per household per day to obtain
	2.2	Minimum efficiency of improved solid fuel stoves to be 40% greater than a three-stone fire in terms of fuel use
	2.3	Annual mean concentrations of particulate matter (PM2.5) < 10 µg/m3 in households, with interim goals of 15 µg/m3, 25 µg/m3 and 35 µg/m3
Space heating	**3.1**	Minimum daytime indoor air temperature of 18ºC
Cooling	**4.1**	Households can extend life of perishable products by a minimum of 50% over that allowed by ambient storage
	4.2	Maximum apparent indoor air temperature of 30 C
Information and communications	**5.1**	People can communicate electronic information from their household
	5.2	People can access electronic media relevant to their lives and livelihoods in their household

Taking the same approach to address energy access in terms of specific energy services, the SE4All established the Cooling for All Secretariat to enhance awareness about the need for universal access to cooling; collate related data and knowledge; and help coordinate focused responses among the governments and other governance institutions involved in energy access (SE4All, 2019). However, the operationalization of such approaches faces several constraints due to a lack of the detailed data necessary to quantify the impact of specific interventions, which would require costly and time-consuming recurrent surveys to obtain (World Bank, 2014; Bhatia and Angelou, 2015).

Nevertheless, across the literature, many argue that benchmarks are crucial to address the goal of achieving energy access for all. Monyei et al. (2019, p. 113) identify “policy vagueness” in the energy access agenda across the Global South, referring to the omission or use of imprecise references and terminologies that allow for divergent interpretations of its objectives. They argue that there is a need to adopt energy access benchmarks which, in addition to those offered by the approaches to measure energy poverty discussed above, incorporate benchmarks of energy mobility which they define as “the ability of households to increase their electricity consumption based on either an increase in the ownership of owned electrical appliances or extended usage of already owned electrical appliances” (Monyei, et al., 2019, p. 114). Furthermore, Monyei et al. (2019, p. 113) argue that “…many so-called off-grid “electrified” households in the Global South can be classified as un-electrified considering the inability of their electrification system to offer them any utility”.

Indeed, according to IEA (2019), some technologies like solar lanterns and mobile phone chargers, provide energy that is considered to be below the minimum threshold to count as providing energy

access. As such, overarching approaches to measure energy access, are critical and must be considered by policy-makers and project developers of energy access initiatives (ESMAP, n.d.). However, Bisaga and Parikh (2018) observe that even low-levels of energy access can be transformative. The following sections outline different DRES and their main features to provide energy access.

3.3.1 Electricity

In general, there are three models for decentralised energy solutions which can be adapted to local needs and conditions: mini-grids, stand-alone systems and combination of both (Chung et al., 2012; Wiemann et al., 2014; Morrison, 2017; World Bank, 2018).

3.3.1.1 Mini-grids

Renewable energy mini-grids are expected to play a major role in the pursuit of universal access to modern energy services (Muhoza and Jhonson, 2018, p. 4). Bhattacharyya (2018) define mini-grids as "electricity providers who supply electricity produced from local generating resources to local users using a local distribution network operating either in an isolated mode or in a grid-interactive mode". The generation capacities associated with mini-grids within the literature are quite variable. Table 3.6 outlines commonly used size definitions that range from 0.5 kilowatt (kW) "pico-grids" to 100 megawatt "micro-grids" (Bhattacharyya, 2018). In contrast Peters et al. (2019) define mini-grids as systems up to 500 kW, whereas Goldemberg (2000) and Weimann et al. (2014) propose different ranges depending on whether a system is solar, wind or hydro-powered. In this thesis, the term mini-grid encompasses all the above-mentioned size ranges.

Table 3.6 Size ranges of mini-grid systems. Source: Bhattacharyya (2018).

Local Grid Systems	Commonly Used Size Definitions	IRENA (2016)
Mini-grids	10 to few MW	0-100 MW
Micro-grids	1-10 kW	5-100 kW
Nano-grids	0.5-1 kW	0-5kW
Pico-grids	0-0.5 kW	0-1kW

Until three decades ago, hydro-powered and diesel-powered mini-grids (World Bank, 2012) were the most widely implemented off-grid solution (Baring-Gould et al., 1997; Goldemberg, 2000; Diaz et al., 2010; IRENA, 2016). Although diesel-powered energy systems require relatively low initial capital investment (Wiemann, 2014), IRENA (2016) asserts that "the near-monopoly that diesel generation

historically has had in many isolated areas has made the cost of electricity fluctuate with international energy markets" (p. 27). These fluctuations are not always reflected in the final tariffs, because diesel is highly subsidised particularly in South America (ESMAP, 2009). However, these systems have very high running costs related to operation and maintenance and buying and transporting diesel fuel and lubricating oil (Goldemberg, 2000). This can represent a significant budgetary burden for states, alongside significant environmental concerns associated with diesel (Diaz et al., 2010).

Small or micro-hydro is the cheapest technology, but also the most site dependent, as it requires a river with specific flow rate and volume conditions (Figure 3.2). Small wind power technology is also very site specific, as wind conditions vary dramatically from place to place. Therefore, wind resources must be carefully studied before a system is installed. Mini-grids based on solar photovoltaic (PV) are suitable for almost any location, but their up-front costs are more expensive than other technologies. Therefore, due to the resource intermittence discussed in the introduction of this chapter, batteries and diesel remain as back-up elements for both solar and wind (Lahimer et al., 2013; Wiemann, 2014).

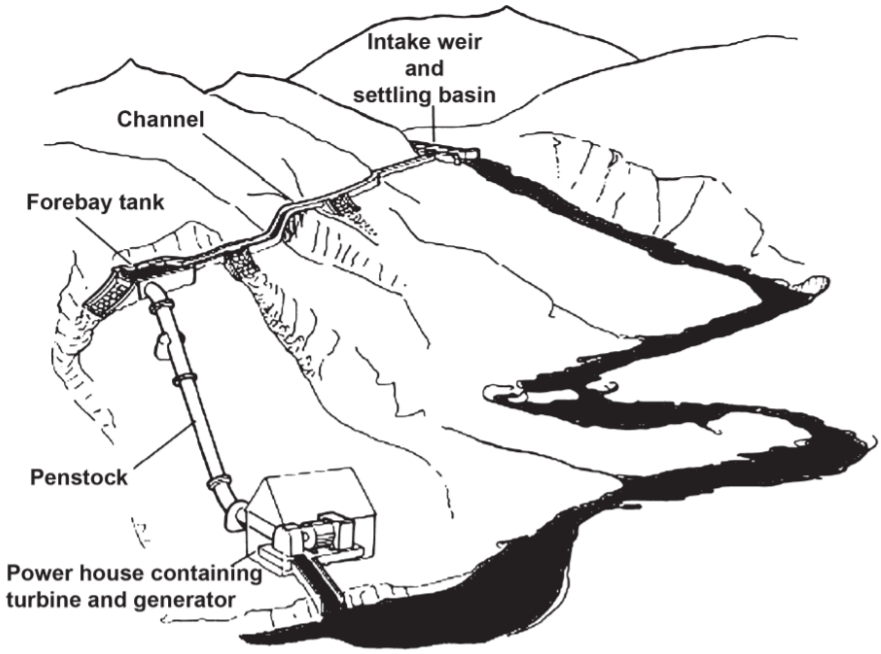


Figure 3.2 Schematic of a hydro-powered technical layout. Source: Sovacool and Drupardy (2012).

The current mini-grid global stock is made up of pure solar, hybrid solar-diesel, hydro-powered (HPMG) and wind based mini-grids backed up with battery storage (Lahimer et.al, 2013). The technical and economic layout and the energy sources that power mini-grids depend on the local energy requirements and the resources available, which are assessed as pivotal stages of the planning process. In this context, Gambino et al. (2019) observe a gap between the academic guidelines for mini-grid planning and mini-grid planning in practice. They therefore propose a comprehensive methodology which can be adapted

to facilitate a case-by case design as illustrated in Figure 3.3. This methodology consists of three interrelated elements the site selection, demand forecast and sizing.

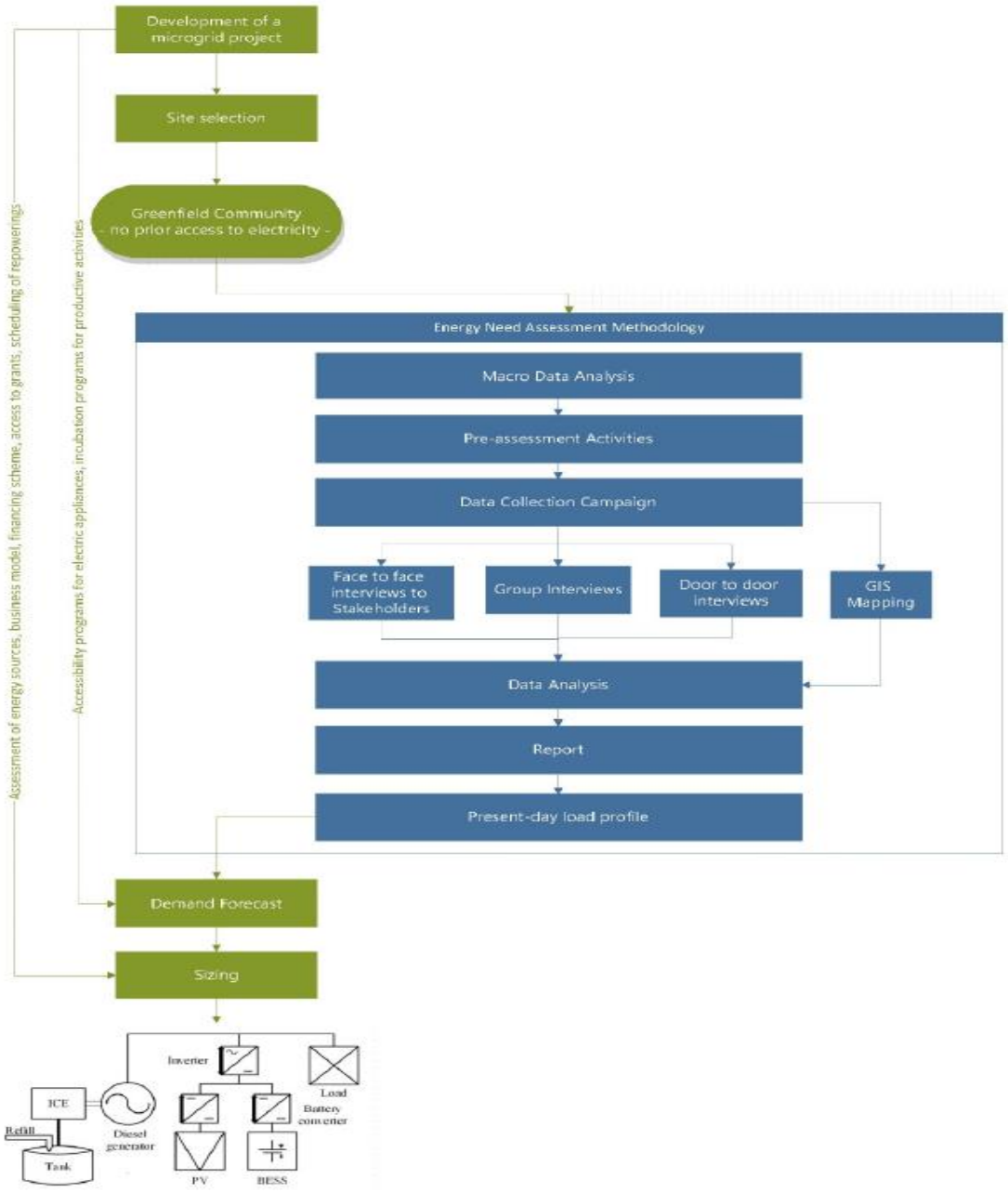


Figure 3.3 Development process flowchart for greenfield mini-grid projects. Source: Gambino et al. (2019)

Although mini-grids involve lower up-front costs than expanding the grid on a large scale, they are still capable of supplying electricity in quantities that can match the services supplied by the grid for households, community services and productive activities (Sovacool and Drupardy, 2012; IRENA, 2017). However, the initial investment can still be challenging, particularly given the low incomes of some rural communities, households and local entrepreneurs - who might be expected to finance and run such

grids (Morrisey, 2017). In order to ensure the high costs mini-grids entail are justified, bespoke energy systems must be designed (Lal and Raturi, 2012; Gambino et al., 2019) alongside appropriate ownership models. Peters, Sievert and Toman (2019, p. 2) explain that there are two main types of schemes: "commercially operated schemes that involve private operator and community-based schemes". Wiemann et al. (2014) also highlight public-private partnerships (PPP) in Indonesia and Laos (Figure 3.4) that enabled the successful implementation of various types of mini-grids.

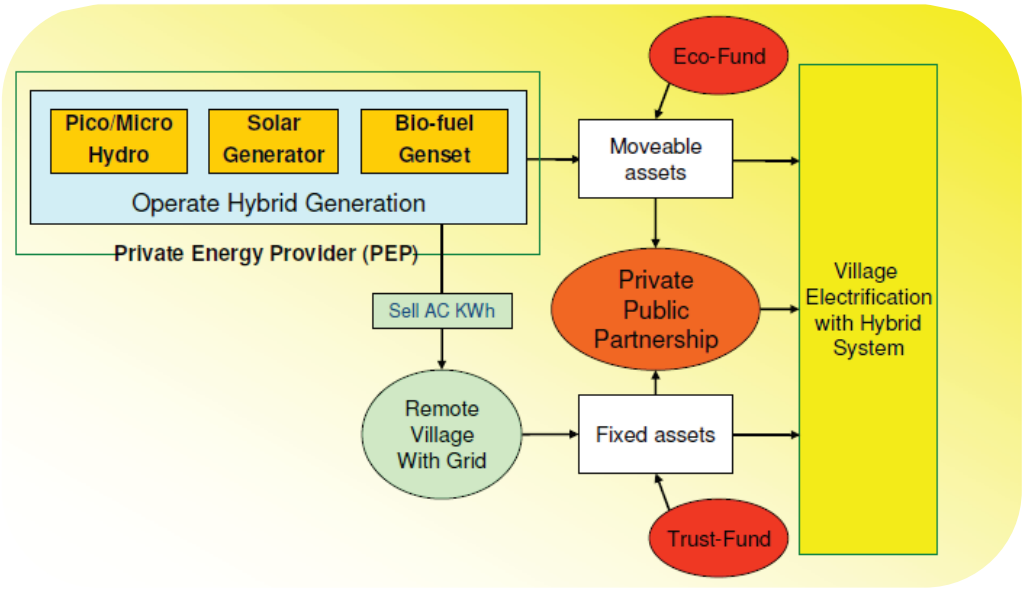


Figure 3.4 Lao project's structure. Source: Wiemann (2014).

3.3.1.2 Standalone systems

Standalone systems can supply electricity for remote communities and scattered households that cannot be connected through mini-grids due to their dispersion. Standalone solutions provide electricity to isolated households through solar PV and less often, wind energy. Goldemberg (2000) describes wind standalone systems with capacities ranging from 50 to 200 watts, that have supplied electricity for lighting, radios, television, and small appliances to more than 500,000 people in Inner Mongolia since the 1990s. However, others argue that stand alone wind systems are too expensive for most rural markets and require a high-level expertise for operation and maintenance (Leary et al., 2012; Lahimer et al.,2013).

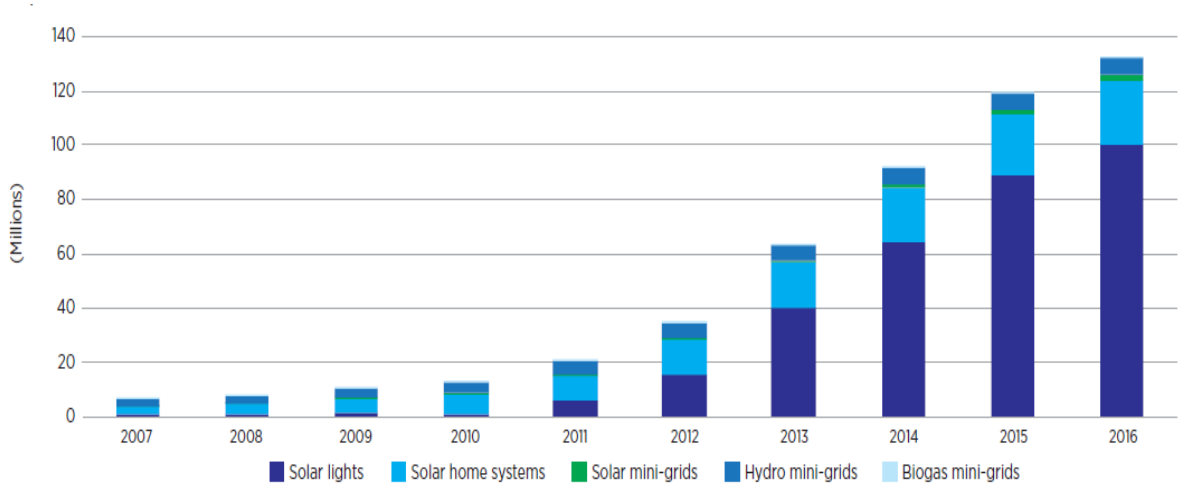


Figure 3.5 Population served by off-grid renewable energy solutions. IRENA (2018)

On the other hand, solar PV, including solar home systems (SHS) and appliances such as solar lanterns and mobile phone chargers can offer households limited quantities of electricity (Morrisey, 2017). Figure 3.5 shows the increasing number of households supplied with solar PV during the last two decades across the Global South. Such trends can partly be explained by the sustained decrease in the cost of solar PV (IRENA, 2017). However, arguably another driver is the fact that solar systems offer "customers in off-grid and rural areas can often choose from a variety of systems and technologies from 10 Watt-peak (Wp) unit for the poorest households, to a 150 Wp unit for wealthier clients. Larger systems have the capacity to connect televisions, radios, and other electric appliances" (Figure 3.6) (Sovacool and Drupardy, 2012).

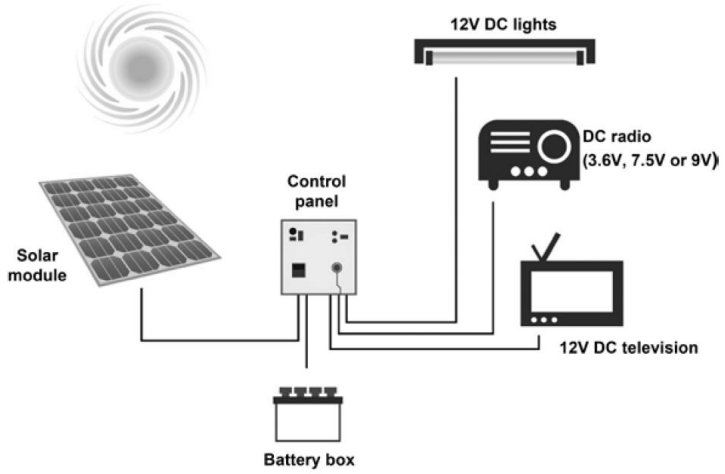


Figure 3.6 Schematic of a solar home system (SHS). Source: Sovacool and Drupardy, (2012).

However, Yadav, Davies, and Palit (2019) observe that despite the growing affordability and environmental advantages of solar solutions, equity and efficiency are still significant issues. They

therefore advocate for electrification policies and strategies based on the principles of diversity in technology use, localised implementation and centralised planning and enforcement. Affordability and energy mobility can be addressed from different approaches. For instance, Zubi et al. (2016) advocate for an evolving techno-economic assessment of off-grid applications that commences by limiting PV power supply to very high added value applications such as lighting and plugging and by properly exploiting technological innovations to enhance energy efficiency and cost reductions to understand how their affordability would evolve over time.

Tripartite models – government, private suppliers and consumers - consisting of subsidised fee-for-service solar electricity social enterprise proved to be successful as an efficient operating model to deploy and scale solar home systems in tandem with local job creation, which together has helped minimising running costs and thus maximising end-user affordability and produce wider local economic benefits in South Africa (Conway et al., 2019).

3.3.2 Clean cooking fuels and technologies

Bhattacharyya (2012) argues that providing electricity does not necessarily solve the challenge of energy access and advocates for the need to design sustainability pathways specifically to meet the demand for cooking and heating. Indeed, cooking fires are the oldest known energy solution in human civilization (White,1943; Nguyen et al., 2019; Urban,2020) and continue to prevail as one of the key sources of energy in many developing countries (Panwar et al., 2012). Amongst the poorest households' stoves can be as simple as three rocks piled up, there are also a wide range of different stoves which use commercial and non-commercial fuels. The efficiency of these different stoves varies widely as illustrated in Figure 3.7 (Goldemberg, 2000; Otte, 2013).

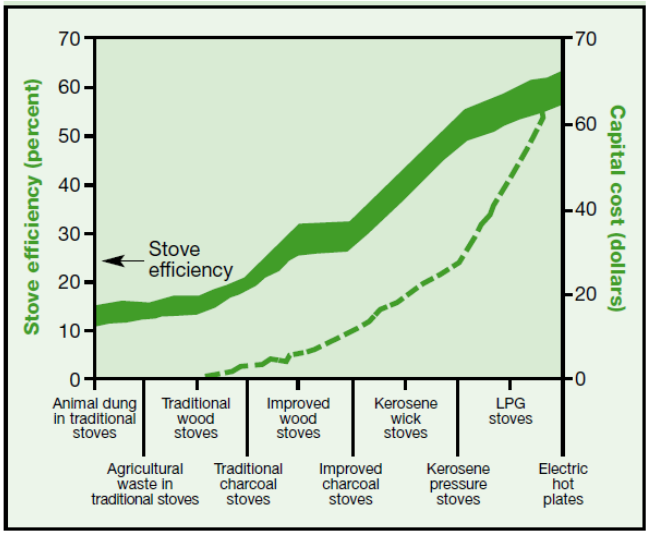


Figure 3.7 Efficiency of stoves with commercial and non-commercial fuels. Source: Goldemberg (2000).

In order to address the efficiency issues alongside the significant environmental and health impacts of traditional fuels including animal dung, agricultural waste, wood, charcoal and kerosene, three mainstream solutions are found across the literature: improved cookstoves, biodigesters and solar cookstoves. First, improved cookstoves can encompass a wide variety of solutions. The efficiency of a cookstove can improve significantly "by something as simple as adding a chimney or more insulation around the stove to retain heat" (Figure 3.8) (Sovacool and Drupardy, 2012, p. 44.). However, besides their technical specifications, improved cookstoves also generally imply a switch in fuel from those on the left towards those on the right in Figure 3.6. Fuels on the right generate less pollution and thereby have fewer detrimental health and environmental impacts.

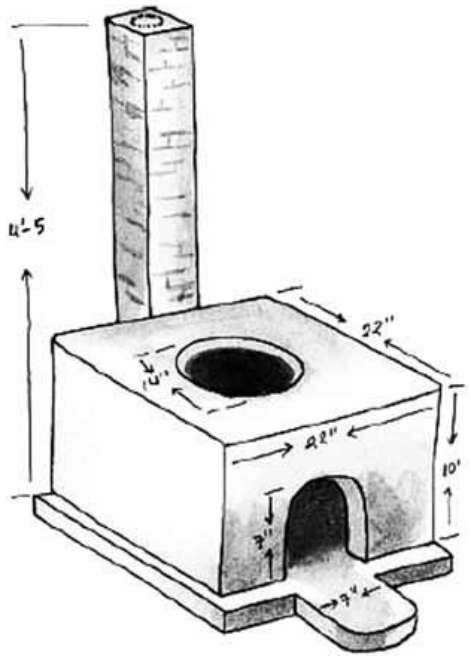


Figure 3.8 Schematic of a one-mouth improved cookstove. Source: Sovacool and Drupardy, (2012).

However, for the process of household cooking fuel transitions, technological solutions are not enough. Many authors agree there is a mismatch between broader policy aims and local household responses to policies relating to cooking fuel use (Akintan et al., 2018; Schunder and Bagchi-Sen, 2019; Jewitt et al., 2020). For example, the introduction of highly subsidised LPG in Ecuador failed to reach half of the intended rural beneficiaries who continued to cook with biomass because the required equipment had never been installed by electricity companies, their stove had broken, or they feared high electricity costs (Gould et al., 2020). Similarly, Crentsil et al. (2019) argued that there is a need to intensify the LPG promotion campaign and adopt strategies that incorporate the still unattended groups in order to

facilitate universal access to clean energy whilst reducing the degree of multidimensional energy poverty in Ghana.

Biogas digesters are a second alternative to provide CCFT for scattered households using agricultural, domestic and/or animal waste that through anaerobic fermentation within a vessel produce clean biogas to cook besides organic fertilizer based on bio-slurry as by-products (Figure 3.9) (Sovacool and Drupardy, 2012). Although small-scale individual systems have proved successful in countries such as Nepal, India and China for more than half century (Gautama et al., 2009), many argue that the permanent nature of the layout, the amount of waste needed for operation, technical management and perceptions of uncleanliness challenge the roll-out of this technology (Goldemberg, 2000; Sovacool and Drupady, 2011; Morrisey, 2017).

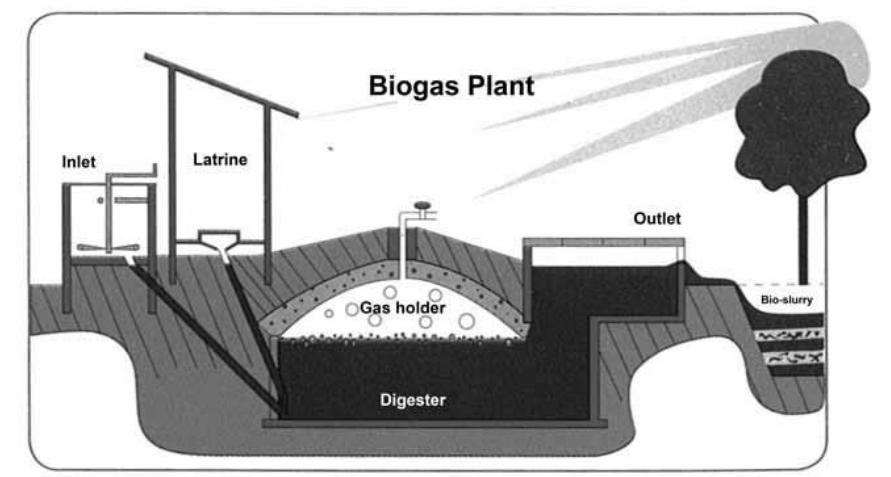


Figure 3.9 Layout of a biogas plant. Source: Sovacool and Drupardy, (2012).

Finally, solar cookers are a "zero emissions and a free, inexhaustible source of energy, and can be effective in settings with high solar irradiance" (Bruce et al., 2011, p. 64) which are found across rural areas like Tibet, on the Altiplano of South America, India and in rural Africa (Panwar, 2012). Although the literature mainly focuses on the many possible technical layouts of solar cookers (e.g. Figure 3.10), and highlighting their environmental benefits and cost savings (Wilson and Green, 2000; Panwar, 2012; Bansal et al., 2013), other authors investigate socio-cultural issues that challenge their uptake and alternative solutions. Otte (2013) for instance, observes that a bespoke needs assessment of the target group can enhance the adoption of solar cookers whilst highlighting that in Mozambique, users were sceptical regarding the usefulness of the technology during rainy seasons and their roll-out needs to be combined with other energy sources to be successful (Otte, 2014).

Figure 3.10 Four general types of solar cookers. Source: Panwar et al. (2012).

3.4 Governance

The deployment of the DRES outlined in the previous section takes place within policy frameworks defined by governance structures and dynamics. Governance is a broad concept which can be defined as "the traditions by which authority in a country is exercised for the common good" (Byer et al., 2009, p. 44). Effective governance is considered a crucial enabler for successful development. Sovacool et al. (2016) identify three defined paradigms through which the common goal of universal energy access has been pursued in developing countries since the 1970s. As illustrated in Table 3.7, each period is characterised by a different configuration of key institutional actors with distinct emphasis and varying degrees of standardisation, capacity building and monitoring and evaluation. There has also been a shift from predominantly public ownership in the 1970s and 1980s to private ownership in the 1990s and most recently, more tailored ownership approaches.

Table 3.7 Three energy access paradigms. Source: Sovacool et al. (2016).

	Donor support approach (starting in 1970s and 1980s)	Market creation approach (starting 1990s)	'Sustainable energy' approach (starting in 2000s)
Actor(s)	Homogenous: bilateral development relationships between country and donor	Heterogeneous: multiple government agencies or donors, plus market participants	Polycentric: multiple public sector, private market, and community development stakeholders
Emphasis	Demonstration: diffusion of technical equipment	Viability of markets: efficiency, financial sustainability, and privatization	Sustainability: meeting economic, environmental and social needs over the longer term
Provision	Electricity or clean cooking	Electricity and clean cooking	Electricity and clean cooking integrated with broader economic development and co-benefits
Standardization	Limited: focus mainly on individual interventions	Moderate: some, especially between programs within the same sector	Extensive: including certification, testing regimes, and national standards
Capacity building	Rare: often limited to technical assistance and maintenance	Emergent: some focus on after sales service and business model development, as well as strengthening regulatory capacities	Integrative: efforts centered on maintenance and business model development coupled with strengthening public and private institutions
Monitoring and evaluation	Limited: perhaps at the end of a single disbursement	More complex: evaluations at beginning and end of programs, some uses of results-based financing	Adaptive: ongoing evaluation and monitoring, results-based disbursement
Ownership	Public: often given away	Private: sold to consumers or intermediaries	Tailored: use of cost-sharing, public-private partnerships, in-kind community contributions

While early governance configurations were largely homogenous, the 1990s saw a gradual shift towards more heterogenous configurations, which in turn have become increasingly polycentric since the 2000s. Anderson and Ostrom (2009) explain that polycentric systems involve multiple decision-making actors that create and deploy information at multiple scales but also possess normative and regulatory independence of the units that make up the system, related to the jurisdictions they operate in. Authors like Goldthau (2014) argue that polycentric governance arrangements are crucial to organize energy infrastructure because of the nature of the challenge of achieving an effective energy transition that requires solutions at multiple scales and shared problem-solving elements and resources amongst the institutions invovled.

However, reflecting on the emergence and the future prospects of polycentric climatic governance, including energy governance, Jordan et al. (2015, p. 977) offer that "while it hints at the potential of more pluralistic forms of governing, its scale is still international and its underlying ontology remains essentially top down and state centric". Furthermore, Morrison et al. (2019) highlights a "black box" of power exerted in polycentric environmental governance shaping policies, normative and regulatory settings and thus the outputs and outcomes. Within the energy access literature, different governance schemes and configurations that have proved successful in addressing the challenge of universal energy access through enabling power arrangements have been identified (Morrison et al., 2019).

For instance, Xu et al. (2019) explain that China's Photovoltaic (PV) Poverty Reduction Program was based on a tripartite governance model with a twofold target: energy access and poverty reduction.

They argue that three elements made this model successful: (1) governmental monitoring and the active participation of both enterprises and households; (2) government leadership to enable the active participation of enterprises and households and resolve conflicts between them; and (3) households having a clearly defined participation in the project. Also proposing a tripartite model, Conway et al. (2019) advocate for subsidised fee-for-service solar electricity through a private social enterprise, as an efficient operating model that is deploying and scaling solar home systems whilst minimising running costs, maximising end-user affordability, creating local jobs for operation and maintenance and thereby creating wider local economic benefits in South Africa.

Alongside government agencies, other actors such as international cooperation entities and development agencies are pivotal in promoting energy access initiatives across the Global South. For instance, Bhamidipati et al. (2019) showed the crucial role that the international cooperation plays within the off-grid solar PV rural electrification regime in Uganda. They noted that in particular, such actors are determinant to mobilize the flow of knowledge, capital and technology.

The governance dynamics engaging the final users are equally important. Graber et al. (2019) found that even though actors agreed that mini grids are a tenable means to deploy reliable and affordable energy access in India, their roll-out was constrained by the lack of confidence and more frequent dialogue among decision makers and users. Furthermore, Josi et al. (2019) observe that energy access projects that do not take the approach of involving communities are challenged by the difficulties experienced in reaching the poorest and establishing sound local supply chains and after-sales service.

Finally, Wittmayer et al. (2017) highlight the crucial need to understand the interactions amongst governance institutions including how they change and evolve over time. Thus they propose the concept of “roles” adopted from the social interaction discipline to study “the changing roles and relations between actor roles as indicative of changes in the social fabric and shared values, norms and beliefs” (Wittmayer et al., 2017, p. 46) and understand them as tools of governance intervention. In this regard, the creation, suppression, altering (through negotiation or flexibilization) and/or assignation of roles should be considered as governance resources to enable paradigm transitions at a policy level but also at a community level (Wittmayer et al., 2017). In this context, Schot et al. (2016) and Lambe et al. (2020) studied the roles of users in shaping transitions to new energy systems showing that addressing human behaviour, defining user typologies and specific targeted policies to enable the adoption of DRES can lead to enhanced development outcomes.

3.5 Policy instruments

A range of different policy instruments are used to promote and support the deployment of DRES and other energy solutions. Figure 3.11 outlines five main types of policy instruments used to promote off-grid rural electrification, ranging from classic financial assistance provided for rural electrification to more recently devised mechanisms targeting both suppliers and final users of DRES (Wiemann, 2014). Donations and subsidies have historically propelled rural energy projects across developing countries, particularly to address the affordability constraints faced by the poorest communities who could not otherwise afford to access DRES (Goldemberg, 2000; Bruce et al., 2011; Morrisey, 2017; Srinivasan and Carattini ,2020).

However, Yadav, Davies and Sarkodie (2019) argue that subsidies "are widely used as a socio-political tool to improve quality of life for those that are disadvantaged but fail to address fundamental structural aspects of the energy system" (p. 4). They argue that after up-front costs have been covered, subsidies can hinder the market processes and reinforce the carbon lock-in poverty cycle because energy transitions within households become subsidy dependant. Therefore they, alongside other authors (World Bank, 2015), advocate for up-front costs subsidies combined with models like Pay-As-You-Go, which is a financing model that allows end-users to pay for solar energy in weekly instalments or whenever they are financially liquid. Similarly, Lensink et al. (2018) show how instruments like commercial credits with innovative business models can enhance the affordability and adoption rates of solar lamps for women in Indonesia.

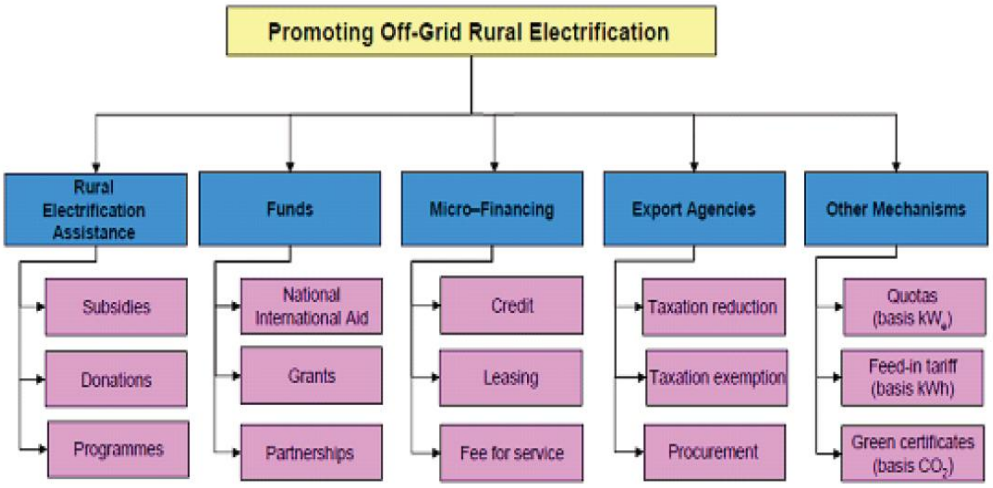


Figure 3.11 Policy instruments. Source: Wiemann (2014).

On the other hand, Xu et al. (2019) and Wu (2020) observe that strong financial support of private suppliers was one of the key approaches underpinning the national electrification policies in China. Likewise, Boliko and Ialnazov (2019) and Ulsrud et al. (2018) advocate for providing further support to private sector-led electrification approaches through funding and tributary exemptions after observing that the socio-economic contributions of four electrification projects run by private suppliers in rural Kenya performed better than public ones. In this context, many different policy instruments are used to incentivise and support private energy suppliers, ranging from subsidies to support the investment, connection, operation, and/or output of DRES; tax credits and low import duties; start-up grants; seed capital; site surveys and market studies among others (Wiemann, 2014; Morrisey,2017).

However, despite the pivotal role of the private sector in many developing countries, there are dissonant voices regarding the benefits of using policy instruments to channel resources to private energy suppliers. For instance, Davies (2018) identified that in Kenya, Uganda and Malawi, market systems can inadvertently reinforce inequalities along the value chain, even if consumers are finally reached. Similarly, Jewitt and Raman (2017) question the role of corporate agendas in the dissemination of CCFT in India due to the socially unequal outcomes they provide.

Overall, it is crucial to acknowledge the need to carefully consider the best choice of policy instruments for a specific situation, acknowledging that there is no *one size fits all* approach. Different circumstances and contexts will require a different mix of policy instruments and a different configuration of public and private involvement and/or investment.

Chapter 4 Theoretical Framework

This chapter explores the theoretical framework underpinning this research. It consists of three main sections. First, Section 4.1 introduces the field of energy humanities and discusses the importance of studying social dimensions of energy. Next, Section 4.3 discusses the philosophical underpinnings of energy justice and the main approaches to studying energy justice. Finally, Section 4.4 outlines the conceptual framework devised for this research.

4.1 Energy humanities

The word *energy* was first introduced by Aristotle who differentiated between several meanings of energy across his reflections on philosophy, physics and ethics (Chung-Hwan, 1956). In the same vein, there are a wide variety of contemporary connotations of *energy* stemming from different contexts such as spiritual beliefs, alternative medicine (Stenger, 1999; Smith, 2010), physical exertion, fuels and so forth. Since the 17th century western science has established an epistemological approach framing energy as a physical-mechanical, quantifiable and measurable phenomenon (Smil, 2006). Within this context, the scientific definition of energy is the capacity of matter to do work[4] (Coehlo, 2009). This definition has become widely accepted as the normalized way of understanding energy, and is characterised by Frigo (2017, p. 7) as the "traditional energy paradigm".

This has occurred at the cost of a certain reductionism, with mainstream approaches to studying *energy* prone to overlook the societal context in which physical units of energy are produced and consumed. The human dimensions of energy are often dismissed within the traditional energy paradigm which tends to focus on techno-economic variables to understand energy systems, obscuring their geographical, historical and cultural contexts, and contributing to a "blind spot to study energy" (Lutzenhiser and Shove, 1999, p. 218).

At a socio-political level, the historic adoption of the traditional energy paradigm in the Western world was a combination of "three interwoven processes: homogenization, colonization, and hegemonic diffusion" enabled through the flourishing of the neoliberal ideology and capitalism (Frigo, 2017, p. 15). Beyond the discussion of the systemic failures stemming from this process, such as the extremely polluting global energy regime and its contribution to exacerbating social conflicts and environmental degradation (Smil, 2006), reflections on the current approach of energy studies stresses the need to

[4] There are widely acknowledged ontological divergences about energy among the different branches of physics leading to different conceptualizations of it (Bunge, 2000; McGinn, 2011; Strassler, 2012) as well as ideas that physicists do not know what energy is at all (Feynman and Sands, 1966).

broaden the predominantly physical-mechanical approach towards the design and implementation of more holistic and socially embedded energy systems (Smith and High, 2017).

The acknowledgement of the critical need to address the social dimensions of energy systems and the subsequent broadening of the traditional energy paradigm have seen more extensive involvement of the social sciences and humanities within energy studies. Indeed, these have included energy as part of their research agenda for at least the last seventy years, since Leslie White (1943) reflected on the crucial role of energy in the development of human culture. Since then, outstanding academic pieces have produced valuable reflections on key topics within energy studies including research investigating energy demand (Wilhite et al., 2012; Rühl et al., 2012; Schmidt and Weigt, 2015; Szeman and Boyer, 2017; Hui and Walker, 2018), energy policy design (2014; Walker, 2014), and the political economies of different energy sources (Damgaard et al., 2017; Kern and Rogue, 2018).

However, there is evidence that the epistemological, conceptual and methodological contributions of the social sciences and humanities still tend to be downplayed by techno-economic approaches applied in mainstream energy studies (D'Agostino et al., 2011; Sovacool, 2014). Therefore, there is a call to reinforce the expansion of energy studies to draw upon "the disciplines of gender studies, philosophy and ethics, communication studies, geography, social psychology, cultural anthropology, development studies, governance, and the sociology/history of technology (among others)", but also through methodological novelty and interdisciplinary collaborations (Sovacool, 2014, p. 2).

In this context, this project aims to contribute to the overarching research agenda of energy humanities by addressing the research problem outlined in Chapter 1 from a specific area of modern philosophy, namely, justice. The application and relevance of justice to analyse energy systems is discussed in depth in the following sections, which introduce the conceptual framework of energy justice. Chapter 5 will then detail the methodological approach and design used in this study, which places the network of stakeholders involved in energy access at the core of the analysis.

4.2 Energy justice

The structuring of energy systems has deep implications for human societies, historically providing unique benefits for some, and depriving others of basic services and healthy environments (Sovacool et al., 2013). Although the techno-economic approaches promoted by the traditional energy paradigm discussed in Section 4.1 can be rather limited in addressing such concerns, social sciences offer "at least fourteen theories deemed most relevant and useful to explain socio-technical change" (Sovacool and Hess, 2017, p. 703). The conceptual framework of energy justice offers elements to address the ethical implications of energy systems, a perspective long avoided by policy-makers and other actors (Jones et al., 2015).

In this regard, the framework of energy justice promotes energy systems that "fairly distribute both the benefits and burdens of energy services, and… contribute to more representative and inclusive energy decision making" (Sovacool et al., 2017, p. 677), through principles of justice, fairness and social equity. According to Sovacool and Dworkin (2014) the energy justice framework offers a novel conceptual tool for ethicists, an analytical tool for energy researchers, and a decision-making tool for policy-makers.

Energy justice is a relatively new and emerging conceptual framework (Jenkins et al., 2016; Heffron and McCauley, 2017). Whilst authors like Agyeman et al. (2010) and McCauley and Heffron (2018) associate energy justice with the environmental justice theory[5], Jayapalan and Ganesh (2019) argue that the two concepts have distinct identities and Jenkins (2018) explains that although environmental justice can offer useful lessons, energy justice must be set "apart from the crowd" of environmental justice and climate justice. Notwithstanding these different perspectives, the discipline of energy justice is in an on-going process of conceptual evolution as discussed in the following sections.

4.2.1 Philosophical underpinnings of energy justice

Across the energy justice literature, different authors have delved into the philosophical scaffolding underpinning different approaches to energy justice. Sovacool and Dworkin (2014) offer an overarching review of the concepts and philosophical influences pertaining to eight key topics within energy research as outlined in Table 4.1. However, a later critique posited that in some cases, the philosophical case of energy justice presented by this work though valuable was "somewhat superfluous" (Sovacool et al., 2015a, p. 144).

[5] Environmental justice is "commonly defined as the distribution of environmental hazards and access to all natural resources; it includes equal protection from burdens, meaningful involvement in decisions, and fair treatment in access to the benefits" (Sovacool and Dworkin, 2015, p. 3).

Table 4.1 Philosophical concepts and influences for global energy justice. Source: Sovacool et al. (2017).

Topic	Concept (s)	Major philosophical influence (s)
Energy efficiency	Virtue	Plato and Aristotle
Energy externalities	Utility	Jeremy Bentham, John Stuart Mill, Henry Sidgwick
Human Rights and Social Conflict	Human rights	Immanuel Kant
Energy and due process	Procedural justice	Edward Coke, Thomas Jefferson, Jürgen Habermas
Energy poverty	Welfare and happiness	John Rawls, Amartya Sen, Martha Nussbaum
Energy subsidies	Freedom	Robert Nozick, Milton Friedman
Energy resources	Posterity	Ronald Dworkin, Brian Barry, Edith Brown Weiss
Climate change	Fairness, responsibility, and capacity	Peter Singer, Henry Shue, Paul Baer, Stephen M. Gardiner, Dale Jamieson, Simon Caney

Three main different types of justice are identified and discussed within the literature, namely, distributive justice, procedural justice, and recognition justice (as defined in Table 4.2). McCauley et al. (2013) and Jenkins et al. (2016) explore the philosophical influences underpinning each of these concepts. Jones et al. (2015), Heffron and McCauley (2017) and Sovacool et al. (2017) also introduce and elaborate upon the concept of "cosmopolitan justice", which recognises that energy justice is a universal problem that applies to all humans irrespective of national agendas, giving rise to ethical responsibilities amongst all the stakeholders involved (Suri et al., 2017).

Table 4.2 Concepts of justice. Source: Walker (2012).

Distributive justice	Justice is conceived in terms of the distribution or sharing out of good (resources) and bads (harms and risks)
Procedural justice	Justice is conceived in terms of the way decisions are made, who is involved and has influence, and access to the formal justice system
Justice as recognition	Justice is conceived in terms of who is given respect and who is and isn't valued

Based on these different types of justice, Jones et al. (2015) offer four supporting assumptions for the conceptual framework of energy justice:

- Every human being is entitled to the minimum of basic goods of life that is still consistent with respect for human dignity.
- The basic goods to which every person is entitled also include the opportunity to develop the characteristically human capacities needed for a flourishing human life.
- Energy is only an instrumental good- it is not an end itself.
- Energy is a material prerequisite for many of the basic goods to which people are entitled (Jones et al., 2015, p. 151-161).

Jones et al. (2015) also propose two principles to operationalize these assumptions. First, a prohibitive principle, which states that energy systems must be devised and established in such a way that does not interfere with the ability to access to the basic goods and services any person demands. Second, an affirmative principle stating that, if any basic goods and services demanded by a person is only accessible through energy services, these become a derivative right (Jones et al., 2015). However, there are two main critiques of such approaches to define the philosophical case of energy justice.

Firstly, it is argued that the philosophical influences outlined in Table 4.1 pertain to western theorists (Frigo, 2017). For example, Broto et al. (2018) assert, "current theorizations of energy justice tend to build upon universalist notions of justice within a western tradition of thought" (p. 645). Therefore, Sovacool et al. (2017) propose exploring non-western theorists as one of the six research frontiers to strengthen the energy justice framework. They introduce five different theories and their applications to energy justice (as summarised in Table 4.3) and call for further engagement with these approaches in future research.

Table 4.3 Non-western theories and energy justice. Sovacool et al. (2017).

Concept	Definition	Application to energy
Ubuntu	The act of building community, friendship and oneness with the larger humanity.	Neighbourhoods efforts to promote energy efficiency, decisions about energy resources within a community
Taoism and Confucianism	The Tao or Dao emphasizes the virtuous path that leads to greater harmony amongst humanity. It assumes a universal nature and the means to an end is more important than the end itself.	Respecting due process in energy decisions, adhering to human rights protections when implementing energy projects
Hinduism and Dharma	Dharma carries the notion of righteousness and moral duty and is always intended to achieve order, longevity and collective well-being. It is context specific and doesn't render itself to universalization. Gandhi is a prominent example of one who espoused and practiced Dharma	Seeking to minimize the extent and distribution of energy externalities, offering affordable energy access to help address poverty
Buddhism	Expounds the notion of selflessness and the pursuit of individual salvation or nirvana. Often criticized for its inability to deal with real social issues	Respecting future generations with energy decisions, minimizing harm to the environment and society
Indigenous Perspectives of the Americas	Cultivation of a cultural mindset that recognizes interdependence of all life and enables good living through responsibility and respect for oneself and the natural world, including other people	Energy systems developed cautiously through long-term experience and sovereign cultural protocols, avoiding dramatic transformation of ecosystems, requiring restoration

Secondly, Galvin et al. (2019) posit that the introduction of non-western approaches to energy justice notwithstanding, the philosophical basis of energy justice scholarship is prone "to fall back on the western enlightenment-informed approach of John Rawls, against which it judges the validity of other approaches" (p. 182). Galvin et al. (2019) draw on Wittgenstein and pragmatist philosophers to reflect on the meaning of making a moral claim, ssuggesting that communicating the findings of energy justice to the different governance institutions involved must occur in such a way as to appeal to their moral maturity, rather than relying on pressuring and moralizing discourses that cannot be deemed of universal validity.

4.2.2 Approaches to operationalizing energy justice

There are two main approaches to operationalizing energy justice within the literature (Heffron and McCauley, 2017; Sovacool et al.,2019). Ramazan et al. (2017) argues that these are complementary rather than mutually exclusive approaches. They include (1) a three-tenet framework that can be used as conceptual normative evaluative tool (Sovacool and Dworkin,2015; Jenkins et al., 2016); and (2) a decision-making framework (Sovacool and Dworkin, 2015; Forman,2017).

The first approach is a three-tenet framework based on distributional, procedural and recognition justice, which was first introduced by McCauley et al. (2013) to bring attention to justice and ethical concerns in energy policy. Building on this idea, Jenkins et al. (2016) propose an evaluative and normative configuration as illustrated in Table 4.4. Although different authors' analysis depends on the research scope and design, the philosophical foundations described in the previous section define certain common elements that each tenet entails.

Table 4.4 The evaluative and normative contributions of energy justice. Jenkins et al. (2016)

Tenets	**Evaluative**	**Normative**
Distributional	Where are the injustices?	How should we solve them?
Recognition	Who is ignored?	How should we recognise?
Procedural	Is there fair process?	Which new processes?

Distributional justice focuses on the distribution of energy as a social good and examines the allocation of associated costs and benefits (Ramazan et al., 2017). This tenet encompasses spatial and temporal dimensions. The former refer to the fact people across different geographic regions may have greater or lesser benefits and burdens related to energy access (Bouzarovski and Simcock, 2017). The latter recognizes the distributive implications of energy across time including the importance of considering the needs of future generations (Galvin, 2019).

Procedural justice focuses on participation, exploring which and how stakeholders are involved in the decision-making processes that govern the distributional rationale defined by the first tenet. Procedural arrangements encompass (1) the ability of stakeholders participate; (2) transparency and information disclosure (Sovacool and Dworkin, 2015; Jones, 2015); (3) representation of the acknowledged and unacknowledged sectorial institutions (Jenkins et al., 2016; Naumann and Rudolph, 2020) and (4) access to legal instruments for redress (Sovacool and Dworkin,2015).

Finally, recognition justice calls for acknowledgement of the diverse values and beliefs related to energy rooted in the different social and cultural backgrounds of stakeholders (McCauley et al., 2013; Ramazan et al., 2017). According to Fraser (1999, p. 7) a lack of recognition is misrecognition, which is the misconstruction of such cultural differences and can manifest as:

> cultural domination (being subjected to patterns of interpretation and communication that are associated with another culture and are alien and/or hostile to one's own); nonrecognition (being rendered invisible via the authoritative representational, communicative, and interpretative practices of one's culture); and disrespect (being routinely maligned or disparaged in stereotypic public cultural representations and/or in everyday life interactions) (Fraser, 1999, p. 7).

Bespoke frameworks building on the basic three-tenet structure can be found across the energy justice literature. For example, Jenkins et al. (2014) incorporates systems theory, proposing a whole system perspective to explore fuel poverty whilst Samarakoon (2019) develops an analytical energy-wellbeing framework to include an ethical imperative to ensure energy justice when provisioning energy services across the Global South. In contrast, Heffron et al. (2015) attempts to define and quantify metrics for energy justice based on environmental and economic indicators.

From a critical perspective, Munro et al. (2017) scrutinize the distributive implications of the widely adopted "energy for all" discourse, in the context of Sierra Leona, concluding that recognition justice is "critical and should be a starting point for realising a more just energy system. Whose knowledge counts has great implications" (p. 640). Likewise, Yadav, Davies and Sarkodie (2019) explore the pitfalls of subsidies to deploy solar technology in rural India, highlighting the procedural concerns such policy instruments entail.

The second approach is a decision-making and evaluation tool that aims to serve as a guide to the creation of energy systems in practice (Forman, 2017; Sovacool et al., 2019; Islar et al., 2017). Sovacool et al. (2017) propose a set of ten normative guiding principles to operationalize such an approach as listed in Table 4.5. Outstanding research has been undertaken drawing on this approach, such as Islar et al.'s (2017) evaluation of the national policy framework for energy access in Nepal considering feasibility for the implementation of energy just policies in this developing country context. However, the application of the second approach is less frequently found across the literature.

Equally important, at least three critiques of both approaches can be found within the literature, challenging the conceptual consistency of energy justice. First, some argue that the tenets and guiding principles can overlap raising questions regarding how they are weighted when assessed in practice (McCauley et al., 2013; Jenkins et al., 2014; Islar et al., 2017). Second, there is a growing number of reflections on the anthropocentric nature of both approaches. In this regard, Sovacool et al. (2017)

explore three existing traditions of non-anthropocentric ethics as an initial effort to include values of nature within energy justice, namely, animal-centered theories, life-centered or biocentric theories, and ecosystem-centered or ecocentric theories. Furthermore, Sayan (2019) applies place-based approaches to strengthen the energy justice concept arguing that "momentum has gained in support of integrating the nonhuman world into energy justice frameworks as a possible frontier to expand the conceptual focus of energy decisions and to effectively address the potential environmental degradation they produce" (p. 99).

Table 4.5 Principles of energy justice. Sovacool et al. (2017, p. 687).

Principle	Explanation
Availability	People deserve sufficient energy resources of high quality (suitable to meet their end uses).
Affordability	All people, including the poor, should pay no more than 10% of their income for energy services.
Due process	Countries should respect due process and human rights in their production and use of energy.
Transparency and accountability	All people should have access to high quality information about energy and the environment and fair, transparent and accountable forms of energy decision-making.
Sustainability	Energy resources should be depleted with consideration for savings, community development, and precaution.
Intra-generational equity	All people have a right to fairly access energy services.
Inter-generational equity	Future generations have a right to enjoy a good life undisturbed by the damage our energy systems inflict on the world today.
Responsibility	All actors have a responsibility to protect the natural environment and minimize energy-related environmental threats.
Resistance	Energy injustices must be actively, deliberately opposed.
Intersectionality	Expanding the idea of recognitional justice to encapsulate new and evolving identities in modern societies, as well as acknowledging how the realization of energy justice is linked to other forms of justice e.g socio-economic, political and environmental.

Finally, the third critique relates to difficulties in applying the frameworks. For example, Heffron and McCauley (2017) argue that "a major limitation of the approaches outlined above – the triumvirate of tenets, energy life-cycle (systems) approach and the principle-based approach – is that there is little

reflection of how these transfer into practice and are 'enforced' in practice, i.e. energy justice becomes a delivered outcome through policy" (p. 659-660). To address this challenge they propose a conceptual framework that combines the two approaches outlined above with the principles of cosmopolitan justice to incorporate the whole system life-cycle approach explored by Jenkins et al. (2014), and introduces an additional tenet namely restorative justice, as illustrated in Figure 4.1.

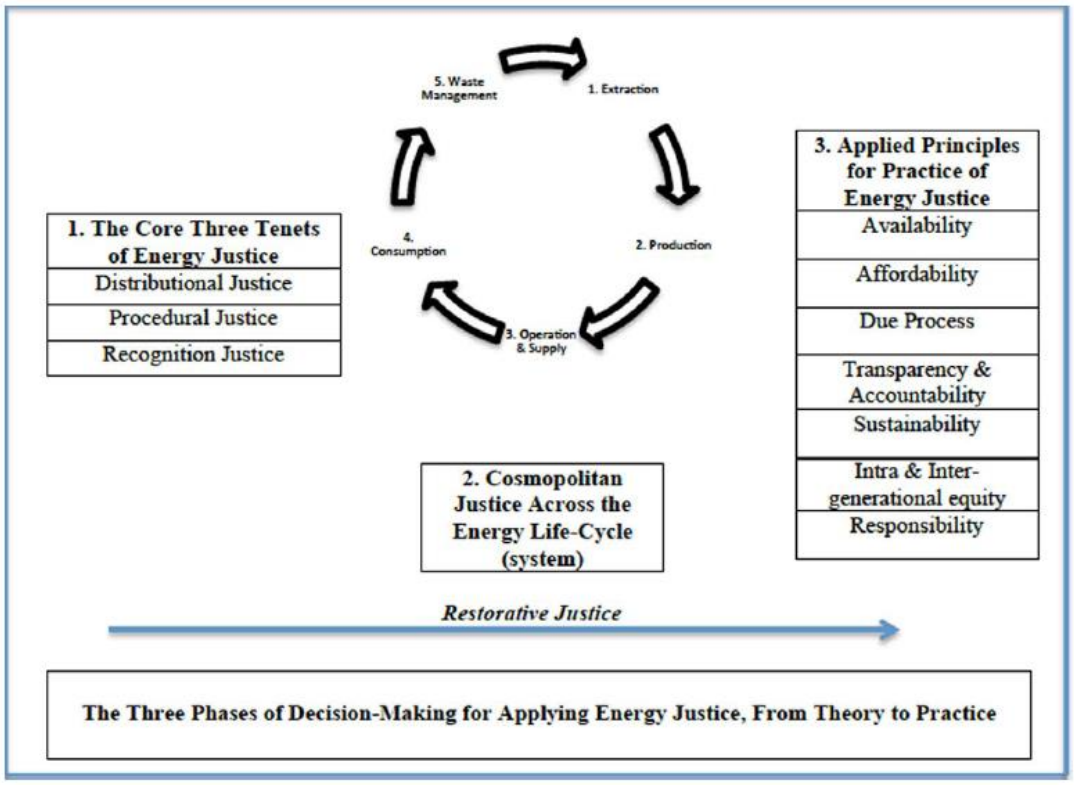


Figure 4.1 The Energy Justice Conceptual Framework. Heffron and McCauley (2017, p 660).

The principle of restorative justice focuses on repairing harms that energy systems can cause to individuals, communities and/or the environment. Heffron and McCauley (2017) introduce restorative justice to raise awareness within decision-making processes regarding potential harms that energy systems can cause and potential prevention strategies to avoid or diminish such harms.

4.3 Conceptual framework of this research

As discussed in Chapter 2, Bolivia has made unprecedented progress towards achieving its goal of universal energy access by 2025. However, evidence shows that as DRES are rolled-out across scattered rural areas, where the access challenge is concentrated, not all the benefits expected from energy access are materializing or are equitable with respect to the benefits of on-grid supply. In some cases undesired social outcomes have also occurred (Monroy and Montaño, 2015; Galoppo and Carlo, 2017;

IDB, 2019). Although authors like Fernandez (2010; 2015), Guzman (2010) and Gomez (2017) have discussed the challenges of off-grid energy policies for rural Bolivia, no research has been conducted to analyse the policy framework from an energy justice perspective.

The conceptual framework of energy justice arguably provides a valuable approach to explore the national policy framework that currently enables rural energy access. As such, drawing on thoughtful reflections on the philosophical foundations, approaches, subsequent critiques and alternatives to address them, the conceptual framework of energy justice applied in this research entails three levels.

First, the conceptual framework adopts the three main tenets described in the previous section, namely distributive, procedural and recognition justice (Jenkins et al., 2014). It is argued that this approach offers a simple yet meaningful analytical tool (McCauley et al., 2013; Jenkins et al., 2016) to explore the justice-awareness of the national policy framework for rural energy access in Bolivia.

The second level introduces the structural elements that make up each tenet. Boyer (2014) argues that due to their dynamic nature, energy systems should be studied from a transition perspective. As such, this thesis adopts such an approach, arguing that the deployment of DRES across rural areas aims to enable a transition process from a traditional rural energy regime to a modern energy regime as discussed in Chapter 3. This level builds on two academic frameworks based on the three-tenets of energy justice: the evaluative, normative and conceptual guidelines proposed by Jenkins et al. (2016), and Williams and Doyon's (2019) research into justice in energy transitions which offers a set of guiding questions drawing upon the literature of transitions, environmental justice, and energy justice.

The combination of both frameworks incorporates elements to address the critiques related to anthropocentrism and the mainstreaming of western thinking traditions discussed in the previous section. Table 4.6 illustrates the guiding questions defined to explore the national policy framework for off-grid energy access in rural Bolivia. However, considering that Jenkins et al. (2014) and Islar et al. (2017) identified overlapping issues between tenets when applied in practice, the categorization of the guiding questions proposed is flexible, with some questions relating to more than one tenet.

Table 4.6 Key guiding questions for the second level. Based on Jenkins et al. (2016) and Williams and Doyon's (2019)

Distributive	**Procedural**	**Recognition**
What is the distribution rationale for the transition to modern energy services across rural population? How is it defined?	Who is part of the decision-making for the transition process?	What pre-existing socio-cultural arrangements are present?
Which, where and how are costs and benefits of energy transition being allocated? Is it different from the previous regime?	Should a wider set of stakeholders be engaged? Why?	Are different worldviews, knowledges, and values recognized and integrated?
	Do power asymmetries exist? Are they addressed? How?	Is non-recognition, misrecognition and/or cultural domination present?
	Do all stakeholders have adequate capabilities to participate?	Are individuals' values and motivations being acknowledged integrated? How?
	Are non-human actors engaged within the procedural arrangements of the energy transition? How?	Are multiple overlapping identities recognized? How?
	Is information related to energy access disclosed and transparent?	

The third level incorporates the guiding principles for energy justice described in Table 4.5. However, considering the critique posed on their normative nature (Frigo, 2017) this final level supports the conceptualization of the first and second level of this framework, rather than focusing on each individually. This framework also advocates for a comprehensive and thoughtful definition of sustainability as an overarching concept within which the two levels of analysis are conducted, rather than limiting it to just one of the guiding principles.

Although similar to Heffron and McCauley's (2017) approach, the bespoke framework for this research focuses on the main three tenets: distributive, procedural and recognition justice, omitting the principles of cosmopolitan and restorative justice. Nevertheless, the conceptual underpinnings of cosmopolitan and restorative justice are considered as part of the elements pertaining to the second level aiming to offer a simpler, yet meaningfully structured framework. It is argued that such an approach can facilitate unpacking the ethical concerns rather than providing a moralizing discourse of universal truths about energy access in rural Bolivia, in order to enhance the policy relevance of this research as proposed by Galvin (2019).

Chapter 5 Research Design

As outlined in Chapter 1, this research aims to explore the national policy framework for rural energy access in Bolivia through the lens of energy justice. This chapter outlines how this research was designed and conducted. Section 5.1 introduces the underlying research paradigm. Section 5.2 then outlines the data collection methods. Next, Section 5.3 explains the discursive approach used to analyse the data. Finally, the ethical implications and limitations of this research are discussed in Sections 5.4 and 5.5.

5.1 Research paradigm

This research draws inspiration from the growing number of social scientists taking the field of energy studies beyond its traditional techno-economic origins (Sovacool, 2014). In this context, this research took a constructivist-interpretivist approach underpinned by four key assumptions: (1) reality is socially constructed; (2) there are as many intangible realities as there are people constructing them; (3) knowledge is subjective; and (4) behaviours and ways of thinking are value-laden (Mertens, 2012; Creswell and Creswell, 2017).

These key assumptions make a qualitative approach the most appropriate approach for this research. Sovacool et al. (2018) posit that this is now a mainstream approach within energy studies due to its exploratory and inductive nature and its capacity to explore particular issues in depth. Qualitative research is particularly well-suited to explore the meanings, interpretations, social constructions and assumptions (McCracken, 1988) through which the national policy framework for off-grid energy access in Bolivia engages with the principles of energy justice.

This research is also informed by interpretive and argumentative policy analysis. The former pertains to a stream of political science which states that policy problems have different meanings among the different stakeholders involved (Scott, 2017, p. 4) rather that reflecting “claims of single rationality and objective truth” (Feindt and Oels, 2005, p. 163). The latter asserts that the struggle over different meanings and arguments are critical in policy processes (Leipprand et al., 2016).

5.2 Data collection

According to Descombe (2010) there are two types of qualitative data: words (spoken or written) and visual images (observed or generated), which can be collected through a variety of methods ranging from documents, interviews, focus groups, and direct and participant observation (Hancke, 2009). This research employs two research methods: documents and interviews with key stakeholders. Following the argumentative approach for policy analysis, these methods were chosen to explore different

arguments around the principles of energy justice and how they play out in the national policy frameworks for rural energy access.

Purposive sampling was used to identify and select the policy documents and potential interviewees for this research. According to Maxwell (2008) this is the most common pathway to obtain qualitative samples and it focuses on "the selection of participants or sources of data based on their anticipated richness and relevance of information in relation to the study's research questions" (Yin, 2011, p. 311), which is further detailed in the following sections.

5.2.1 Documents

Documents are a common source of data within qualitative social research. In particular, "government publications and official statistics have come to provide a key source of documentary information for social scientists" (Bowen, 2009, p. 217). This research draws on several key policy documents, as they provide a literal account of Bolivia's national policy commitments related to rural energy access.

5.2.1.1 Conceptualization

Atkinson (2005) argues that texts must be addressed in research considering "their socially organised and conventional properties, and because of the uses that they are put to, in their production, circulation and consumption" (p. 3). In this research, the policy documents under review are considered as produced, organised, shared, and implemented "social facts" (Atkinson and Coffey, 2004, p. 56).

Additionally, Bowen (2009) highlight that documentary data is particularly useful to identify underlying arguments and social interactions behind the words of different actors that participate in the construction of a problem. In this context, this research uses policy texts to "uncover meaning, develop understanding, and discover insights relevant to the research problem" (Merrian, 1988, p. 118).

5.2.1.2 Sampling

As mentioned above, purposive sampling was used to identify the specific data required to achieve the research objectives. In particular, the key policy documents that constitute Bolivia's national energy policy were identified. Then a second stage of sampling carefully delimited the policy documents that specifically make up the national policy framework for off-grid energy access in rural areas.

5.2.1.3 Collection

Although the policy documents relating to the energy sector were previously available on the Ministry of Energy's website, they have not been available online since the beginning of 2019. However, fortunately most of the relevant documents were found among files saved by the researcher due to her

professional background working in the Bolivian energy sector. During field work, the government representative interviewed was asked about the public availability of the policy documents and he responded that online publications are the responsibility of the Communication Unit of the Ministry of Energy for which he could not provide information.

Five key policy documents relating to energy access in rural Bolivia were identified. During field work, the government representative interviewed confirmed that although some specific goals related to electricity generation capacity have changed, these documents remain current within the sectorial agenda. They include:

- Agenda Patriótica 2025 (Patriotic Agenda 2025)
- Plan de Universalización Bolivia con energía 2010 -2025 (Plan for Universalization: Bolivia with Energy 2010 - 2025)
- Política de Energías Alternativas para el Sector Eléctrico en el Estado Plurinacional de Bolivia (Policy of Alternative Energies for the Electricity Sector in the Plurinational State of Bolivia)
- Plan para el Desarrollo de las Energías Alternativas 2025 (Plan for Development of Alternative Energies 2025)
- Plan Nacional de Desarrollo 2016 - 2025 (National Development Plan 2016 – 2025)

5.2.2 Interviews

Interviews are perhaps the most common approach to data collection in qualitative research (Sovacool, 2016). Interviews can take a variety of forms depending on the purpose and context of the research being undertaken. However, they share a common question-answer approach to elicit ideas, perspectives and arguments from interviewees. In this research, key stakeholders within the Bolivian energy sector were interviewed about their engagement with the national policies for rural energy access and their experiences with the guiding principles of the energy justice framework (Roulston, 2010).

5.2.2.1 Conceptualization

Interviews are underpinned by a number of assumptions that distinguish them from casual conversations (Silverman, 1985). These assumptions influence both the structure and application of interviews and the analysis and representation of the data obtained through them. In this context, Roulston (2010, p. 2) outlines a continuum of six conceptualizations of interviews relating to neo-positivism, romanticism, constructivism, postmodernism, transformative and decolonizing approaches.

The interviews designed and undertaken for this research adopted a constructivist approach in accordance with the underlying research paradigm described in Section 5.1. As such, this research

defines interviews as “sensemaking work through which participants engage in explaining, attributing, justifying, describing, and otherwise finding possible sense or orderliness in the various events, people, places, and courses of action they talk about” (Baker 2002, p. 781). In other words, the interviews are conceptualized as instruments to elicit interpretive arguments, which “focus on ideologies, discourses and cultural frameworks” (Alford, 1998, p. 42).

5.2.2.2 Sampling

The sampling process for the interviews draws on the limited yet rich literature focused on off-grid energy access in rural Bolivia. Pansera (2012) shows that universities, local enterprises, non-government organizations (NGOs) and national and local institutions make up a knowledge network of stakeholders and institutions involved in renewable energy for rural areas of Bolivia. Identifying a similar range of stakeholders, Canedo (2005) uses a more specific terminology, namely, academia, private suppliers, NGOs, and central and local governments. Additionally, Fernandez (2015) and Montaño and Monroy (2015) portray the crucial role of international cooperation within the energy sector in Bolivia, with international actors ranging from multilateral banks to aid agencies and charities all playing an important role. Sampling was also informed by the researcher’s professional network within the Bolivian energy sector.

Drawing upon the considerations above, five key stakeholder groups were identified: academia, private energy suppliers, NGOs, central government, and international cooperation entities (because the focus of this research is Bolivia’s national response to energy access in rural areas, local governments were not selected as one of the group of stakeholders for this research). A total of 15 key informants were then identified from a wide range of institutions within the five stakeholder groups, as outlined in Table 5.1. The final interviewees who participated in this research will be discussed in Section 5.2.2.4.

Table 5.1 Target sample

Stakeholder group	Institutions	Actor
Universities	• Universidad Catolica Boliviana • Universidad Mayor de San Andres • Bolivian Science Academy (ABS, for its acronym in Spanish)	• Departments of energy, sociology, economy • Senior researcher focused on rural energy solutions • Energy Scholars
Local enterprises	• PROSOL • Centro de Desarrollo de energia solar (Solar Energy Development Centre - CEDESOL, for its acronyms in Spanish)	• Pioneer in the rural energy market • Managers
NGOs	• ENERGETICA • Centro de Informacion de Energias Renovables (Renewable Energy Information Center - CINER, for its acronym in Spanish) • Practical Action • World Wildlife Fund	• Primary focus of intervention on rural energy markets • Director/manager
Government	• Ministry of Energy • Viceministry of Electricity and Renewable Energy • Programa Electricidad para vivir con dignidad (Program Electricity to live with dignity – PEVD for its acronym in Spanish)	• Directly involved in rural energy policy-making or decision-making • Deputy • Program Director
Funding institutions	• Energising Development (ENDEV) • Inter American Development Bank (IDB) • World Bank	• Donator portfolio engaged in rural energy • Investor portfolio engaged in rural energy • Senior Energy Specialist

5.2.2.3 Interview Design

Interview questions can be open or closed. While closed questions usually lead to short yes/no answers, open questions can generate a much wider variety of responses. Open questions also provide the opportunity for interviewees to give more detailed responses that "generate in-depth descriptions of people's perceptions and experiences" (Roulston, 2010, p. 5).

The interviews conducted during this research encompassed a combination of both open and closed questions and *probes*. Probes involve following up on a response that has been uttered by asking

additional open questions to elicit more details, as illustrated in Figure 5.1. According to Roulston, (2010) probes build on the interviewees' own words to generate the next question, rather than relying solely on the interviewer's initial understanding of the interviewee's response, which can sometimes distort participants' utterances.

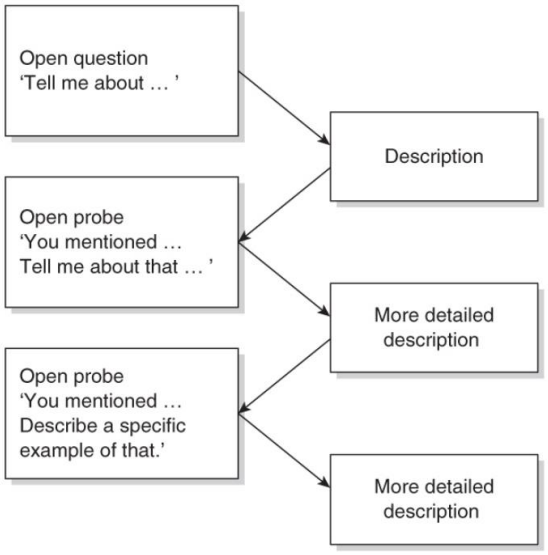


Figure 5.1 An open question and possible ways of responding (Roulston,2010)

Interviews can range from rigidly to loosely structured (Denscombe, 2010). In this research, semi-structured interviews were chosen to elicit data openly and according to the priorities of the interviewees while maintaining a topical framework in line with the purpose of the interviews in this research.

Two methods were used to record the interviewees: an audio recorder (for the interviewee that consented to be recorded) and field notes. Appendix 1 contains the participant consent form which seeks permission from the interviewee to be recorded at the beginning of the interview. However, although audio recordings can provide a precise record of verbal accounts, they cannot capture the context and non-verbal communications and perceptions which are also critical from an interpretive stance. Thus fieldnotes were also crucial to register data that might be not be explicit in audio recordings, as well as taking notes for all the interviewees that did not want to be recorded. Therefore, both instruments complement each other's functions (Denscombe, 2010).

Table 5. 2 outlines the interview guidelines used in this research. Overall, the interviews were designed to provide a clear structure to elicit information about the interviewee's experience regarding rural energy access in Bolivia; personal arguments regarding the three tenets of the energy justice framework; and opinions on the engagement of the national policy framework for rural energy access

with the energy justice framework. The questions did not explicitly refer to any of the tenets of energy justice presented in the previous chapter in order to avoid what Krosnick and Presser (2010) call social desirability bias. This refers to when interviewee's intentionally or unintentionally modify their responses in order to show themselves more favorably to the interviewer. The specific questions developed for this research are presented in Appendix 2.

Table 5.2 Guidelines for semi-structured interviews

Semi-structured interview guidelines
1. Introduction
- Interviewer introduction
- Purpose of research and interview
- Reason for interviewing individual
- Format of interview
- Assurance of confidentiality
- Summary of participant rights
- Participant consent requested
- Request for permission to record interview
2. Interviewee background
- Occupation and years of experience
3. Experience in rural energy access
- Definition of energy access
- Importance of rural energy
- Current situation of rural energy in Bolivia
4. Energy justice
- Personal arguments to address the tenets
- Specific personal experiences
- Opinions on the engagement of national policies with the tenets.
5. Conclusions
- Additional contributions

5.2.2.4 Conducting the interviews

The interviews were conducted during the last week of July and third week of September 2019. However, the initial contact with targeted interviewees began in the second week of June 2019. Most target stakeholders were contacted by email in order to ascertain their availability and willingness to participate in this research. In the case of public authorities, a more formal approach was taken with

two letters sent to the Ministry of Hydrocarbons and the PEVD, via their institutional fax numbers respectively. All participants were thoroughly introduced to the purpose of the project and the approach of the research which was summarised in an information sheet (Appendix 3), which also included the confidentiality terms and the interviewee's rights.

A total of 11 interviews were conducted. Ten of these were undertaken face to face during field work in Bolivia In July and August whilst the last one was conducted on September via Skype due to the availability of the interviewee. All interviews were conducted in Spanish and ranged from forty minutes to one and half hour in length. Of the 11 interviewees, only one, who had a pre-existing professional relationship with the researcher, agreed to be recorded. All the other interviewees indicated that they would prefer not to be recorded due to the sensitive nature of the topic. They also requested to be identified by a generic descriptor. Table 5.3 provides an overview of the number of interviewees and the corresponding descriptors.

Table 5.3 Number of interviews for each stakeholder group

Stakeholder group	Number of interviews	Descriptor
Academia	2	*Academic #1* *Academic #2*
Private energy suppliers	2	*Private Energy Supplier #1* *Private Energy Supplier #2*
Non-government organisations	3	*NGO Representative #1* *NGO Representative #2* *NGO Representative #3*
Government	1	*Government Representative*
International cooperation	3	*International Cooperation Representative #1* *International Cooperation Representative #2* *International Cooperation Representative #3*

Government

One government representative from the Ministry of Energy was interviewed for this research. This representative holds a high-level position within the Ministry, however he explained that due to confidentiality reasons he could not be identified. A supporting technician also participated in this

interview, occasionally providing information and data to the representative. The second government agency approached for an interview, the PVD, declined the request for an interview stating that policy issues should be discussed with the Ministry.

Other stakeholders

Although having initially accepted an interview request, one representative of a multilateral bank requested a copy of the interview guidelines and then discontinued communication. Academics were particularly interested in the topic. However, none of the academics with an engineering background responded. Finally, representatives of NGOs and private energy suppliers where reluctant to elaborate on specific questions targeting the government's performance.

5.2.2.5 Interviewer effect

It is widely argued that in qualitative research, the researcher can have a great impact on both data collection and analysis. This is sometimes referred to as as the interviewer effect (Bowen, 2009). Therefore, it is important that researchers are aware of and explicit about their social and professional assumptions (Berger, 2015) and consider how the design, process and outcomes of the research is affected by their personal characteristics and experiences (Bishop and Shepherd, 2011; Hunt, 2010).

I am a Bolivian female novice researcher, pursuing a postgraduate degree overseas. I have five years of professional experience in the field of rural energy in South America, hence I already had values and perceptions regarding planning for energy access before conducting this research. As an econometrist, this work constituted my first experience in qualitative research. During fieldwork, I perceived that the following aspects of my identity could have influenced in the outcomes and the elicited arguments from interviewees: education, working experience, gender and age.

For example, although I had previously met most of the interviewees due to my working experience within the sector, the interview was the first time I was meeting other participants. Given that my age and gender make up an unusual profile within the Bolivian energy sector, some participants' answers were noticeable highlighting the positive aspects of the policy framework, as they perceived me as an outsider. On the other hand, one of the participants who I had previously met and was aware of my education and working experience within the sector was noticeable providing answers highlighting the social aspects of the policy.

5.3 Data analysis

Denscombe (2010) characterises qualitative data analysis as iterative, inductive and researcher-centred. Accordingly, the analysis in this research was a dynamic process designed to study the meanings,

structures and sequences of both text and talk. Leavy (2010) posits that the first step for data analysis is data preparation. In this research this stage was two-fold. Firstly, the policy documents selected were copied in their entirety into a Microsoft Excel workbook, with the data was organised into individual sheets for each policy text. The recorded interview and fieldnotes were also organised within the same folder. Secondly, specific excerpts of both policy documents and individual interviews were translated from Spanish to English as required for reporting and quoting findings.

The second step is the exploration and reduction of data (Hesse-Biber and Leavy, 2010). To undertake this step, this research employed discourse analysis. Indeed, an increasing number of academics are using discursive approaches to explore energy policy and understand the transformation of energy systems and the related discourses through which these changes are given meaning (Isoaho and Karhunmaa, 2019). Particularly relevant to this research, Islar et al. (2017) use discourse analysis to explore the guiding principle energy justice to determine the feasibility of a fair energy system in Nepal. Sovacool (2014) argues that discourse analysis embodies one of the "promising avenues" to broaden the methodological scope of energy research and social science. It is also one of one of the six research frontiers that Jenckins et al. (2017) and Sovacool et.al (2017) identify as a cutting-edge method for energy justice scholarship.

5.3.1 Discourse analysis

Hewitt (2009, p. 3) explains that the term discourse refers to the "story" underlying debates, dialogues or discussions. Similarly, Hajer (2006, p. 45) defines a discourse as "an ensemble of ideas, concepts, and categories through which meaning is given to phenomena." Therefore, discourse analysis is a method to process qualitative data focusing on the implicit, rather than on the explicit content of the data (Denscombe, 2010). In this context, text and talk are not considered at face value, rather, they are deconstructed to reveal hidden messages and the way they create meaning. Among the various academic traditions and methods to undertake discourse analysis, this research draws upon Argumentative Discourse Analysis (ADA). This approach was developed by Maarten Hajer and introduced in his book: *The Politics of Environmental Discourse,* which was published in 1995 and draws upon the ideas of Foucault and Giddens (Spath, 2012).

ADA stems from the approaches of interpretive policy analysis and argumentative policy analysis. It is based on the idea that policy making encompasses argumentative dynamics among key actors in key circumstances where they position themselves to debate the policy problem. Therefore, Hewitt (2009) and Scott (2017) argue that from an ADA perspective, public policy is a product of an argumentation struggle "to establish a dominant political 'truth' that in turn legitimizes societal intervention strategies

by means of policies and policy instruments" (Winkel and Leipold 2016, p. 110). Similarly, Myerson and Rydin (cited by Hajer and Versteeg, 2005) and Hugh and Brown (2009) observe that regulatory arrangements and ultimately, enabling or constraining power and agency structures stem from the different meanings underlying the different discourses of stakeholders that construct environmental policy. Späth (2012) and Jenkins et al. (2017) argue that such institutional frameworks depict the distributional, procedural and recognition rationale of the national policy framework for rural energy. ADA is underpinned by a series of conceptual elements as outlined in Table 5.4.

Table 5.4 Conceptual elements of Argumentative Discourse Analysis

Term	Definition
Metaphors	'Metaphors are generally two- or three-word phrases which symbolise the key ideas of the discourse such as 'climate change' and 'access to services'' (Hewitt,2009, p.10).
Storylines	'Storylines are a common way for actors to attempt to ensure their discourse is heard and understood. Storylines are described as "a condensed sort of narrative that connects different discourses" (Hajer, 2005, 448). A storyline is a subtle mechanism of creating and maintaining discursive order. The function of storylines is that they suggest unity in the bewildering variety of separate discursive component parts of a problem such as climate change. The storyline evokes a more complex issue and so they are simplifications that allow people to understand the larger and more complicated issue (Hajer, 1995, 56)' (Scott, 2017, p.4).
Discourse coalitions	'Actors engaged in a certain political struggle (e.g., about environmental policy) try to achieve dominance or hegemony in that discursive space. In doing so, they form discourse coalitions, i.e., groups of actors that—for various reasons—are attracted to a specific (set of) story-lines' (Spat, 2012, p.1260).
Discursive affinity	'Arguments may vary in origin but still have a similar way of conceptualising the world' (Hajer, 2006, p.70).
Discourse structuration	'A discourse can begin to dominate the way in which a social entity (e.g., policy area, enterprise, society as a whole) conceptualizes the world e.g., by making things appear "traditional", "natural" or "normal". He calls this the condition of "discourse structuration" '(Spat, 2012, p.1260).
Discourse institutionalisation	*'Discourse institutionalisation* takes place when discourse is reproduced in practices which become routinized. For example, climate change discourse becomes institutionalised when a municipal department changes its name from an 'environmental department' to an 'environmental and climate change department', or when a whole new climate change section is established in a municipality. In this way, the discourse stabilises and becomes entrenched in policy and decision-making processes (Hajer, 1995, 57). Institutions function as they are constantly reproduced in actual routinised practices' (Scott, 2017, p.7).
Dominant discourse	'If both criteria are fulfilled [discourse structuration and discourse institutionalization] we argue that a particular discourse is dominant '(Hajer, 2006, p. 68).

Hajer (2005) proposes a ten-step process to conduct ADA, as illustrated in Table 5.5.

Table 5.5 Ten steps for discourse analysis (Hajer, 2006, p. 73-74)

Hajer's ten steps to conduct discourse analysis
1. Desk Research: first reading of events through general survey of the documents
2. 'Helicopter Interviews': obtaining key insights from a small elite of stakeholders
3. Document Analysis: identifying story lines and metaphors, and the practices of discursive struggle
4. Interviews with key players: enabling the researcher to construct the interviewee discourses and the shifts in recognition of alternative perspectives
5. Sites of argumentation: searching the data related to the argumentative exchange
6. Analyse for positioning effects: showing how people, institutions or nation-states get caught up in an interplay
7. Identify key incidents: understanding the discursive dynamics and the outcomes
8. Analysis of practices in particular cases of argumentation: by going back to the data to see if the meaning of what is said can be related to the practices in which it was said.
9. Interpretation: providing an account of the discursive structures, practices, and sites of production
10. Second visit to key actors: presenting the outcomes to respondents who should be able to recognise the hidden structures of language found.

Drawing on Hajer's conceptual and operational guidelines, this research aims to deconstruct the discursive structures that make up the national policy framework for off-grid energy access in Bolivia. However, due to time and resources constraints several modifications were made, as summarised in Table 5.6. First, step one (desk research) step three (document analysis) and step seven (identifying key incidents) were undertaken concurrently to provide a first reading of events including: (1) a historical account identifying the key incidents; (2) the national policy framework; (3) the current situation; and (4) key messages regarding off-grid rural energy access in Bolivia. Next, the interviews with key players were undertaken. Step five (identifying sites of argumentation) and step eight (analysing discursive practices) were then undertaken concurrently to identify and analyse: (1) discursive themes; (2) storylines; (3) practices and sites of argumentation. Finally discourse coalitions and discursive structures were identified and analysed.

Table 5.6 Five-step process to conduct ADA in this project

1. First reading of events
A historical account of energy access in rural Bolivia
Current national policy framework for energy access in off-grid rural Bolivia
The current state of energy access in rural Bolivia
Key messages
2. Interviews with key players
3. Data analysis
Discursive themes
Story-lines
Practices and sites of argumentation
4. Discourse coalitions
5. Discursive structure

The five-step ADA process designed for this project aims to address the second and third research questions, providing an overview of (1) the engagement of the discourse that makes up the national policy framework with the guiding principles of energy justice; (2) counter-discourses and their engagement with energy justice; (3) governance arrangements in rural energy access policy; and (4) absent agendas. These four outcomes collectively provide an understanding of how the guiding principles of energy justice play out in the national policy framework through different discursive structures, promoted by different key actors in different governance positions and holding different levels of power. Furthermore, they illuminate potential actions for moving towards a more justice-aware policy framework.

5.4 Ethics

Based on the Massey University Human Ethics Checklist, this project was identified as low-risk. Therefore a low-risk ethics application was completed. This involved consulting the *Massey University Code of Ethical Conduct for Research, Teaching and Evaluations Involving Human Participants* in order to identify the potential ethical issues that might arise. These issues and possible ways to minimise them were then discussed with my supervisor who peer-reviewed my ethics application.

Because this research elicits personal statements from key stakeholders about public policy issues, the main ethical concern identified related to the privacy and confidentiality of participants, who could refrain from making public statements around sensitive issues, such as policy-making and social justice

due their strategic sectorial positions. To address this concern, each informant received an information sheet prior to the interview (Appendix 3). This outlined the purpose of the study, the fact that participants' confidentiality would be protected, and the rights of participants including (1) to withdraw from the research even after the interview was conducted; (2) to decline to answer specific questions for any reason; (3) to request further information about the research at any time; and (4) to decline from being recorded. These points were reiterated verbally before starting each interview and prior to obtaining written consent from each interviewee.

Each informant was asked how they would prefer to be identified or if they would prefer to have their identity revealed. As none of the interviewees opted for the latter option, each interviewee was given a generic descriptor according the stakeholder group they represent as outlined in Table 5.3. Finally, participants were informed that all data elicited is to be used only for the purposes of this research, and that the data will be stored securely until this research is completed, after which it will be destroyed.

5.5 Limitations

Qualitative research is sometimes criticised for lacking representativeness, biased interpretation, decontextualization of meaning, and oversimplification of explanations (Denscombe, 2010). In this context, one limitation of this research is that the number of stakeholders interviewed was fairly small, raising potential issues of representativeness. It is possible that the stakeholders who did not respond to the invitation to participate or declined to participate, might have contributed additional different discursive structures, which were not captured by this research. Therefore, the results of this study cannot be said to have captured *all* the possible narratives within the Bolivian energy sector. However, this research does provide meaningful insights into the engagement of the national policy framework for off-grid energy access in rural Bolivia with the notions of energy justice.

Potential issues of oversimplification were addressed through data triangulation, which provides more than a single perspective on the research problem, enriching the data analysis and providing more potential arguments and explanations. This research also drew on reflexivity accounts throughout the research process. According to Berger (2013) this is a sound strategy for quality control in qualitative inquiry, providing insights to gain a better understanding of how the researcher conceives research questions, interacts with interviewees and ultimately makes sense of data (Frank, 2002).

Chapter 6 First Reading of Events

Drawing on an analysis of the key policy documents identified in Section 5.2.1, this chapter provides a chronology of the key events related to rural energy in Bolivia, the first step in the discourse analysis process outlined in Section 5.3.1. First, Section 6.1 provides an account of the socio-historical context that constructs and defines the political problem of lack of energy access in rural Bolivia. Section 6.2 then describes the current national policy framework for energy access in rural Bolivia. Next, Section 6.3 describes the current state of energy access in Bolivia. Finally, Section 6.4 summarises the main findings stemming from this first stage of the analysis.

6.1 A historical account of energy access in rural Bolivia

The first documented milestones on power generation in Bolivia date back to the late nineteenth and early twentieth centuries, propelled by the economic boom of the mining industry, particularly in the western Andean cities (Jimenez, 2018). During the first four decades of the twentieth century, the growing demand of households in urban areas, public lighting, new extractive activities and the traditional mining industry, catalysed the development of hydropower plants (Bolivian Company of Electricity, 2007). Although most of this power was generated in rural areas, the supply was exclusively directed to the main urban areas and mining sites (Jimenez, 2018). As such, communities living in rural areas, including the indigenous employees within the mining sector, did not benefit from this early energy transition (Zavaleta, 2013).

This urban-rural chasm was raised by indigenous representatives who publicly demanded access to "electricity force" for their jurisdictions during the first National Indigenous Congress in 1945, at the dawn of the National Revolution that promised to change the socio-economic status of Bolivia's indigenous population (Shesko, 2010, p. 9). However, historical records show that rural energy was not part of the official political agenda for development until the early 1960s (Canedo, 2005). Since then, four historical stages can be identified as key incidents that have shaped the discourse framing the national policy framework for off-grid rural energy access in Bolivia.

6.1.1 Incorporation of rural electricity in the political agenda

Almost two decades after the first official request for electrification by indigenous leaders, the national policy agenda incorporated the goal of rural energy access for the first time in 1960. Stemming from the Basic Development Plan for the Electric Sector, the National Institute for Rural Electrification (INER for its acronym in Spanish) was created to provide electricity to isolated rural areas and small remote communities (Rizzo, 2004). However, although rural electrification was formally acknowledged within

the Basic Development Plan for the Electric Sector, it hierarchized communities into communities with "highlighted social or economic significance" which together with urban areas were the responsibility of the National Electricity Company (ENDE), and communities "out of ENDE's action scope" which were the responsibility of INER (Quiroga, 1984, p. 23-24). As such, most rural communities remained marginalised due to the lack of public budget.

During this period, institutionalization remained weak in terms of technical capacity, budgetary availability and a lack of specific regulation to improve rural energy access (Birhuet and Fernandez, 2002). Indeed, international cooperation played a critical role in facilitating the diffusion of technical knowledge and funding. INER mainly focused on a very limited deployment of small-scale power units, mainly diesel-oil generators ranging from 50 to 120 kWh targeting 4 to 6 hours of electricity supply per day for a limited group of remote communities. However, it also propelled seminal research on off-grid solar energy (Quiroga, 1984) and the first study on energy demand in Bolivia per source and sector (Guzman, 2010).

6.1.2 Privatization of the electricity sector

During the 1990s, the government largely privatized the electricity sector, but rural electrification remained as a responsibility of the government. Although there is consensus among the sectorial actors that "the main losers" of this process were rural areas (Barbu and Luzuriaga, 1999, p. 3), the government introduced the Rural Electrification Regulation in 1997 (Law 24772), the National Program for Rural Electrification and the concept of "rural electrification agents" - which encompassed promoters of projects, funding and goods and services related to rural electrification - institutionalizing a new sectorial governance structure (Arce and Guzman, 2010, p. 77). As a result, new stakeholders emerged during this period stemming from successful university spin-offs particularly focused on small-scale solar energy solutions, which then consolidated as small enterprises or NGOs in the early 1990s (Pansera, 2012).

Throughout this process, international cooperation continued to provide funding, technical know-how, and research studies such as the Survey on Rural Household's Energy Demand undertaken by the National Academy of Sciences and INE in 1996, supported by ESMAP (Guzman, 2010), and the Evaluation of Technological Needs for Climate Change which included energy needs for rural areas sponsored by the United Nations (Ministry for Sustainable Development, 2002). According The Food and Agriculture Organization of the United Nations (2000), around 3000 SHS were in use across Andean communities by 1997, 2000 SHS in the eastern area, and the University Mayor de San Andrés started to deploy hydro powered mini-grids.

Finally, social reforms in the mid-1990s provided municipalities with financial resources under the Law of Decentralization and the Law of Popular Participation. Although originally planned to meet the local requirements of health, education, roads and micro-irrigation, some of this funding was invested in electrification (Fernandez, 2010). However, many criticised these initiatives because local governments opted for grid extensions without considering other off-grid alternatives for electrification (Birhuet and Fernandez, 2002).

6.1.3 Disruption of international cooperation entities

One of the first interventions to deploy clean cooking technologies through solar stoves in Bolivia began in the early 2000s through the cooperation of the French government and a private non-profit association (Inti Illimani, n.d.). This represented a national milestone to address clean cooking technologies and fuels. Although this did not manifest within the political rhetoric as such until the next key event explained below, it started to shape a coalition for CCFT explained in Chapter 7

The Rural Electrification Plan Bolivia was introduced in 2003 aiming to achieve the socio-economic development of rural areas through access to, and efficient and productive use of, electricity. Micro-finance institutions were incorporated as rural electrification agents and granted funding to develop financial products for the rural energy market, through the National Funding Scheme for the Financial System and Productive Development (FONDESIF for its acronym in Spanish).

During this period, statistics show that rural electrification coverage took off in a significant way compared to previous periods, increasing from 12% to 30% between 1997 and 2007 at an average annual growth rate of 2.4%, compared to an increase from 9% to 12% between 1976 and 1997 (an average annual growth rate of just 0.3%) (Fernandez, 2010). However, Birhuet and Fernandez (2002) assert that this outcome reflects the efforts of local governments and non-government organisations rather than central government policy and planning.

6.1.4 Introduction of a new political regime

As explained in Chapter 2, in 2006 the new political regime proposed a new development paradigm based on the acknowledgment of the pluricultural nature of Bolivia. This vision is now pervasive across the political rhetoric of every sector of the economy, including the national policy framework for off-grid rural energy access. In this context, electricity access and CCFT (which is considered within the "other basic services" category), is framed as a historical social debt the State owes rural areas whilst maintaining the core instrumental idea of energy access for development.

The new political regime introduced the National Development Plan in 2007 (Law 29272). This plan declared the electricity sector as strategic to enhancing economic growth and improving living conditions for the population of Bolivia. Four policy pillars were set out: infrastructure development, universalization of electricity services, sovereignty and independence, and consolidation of state participation (National Development Plan, 2007).

The second pillar, universalization of electricity services specifically focused on rural areas and the government became the main protagonist in electrification planning. However, it continued to depend upon on funding mechanisms from private and public actors. Therefore, the National Development Plan devised two policies: The Dignity Tariff (Tarifa Dignidad) and the Program Electricity for Living with Dignity (PEVD for its acronym in Spanish). The former defined a 25% tariff reduction for grid users located in peri-urban and rural areas consuming less than 70-kWh/month (Law 285653). The latter was created in order to contribute to a substantial increase in electricity coverage and contribute towards achieving universal access.

The PEVD devises both centralized solutions (extensions and densification of the national transmission and distribution grid) and decentralized renewable energy solutions (DRES) (Law 29635). The program seeks to solve three problems: economic asymmetries, a social debt with rural areas and lack of disruptive technologies for clean energy supply (for the main objectives, strategies and instruments of the PEVD see Appendix 4). However, although the program acknowledges other household energy requirements, the use of traditional biomass sources for heating and cooking across rural households and communities is not addressed.

Supporting the new institutionalization of energy access, the CPEP (2009) established historic milestones for the population, asserting that:

> Every citizen has the right to universal and equitable access to basic water supply, sewage network, electricity, domestic gas, postal services and communications. II. The supply of these services must comply with the criteria of universality, responsibility, accessibility, continuity, quality, efficiency, efficacy, equitable prices and adequate coverage; with social participation and control. Article 20 (p. 6).
>
> Access to different forms and sources of energy is a fundamental and essential right for integral and social development in the country, hence must be managed considering the principles of efficiency, continuity, adaptability and preservation of the environment. Article 379 (p. 98).

6.2 Current national policy framework for energy access in off-grid rural Bolivia

Stemming from the CPEP's call for universal access to basic services, the national policy framework for off-grid energy access in rural Bolivia is constructed and implemented through five main policy

documents that have specific implications for the deployment of off-grid renewable energies in rural areas:

- Universalization Plan: Bolivia with Energy 2010 – 2025,
- Policy for Alternative Energy for the Electricity Sector in the Plurinational State of Bolivia 2011,
- Development Plan for Alternative Energies 2025,
- The Patriotic Agenda 2020 – 2025, and
- The Plan for Development 2016 – 2025.

The *Universalization Plan: Bolivia with Energy 2010 – 2025* specifically uses the word *energy*, rather than only addressing *electricity* and conceptualizes the lack of energy as a historical social debt the country owes to the rural population. Although biomass is recognised as an alternative source of electricity generation, the policy does not address biomass as the main energy source for cooking and heating across rural households (Fernandez, 2010; Guzman and Molina, 2017). Consequently, the PEVD's guidelines are mainly focused on electricity and introduce three disruptive elements as summarised in Table 6.1.

Table 6.1 Universalization Plan: Bolivia with Energy 2010 – 2025

Goals	Instruments	Stakeholders	Policies
Universal access to electricity by 2025. 548 384 rural households respectively. 45% must be supplied with electricity by 2015. 127 338 direct and indirect jobs created.	PEVD	-Ministry of Hydrocarbons and Energy (MHE) -Department governments - Municipalities - NyPIOC	On-grid and DRES for rural areas. Supply: 70% grid extensions, 20% grid densification and 10% DRES. Strengthening productive uses of energy: Identification of productive potentialities according to macro regions.

Firstly, it (re)allocates a significant part of the budget required to achieve universalization to the state whilst acknowledging the financial resources stemming from international cooperation are also critical. Secondly, NyPIOC are included as key stakeholders aligning with the vision of the Plurinational State of

Bolivia conceptualized in the new CPEP. Finally, the policy emphasizes the productive uses of electricity, exploring potential productive applications of electricity to enhance rural supply chains.

The second key policy, the *Policy for Alternative Energy for the Electricity Sector in the Plurinational State of Bolivia 2011* offers a framework to increase renewable energy within the electricity mix of Bolivia. It addresses key boundaries, stakeholders involved, policy guidelines and pillars, proposed programs and transversal topics for renewable energy projects as outlined in Table 6.2. Four crucial elements are particularly relevant for off-grid energy access: academia is highlighted as a crucial sectorial institution, social and environmental criteria for project assessment are emphasised, new policy instruments identified and the term *Energy Universalization* utilized.

Table 6.2 Policy for Alternative Energy for the Electricity Sector in the Plurinational State of Bolivia 2011

Goals	Instruments	Stakeholders	Policies
Deployment of alternative energy within the electricity sector.	Four programs: -Electricity generation based on RE. - PEVD. -Regulation development and Institutional Strengthening. - Research, technology transfer and diffusion.	- MHE. - PEVD. -Department governments. - Municipalities. - NyPIOC. - Academia and research centres with key technological expertise. - National and international institutions channelling funding for electrification.	5 criteria for project planning: economic-productive, technological-industrial, social, environmental and institutional. - Design enabling regulation for alternative energies. - Establish tax incentives. - Assess the alternative energy potential for electricity generation. - Funding mechanisms to enhance the deployments of AES.

The last element is particularly critical since it is no longer referring exclusively to electricity but aiming to “ensure universal and equitable access of natural gas and electricity supply” (MHE, 2011). However, the document does not further refer to any policy regarding the deployment of natural gas or other energy requirements across rural areas beyond electricity for lightning, productive uses or social uses, as first established by the PEVD.

The third key policy is the Patriotic Agenda 2025, a thirteen-pillar national development plan. Table 6.3 summarises the development vision proposed which includes the principle of *Vivir Bien* stemming from

the *Law of the Mother Earth and Integral Development for Living Well* (Law N° 300). Although this normative framework is not regulated, it calls for energy access and the subsequent development outcomes to be culturally and environmentally respectful with the existing ecosystem and its regenerative capacity. Overall, the Patriotic Agenda 2020 – 2025 reaffirms the universalization goal for off-grid energy access for rural communities, while promoting protecting local cultures and ecosystems.

Table 6.3 Patriotic Agenda 2025

Goals	Instruments	Stakeholders	Policies
Establishing a framework to build an inclusive and participative society, a democratic state, without discrimination, racism, hatred nor division.	Thirteen pillars: 1. Eradication of extreme poverty. **2. Universalization of basic services with sovereignty for Vivir Bien.** 3. Health, education and sports for integral human development. 4. Scientific and technological sovereignty. 5. Community financial sovereignty. 6. Non-capitalist productive sovereignty. 7. Sovereignty over the national natural resources towards industrialization in harmony with the Mother Earth. 8. Food sovereignty. 9. Environmental sovereignty. 10. Complementary integration of native population with sovereignty. 11. Public management based on transparency. 12. Cultural abundance and plenitude. 13. Sovereign encounter with happiness, joy, prosperity and recover access to the coast.	- 21 Ministry that constitute the executive branch.	-100% rural population access to electricity services and lighting. - 100% of rural population count on basic services and proper households that allow families to achieve the *Living Well*.

The fourth key policy is the *Development Plan for Alternative Energies 2025* which was proposed in 2014. It encompasses new elements within the scope of energy access for rural areas in Bolivia, although the main objective is specifically focused on electricity deployment. It provides updated information about the new programs executed by the PEVD and includes new and crucial sectorial stakeholders within the

institutional framework to pursue universal energy access. Table 6.4 summarises the key elements of this policy.

Table 6.4 Development Plan for Alternative Energies 2025

Goals	Instruments	Stakeholders	Policies
Defining the necessary action lines to support the deployment and development of DRES.	Four programs: -Electricity generation based on RE. - PEVD. -Regulation development and Institutional Strengthening. - Research, technology transfer and diffusion.	-Ministry of Hydrocarbons and Energy (MHE). - PEVD. -Department governments. - Municipalities. - NyPIOC. - Academia and research centres with key technological expertise. - National and international institutions channelling funding for electrification. -Private Suppliers of technologies, operation and maintenance.	-100% of rural households and social infrastructures that cannot be reached through grid extensions, will receive electricity supply through AES. -New subprograms introduced by the PEVD: 1. IDTR (included improved stoves) 2. GGlobal Partnership for Output-Based Aid in Bolivia 3.KfW 4. EUROSOLAR 5. Energizing Development ENDEV. 6. Program of Rural Electrification (PER for its acronym in Spanish)

Within this policy document, academic research is identified as one of the most crucial requirements for the development of DRES. For instance, it offers that experiences like the Stove Testing Centre funded by the German Technical Corporation Agency in 2007, should be replicated and scaled up because it "illuminated the need to count on a neutral entity that provides regulation and standards for the deployment of improved stoves… through the application of international protocols and ensure that public resources are allocated efficiently to procure high quality, and safe products" (MHE, 2014, p. 91).

Interestingly, Energising Development (ENDEV) is introduced as one of the new programs executed by the PEVD (MHE, 2014, p. 37). Whilst ENDEV holds a critical and strategic cooperation agreement with

the MHE, it is an international cooperation body funded by different EU countries. Nevertheless, just the consideration of ENDEV within the key action lines of the PEVD depicts a milestone in energy planning. Considering that one of the central elements of ENDEV's operation since 2007 is focused on CCFT, the latter is therefore positioned at the core of the energy access challenge acknowledged by the central government.

Indeed, the new phase of IDTR encompasses the deployment of 7649 improved stoves. This process is enhanced by the stakeholders acknowledged within the policy text: academia and private suppliers of DRES. It introduces important institutional agreements with public universities focused on small-scale DRES for rural areas and the development of quality standards for improved stoves and SHS. Regarding private suppliers the policy document offers that "an evaluation of private suppliers points out that the national supply of turbines and hydraulic systems guaranties the good quality and technical sustainability for maintenance and replacement requirements" (MHE 2014, p. 44).

Finally, the *Social and Economic Development Plan 2016-2020* (PDES for its acronym in Spanish) refreshes the national development agenda. The deployment of DRES, particularly SHS, for rural areas, is acknowledged as a crucial strategy to achieve universal access to electricity, whilst maintaining grid extensions and densifications as the main strategy. Although the document does not discuss CCFT and other energy requirements for rural households and communities, policies focused on the deployment of the natural gas pipeline network aim to reach rural areas by 2025. It is estimated that more than 120 000 scattered rural households will access natural gas through conventional methods, namely, LPG cylinders by 2025. Table 6.5 outlines the relevant elements of the *Social and Economic Development Plan 2016 – 2020.*

Table 6.5 Social and Economic Development Plan 2016 - 2020

Goals	Instruments	Stakeholders	Policies
Establishing general guidelines to operationalize that proposed in the Patriotic Agenda.	"The thirteen pillars outlined in the Patriotic Agenda (as listed in Table 6.3)".	- 21 Ministry that constitute the executive branch.	-100% rural population access to electricity services and lighting. -DRES are crucial to achieve universal electricity access in rural areas. - 100% of Bolivian population has access to natural gas either through the national pipelines networks or LPG cylinders.

6.3 The current state of energy access in rural Bolivia

The historical chasm in electricity access between urban and rural areas of Bolivia has progressively diminished during the last four decades. In 1994, around 93% of urban Bolivians and only 12% of rural Bolivians had access to electricity. By 2018, 93% of the national population had access to electricity (99% of urban dwellers and 80% rural dwellers) as illustrated in Figure 6.1 (Ministry of Energy, 2019). However, although remarkable efforts have been made to provide on-grid energy solutions for urban and rural areas, there are more than 400 000 scattered rural households where grid solutions are not tenable (Fernandez, 2010; MHE, 2014).

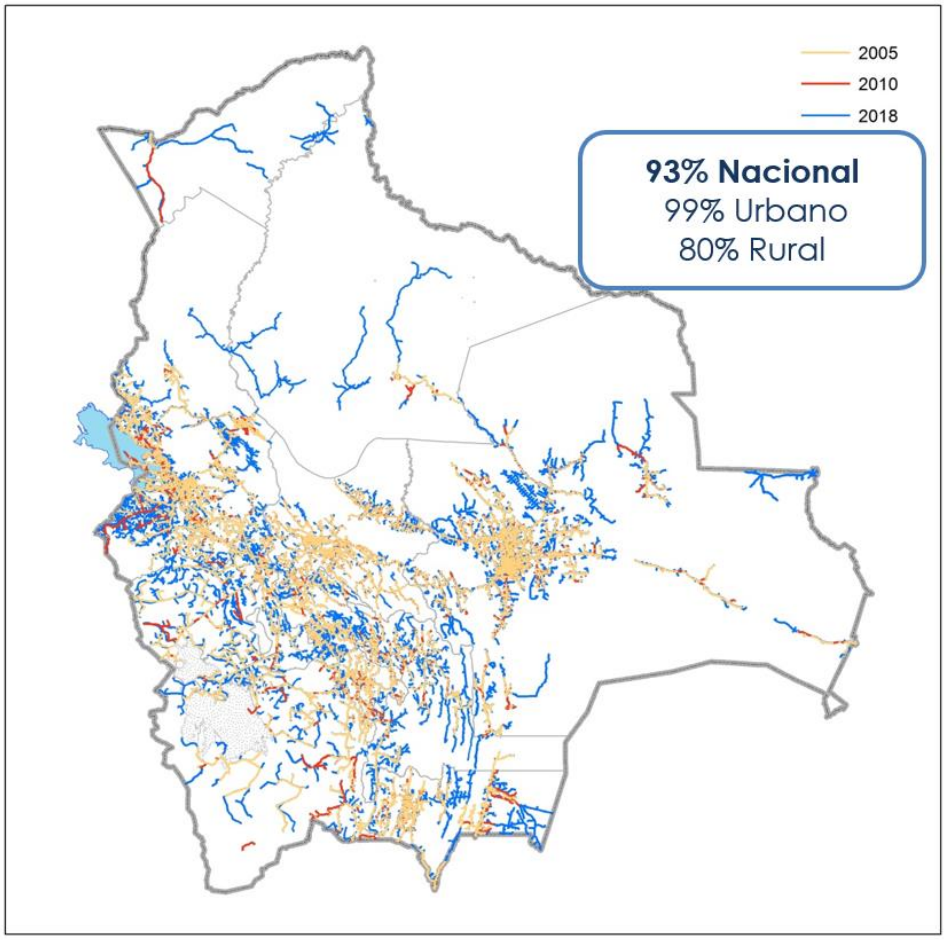


Figure 6.1 Electricity Access in Bolivia 2005 – 2018 (MHE, 2019).

Indeed, the deployment of DRES – including solar home systems, solar lanterns, standalone wind systems and hydro-powered mini grids, among others – dates back to the 1980s as outlined in Section 6.1. However, Gomez (2017) highlights ongoing challenges for rural communities seeking to access modern energy services for which the off-grid energy access challenge continues for around 250 000

hitherto unprovided households which are part the 20% of the total rural population still lacking access to electricity in 2018 (Smart Villages, 2016; Ministry of Energy-MEN, 2019).

However, there is no further detail regarding the specific types of DRES deployed across scattered communities. Although the MEN offers the PEVD's incidence area by municipalities through the Spatial Data Infrastructure of the Plurinational State of Bolivia as illustrated in Figure 6.2 (and Appendix 5 provides georeferenced projects executed by PEVD in 2018), no comprehensive information regarding the full portfolio of DRES deployed by different stakeholders in Bolivia was found.

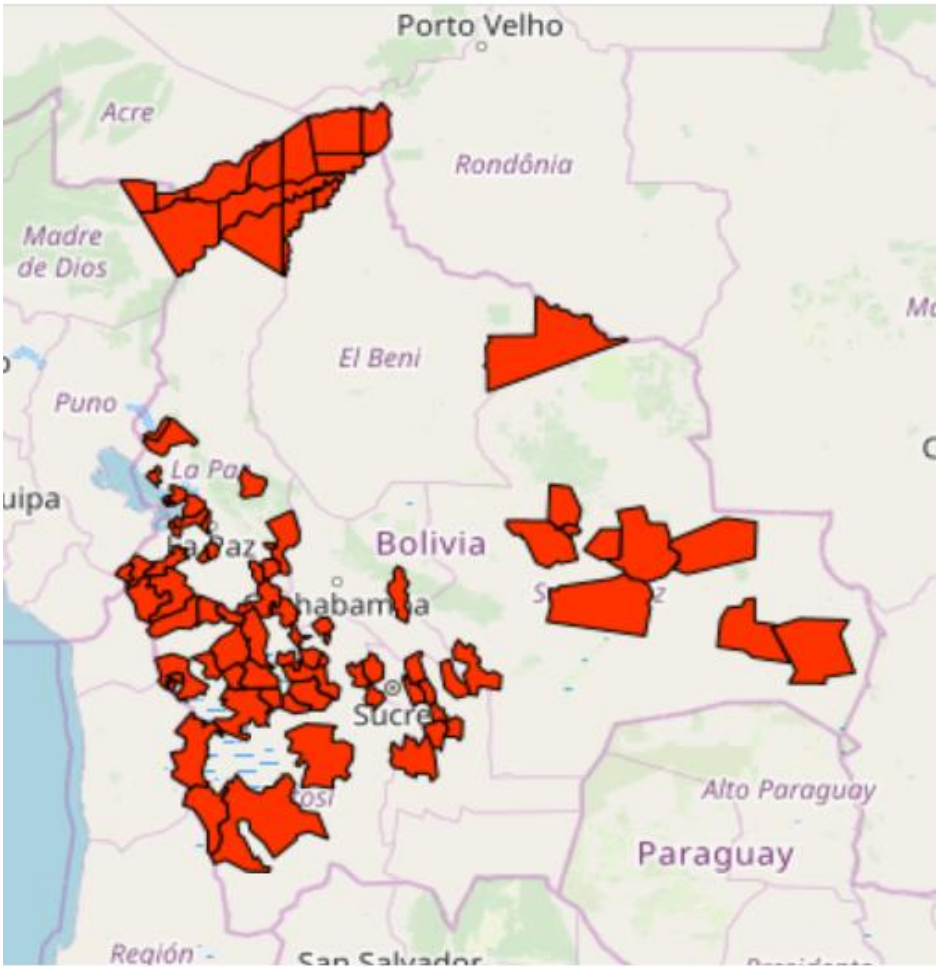


Figure 6.2 PEVD incidence area - 2018 (IDE-EPB, 2019).

The World Bank estimates that 83% of the national population had access to CCFT by 2018 (World Bank, 2018). In total, the natural gas pipeline network reached a million household connections across the national territory in 2019 while 135 000 to 155 000 LPG cylinders are refilled daily (YPFB, 2019). However, network solutions are mainly deployed in urban areas and unlikely to reach remote communities (MHE, 2014). Similarly, the LPG market is mostly concentrated on urban centres of capital

cities as shown in Figure 6.3 (INE, 2015). Indeed, biomass continues to make up between 80 to 97% of energy use in rural households, 80% for cooking services (Fernandez, 2010; Arce and Guzman, 2014).

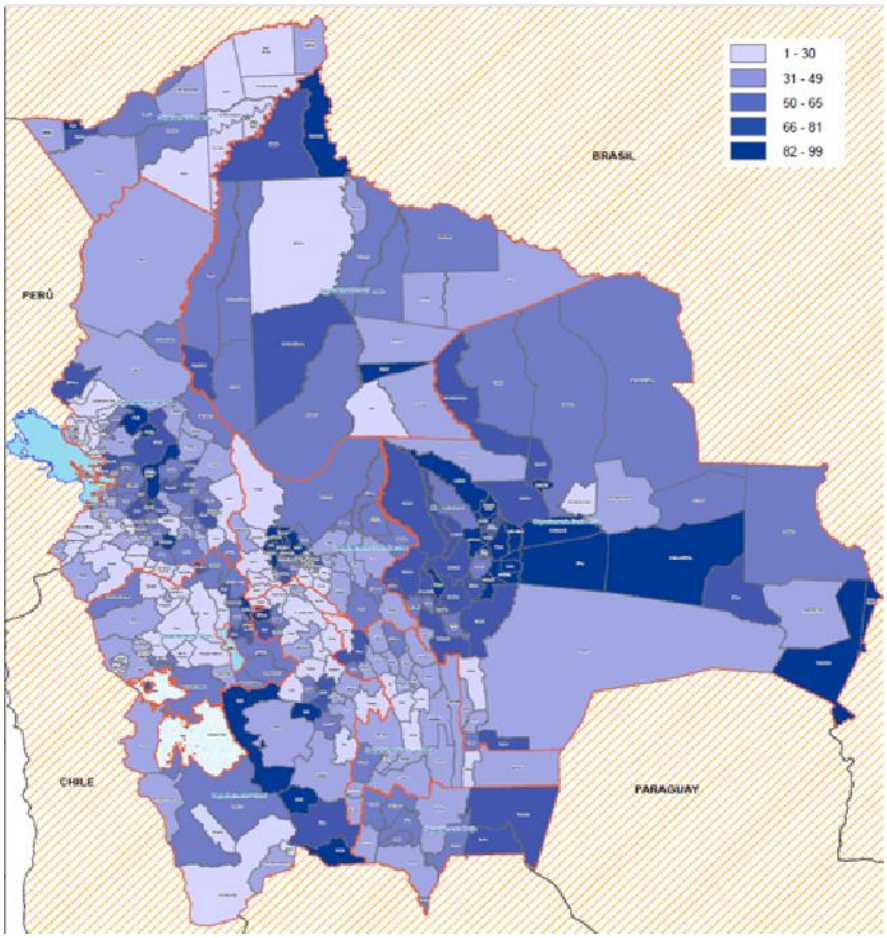


Figure 6.3 Households using LPG cylinders. INE (2015).

As outlined in the previous section, the government currently deploys clean cooking solutions like improved cookstoves, solar cookstoves and biogas digesters through ENDEV in tandem with private suppliers. However, although different stakeholders offer information about their individual portfolios (e.g. ENDEV, n.d; Inti Illimani, n.d. and CEDESOL, n.d.), no comprehensive centralized information regarding the CCFT deployed across rural areas was found.

The limited empirical applied academic and non-academic research on off-grid energy access in rural Bolivia does offer rich information on the benefits expected from improved energy access. For instance, the Interamerican Development Bank (2019) shows that solar lanterns in the Chiquitania region create household savings, improve the quality-price energy ratio from traditional lighting sources, but benefits regarding agricultural activities, communications and study hours were not found to be statistically significant. Similarly, Montaño and Monroy (2015) show that although HPMG bring socio-economic benefits, the availability of electricity enables the use of televisions causing undesired social effects, like

children avoiding schoolwork. Finally, Galoppo and Carlo (2017) assert that income diversification and local productivity benefited from PEVD's GPOBA project, but that these were unequitable between grid and DRES users and no impact on education was evidenced.

6.4 Key messages

Drawing on the historical account of how off-grid energy access in rural areas has been addressed as a political issue, the incumbent national policy framework and the current state of energy access in Bolivia, several key messages are identified. The central discourse through which the incumbent policy regime makes sense of energy access in rural areas can be characterised as *access for development*. This discourse is constructed around the core concept of modern energy services which is underpinned by two key elements as illustrated in Figure 6.4. Firstly, the instrumental value of energy services to provide socio-economic and environmental benefits, namely, enhancing the local economy, education, health and productivity. Secondly, the key types of energy services, mainly focused on electricity but also incorporating CCFT and other energy requirements.

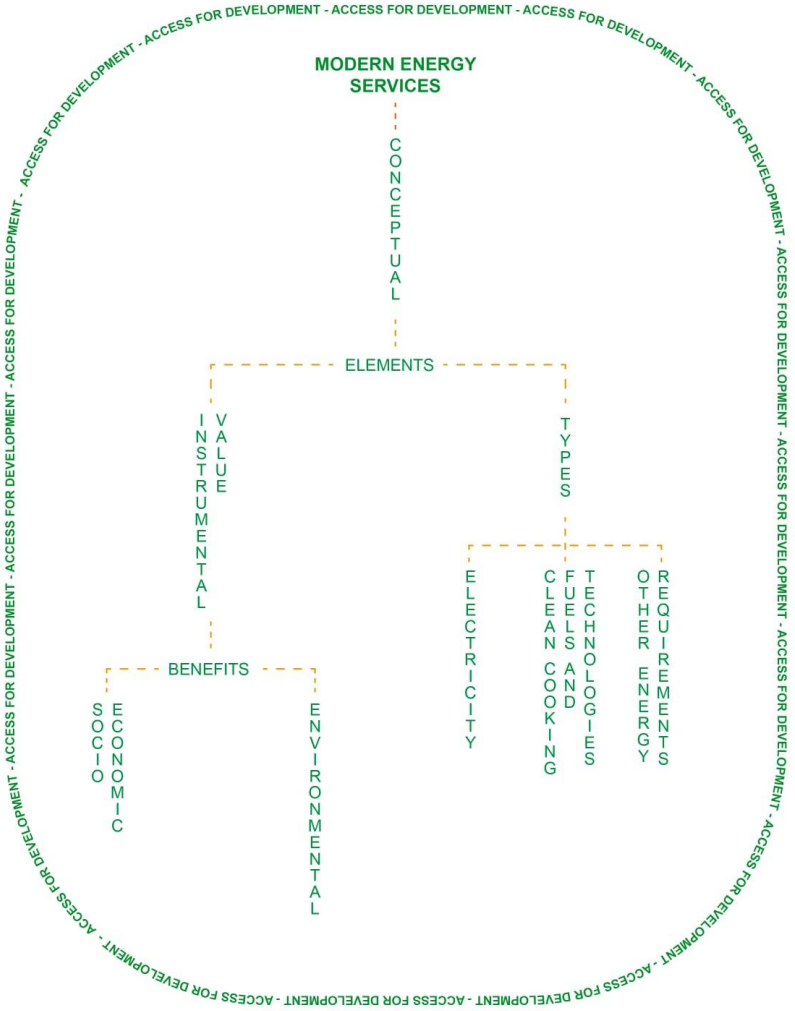


Figure 6.4 Key messages from the first reading of events.

Chapter 7 Findings

This chapter outlines the findings addressing the second research objective: exploring the discursive dynamics around rural energy access amongst key stakeholders and policy documents. Section 7.1 presents the findings from the interviews with key players within the Bolivian energy sector. Section 7.2 then analyses the data, identifying discursive themes, storylines, practices and sites of argumentation, and discourse coalitions. Finally, Section 7.3 considers the discursive structure of the national policy framework for off-grid energy access in rural Bolivia.

7.1 Interviews with key players

This section outlines the results of the eleven interviews carried out with key stakeholders within the Bolivian energy sector. As outlined in Chapter 5, ten of these interviews were carried out in-person in Bolivia in July 2019, with the final interview conducted via phone from New Zealand in September 2019. This section is structured around the interview questions (for the full list of interview questions please see Appendix 2).

7.1.1 Professional background

Interviewees were first asked about their professional background. Seven interviewees are senior experts with engineering degrees and more than 15 years of expertise in the rural energy sector. In contrast, three interviewees have social science backgrounds and less than three years of experience in rural energy within the academic and international cooperation fields. The different backgrounds and levels of experience of the interviewees provides insight into the diversity of professionals involved in the rural energy sector in Bolivia. For example, *Academic #2* belongs to a climate justice advocacy group in Bolivia and has only recently started reflecting on the national energy paradigm. Likewise, the *International Cooperation Representative #1* has no previous knowledge about rural energy but has around 20 years of experience in banking, start-ups and entrepreneurship to guide private suppliers of DRES.

7.1.2 Conceptualizing energy access

Participants were asked to define energy access. Their responses offer a continuum of definitions. At the practical end of this continuum, the *International Cooperation Representative #2* argued that:

> Energy access is having access to bulbs for lightning, plugs to charge your phone, plugs for charging and household benefits in general.

In contrast, an NGO representative provided a more holistic definition, arguing that energy access is:

> …counting on different manifestations of useful energy for individual and community welfare encompassing domestic, transformation and recreational uses (*NGO Representative #1)*.

The core idea underpinning both statements is that energy access is a channelling pathway towards some benefit, understood as different dimensions of development. However, the definitions offered by interviewees varied in terms of the types of energy requirements mentioned and the subsequent benefits identified. Eight interviewees agreed that energy access encompasses both access to electricity and access to heat, arguing that both improve welfare and contribute to productive activities. For example, an NGO representative argued that:

> Energy access is electricity and heat harnessing for basic uses but also to enhance productive activities, consequently leading to improve people's lives (*NGO Representative #3*).

However, it is interesting to note that seven interviewees mentioned electricity first and then heat or cooking facilities in a complementary sentence.

Participants were then asked if their definition of energy access changes in rural contexts. Two interviewees elaborated on further considerations to conceptualize energy access in rural areas as outlined below:

> It [the concept] changes because *access* is a social construct. Consequently, the definition changes according to the jurisdiction where it will be analysed. There are households in rural areas that do not need electricity because they go to sleep at dusk and wake up with the sunrise. For them, energy access might not be a matter of having light bulbs (*Academic #2)*.

> Energy access for rural areas in Bolivia, has a social connotation as a product of the sectorial policy applied during former neoliberal governments during the 90's, hence it is a social debt accumulated by the state (*Government Representative*).

7.1.3 Current state of off-grid energy access in rural Bolivia

Interviewees were asked about their opinions of the current situation of off-grid energy access in rural Bolivia. All the participants agreed that electricity access in rural areas has improved significatively:

> Universalization of electricity services in Bolivia increased historically during the last 15 years. Since 2006, the government is committed to paying off the social debt to rural areas and providing real access through the deployment of all off-grid technologies once left to the market forces back in neoliberal times. Access currently reaches up to 80% of rural population (*Government Representative*)

However, seven participants agreed that beyond electricity, energy access is challenged by the availability of other modern energy services. In particular, stakeholders involved in clean cooking solutions elaborated on this issue. For example, an NGO representative explained:

> Whilst electricity access has progressed in rural areas, I am not so sure about the significance of it. We know that 90% of energy requirements in rural households are involved with the use biomass. People use for lighting but mainly for cooking and heating. Hence, energy access in remote areas is an unsolved problem from my perspective (*NGO Representative #3*).

7.1.4 National policy framework for rural energy access in Bolivia

This section is divided into two parts. The first part explores interviewees' general opinions about the current policy framework. The second part then explores the views of participants with regards to specific dimensions of the current policy framework relating to the tenets of the energy justice framework discussed in Chapter 4.

7.1.4.1 General perceptions of the national policy framework

Participants were asked about their opinions of the current national policy framework for off-grid energy access in rural areas. The government representative offered a summary of the policy documents that make up the national policy framework outlined in Chapter 6. However, seven participants identified a dichotomy between electricity and other energy requirements. They claimed that off-grid rural energy policy focuses solely on electricity, which stems from the constitutional competences allocated to the Viceministerio de Electricidad y Energías Alternativas (VMEEA).

> The new CPEP established the universalization of basic services for all Bolivians. However, in rural areas, public policy is particularly focused on electrification and water access to some extent (*Private Energy Supplier #2*).

Specifically regarding electricity, all participants had a positive perception of the policy framework, although some argued that it needs strengthening in relation to two key issues: productive uses and reaching the most remote areas.

> Rural electrification policy has achieved major improvements among rural communities. However, there is 20% of the rural population to address which are the most remote, dispersed and poor. Hence policy strategies need to adapt (*NGO Representative #3*).

> Bolivia has a strong policy framework for rural electrification targeted to households, but productive uses are barely addressed (*International Cooperation Representative #2*).

Four interviewees also highlighted the absence of policy guidelines to address other energy requirements such as cooking.

> There is an intensive policy to deploy the natural gas national network and LPG cylinders for urban areas, but biomass use for cooking or heating in rural households is marginally addressed by the PEVD (*NGO Representative #2*).

> The government has occasionally subsidised improved stoves for rural areas since 2012, but all policy guidelines and the public budget are primarily focused on electrification. (*International Cooperation Representative #2*).

Drawing on these responses, follow up questions were used to elicit considerations about (1) strengths, (2) weaknesses, (3) challenges and (4) gaps between policy rhetoric and implementation. Table 7.1 summarises the main ideas raised by participants regarding the first three of these elements.

Seven participants agreed that there is a significant gap between policy rhetoric and implementation. They explained that different governance institutions share responsibilities for planning and implementation. Although the central government holds the constitutional obligation of planning for universal energy access, the CPEP also allocates similar responsibilities to other levels of government. *Academic #1* summarised some of these concerns:

> There are seriously misleading guidelines within the CPEP, since it defines that universalization policies are competence of the central government, but also claims that rural electrification is an exclusive responsibility of the Department Governments (Article 300) and indigenous autonomies (Article 304). Additionally, the Law of Popular Participation channels financial resources to Municipalities to invest in local electrification programs as well.

In total, nine interviewees pointed out that despite the current political rhetoric proposing an overarching vision to address the universalization goal, it has not necessarily materialized within the agenda of Department Governments and Municipalities. They argued that the former are more focused on grid solutions whilst the latter have a strong commitment but are highly limited by technical expertise. As explained by one of the NGO representatives:

> The PEVD is one of the biggest and most ambitious programs for rural electrification in South America and is supported by significant public investment focused on electricity services. However, institutional capabilities are limited in rural municipalities which hinders policy implementation (*NGO Representative #2*).

Interviewees also highlighted that although the rhetoric within central government policy documents provides a broad national framework, the ultimate implementation guidelines are determined by the different institutions that provide funding for the implementation of projects. For example, two interviewees who work for organisations funding energy projects in rural areas explained:

> Based on our own framework for inclusive development, we provide the PEVD with specific guidelines and contents for the formulation and implementation of rural electrification projects that must be complied with as part of the funding agreement. The government knows what kind of projects we fund (*International Cooperation Representative #1*).

> All the projects for rural energy that we have implemented with external resources are exclusively based on our guidelines, however those are undoubtedly focused on contributing to the government vision and agenda (*NGO Representative #2*).

Table 7.1 Opinions on strengths, weaknesses and challenges for the national policy framework.

Elements	Ideas	Participants
Strengths	The PEVD counts on more financial resources than former rural electrification programs.	7
	Strong collaboration with international cooperation	5
	Consideration of social and productive uses of electricity	3
Weaknesses	Limited institutional knowledge of DRES.	8
	Public funding for projects implementation is intermittent.	6
	Financial resources are not enough and create conflict among rural communities	5
	Subsidies and fiscal incentives are provided on a case to case basis	3
Challenges	Institutionalization of universalization of other energy requirements in rural areas.	10
	Provide mechanisms to ensure the long-term use of DRES.	8
	Strengthen guidelines for productive uses of electricity and biomass.	6
	Provide incentives to enhance the participation of private suppliers of DRES	2

7.1.4.2 Specific dimensions of the national policy framework

Further questions were asked to elicit interviewees opinions about specific dimensions of the policy framework related to the tenets and guiding principles of the conceptual framework including: the quality of energy supply, the long-term use of energy solutions, end uses of energy, socio-cultural processes, familiarity with energy solutions provided, actors involved in policy making and environmental implications.

Quality of energy supply

Participants were asked how the quality of energy provided in rural areas compares to that provided in urban areas. The government representative explained that policies aim to ensure that rural populations can access the same quality of electricity in terms of voltage and applicability:

> Universalization policy aims to provide real access to electricity for rural populations through grid densifications to ensure the same voltage that urban areas have. As to off-grid appliances based on AES, systems provided are modular in design and therefore expandable and can be used in a wide range of applications (*Government Representative*).

However, other interviewees reflected on other qualitative attributes of energy supply. Specifically, three informants mentioned the duration and seven referred to the availability of supply, which in their opinions are limited under current rural energy policies.

> DRES deployed in rural areas provide only few hours of electricity compared to the permanent supply of electricity in urban areas (*NGO Representative #2*).

> Although improved stoves optimize the process of biomass burning, collecting biomass is still needed which is usually a responsibility allocated to woman and girls affecting their health as well, whereas urban households have uninterrupted natural gas supply (*NGO Representative #3*).

Long-term use of energy solutions

Interviewees were consulted about their opinions on the long-term use of energy solutions provided. The government representative explained that this is a crucial element of projects and explained the current policy mechanisms applied to address it, highlighting economic barriers to consider:

> Current sustainability mechanisms focus on creating a culture of responsibility among beneficiaries that commit to operate and maintain the solar systems and replace at least one battery at the end of its life-cycle, which is complicated because of the limited financial resources of rural population (*Government Representative).*

The rest of the informants posited that sectorial policies have accelerated energy access by covering the initial financial burden of up-front costs of DRES for rural communities that could not otherwise afford

them. However, they argued that such an achievement is not currently supported by adequate strategies to ensure their long-term sustainability, as illustrated by the quotes below:

> Current policies for universal electricity access help in overcoming the upfront costs related to small-scale clean energy technologies, which was a huge barrier never addressed in previous policies. The problem is how to ensure that beneficiaries keep using them after a project is finished and this is projects' Achilles heel (*Academic #2)*.
>
> Many of our projects consisted of repairing and reactivating solar systems and small hydroelectric plants that have been abandoned because users did not know how to fix them, and this is part of the overlooked technical sustainability of public policies (*NGO Representative #3)*.
>
> During 10 years of work in rural areas, I have seen children playing soccer with solar lamps and broken small wind turbines used to hang wet clothes (*Private Energy Supplier #1).*

End uses of energy

Participants were asked whether they thought the policy framework considers the end uses of energy by the target population. Opinions varied widely and focused on different dimensions of energy access. On one hand, the government representative and a private energy supplier believed that the end uses of energy are considered and play out as the targets of projects:

> Rural electrification projects consider final uses of electricity which are mainly for lightning, information and communications, namely radios and charging mobile phone batteries. However, we are currently undertaking a study of energy yields within rural households to improve our knowledge (*Government Representative*).
>
> All projects are focused on specific targets: households, schools, health centres and communal houses. Within households, electricity aims to provide more hours of light for work and study for children and reduce women's household workload (*Private Energy Supplier #1*).

An NGO representative argued that although the end uses of energy are not explicitly considered they are addressed just by making energy available:

> I reckon that final uses of energy are not explicitly determined within energy policies for universalization access. It is rather an assumption of the logic consequence of the availability of energy (*NGO Representative #2*).

On the other hand, eight interviewees argued that final uses of energy in rural communities are not adequately addressed by current sectorial policies from a holistic perspective. For example, an academic explained:

> The main justification for rural electrification is development but no one knows how it will materialize. Policies preach that access will enable people to operate

> electric machines and tools, but projects just bring the electricity. There is no conjunct action with other actors working in rural development (*Academic #2)*.

Socio-cultural characteristics

Interviewees were asked whether they thought the current policy framework considers the socio-cultural characteristics of rural communities. All participants agreed that the national policy framework acknowledges and respects the socio-cultural characteristics of rural communities in which energy access projects are implemented. The government representative explained the socio-cultural considerations in electrification projects:

> All rural electrification projects are respectful of local habits and customs. Solar systems commonly do not affect significantly habits and customs. Additionally, trainings and capacity development are focused on women to enhance a harmonious appropriation of technologies within households.

However, the other participants argued that there are no official guidelines or regulations on how to address socio-cultural characteristics within projects with some going on to explain how their organisations' sought to address these issues:

> In general, the rhetoric of policies for universalization of basic services are broad, general and do not provide specific guidelines to adjust projects for each social and cultural realities across the different regions in Bolivia (*Academic #1*).

> In the absence of official guidelines from the government, we undertake a base line study to identify gender roles and power relationships, vulnerabilities and capabilities. Based on this we enhance the participation of women and children in workshops and training sessions which are provided in the local native language (*NGO Representative #1*).

Familiarity with energy solutions

Participants were asked whether they considered that the energy solutions provided are familiar to rural communities. Most interviewees agreed that in general, rural populations have a basic knowledge of small-scale renewable energy technologies which is reinforced during the design and implementation of projects. The government representative explained:

> Rural communities usually know about DRES by word of mouth from nearby communities. Under the PEVD schemes, projects are awarded to private technology suppliers who are responsible to transfer the required knowledge about the solutions provided (*Government Representative*).

However, three interviewees argued that knowledge and the dissemination of information undertaken under the current policy schemes can be shallow and asymmetric among members of rural communities. They argued that more effective engagement and outreach programmes are therefore needed:

> It is mandatory to strengthen both processes and mechanisms with which rural communities are introduced to clean technologies amongst different groups of users. The ex-post evaluation of electrification projects we funded revealed that older woman in an Andean community were not using their solar lamps because they were afraid of them and the intensity of the light it provided (*International Cooperation Representative #3*).

Actors involved in policy making

Interviewees were asked to what extent other sectorial stakeholders are involved in policy-making processes. All the interviewees explained that different levels of the public sector are involved in such processes as mandated by the. However, six participants argued that although the CPEP also defines participatory policy making, for which other stakeholders involved in rural energy should contribute their expertise, this does not always happen in practice. As two interviewees explained:

> Energy policy in Bolivia stems from a desk work. Although there are some workshops where different actors involved in rural energy share their experiences, these are not systematically incorporated into policy nor particular regulations which is a waste of institutional efforts (*Academic #1*).

> We annually report to the government about the projects we implement with different funding sources, providing a detailed account of lessons learned and good practices but we have never had feedback or been asked for further information. Knowledge we gain in field should be a crucial input for policy-making (*NGO Representative #3*).

Environmental implications

Interviewees were asked whether they considered that environmental implications to deploy rural energy access were adequately addressed within the current policy framework. Nine participants said they believed environmental issues were adequately considered within the policy framework. They pointed to the promotion of DRES to provide clean energy displacing the use of fossil-fuel lamps, small and medium disposable batteries and candles. Five interviewees added that DRES and improved cookstoves addressed environmental impacts in tandem with health benefits for rural households:

> The deployment of DRES including improved cookstoves that provide clean energy are aligned to the environmental pillar of electrification policies, but it also contributes to improve air quality standards by displacing toxic gases emitted by kerosene lamps and traditional biomass burning thus bringing a positive impact on health of rural population (*Private Energy Supplier #1*).

However, two participants elaborated on other environmental dimensions currently absent in the policy framework, such as the management of disposable batteries displaced by new technologies and the failure to address the greenhouse gases emitted by biomass use within rural households.

> Environmental issues are partially addressed… policies do not consider what they are displacing. Some projects include components to recycle small and medium size batteries used for radios and bigger generators, but not because the policy requires it, it is rather an individual initiative. (*NGO Representative #2*).
>
> Policies are short-sighted in this matter. Our products avoid GHG emissions, we quantify them in accordance to the Bolivian standard NB-ISO 14064 which defines a footprint measuring protocol and sell them to private companies that want to compensate their carbon footprint whilst providing benefits to rural communities that cannot afford our stoves. Policies should consider this within the environmental dimension of energy access (*Private Energy Supplier #2*).

7.2 Data analysis

Drawing on the data collected through desktop research and interviews, this section analyses the discursive structure of the national policy framework for off-grid energy access in rural Bolivia, addressing the second research objective of this project. In particular, four elements are discussed: discursive themes, storylines, practices and discourse coalitions.

7.2.1 Discursive themes

Three discursive themes underpinning the discourse of universal energy access for development were identified*: CLEAN ENERGY, REAL ACCESS* and *HARMONIOUS DEVELOPMENT*. Each of these themes present different variations and nuances of meaning among the different narratives introduced by sectorial stakeholders and policy texts as illustrated in Figure 7.1.

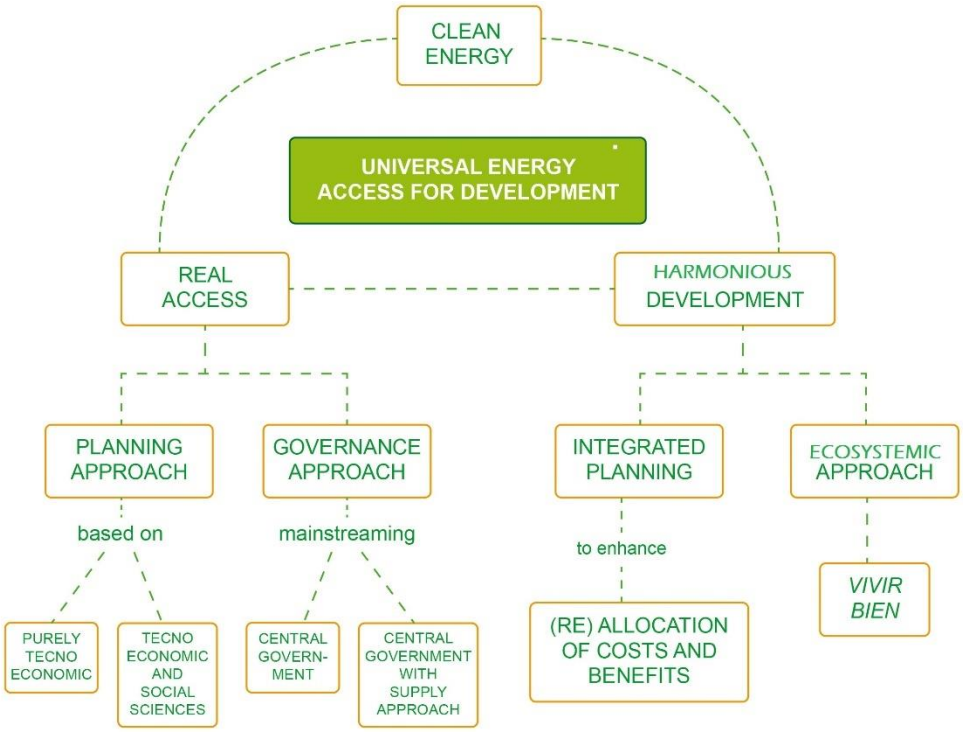


Figure 7.1 Discursive themes.

The first discursive theme is *CLEAN ENERGY* which depicts a group of renewable sources of energy that, within the narrative of rural energy access, aim to displace the use of fossil-fuel based technologies for lighting and the inefficient use of biomass for cooking and heating across rural communities and households. All the participants drew upon this theme within their interviews. For example, the government representative stated:

> Certainly, the PEVD considers the deployment of *clean energy* based on solar energy, which is environmentally friendly and replaces diesel oil lamps, batteries and candles that emit toxic gases, enhancing a local development (*Government Representative*).

The second discursive theme, *REAL ACCESS*, is characterised by two variations of meaning. On one hand, it refers to the planning approach that sectorial actors take and was identified as either (1) purely focused on techno-economic aspects of an energy solution; or (2) focused on both the techno-economic and social dimensions of an energy system as depicted by the quotes below.

> Only through a sharp and proper engineering planning to harness the most potential from energy sources is it that we can provide *real access.* (*Government Representative*)

> We undertake an overarching socio-economic diagnostic in tandem with the energy resources evaluation to provide microgrids that offer real solutions and *real access* (*NGO Representative #2*).

On the other hand, the discursive theme *REAL ACCESS* also represents the governance structure within the discourse, which has two approaches. Firstly, it focuses on the demand side of the market highlighting the critical role played by the government as argued by the government representative:

> Since 2006, the government is committed to pay off the social debt with rural areas and provide *real access* through the deployment of all off-grid technologies once left to the market forces back in neoliberal times (*Government Representative*).

The second approach acknowledges the role of the government in the strengthening process of the demand, focusing however on the critical need to support the supply side of the market. This supply approach is explained by a representative of an International Cooperation agency below:

> Without the government commitment, no progress would have been possible. But few efforts are currently putting in the long-term sustainability of the solutions deployed. We must empower suppliers to meet the demand conditions now and in the future without government intervention. That is the challenge now for the sake of *real energy access* (*International Cooperation Representative #2*).

The third discursive theme, *HARMONIOUS DEVELOPMENT*, also has two meanings within the discourse. Firstly, it depicts an integral planning approach to enhance the development outcomes of the deployment of energy solutions as an NGO representative explained:

> In the absence of official guidelines from the government, we have our strategies to address the socio-cultural specificities of rural communities provided with different *clean energy* solutions to promote *harmonious development*. We undertake a base line study to identify gender roles and power relationships, vulnerabilities and capabilities. Based on this we enhance the participation of women and children in workshops and training sessions which are provided in the local native language (*NGO Representative #1*).

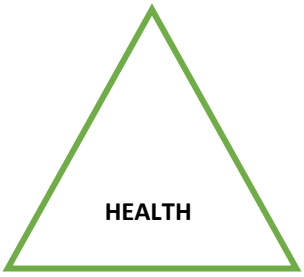
At the same time, *HARMONIOUS DEVELOPMENT* also reflects the ecocentric development approach proposed by *Vivir Bien* as explained by one of the academics interviewed*:*

> *Vivir Bien* depicts a vision of *harmonious development* of processes that will not affect the regeneration capacity within an ecosystem where nature, man and culture coexist (*Academic #1*).

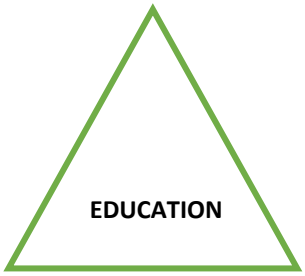
7.2.2 Storylines

According to Hajer (2005), a storyline can be understood as an utterance that tells facts depicting structural elements of a discourse. Thus, the concept of storyline refers to "a condensed statement summarising complex narratives, used by people as "short-hand in discussions" (p. 69). The data analysis process identified fourteen storylines within the narrative of off-grid rural energy access in Bolivia which focus on the benefits expected from energy access. These storylines are organised around five dimensions, namely, local economy, health, education, gender and communication as outlined below. Collectively these storylines support the discourse of energy access as a tool for development and the discursive themes discussed above.

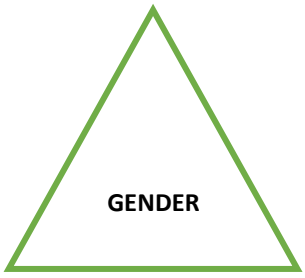
* DRES create savings for rural families
* The establishment of market mechanisms to ensure that the use of energy solutions provided in rural areas is sustained over time has a multiplier effect on local entrepreneurship, enhancing employment opportunities.
* Productive uses of electricity enhance local economies, diversifying opportunities and sources of income and employment.



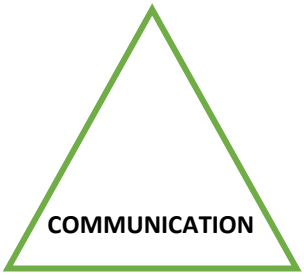
* Electricity improves the conditions in which rural health centres operate.
* Electricity improves health standards providing cooling for vaccines and other medications in rural areas.
* Clean cooking technologies improve indoor air quality standards improving the health of woman and girls.
* Solar energy can heat water for schools, households and community centres enhancing hygiene habits among rural communities.



* Electricity increases the hours children that live in rural areas can study.
*Clean cooking technologies save wood collection time for girls allowing them to study.
* Electricity allows schools to access to computers and didactic tools to improve education levels.



* Improved stoves and solar cooking technologies reduce the amount of biomass burnt and the time required to collect fuel and cook, tasks primarily undertaken by woman and girls.
* Electricity access can empower women through their active involvement in training sessions about and for the use of DRES.



* Electricity availability allows domestic use and charging of mobile phones for communication.
* Electricity access enable communication centres and use of ICTs.

It is important to note that these statements depict the main ideas identified within the utterances of interviewees. These storylines and narratives are constantly evolving and changing. However, the cores of such storylines are structural elements of policy interventions materialized in the specific practices outlined in the next section.

7.2.3 Practices

The discursive themes and storylines outlined in the previous sections are used within identifiable routines understood as practices shared by the stakeholders involved in the policy problem (Hajer, 2005). Three interrelated institutional practices were identified within the discursive structure of the national policy framework for off-grid energy access in rural Bolivia: planning, implementing and networking (as illustrated in Figure 7.2).

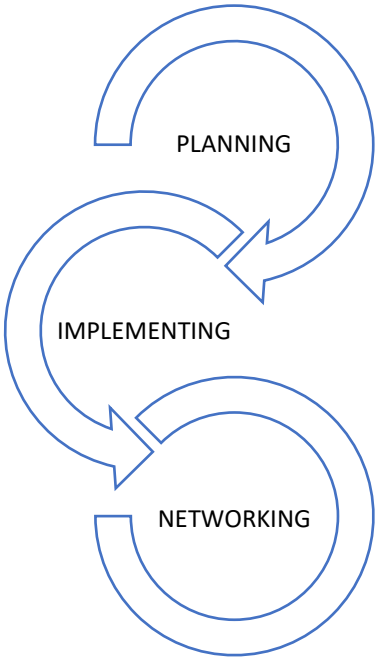


Figure 7.2 Discursive practices.

During planning processes for both individual projects and broader public policy interventions, stakeholders involved in rural energy access use storylines to shape narratives according to their roles within the sectorial governance. These storylines contribute to constructing (1) political positions and ideologies within government planning processes; (2) the guidelines of international cooperation and participant funding bodies and donors; and (3) the design of projects implemented by NGOs and private energy suppliers according to the requirements of the government and/or funding institutions.

Drawing on the discursive themes and storylines described above, planning objectives and goals materialize through policy implementation, the key second practice identified. This practice includes the final or ex-post evaluation processes informing the outcomes and outputs of energy access projects displaying specific narratives.

Finally, the third practice entails sectorial networking including events such as workshops and summits to exchange good practices and lessons learned. All the stakeholders interviewed in this research are

actively involved in this practice. The most important element of this practice is that it provides a space for debate and argumentative processes where different narratives play out in face to face discussions. The practice of networking includes the physical and virtual spaces in which stakeholders involved in rural energy access get involved in argumentation processes, exchanging knowledge. This encompasses workshops, congresses, summits and panel discussion as well as more informal interactions. However, it is important to note that the outcomes of these events do not have the power to directly influence public policy or set binding precedents. As such, they do not necessarily translate into public policy outcomes.

7.2.4 Discourse coalitions

The concept of discourse coalition refers to "a group of actors that, in the context of an identifiable set of practices, shares the usage of a particular set of storylines over a particular period of time" (Hajer, 2006). The data analysis process identified two main discourse-coalitions relating to rural energy access in Bolivia: electricity access and clean cooking fuels and technologies. The main elements of each of these discourse coalitions are outlined in Table 7.3. Although electricity access was found to be the main focus of government rhetoric and consideration of clean cooking technologies and fuels was marginal, its importance was strongly advocated by other actors directly engaged with the topic.

Table 7.2 Discourse coalitions.

Discourse coalition	Storylines	Practices	Governance institutions	Period of time
Electricity access	Local Economy	Planning	GOV	Established during the 1960s within the national political agenda.
	Health	Implementing	INT	
	Education			New stakeholders were incorporated during the 1990s including framing of Rural Electrification Agents.
	Gender	Networking	PRI	
	Communication		NGO	
			ACA	Framing of social debt was incorporated in 2006.
Clean cooking	Local Economy	Planning	GOV	Established around the early 2000s as initiatives of new international cooperation visions.
		Implementing	INT	

technologies and fuels	Health Education Gender Communication	Networking	PRI NGO ACA	Introduced in the political agenda in 2006 as one of the elements pertaining to universal access to basic services and framing related to social debt.

It was found that both discourse coalitions make up the governance structure within which the national policy framework for off-grid rural energy access in Bolivia has evolved. Findings show small but meaningful changes in the governance arrangements depicted by two elements: the framing strategy and the institutions involved. Both elements connect in three points that explain the discursive evolution.

First, rural energy policy during the 1990s took a market approach and was focused on providing access mainly through non-governmental actors which were framed as "rural electrification agents" (Arce and Guzman, 2010, p. 77). From 2006 onwards this frame has been removed from the policy rhetoric by the new regime, curtailing the influence of the financial institutions and NGOs within the discourse.

Second, the concept of "social debt" was introduced as a frame to represent a new enhanced role of the central government outlined in section 7.1. By subsuming the constitutional mandate of universalization through the PEVD (see Section 6.2), the central government has positioned itself at the forefront of universalization. Therefore, it assumes a significant budgetary commitment for rural electrification for the first time in Bolivian history, committing at least $130 million USD[6] for rural electrification between 2011 and 2021 (MHE, 2017).

However, the government acknowledges that universalization poses a particular challenge for remote areas and the associated costs exceed the national government's financial capacity. As such, complementary investment is expected from municipalities and private actors participating in the market (MHE, 2011). Indeed, both private suppliers and NGOs continue to develop electrification projects in tandem and independently of the PEVD, funded either by international cooperation, private and public institutions or even without external funding (Fernandez, 2015). As such, all the governance institutions participating in rural energy access during neoliberal times still make up the incumbent governance structure as illustrated in Figure7.3.

[6] Including donations, grants and loans from international cooperation entities.

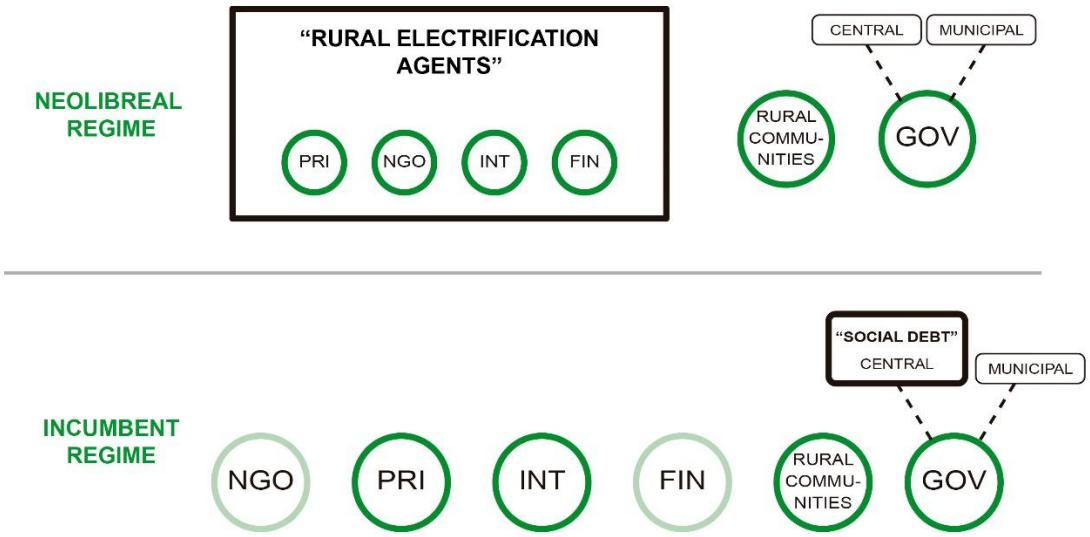


Figure 7.3 Changes in governance

Finally, the third point stems from the argumentative turn of public policy in 2006 that introduced a new epistemic approach towards the environmental implications of energy access in rural areas framed by the Law of the Mother Earth (Law 300, 2012). Within this law, *Pachamama* (Mother Earth) is defined as a "living dynamic system that encompasses an indivisible community of all living systems and beings, interrelated, interdependent and complementary, sharing a common destiny" (p. 6). In this context, Law 300 establishes and acknowledges the rights of Mother Earth to sustain and reproduce its dynamic systems and requires these to be considered within development processes. As such, it establishes the natural ecosystem within which DRES are deployed, as a nonhuman actor involved in rural energy access.

However, Law 300 lacks specific regulations and rural energy projects therefore continue to be regulated by two laws established by the previous neoliberal regime. The Electricity Law No. 1604 (1992) establishes a sectorial environmental conservation principle and requires hydro powered electrification projects to be accountable for the upstream basin management. On the other hand, the Decree 27173 (2003) classifies projects to deploy SHS and other standalone DRES as low environmental impact (Category 4 defined in Law No. 1604) which means they are exempt from requiring an environmental impact assessment. Therefore, although the Mother Earth is included as an actor within the incumbent governance structure it continues to occupy a marginal position due to the absence of specific regulatory arrangements and the persisting influence of pre-existing laws.

Further analysis reveals two micropowers that guide the discursive dynamics within the governance structures enabled by a discursive affinity. As Hajer (2006) explains, micropowers are forces that influence the way in which actors make sense of a political problem. In this research, knowledge and

funding are identified as important micropowers. It is argued that the institutional practices outlined in Section 7.2.3 materialize through the flows of technical knowledge and funding between governance institutions.

These micropowers often act through a joint knowledge-funding action mechanism. International financial flows – either loans from multilateral banks, donations or research grants – available to the government, NGOs, private suppliers of DRES and academics, tend to be conditioned to specific narratives and approaches to rural energy access that projects must incorporate. Although there is a process of mutual feedback in this knowledge-funding dynamic between stakeholders, international cooperation significantly influences the definition of governance dynamics and materialization of institutional objectives.

Finally, the action mechanism of micropowers as well as the inclusion of all storylines within both discourse coalitions are enabled by a discursive affinity. Although actors engage with nuanced conceptualizations of energy access, discursive themes and storylines, the data suggests that overall, there is affinity rather than conflict or contradiction between actors. Such conditions enable the enactment of micropowers that commences with the core idea of energy access as a tool for development, as outlined in the key messages of Chapter 6.

7.3 Discursive structure

Figure 7.4 illustrates the discursive structure underpinning the national policy framework for off-grid rural energy access in Bolivia, encompassing all the elements identified in the data analysis process. At the core of this discursive structure is the concept of energy access as a tool for development, as discussed in Chapter 6. The three discursive themes: *CLEAN ENERGY, REAL ACCESS* and *HARMONIOUS DEVELOPMENT* and the fourteen storylines (SL) grouped around local economy, health, education, gender and communications, support the structural core of the discourse. Both elements are used within practices and sites of argumentation where two coalitions relating to the types of energy services considered in the conceptualization of energy access can be identified.

As explained in Section 7.2.4, the governance structure and dynamics are made up by the sectorial institutions, the micropowers enabled by a discursive affinity and framing strategies. The three elements converge in the physical and virtual places that pertain to the institutional practices outlined in Section 7.2.3. Such practices form the foundations for the discursive evolution of the national policy framework for rural energy access in Bolivia from the previous neoliberal regime's policy framework to the incumbent regime's policy framework and towards future governance arrangements.

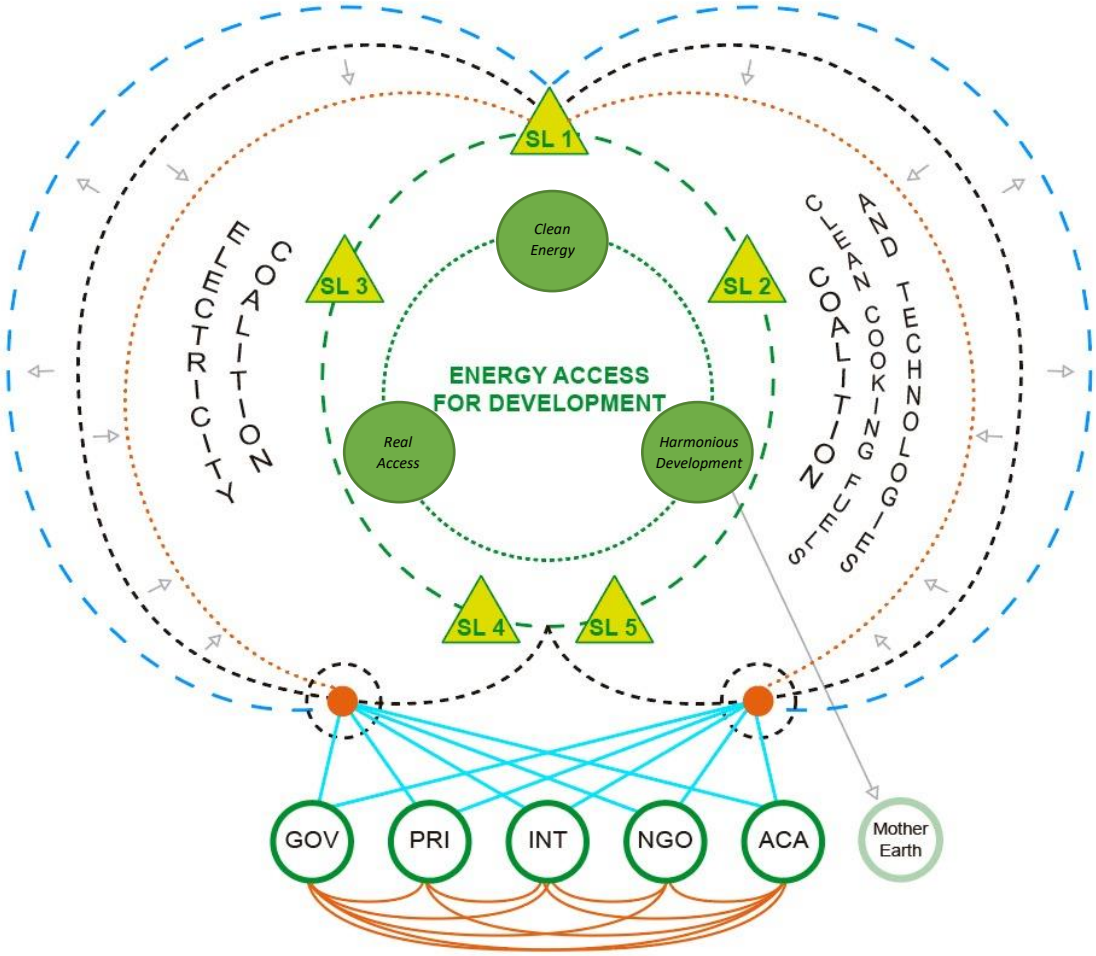


Figure 7.4 Discursive structure

Chapter 8 Discussion

This chapter explores energy justice within the discursive structure underpinning the national policy framework for energy access in off-grid rural areas of Bolivia. The findings presented in Chapters 6 and 7 are discussed in the context of the energy justice literature explored in Chapter 4. Findings show that despite echoing global narratives, there are key conceptual differences between the discursive elements of the SDG7, SE4All and the Paris Agreement, among other high-level global initiatives, and those characterising the Bolivian policy framework which pursues and promotes its own unique approach to energy justice. The discourse analysis also identified a conceptual pluralism amongst the interviewees from within the government, international cooperation entities, private energy suppliers, NGOs and academia, from whom different approaches to enact energy justice emerged.

This chapter is divided into four main sections. Section 8.1 discusses the distributive rationale of Bolivia's national energy policy framework, focusing on the policy framework's conceptualisation of the policy problem. Section 8.2 then explores the procedural arrangements of the policy framework focusing on the governance structure and dynamics. Section 8.3 addresses the findings from the perspective of justice as recognition. Finally, Section 8.4 reflects on the potential for discourse analysis to enhance the contribution of the energy justice conceptual framework.

8.1 Distributive justice

Drawing on the philosophical underpinnings of distributive justice, this section explores two elements that make up the distributive rationale of the national policy framework for energy access in off-grid rural areas. Section 8.1.1 focuses on the rationale to address the policy problem, namely the coverage disparities of modern energy services across Bolivia. Section 8.1.2 then explores the (re)allocation of the costs and benefits related to energy access in rural areas, adopting a transitional perspective.

8.1.1 Addressing the policy problem

As outlined in Chapter 6, the deployment of modern energy services in Bolivia has occurred in an unequal fashion, privileging big industries and urban settings. Consequently, the national policy framework for energy access across historically marginalized rural areas through decentralized renewable energy solutions (DRES), is a manifestation of distributive justice within the national energy policy agenda. Due to the catalytic importance of modern energy services for the wellbeing and development of contemporary society, the rationale to provide such services is defined and framed by *universality*, echoing the global and widely used discursive frame of *energy for all* (SE4all, n.d.; SDG7, n.d.).

In this context, the findings revealed key elements, concepts and frames providing insights into the intricacies and political and historical significance of *universality* within the Bolivian context. The discussion is informed by one of the elements that make up the definition of modern energy services at the core of the discourse, namely, the types of energy services promoted in Bolivia. It also builds on Monyei et al.'s (2019) research on "policy vagueness" (p. 113) across the Global South. This term refers to the omission or use of imprecise references and terminologies that allow for divergent interpretations of policy objectives targeting energy access. It is argued that the way the concept of modern energy services is currently (un)defined contributes to instances of injustice in the universalization process due to three key issues: the lack of quantitative and qualitative benchmarks, a disproportionate focus on electricity and a binary approach for tracking progress. Each of these issues will be discussed below.

8.1.1.1 Lack of benchmarks

It was found that that there are very few benchmarks for energy quantity and limited consideration of energy mobility[7] within the discourse. All the interviewees involved in CCFT, mentioned the Bolivian Cookstove Norm NB 83001 which establishes technical benchmarks for the installation and functioning of improved cookstoves (IBNORCA,2012). However, the only benchmarks relating to electricity access, are those associated with policies for Solar Home Systems (SHS). Three interviewees referred to a target of a minimum supply threshold of 25 kWh/month for rural households including PEVD projects. The government representative also explained that SHS deployed are modular and expandable so they can modified to address foreseen future demand increases.

No such benchmarks are available for hydro-powered mini grids (HPMG) or for the social and productive uses of energy. Whilst it could be argued that bespoke demand analysis and forecasting could address this lack of benchmarks, such practices are not standardized or applied consistently for different projects. This lack of standardization has the potential to contribute to inequitable planning processes for rural energy projects and constrains the development of comprehensive data and understanding regarding the true extent of energy access and to what extent *REAL ACCESS* is being achieved across rural Bolivia.

In the absence of minimum benchmarks for the quantity of the energy supplied or uniform approaches to assess energy mobility, questions arise regarding the engagement of the distributive rationale with issues related to energy availability and sufficiency. These attributes of energy supply pertain to a

[7] Monyei et al. (2019, p. 114) define electricity mobility as "the ability of households to increase their electricity consumption based on either an increase in the ownership of owned electrical appliances or extended usage of already owned electrical appliances".

wider set of quality attributes identified by high-level global initiatives and within the academic literature, which assert that sustainable energy supply must be affordable, clean, reliable, available, convenient, legal, healthy, and safe (SE4All, n.d.; SDG7, n.d; Bhatia and Angelou, 2015). Although some of these attributes are part of the stakeholders' narratives, only a few are specifically captured by benchmarks within the policy framework, establishing a gap which arguably hinders the process of achieving equitable universal access (Pachauri, 2011).

8.1.1.2 Disproportionate focus on electricity

The second issue stemming from the policy vagueness identified is a disproportionate focus on electricity over CCFT and other types of energy services. The global energy access discourse has recently shifted to acknowledge the importance of CCFT (World Bank, 2018) and institutionalize a broader understanding of energy access through specific initiatives like the Total Energy Access Index proposed by Practical Action (2014) and frames such as *Cooling Energy for All* and *Efficiency for Access* (SE4All, n.d.). However, within Bolivia's national policy framework there is still an entrenched dichotomy between electricity and other energy services. This was highlighted by all but one of the interviewees. For example, the government representative explained:

> It is true, [energy access] is not limited to electricity, it comprises thermal comfort and others, but the Ministerial competences are restricted to electricity (*Government Representative*).

Although many argue that electricity encompasses all energy requirements in rural areas, authors like Goldberg (2000, p. 374) assert that "for many years to come, electricity is unlikely to be practical for general cooking in most rural areas of the developing world." This is particularly significant for a policy framework specifically targeting off-grid access since DRES are not comparable to industrialized on-grid supply. Standalone systems and mini grids offer different supply levels as the multi-tiered supply metrics of Bhatia and Angelou (2015) described in Chapter 2 illustrate.

The DRES deployed across rural Bolivia offer access ranging from Tier 1 (e.g. individual solar appliances) to Tier 3-4 (e.g. hydro-powered mini grids). As such, the electricity available is not always enough to cook or provide other services such as heating and cooling. Considering that cooking makes up 89% of energy demand in remote households (Fernandez; 2010) and that the wide range of geographic regions and variable weather across Bolivia give rise to the need for specific energy services such as heating and cooling, providing only electricity solutions does not provide universal energy access for *all.* This raises issues of recognition justice which will be discussed further in Section 8.3.

This bias is evident in the frames that construct the national policy framework and its policy instruments which mainly focus on electricity. For example, although the CPEP (2009) does establish

universal electricity access and universal access to CCFT as constitutional rights for all Bolivian citizens, the latter is a only secondary category encompassed within basic services. The *Universal Access Bolivia with Energy 2010 – 2025* policy does not consider CCFT at all, with the word *energy* used to refer exclusively to electricity. Similarly, the *Policy of Alternative Energies for the Electricity Sector 2011* and the *Development Plan for the Development of Alternative Energy 2025* establish the deployment of renewable clean energy to meet the *electricity* requirements of rural areas with no reference to the provision of other energy services. As explained by one of the private energy suppliers interviewed:

> The new CPEP established the universalization of basic services for all Bolivians. However, in rural areas, public policy is particularly focused on electrification and water access to some extent (*Private Energy Supplier #2*)

Likewise, mainstream policy instruments are mainly focused on electricity solutions. Most auctions and subsidies offered by the PEVD target SHS and solar lanterns and its portfolio of full grants is exclusively designed to cover upfronts costs of HPMG. Subsidies for projects to deploy CCFT and solar-based water heating for health and education facilities are sporadic and mostly planned within electrification projects. While CCFT and other decentralized energy appliances for water harvesting and pumping and community services are partially subsidised through the cooperation agreement with *Energizing Development* (ENDEV) in coordination with municipalities, such instruments remain marginal within the discourse and in practice. For example, in 2009 fiscal incentives were provided within the current policy framework (Decree 280) to import solar and small-scale wind power equipment donated by the Euro-Solar project (IRENA, 2015) but there are no systematic policy instruments to encourage or support projects promoting CCFT, heating or cooling.

The disproportionate focus on electricity undermines the systematic development of policy instruments focused on CCFT and the other energy requirements of households, community services and productive activities. However, findings also show that despite the marginalization of CCFT within the regulatory arrangements, some progress has been made, as explained by a private energy supplier:

> The lack of technical capacity and irresponsibility of public policies to address energy access in rural areas notwithstanding, the clean cooking solutions market is reality that started three decades ago and continues to grow in a regulatory vacuum. Yet, the government is showing more interest and its interventions are becoming less passive (*Private Energy Supplier #1*).

In this context, the concept of CCFT has become a structural element of the governance discourse which will be further analysed in Section 8.2.

8.1.1.3 Binary view of energy access

It was found that the Bolivian policy framework is underpinned by a *binary* view of energy access (Practical Action, 2014; Morrisey,2017) whereby rural populations are considered to either have electricity access or not. This is particularly problematic in off-grid energy access policies given that DRES offer different tiers of energy supply. As explained in Chapter 3, lower tier DRES like solar lanterns enable only lighting for limited periods of time whilst HPMG enable a greater number of electricity appliances. Such nuances are lost within a binary perspective of energy access.

The binary approach underpinning the policy framework raises at least two issues. First, it is prone to perpetuate access disparities amongst rural communities by promoting temporary energy solutions. This tendency is exacerbated by both the lack of benchmarks for energy access and mobility and the disproportionate focus on electricity discussed above. As a consequence, "…many so-called off-grid "electrified" households in the Global South can be classified as un-electrified considering the inability of their electrification system to offer them any utility" (Monyei et al., 2019, p. 113). This binary approach also raises questions regarding the transparency and accountability of the current policy framework, which Zegada (2016) argues may hinder further investments, DRES deployment and the evolution of low-cost applications.

8.1.1.4 Reconceptualising the policy problem

In addition to systematically incorporating CCFT and other energy requirements within the national policy framework, a two-step process is proposed to achieve a fairer and more engaged *universalization* process within rural communities. First, it is crucial to establish quality and quantity benchmarks and define a uniform approach to analyse and forecast the demand for new projects. This approach should incorporate the multidisciplinary knowledge of the governance institutions involved, focusing on a common objective instead of a common theoretical framework as recommended by Schmidt and Weigt (2015). Such a process could engage more deeply with the local and temporal contexts (Walker, 2014), the spatial dynamics of a range of changing social practices and the changing climate (Hui and Walker, 2018), and the rapid adoption of new technologies and changes in end-use practices (Sharmina et al., 2019), all of which are not traditionally captured by mainstream demand econometric forecasting methods (Winther, 2015).

For the second step, all the data gathered in the first step could be organized and displayed using an already existing but currently underutilized platform called Geoportal VMEEA[8] where some projects

[8] The Geoportal VMEEA is an online platform that pertains to the national planning infrastructure of spatial data led by the Vice-presidency of the State and the National Army. The 21 ministries that make up the executive branch display their sectorial information through this platform. As such, the Ministry of Energy displays information related to the

currently implemented by the PEVD are georeferenced alongside the national electricity grid system. This platform could be further enhanced to provide a meaningful planning tool like the Energy Access Explorer developed by the World Resources Institute illustrated in Figure 8.1.

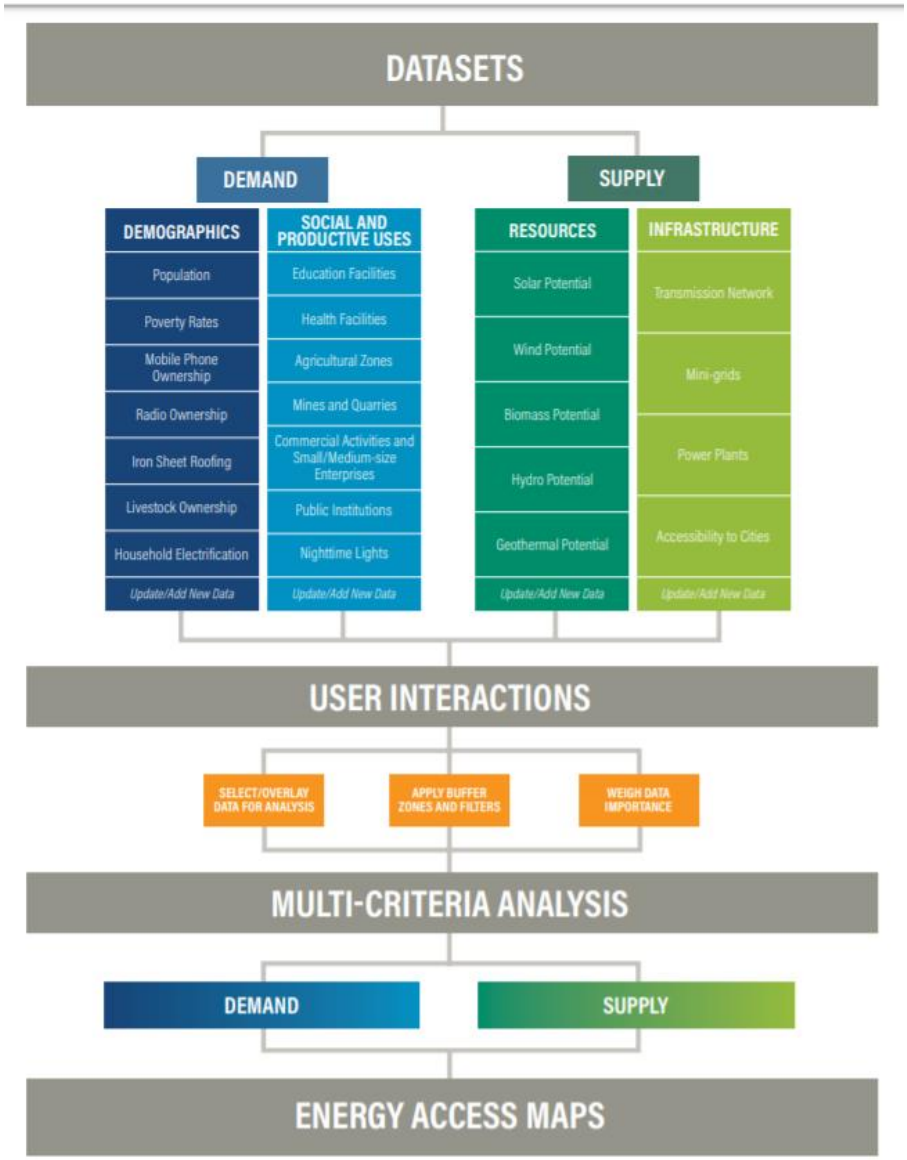


Figure 8.1 Methodological framework of Energy Access Explorer. Source: Mentis et al. (2019).

Drawing on such a tool, the Geoportal VMEEA could incorporate additional data like local resource availability, infrastructure data to represent energy supply, and demographic data to enable the identification and prioritization of areas where energy access can be improved and expanded by new

constitutional competences of the VMEEA, including electricity access (it can be accessed from: http://sigvmeea.minenergias.gob.bo/maps/60/view).

projects (Mentis et al., 2019). This could be informed by similar projects elsewhere. For example, Varshney et. al (2015) offer useful lessons which can be learned from their application of geospatial data to design the siting and planning of solar-powered microgrids in remote villages in India.

It is argued that the adoption of such a planning tool including the additional three elements discussed, could contribute to establishing a sound basis to address issues of disparities, availability, mobility and enhance the transparency and accountability of the policy framework currently surrounding the *universalization* rationale. However, this will also require adjustments to the current procedural arrangements discussed in Section 8.3.

Finally, the discourse analysis showcases the historical and political significance of *universalization* within the national policy agenda. Rural energy became part of the political agenda in Bolivia – albeit marginally – in 1960, almost fifty years after urban areas and propelled by a rather weak institutional framework that gave rise to several access disparities. Recognising this, the incumbent national policy framework for rural energy introduces the principle of universality within rural energy policy through a discursive turn strongly influenced by the political ideology of the first indigenous government in Bolivia which was elected in 2006. Findings show that the discourse uses two frames to depict distributive disparities occurring at two scales: urban-rural and rural-rural.

Regarding the urban-rural scale, the new CPEP targets *sustainable and holistic* rural development as a structural component of the national economic agenda (Article 405). This constitutional mandate is played out through two instruments: the Dignity Tariff and the PEVD. The former redistributes the costs of electricity for on-grid rural users – who until then had to pay more than urban users – by allocating a 25% bill subsidy covered by generators and distributors of the national electricity grid (Arze and Guzman, 2014). At the same time, the creation of the PEVD subsumed the universalization mandate to deploy modern energy services to the hitherto underprovided Bolivian population (MHE, 2010). For both instruments, the word *dignity* frames and enhances their historical significance.

The policy framework also seeks to target disparities within and between rural areas. Until the early 1990s, energy policies for rural areas prioritized communities with “highlighted social or economic significance” (Quiroga, 1984, p. 23 - 24), referring to those that could be supplied with grid solutions. Therefore, off-grid rural areas were particularly underprovided as outlined in Chapter 6. Furthermore, the deployment of DRES solutions promoted by NGOs and university spin-offs supported by international cooperation entities were hindered by the lack of enabling policies (Birhuet and Fernandez, 2002; Fernandez, 2010).

Addressing such disparities, the PEVD is strongly focused on off-grid solutions for remote rural areas (Law 29635). By 2017, at least seven sub-programs systematically deployed DRES including solar PV, small-scale wind, HPMG and the efficient use of biomass for the first time in Bolivia. The *Universal Plan Access Bolivia with Energy 2010 – 2025* acknowledges the historical and political significance of energy access disparities through the concept of *social debt*, which frames the government as owing rural areas access to energy, thereby positioning rural energy in a far less marginal place within the national energy agenda than under the former regime.

8.1.2 (Re)allocating costs and benefits of off-grid rural energy access

The second element of the distributive rationale defines the allocation of the costs and benefits related to energy access in rural areas. Considering that the universalization goal entails a transition process from an energy regime based on candles, batteries, fossil fuel generators and inefficient biomass burning, towards a regime based on DRES for electricity and CCFT, the distributive rationale introduced by the current national policy framework aims to (re)allocate the costs and benefits related to energy access. The discourse analysis reveals two elements underpinning this distributive rationale: the new governance structure, and at the core of the discourse, the second element of the definition of modern energy services, namely, their instrumental value.

8.1.2.1 New governance structures

The new national policy framework gives rise to small but meaningful changes in the governance arrangements as explained in Section 7.2.4. Although the pre-existing market-based approach during the neoliberal regime has not changed, the new policy framework introduces a new governance structure and dynamics including:

> (1) Eliminating the concept of "rural electrification agents" (Arce and Guzman, 2010, p. 77), curtailing the influence of financial institutions and NGOs;
>
> (2) Positioning the central government at the forefront of universalization and the establishing of the frame "social debt"; and
>
> (3) Incorporating the Mother Earth as an actor within the energy sector.

By subsuming the constitutional mandate of universalization through the PEVD, the central government assumes a significant budgetary commitment for rural electrification for the first time in Bolivian history, committing at least $130 million USD[9] for rural electrification between 2011 and 2021

[9] Including donations, grants and loans from international cooperation entities.

(MHE, 2017). Indeed, the PEVD embodies a shift in the role of the Bolivian government from an enabler of private investment during neoliberal times (Arce and Guzman, 2010) to an investor in the rural market of DRES. From this perspective and considering how energy access for urban and on-grid rural areas was previously prioritised over remote rural areas, it could be argued that the PEVD represents an income redistribution policy beyond the energy access agenda. In this context, one of the NGO representatives interviewed, characterised the PEVD as:

> …currently one of most ambitious government-funded programs for rural electrification in South America. Despite its limitations, it is a game-changer (*NGO Representative #3).*

However, the government acknowledges that universalization poses a particular challenge for remote areas and the associated costs exceed the national government's financial capacity. As such, complementary investment is expected from municipalities and private actors participating in the market (MHE, 2011). Indeed, both private suppliers and NGOs continue to develop electrification projects in tandem and independently of the PEVD, funded either by international cooperation, private and public institutions or even without external funding (Fernandez, 2015). Indeed, seven of the interviewees argued that one of the main weaknesses of the policy framework is that financial resources are not sufficient and four of them asserted that this creates conflict among rural communities due to the unequal application of subsidies.

In this context, the discursive theme *REAL ACCESS* offers two parallel perspectives of the current governance arrangements. First, the PEVD in coordination with municipalities, partially assumes the upfront costs of DRES, one of the bottlenecks for the roll-out of such technologies in rural Bolivia, particularly amongst the poorest communities (Fernandez, 2010) which were categorically neglected by previous political regimes.

In tandem, albeit less dominant within the discourse than the first element, actors within the international cooperation sector introduce narratives regarding strengthening the supply side. Building on the newly enhanced government commitment and participation within the market, the supply approach represented by *REAL ACCESS* advocates for policies that empower suppliers so they can meet the current and future demand conditions independently from the government and thereby support the long-term sustainability of solutions deployed in the rural energy market.

International cooperation such as the Energy and Environment Partnership Andean Region (EEP-AR) which ran until 2016 and the current Fund for Sustainable Access to Renewable Energy and Efficient Technology through ENDEV, are supporting DRES suppliers developing business and funding models for rural markets. Such initiatives are crucial to reach scattered rural populations and ensure the long-

term use of energy solutions provided. Indeed, these kinds of businesses are becoming mainstream across the Global South to support government efforts in the provision of energy access (Singh, 2019) and other basic services in poor rural areas (Lammi et al., 2015).

The EcoMicro[10] program and the EEP-AR have also raised awareness of the pivotal role of commercial traditional and non-traditional financial institutions and products (IDB, 2015; AEA, 2016). Hall et al. (2018) assert that non-government funding alternatives are crucial for energy policies to shape the justice outcomes of energy transitions, particularly to ensure the affordability of energy solutions. However, considering that the central government stresses the need for additional financial resources to achieve universalization (MHE, 2011), the marginal representation of the supply approach within the discourse shows contradictions in the governance configuration.

Considering that most rural communities are very poor and therefore have limited capacity to pay for the upfront, operation and maintenance costs of DRES, the absence of adequate funding can totally undermine the goal of universal access. An NGO representative and a private energy supplier provide two examples of non-traditional funding models currently being used to address this challenge:

> We are committed to alternative financing mechanisms in the absence of public funding. We have raised funding for projects through crowdfunding platforms (*NGO Representative #2*).

> Although carbon market is a forbidden word in Bolivia, the voluntary market is still an option. Many businesses we partner with aim to compensate their footprint by subsidizing our clients' purchases (*Private Energy Supplier #3*).

Overall, Bolivia's new governance structure demonstrates a more committed government aiming to reallocate the costs of energy access and acknowledge the poverty levels of rural communities in Bolivia. However, it is still insufficient to achieve energy access *for all* and continues to create disparities between communities. In this context, from a marginal position within the discourse of the national policy framework, the supply approach is offering complementary support to the government's efforts to address the affordability of energy solutions for rural communities, understanding energy access as a continuum of quality and mobility improvements (Alstone et al., 2015).

[10] EcoMicro is a technical cooperation program implemented by the Interamerican Development Bank to support commercial financial institutions in the development of green finance products that enable the deployment of DRES (EcoMicro, 2020).

8.1.2.1 The instrumental value of energy services

Alongside the governance arrangements, the second element of the definition of modern energy services, namely, their instrumental value, illuminates two main types of benefits derived from DRES: socio-economic benefits and environmental benefits. The storylines and discursive themes of *CLEAN TECHNOLOGY* and *HARMONIOUS DEVELOPMENT* both provide insight into the (re)allocation of both types of benefits for rural households and communities.

The 14 storylines outlined in Chapter 7 portray the ideal (re)allocation of direct and indirect benefits expected from energy access for the local economy, education, gender, communication and health at both household and community levels. Such narratives echo the global rhetoric on the relationship between off-grid energy access and development in rural areas. However, findings show that the national policy framework for off-grid energy access in rural Bolivia lacks a regulated strategy to address the (re)allocation of these benefits. The academics and NGO representatives interviewed offered that in general, the development rhetoric of policies for universalization of basic services in Bolivia is ambitious but lacks regulatory and operational rigour.

A vast body of literature from across the Global South has proved that development benefits from energy access are mediated by pre-existing socio-cultural arrangements (Otte, 2014, 2015; Boamah and Rothfuß, 2018; Padmanathan, 2019) and local political issues (Mceachern et al., 2008). By ignoring such issues, rural energy policies can fail to create any benefits (Aklin et al., 2017), create benefits with socially inequitable outcomes (Azimoh et al., 2015, Treiber et al., 2015; Munro et al., 2017; Kumar, 2018), or in some cases reinforce pre-existing social inequalities (Marshall et al., 2017; Sunikka-Blank et al., 2019). Indeed, the very limited empirical evidence available for Bolivia, shows that not all the anticipated development benefits associated with energy access are materializing or are inequitable with respect to on-grid benefits, with undesired social outcomes occurring in some cases (Monroy and Montaño, 2015; Galoppo and Carlo, 2017; IDB, 2019).

The regulatory gap notwithstanding, the discursive theme *HARMONIOUS DEVELOPMENT* at the core of the discourse, represents an integral and multisectoral planning approach that seven interviewees identified as a strategy to enhance the (re)allocation of benefits from energy access specified in the storylines. However, one of the academics argued that although the policy rhetoric preaches development, most of the projects implemented just provide electricity without a conjunct action with other actors working in rural development to ensure genuine socio-economic benefits are achieved.

The integral approach depicted by the discursive theme of *HARMONIOUS DEVELOPMENT* resonates with energy practitioners that advocate for universal energy access based on integrated planning that cuts across sectors and matches new supply with parallel productive-use and local income-generation

activities. For instance, the SE4all (2019) has recently released a guide entitled "Integrated Electrification Pathways for Universal Access to Electricity: A Primer" introducing a set of inclusive planning approaches and policy measures to provide electricity and the associated energy services necessary to meet human needs and contribute to sustainable development. However, Holden (2012) also reflects on the pitfalls of integrated planning in the context of diverse aspirations for sustainability noting that it does not necessarily offer more than the sum of its parts.

Building on a combination of both an integrated approach and the supply approach of the governance structure explained in the previous section, it is argued that the policy framework could be enhanced by an integrated planning approach through the private suppliers to further engage with the local context and enhance the likelihood of achieving the development targets. Such an approach could replicate and adapt intervention models such as the Grameen Shakti business model that has delivered DRES in poor rural communities in Bangladesh since 1996 (Amin and Langendoen, 2012). This model simultaneously deploys solar home systems, biogas for use as cooking fuel, electricity production and organic fertilizer; and improved cooking stoves whilst creating employment and fostering entrepreneurship through a social business component.

It is also crucial to note that gender was the main socio-cultural dimension discussed by all the interviewees. Gender is also the focus of a great deal of literature related to off-grid energy access. Scholars advocate for an in-depth commitment to addressing gender issues which tend to be overlooked and unexplored in energy transitions (Lieu et al., 2020). Due to cultural norms in rural Bolivia, Canedo (2005) asserts that women are prone to being marginalised from participating in energy access projects and programmes. In similar contexts, Marshall et al. (2017) and Sunikka-Blank et al. (2019) have shown that failing to address gender issues in electrification projects reinforced previous gendered power imbalances through the uptake of DRES in Kenya and India respectively.

Strategies to address gender issues can include overarching approaches such as a programme described by one of the NGO representatives interviewed. Before implementing DRES projects, their NGO undertakes a base line study to identify gender roles, power relationships, vulnerabilities and capabilities to design workshops and training sessions in the local native languages. In contrast, the government representative asserted that training sessions for operation and maintenance are focused on women since they lead the technology appropriation of DRES. However, when asked whether empirical evidence was available to confirm this is the case, the government representative said there wasn't. Rather, it stemmed from a "logical assumption".

Considering that the storylines related to gender portray that gender is intertwined with the other socio-economic dimensions, it is argued that the absence of a national strategy to address the gender

issues of off-grid energy access is problematic for the distributive rationale of the policy framework. Therefore, the policy framework should develop a gender strategy, which builds on the approaches offered by the different governance institutions but also draws on state-of-the-art academic approaches. For instance, the policy framework could adapt and incorporate elements from Osunmuyiwa and Ahlborg's (2019) model for a "gender sensitive electrification project, where the provision of decentralised electricity is understood as a cyclical and dynamic process with multiple possibilities to introduce strategies and components to overcome gender-specific barriers, achieve equal opportunity, access and use" (p. 154), as illustrated in Figure 8.3.

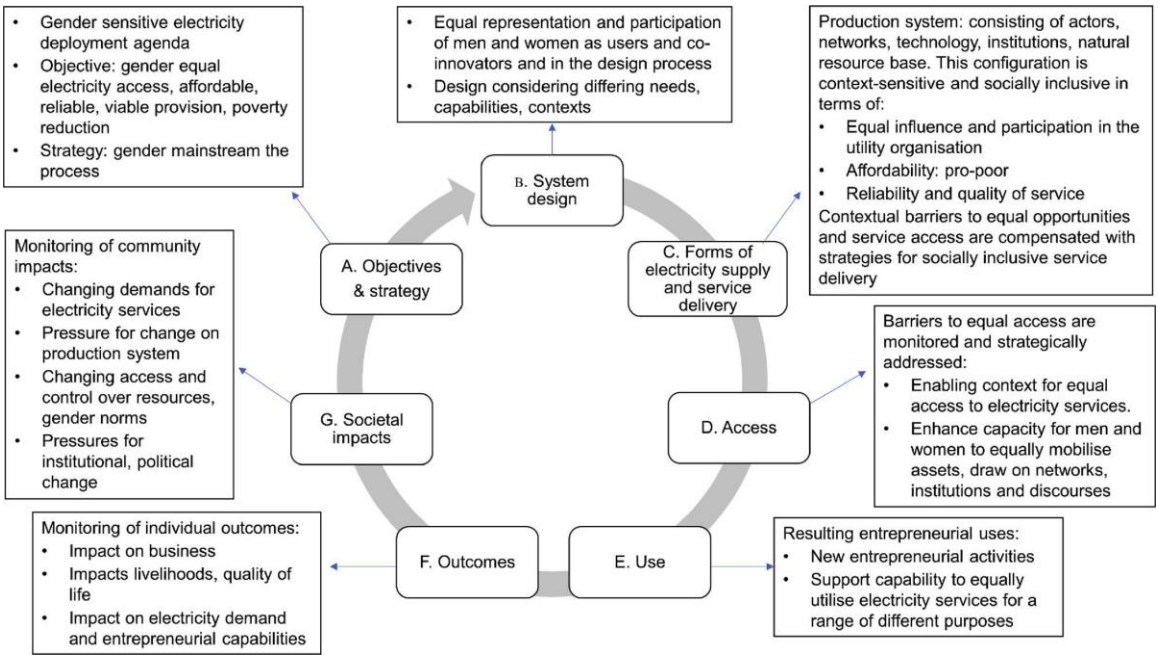


Figure 8.3 Process of gender mainstreaming an electricity project. Source: Osunmuyiwa and Ahlborg (2019).

Considering that energy access projects are implemented through different institutional channels, the absence of a regulated holistic strategy defined within the national policy framework is contributing to disparities between energy access projects' ability to optimize the (re)allocation of socio-economic costs and benefits from energy access, denoting inconsistency of the (re)allocation rationale of the policy framework. Therefore, it is argued that the policy framework should explore models to engage with potential socio-economic impacts throughout the policy cycle (Sovacool et al.,2015; Jenkins et al., 2017; Castree and Waitt, 2017). For instance, Miller et al. (2015) offer that energy policy is a problem of socio-energy system design and argue that therefore it "must expand to acknowledge, recognize, assess, and incorporate the fact that its objectives and outcomes are not just to change either the fuels or technologies of energy but to transform socio-energy systems" (p. 38).

Terrapon-Pfaff et al. (2018) argue that systematic evaluation of energy access projects must be undertaken. They recommend conducting analysis of projects' contributions based on theories of change, exploring what changes occurred but also how and why. Such an approach would unveil the "black box" between the input activities and the observed outcomes and impacts" (p. 85), as illustrated in Figure 8.4. An aggregation of the evidence obtained through such an approach could inform strategies to better enhance and engage with the development benefits of energy access.

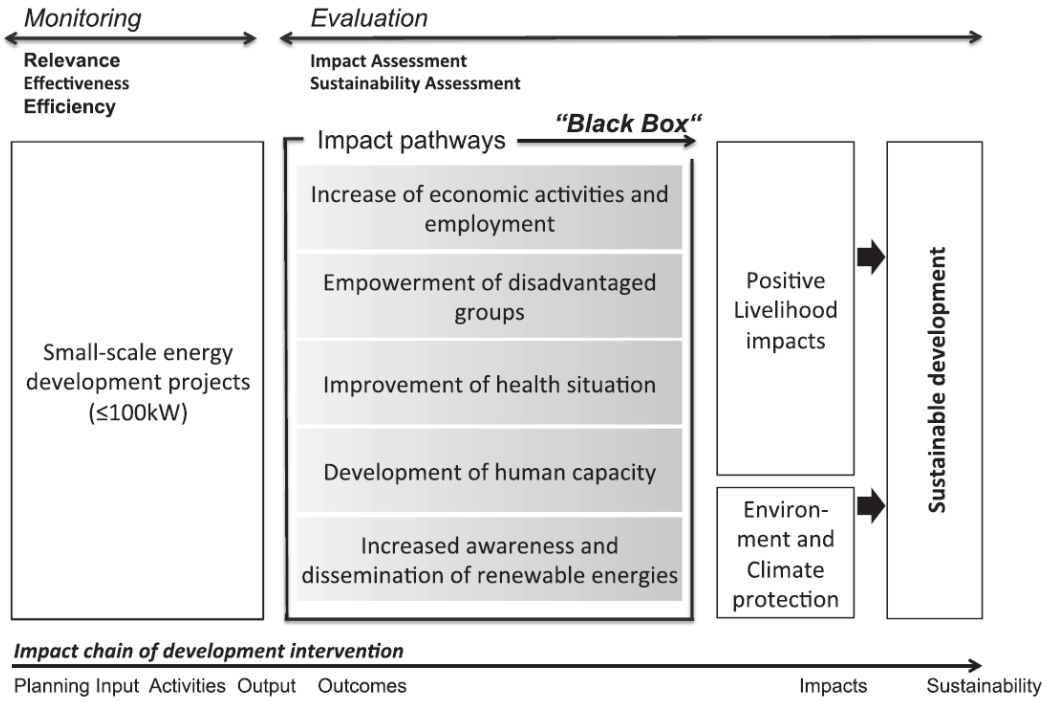


Figure 8.4 Overview of the theories of change of small-scale energy development projects. Source: Terrapon-Pfaff et al. (2018)

The discursive theme *CLEAN ENERGY* highlights the (re)allocation of the environmental costs and benefits associated with the clean nature of the energy sources harnessed by DRES. In line with the literature relating to energy access and the environment (e.g. Johansson et al., 2012; Chung et al., 2012; Lay et al.,2013; Stern et al., 2016), all the interviewees identified DRES as means of transitioning from a reliance on polluting fossil fuels and inefficient burning of biomass towards low-carbon rural energy development.

As discussed in Chapter 7, the Law of the Mother Earth (Law 300, 2012) established the natural ecosystem within which DRES are deployed, as a nonhuman actor involved in rural energy access. However, Law 300 lacks specific regulations and rural energy projects therefore continue to be regulated by laws established by the previous regime. As a result, there is a lack of coherence within the national energy policy framework with the current environmental regulations for off-grid rural

energy access not aligned with the principles outlined in the Law of Mother Earth. To address this, there is a need for the policy framework not only to consider the environmental benefits of DRES compared to traditional energy sources, but also recognise the environment as the supplier of energy sources and the recipient of impacts associated with energy systems. In this context, a life-cycle perspective of DRES could help clarify the environmental dimensions of proposed energy solutions.

Two NGO representatives referred to the value of a lifecycle perspective for the (re)allocation of environmental costs and benefits of energy access in rural areas. One argued that although the policy framework does not consider the technologies it displaces, some projects include the recycling of small and medium size batteries used for radios and bigger diesel-powered generators. The second reflected on the lack of attention among stakeholders involved in energy access in rural areas regarding the lifecycle impacts of DRES including the management of plastics from solar lanterns, batteries, turbines and so on. Indeed, electronic waste (e-waste) derived from DRES for rural energy access is a growing issue across the Global South demanding the attention of policy makers (Bates, 2014; Bensch, 2015; Heacock et al., 2016). It is crucial to develop an appropriate scheme for e-waste collection and recycling (Magalini,2015). This could draw upon frameworks like Hansen et al.'s (2020) approach to solar e-waste tested in Kenya. This model focuses on environmental upgrading in the value chains of DRES combined with social anthropology and life-cycle assessments to address end-user behaviour and appropriate waste disposal.

However, such approaches still do not fully capture the overarching ecosystemic approach called for by the Law of the Mother Earth. Therefore, it is argued that the policy framework should explore additional approaches to enhance its engagement with the environment. For instance, the water-energy-food nexus is a widely implemented approach to design off-grid rural projects that optimize integrated resource management of local ecosystems (Gute et al., 2017; Wolde et al., 2020), which have proved successful in transforming rural livelihoods and well-being in southern Africa (Nhamo et al., 2018; Mabhaudhi et al., 2019; Bruna, 2019; Uamusse et al., 2019).

8.2 Procedural justice

This section explores four aspects related to the procedural rationale of the national policy framework. Section 8.2.1 considers the governance structure followed by an analysis of the governance dynamics in Section 8.2.2. Section 8.2.3 then reflects upon the constraints on participation in the governance arrangements whilst Section 8.2.4 broadens the scope to examine the current configurations of the governance structure.

8.2.1 Coalitions as governance substructure

The discourse analysis reveals a conceptual pluralism amongst stakeholders and institutions within Bolivia's energy sector, with different stakeholders conceptualising and seeking to achieve energy justice in different ways, as discussed in Section 8.1.2. This pluralism has contributed to a polycentric governance system which has developed through a process of discursive evolution through the history of the policy framework as outlined in Chapter 6. This process reflects the evolution of the energy access paradigm through the three stages proposed by Sovacool et al. (2016) as detailed in Figure 3.5. The Bolivian energy access policy framework has elements pertaining to each of the three paradigms.

However, the findings suggest that within this polycentric configuration, the two coalitions identified in Section 7.2.4, *Electricity Access* and *Clean Cooking Fuels and Technologies,* make up critical governance substructures. Whilst authors analyse coalitions as contestant units employing framing as a tool to impose discourses like Hess's (2019) research on energy communities in California, this research identified two parallel coalitions propelling the same goal of universal energy access where framing occurs as an internal process that informs that action of the stakeholders involved, maintaining a pluralistic governance approach. Considering the critical importance of both coalitions, the legitimization of both the supply approach of electricity access and CCFT and other energy requirements within the national policy discourse should be a policy priority not only for institutional strengthening but also for a more engaged governance with the rural communities involved.

8.2.2 Micropowers as governance dynamics

The pluralistic governance structures notwithstanding, the discourse analysis showed that the governance dynamics are guided by what Hajer (2006) calls micropowers, referring to the forces that influence the ways in which actors make sense of a political problem in such a way that is comprehensible within the prevailing the societal structure. The findings shed light on knowledge and funding as micropowers influencing a hierarchical arrangement of stakeholders within the governance structure and substructure in line with Bryant's (1998) reflections on the enactment of political ecology in the developing world. One of the representatives of the international cooperation portrays the enactment of these micropowers, asserting that funding agreements provide the PEVD with specific guidelines for the formulation and implementation of rural electrification projects that must be complied with.

Both micropowers have played an important role in the provision of off-grid energy access in Bolivia since the beginning of the deployment of DRES, not necessarily as explicit exertions of power, but often as elements for knowledge and technology transfer from international cooperation entities.

However, drawing on Morrison et al.'s (2019) research on the black box of power exertion in polycentric environmental governance, the current configuration explains uneven outcomes of energy access projects due to the problematic of lack of standardization discussed in Section 8.1.1.1.

Due to its limited financial capacity to independently fund energy access projects, the Bolivian Government relies on the participation and contribution of international cooperation entities and private energy suppliers. Indeed, Pansera (2012) asserts that private suppliers of DRES are the most active actors within the off-grid rural energy market in Bolivia, they understand the local context, and are prepared to provide policy inputs. However, there is evidence that the institutional evolution and knowledge gained from international cooperation also empowers other actors within the argumentative processes that build the discourse and inform policymaking and implementation. .

In this context, five interviewees reflected upon the lack of participative policy making in Bolivia, observing that although different workshops are organised for actors involved in rural energy to share their experiences, these are not systematically incorporated into the development of policy or particular regulations representing a waste of institutional efforts. Therefore, it is crucial that the national policy framework enables sites of argumentation that create collective inputs for future policy. These could build upon past events that explored these issues., such as a workshop entitled "Sustainable energy sources for off-grid rural communities in Bolivia: opportunities, challenges, and perspectives" organized by Smart Villages in 2016, where 50 representatives of the governance institutions reflected upon rural energy access in Bolivia. The participants of this workshop concluded that such events are critical sites of argumentation to construct the pathway towards universal energy access (Smart Villages, 2016).

8.2.3 Participation constraints

As well as establishing sites of argumentation, it is important to address questions regarding the capacity of all actors to participate. Indeed, the storylines draw attention to the education investments - rather than costs - that the universalization process requires. The policy framework defines capacity building as one of the objectives of the *Policy for Alternative Energies for the Electricity Sector in Bolivia 2011* through the component *Regulation and Institutional Strengthening*. In particular, the narratives built around education are focused on training for final users of DRES focusing on (1) operation and maintenance; and (2) renewable energy for rural areas focused on new local job opportunities and technical sustainability. However, although from an overarching approach, the policy targets not only final users but aims to build human capital across all the governance institutions, there currently is no

institution responsible for achieving this goal. Indeed, Altpeter et. al (2014) identified that there is a substantial lack of qualified experts in renewable energy projects and services in Bolivia.

Although collaboration between government and academia on specific projects for rural energy access has contributed to developing human capital, much of this collaboration has specifically focused on technology research (MHE, 2014). This suggests a tendency towards the *traditional energy paradigm* proposed by Frigo (2018) which disproportionately focuses on the techno-economic over the social dimensions of energy systems. However, Altpeter et. al (2014) identified that energy experts from the social sciences are currently most in demand for projects focused on renewable energy in Bolivia.

At the project level, the empirical evidence suggests that all energy access projects include some training sessions targeting diverse topics. However, the absence of a uniform, systematic and regulated strategy to guide such training sessions has resulted in disparities in the quality of education programmes with approaches ranging from single training sessions for solar lantern users in Potosi (EEP-RA,2016) to multidisciplinary training sessions for DRES suppliers and final users implemented in all PEVD projects funded by the Interamerican Development Bank (IDB, 2016). Indeed, one interviewee shared an anecdote of solar lanterns being used as foot balls, arguably the outcome of inadequate education of users. Furthermore, one of the NGO representatives interviewed critiqued this regulatory gap, arguing that an "energy alphabetization" component must be included within sectorial policies to ensure that communities gain deep knowledge about modern sources of energy and their benefits.

Building on the institutional foundation that offered by the *Regulation and Institutional Strengthening of the Policy for Alternative Energies for the Electricity Sector in Bolivia 2011*, it is argued that the education investment for rural energy access can be improved by learning from approaches like Colombo et. al's (2017) human capital multi-level capacity building for energy access. They argue that this approach can "develop the local expertise needed to replicate and scale-up successful initiatives, support ownership of stakeholders, and foster sustainability beyond the withdrawal of external partners" (p. 1). Likewise, lessons can be learned from Electricité de France that implemented the program *Initial and Continuing Training of Operators and Actors of Rural Electrification in Western Africa*, which sought to institutionalize vocational training and capacity building in tight cooperation with Ministries of Education in Burkina Faso and Mali, which like Bolivia are significantly advanced in achieving their rural electrification goals (Cattelaens and Fromme, 2014).

8.2.4 Governance from ruralizing energy

Finally, the analysis reflects upon the fairness of the governance structures identified, building on Naumann and Rudolph's (2020) thoughts on ruralizing energy research and energizing rural studies.

Whilst the former refers to the approach taken by this research, the latter focuses on rural areas as a pool of energy resources used by different actors across rural areas, not only rural communities. Considering the second perspective in tandem with the ecosystemic approach proposed by the Law of Mother Earth discussed above, it is argued that rural areas can be understood as complex ecosystems of human and nonhuman actors.

In order to ruralize energy, the policy framework could explore ecosystemic planning like Surie's (2018) models applied in the renewable energy sector in India, which were "designed to generate various types of resources and achieve scale through interactions among diverse players to ensure sustainability" (p. 30). The first step would be the identification of actors that harness energy resources in tandem with communities within rural ecosystems such as actors from the oil and gas industry, power transmission companies and project developers of large-scale DRES. The socio-environmental safeguards that current regulation establish for the activities of these three groups of actors are imprecise, vague and lack consistency (Coaquira, 2010). Furthermore, the regulatory framework lacks an ecosystemic perspective that makes the actors accountable for improving rural ecosystems involved in the local energy transition. Therefore, incorporating these such actors within the governance structure of off-grid rural energy access through an approach that ruralized the policy framework could be arguably understood and framed as paying-off of the *ecological debt* owed to rural areas since the dawn of electricity in Bolivia as discussed in Chapter 6.

Such accountability could be materialized through regulated financial obligations that the newly incorporated actors would be required to comply with to support the goal of universalization. This could help address the lack of financial resources which currently pose challenges for achieving universalisation. The establishment of public-private partnerships (PPP) could provide another source of funding. According to Chaurey et. al (2012), enabling PPP is paramount for policies that require additional funding sources to deploy energy access in local communities. Therefore, such incorporation could arguably strengthen the justice-awareness of the policy discourse.

8.3 Justice as recognition

This section explores the recognition rationale of the national policy framework from three perspectives. Section 8.3.1 examines pre-existing cultural processes. Section 8.3.2 the reflects on the politics of mis-recognition and Section 8.3.3 considers issues relating to individual recognition.

8.3.1 Pre-existing indigenous cultures

Fraser (1996) asserts that recognition justice entails the acknowledgement of different identities, advocating for "a difference-friendly world, where assimilation to majority or dominant cultural norms is no longer the price of equal respect" (p. 3). In this context, the Plurinational State of Bolivia encompasses 37 constitutionally recognized indigenous peoples (NPIOCs) and the *Vivir Bien* philosophy establishes that rather than being based on western ideals of progress, rural policy should be culturally appropriate to the ancient knowledge and cosmovision of NPIOCs (Gudynas and Acosta, 2011). Within the energy arena, Article 304 of the Constitution explicitly acknowledges the energy needs of NPIOCs which make up more than 60% of the rural population (INE 2018). This acknowledgement occurred for the first time within the national policy agenda more than half century after indigenous leaders first demanded access to the "power of electricity force" in 1945 (Shesko, 2010, p. 9).

However, no institutional guidelines are provided to specifically address the energy requirements of NPIOCs which raises questions regarding recognition justice. Despite this, six of the interviewees argued that electrification projects are respectful of local habits and customs, with some offering examples of specific measures to ensure cultural factors are addressed:

> We developed tools that we believe, enhance the cultural acceptance of our solar stoves... For instance, recipe books with traditional dishes of every region we work in, so woman feel identified with the product, can relate to them and hence the technology has more chances to be accepted (*Private Energy Supplier #2*).

> Our funding process requires social consultations to find out if communities aim for and agree with a change in their life, habits and customs. Consultations and follow-up workshops are provided in the local language and woman, children and young population are encouraged to participate. This process is a mandatory social safeguard that we require the government to undertake for all projects we fund (*International Cooperation Representative #3*).

Kumar (2018) argues that energy access projects should be tailored and adapted to bring greater benefits to rural communities. In this context, the national policy framework could explore ways to promote further engagement with indigenous forms of community work such as *ayni* and *minka*[11] used to build collectively bio climatized households in Andean cultures shared by Bolivia and Peru (EEP-AR, 2016) or non-monetary returns like the *trueque*[12] for energy access exchanges which Singh et al. (2018) found to be feasible in India (2018). Aliaga and Herrera (2015) found that the introduction

[11] "Ayni of the central coast means reciprocity and work of societies without classes like fishermen and crayfish-men, while minka is related to herders, farmers, stone-men-work and specialized groups (Enciso and Mendoza (2011).
[12] Trueque is a traditional community form of economic articulation which is based on a non-monetary means of payment or exchange (Rabey et al., 1986).

of an indigenous leader yields the best result for water management in the Bolivian Altiplano for which pre-existing cultural institutions can also be explored such as the Committee of Community Justice existing across all rural areas to lead the local governance arrangements around energy access at a community level. Such institutions already exist but don't currently lead local governance around energy access.

8.3.2 The politics of misrecognition

It is argued that the dichotomies occurring within the policy argumentative process, namely, (1) the electricity vs CCFT and other energy requirements and (2) the demand approach solely focused on the central government vs the supply approach based upon the new central government role within the governance, depict misrecognition issues. On one hand, the marginal acknowledgement of CCFT within the discourse affects the 86% of rural population whose energy demand is mainly for cooking (Arce, 2014). On the other hand, the marginal acknowledgement of the supply approach by the government affects the rural population whose energy budget is not enough to support an energy transition process that is sustainable in time. Such budgetary limitations are a feature of the socio-economic identity of a significant proportion of Bolivia's rural population as explained in Chapter 2.

Findings suggests that both issues of misrecognition are marginalised by the discursive affinity of the political ideology that represents the current regime. First, "voltios por votos" (volts for votes) is a common saying in South America (Practical Action, 2014, p. 28) that arguably partly explains the politics of mainstreaming electricity over other energy requirements in rural areas as it appeals to the social imaginary of a historical lack of electricity. Second, the marginal position of the supply approach within the governance discourse stems from the political ideology of the incumbent government condemns capitalism including market approaches for social policies.

However, findings also show that such politics are evolving as the goal of universal electricity access advances, recognising the critical importance of CCFT in rural areas, other energy requirements across the diverse geography of Bolivia and the need of financial and technical inputs to ensure affordability and the long-term use of DRES. One of the international cooperation representatives highlighted this shift:

> In 2014, the EEP-AR[13] was categorically rejected by the Ministry of Energy when proposing cooperation to strengthen the supple side of the rural energy market

[13] The Energy and Environment Partnership Andean Region is a cooperation program focused on the deployment of sustainable energy in rural areas of Bolivia, Colombia, Ecuador and Perú, which ran from 2012 to 2016 (EEP-AR,2016).

> but now it is the government, through ENDEV, propelling this approach (*International Cooperation Representative #3*).

8.3.3 Overlapping identities and individual recognition

As discussed in Chapter 2, the societal composition of rural areas in Bolivia is complex, with individuals and communities having overlapping identities including both indigenous and non-indigenous cultures. Exploring the linkages between the relational texture of day-to-day life and the ethical meaning of energy, Groves et al. (2017) show that individuals' embodiments, attachments and narratives "are features of sense-making that contribute significantly to everyday understandings of the ethical meanings of different ways of using energy" (p. 73).

Although such approach is currently absent within the policy framework, academic initiatives like the study Energy and Society conducted by the Working Group for Climate Change and Justice (2017) explore the perceptions and imaginaries regarding the energy across different actors in Bolivia including final users. Such a study could be a referential starting point to identify Indeed, the Working Group for Climate Change and Justice (2017) studied the perceptions and imaginaries regarding the energy policy in Bolivia across different actors including final users. Although such study is mainly focused on urban and peri-urban areas, it could be a referential starting point to identify the significance of energy access for different cultural identities existing and subsequent alternative routes for just and sustainable energy transitions.

Additionally, it is argued that the national policy framework could further engage with individual rural communities. Such an approach could draw on Schot, Kanger and Verbong's (2016) research on consumers as pivotal stakeholders in the energy transition process, shaping new routines and enacting system change. They advocate for the identification of a typology of user roles and subsequent targeted policies to enhance them.

8.4 Discourse analysis and energy justice

This research used discourse analysis to explore the national policy framework for off-grid rural energy access in Bolivia. Two elements of its potential contribution to the energy justice framework are observed. First, using discourse analysis to study energy justice can provide in-depth insights into both *top-down* and *bottom-up* approaches promoting energy justice (Sovacool and Dworkin, 2014). Therefore, discursive approaches can potentially address Bickerstaff et al.'s (2013) and Forman's (2017) concerns and arguments that energy justice frameworks sometimes privilege high-level participants and initiatives within the energy sector, overlooking the diversity of stakeholders actually

involved and the significance of meso and micro initiatives promoting and supporting energy access. Second, this research highlights the potential for discourse analysis to illuminate the pivotal role of coalitions and frames to reveal and reflect upon the power dynamics and the politics of rural energy transitions.

Chapter 9 Conclusions and Recommendations

This research aimed to explore the national policy framework for rural energy access in Bolivia by applying the key tenets and guiding principles of the energy justice framework to provide insight into the development and implementation of energy policy in rural Bolivia. To achieve this aim the three objectives of this research were: identifying the national policy framework for off-grid rural energy access in Bolivia; using discourse analysis to explore the key principles of the energy justice framework within Bolivia's energy policy; and making recommendations to inform future policy development and implementation. This chapter outlines the research conclusions, makes recommendations for future policy, and suggests new avenues for research to further understand and enhance the justice-awareness of the national policy framework for off-grid rural energy access.

9.1 Research conclusions

This research has shown that despite echoing global narratives, the national policy framework for off-grid rural energy access in Bolivia is underpinned by its own unique discourse promoting universal energy access for development. This discourse emphasises both the socio-economic and environmental benefits associated with modern energy services and is shaped by two parallel discourse coalitions built around (1) electricity and (2) CCFT and other energy requirements. Both coalitions contribute to the incumbent governance structure that positions the government at the forefront of addressing the challenge of achieving universalization as a constitutional right for all Bolivian citizens and also introduce the environment as a non-human actor within the energy sector. The discourse is also characterised by an epistemic approach based on the indigenous philosophy *Vivir Bien,* calling for a conceptualization of the instrumental value of modern energy services from an ecosystemic perspective.

However, the analysis identified several issues challenging the consistency of the dominant discourse and its potential to fulfil the three tenets of energy justice. It is argued that issues are currently contributing to instances of injustice, and exploratory measures to address them are offered. Within the distributive rationale, the analysis highlighted a policy vagueness dimming the universalization rationale within the policy framework including (1) a lack of benchmarks for targets and goal tracking processes; (2) a disproportionate focus on electricity over CCFT and other energy requirements; and (3) a lack of uniform and regulated standards to address the reallocation of the socio-economic and environmental benefits of energy access, which was indeed the starting point of this project.

In order to address these issues, a two-step reconceptualization of energy access was proposed. First, it is crucial to establish quality and quantity benchmarks and define a uniform approach to analyse and forecast the demand for new projects, incorporating the multidisciplinary knowledge of key governance institutions and other stakeholders involved in the energy sector. Second, all the data gathered in the first step could be organized and displayed using an already existing but currently underutilized platform called Geoportal VMEEA where some projects currently implemented by the PEVD are georeferenced alongside the national electricity grid system. This platform could be further enhanced to provide a meaningful planning tool for energy access. Finally, it is argued that the policy framework should explore models to engage with potential socio-economic impacts throughout the policy cycle including systematic analysis and evaluations of projects' contributions exploring what changes occurred but also how and why.

The analysis also illuminated the procedural arrangements underpinning Bolivia's national energy policy. It highlighted the influential role that knowledge and funding play in shaping the conceptual pluralism of the discourse. These micropowers and associated discursive affinities have contributed to establishing a hierarchy of governance institutions for the argumentative process that guides policy making and implementation according to the power of funding and knowledge. It was therefore argued that there is a need to establish and institutionalize new sites for argumentation through systematic technical workshops where the identified issues hindering the universalization are addressed by drawing on the cumulative institutional knowledge and experience of stakeholders within the energy sector. Such an initiative could help to (1) empower less privileged institutions to participate in the argumentative processes and practices; and (2) enable more equitable processes and the (re)allocation of costs and benefits of DRES deployment amongst communities.

Two additional questions around procedural arrangements were also identified. First, are all governance institutions capable of participating in the argumentative process of rural energy policy-making and implementation? The answer is currently no. It is clear that additional capacity building and human capital is needed to implement and support improved energy access in rural areas, particularly for DRES that demand specialized knowledge. Second, is the governance structure fairly defined? It is argued that adopting a perspective that ruralizes energy, which is understanding energy as a local resource that participates in the metabolic processes of the ecosystem, can support the incorporation of all the governance institutions involved in the socio-metabolic processes of the rural energy agenda. This can in turn inform a (re)allocation of the costs and benefits across the whole local energy system arise, and help identify potential new partnerships and funding alternatives for the achievement and long-term sustainability of universal energy access.

The analysis of the tenant of recognition justice found four instances of misrecognition within the configuration of Bolivia's national policy framework for rural energy access:

1) A lack of knowledge and non-recognition regarding the different meanings of energy amongst the 37 indigenous peoples that make up the Plurinational State of Bolivia;
2) A lack of awareness related to the overlapping identities in the rural areas considering the highly complex societal configurations in Bolivia;
3) A dichotomy between electricity and other energy requirements; and
4) A dichotomy between the demand approach focused solely on the central government vs the supply approach based upon the new central government role in energy governance.

Possible options to address the first issue, include exploring traditional ways of economic organization like *trueque* as non-monetary approaches to exchange energy services and engaging the cultural figures involved in Community Justice to lead the local governance arrangements around energy access at a community level. Regarding the third and fourth issues, a reflection on the politics of misrecognition suggests that the acknowledgment of the marginal elements of both dichotomies is constrained by political strategies stemming from the ideology of the incumbent political regime.

Overall, the research has shown that the national policy framework for off-grid rural energy access has established an institutional scaffolding based on a meaningful justice-awareness and proposed specific possible actions to address the issues challenging its consistency. By addressing these issues, the policy framework will strengthen not only its engagement with the socio-cultural configurations of scattered rural areas, but also better align its underlying institutional structure towards achieving equitable universal access in Bolivia by 2025.

9.2 Policy recommendations

These findings indicate a need to address important aspects of the institutional response to rural energy access in Bolivia. Four main recommendations are made regarding how to better foster engagement among stakeholders within the energy sector and strengthen efforts to achieve universal energy access in Bolivia.

9.2.1 Standards and policy instruments

Policy vagueness, including the omission of key concepts and use of imprecise references and terminologies that allow for divergent interpretations of policy objectives (Moyei et al., 2019) is jeopardizing (1) adequate attention to all energy requirements not just electricity; (2) an equitable

deployment of DRES; and (3) an equitable (re)allocation of costs and benefits stemming from energy access. In this context, this research suggests exploring:

- Policy instruments such as auctions of energy access projects and fiscal incentives for *all* potential energy solutions (not just electricity);
- Benchmarks for minimum access, mobility and demand forecasting for projects; and
- Regulated strategies to address the (re)allocation of socio-economic and environmental benefits of energy access.

New policy instruments to strengthen the rationale of recognition justice could also target:

- Specific user profiles to address overlapping identities; and
- Traditional forms of economic articulation as potential alternatives to market-based transactions for energy access projects that target indigenous communities.

9.2.2 Governance

The affordability of DRES and their long-term use are dependent on the availability of adequate and reliable funding and suppliers that can operate within rural market conditions. It is therefore important to acknowledge and incorporate the supply approach through a specific program that addresses both suppliers and traditional and non-traditional financial actors and products.

Capacity building and strengthening human capital are paramount costs of energy access that are currently inadequately addressed. Investing in these would strengthen the whole policy process and enhance policy implementation. Thus, it is critical to develop bespoke education programs that encompass the whole range of actors involved.

Third, it is argued that by ruralizing energy and adopting an ecosystemic approach, broader governance structures could be pursued. Including actors that participate within the metabolic processes of rural ecosystems such as hydrocarbon companies as part of the governance institutions related to rural energy access can enable additional funding and partnerships to strengthen the universalization goal by making them accountable for their impact on the ecosystem.

Fourth, in order to balance the configuration of micropowers, new permanent sites of argumentations, like systematic technical workshops should be explored, which will empower less privileged actors to participate in policy development and implementation.

9.2.3 Legitimization and framing

Literature shows the relevance of framing within energy transitions. It is suggested that all the recommendations provided in this section are legitimized through appropriate framing. In order to achieve enhanced and participatory governance, strengthened and more informed institutions and a more balanced configuration of micropowers, the framing *Universal energy access for and from all* could be Incorporated within the incumbent discourse. Likewise, the more authentic inclusion of the Mother Earth within the governance structure and the adoption off the ecocentric approach proposed by the *Vivir Bien* to broaden the scope of institutions involved in rural energy could be portrayed by the frame *ecological debt.*

9.3 Avenues for future research

This research gives rise to at least two avenues for future research into Bolivia's national energy policy framework and measures to strengthen its engagement with the social and cultural characteristics of rural communities. First, ethnographic work has provided critical inputs to this research and further ethnographic research to investigate the profiles and perspectives of rural communities and non-traditional ways of economic articulation would provide invaluable insights to inform future policy development and implementation. Second, this research has highlighted the crucial role of both the private sector and non-profit sector in funding and delivering off-grid energy projects in Bolivia. As such, it would be fruitful to explore business models for energy suppliers and financial institutions to support the goal of universalization in Bolivia.

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Appendices

Appendix 1: Consent form

Project Title: Exploring energy justice in Bolivia

PARTICIPANT CONSENT FORM – INDIVIDUAL

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree / do not agree to the interview being sound recorded.

In the research, I would like to be referred to by using:

☐ My name and position (**Please specify**: _____)

☐ My position only (**Please specify**: _____)

☐ A descriptor (i.e. government spokesperson, NGO representative, academic, entrepreneur, etc).

I agree to participate in this study under the conditions set out in the Information Sheet.

Signature: _____ Date: _____

Full Name: _____

☐ I would like to receive a summary and/or copy of the research.

Email address: _____

Appendix 2: Interview questions

Project Title: Exploring energy access in rural Bolivia

1. Rural energy access in Bolivia

1. Could you please tell me about your experience in rural energy in Bolivia?
2. What does energy access mean to you?
3. Does that definition change in a rural context? If so, how?
4. To your knowledge, what is the current state of rural energy access in Bolivia?

2. National policy framework of rural energy access in Bolivia

5. What is your opinion of the current national policy framework for rural energy access in Bolivia?
    a. What do you think are the main strengths?
    (Ask to elaborate upon relevant answer)
    b. What do you think are the main weaknesses?
    (Ask to elaborate upon relevant answer)
    c. Which challenges do you think must be addressed most urgently by the current national policy framework? How should them be addresses?
    d. In your opinion, is there a gap between the written policy documents and the implementation phase?
    (Ask to elaborate upon relevant answer)

2.1 Tenets and principles. Recognition and procedural justice

e. In your opinion, how does the quality of energy provided in rural areas compare to that provided in urban areas?
(availability, due process, intergenerational equity, intersectionality, convenience)
f. In your opinion, does the policy framework ensure that the use of energy solutions provided in rural areas are sustained in time?
(availability, due process, intergenerational equity, intersectionality, convenience)
g. In your opinion, does the policy framework consider the target population's end uses of energy? To what extent?
(availability, due process, intergenerational equity, intersectionality)
h. Do you think the policy framework acknowledges and considers the cultural differences among its target population?
To what extent?

(availability, due process, intergenerational equity, intersectionality)

i. To your opinion, are rural communities familiar with the energy solutions provided in rural areas?
(availability, due process, intragenerational equity, transparency and accountability)

j. To your opinion, do rural communities get involved on the policy-making process? If yes, how?
(availability, due process, intergenerational equity)

k. To your opinion, are stakeholders involved in the process of policy-making? If yes, how?
(availability, due process, intergenerational equity)

l. To your opinion, does the policy address the environmental implications of new technologies used for the deployment of rural energy access?
(sustainability, intergenerational equity, due process)

Appendix 3: Information sheet

Exploring energy justice in rural Bolivia.

INTRODUCTION

The aim of this research is to explore the way in which the national policy framework for rural energy access in Bolivia addresses the social and cultural characteristics of its target population and how they shape the development outcomes of energy access. In this context, I am seeking to interview government officials, academics, and representatives of funding institutions, NGOs and private initiatives.

Participating in this research will take between 30 to 45 minutes. You will be asked questions about your experience in relation to rural energy, your perception of the current state of energy access in rural areas of Bolivia, and your views regarding Bolivia's current energy policies.

CONFIDENTIALITY

With your permission, I would like to record the interview. You will not be identified, or your name and position disclosed, in any publication or dissemination of the research findings without your approval. All information collected during the interview will be accessible only to me and my supervisor and will be kept strictly confidential. The summarised data from this study will be stored in a password protected computer at the School of Agriculture and Environment, Massey University, Palmerston North in New Zealand.

PARTICIPANT'S RIGHTS

Participation in this study is voluntary. You do not have any obligation to accept this invitation; however, your contribution to this research would invaluable. If you decide to participate, you have the right to:

- decline to answer any particular question
- withdraw from the study at any point
- ask any questions about the study at any time during the interview
- provide information on the understanding that your name will not be used unless you give permission to the researcher
- be given access to a summary of the project findings when it is concluded
- ask for the recorder to be turned off at any time during the interview (if you agreed for the interview to be recorded)

Project contacts

You are welcome to contact the researcher and/or supervisors if you have any questions about the project.

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Appendix 4: Program Electricity for Living with Dignity (PEVD)

Objective

Achieve universal Access to electricity in urban and rural areas in 2025, drawing on public and private investment. The PEDV aims to contribute to improve living conditions, reduce poverty, job creation and consolidation of a productive, economic and social structure for all Bolivians.

Goals and Stages

In line with the PDE, the PEVD aims to promote universal access to electricity by 2025 through a four-stage plan:

Stage I: 2006 -2010

- Rural electrification from 33% to 53% (210 000 households)
- Urban electrification from 87% to 97% (460 000 households)

Stage II: 2011 – 2015

- Rural electrification reaches 70%
- Universal access accomplished in urban areas

Stage III: 2015 – 2020

- Rural electrification must reach 87%

Stage IV: 2020 - 2025

- Universal Access to electricity

Stakeholders

The PEVD was dependant of the Ministry of Hydrocarbons and Energy through the Viceministry of Electricity and Alternative Energies. Additionally, the following institutions were key coordination stakeholders:

- Ministry of Development Planning, through the Viceministry of Public Investments and Foreign Funding (VIPFE for its acronym in Spanish), international cooperation agencies, national and international NGOs.
- Department Governments.

- Municipalities.
- Stakeholders involved in electricity distribution.
- FNDR
- FONDESIF

Institutional Structure and funding schemes

The PEVD was organized in four areas:

1. Technical operations: identification, design, evaluation and execution of programs and projects.
2. Monitoring: following up the accomplishment of objectives.
3. Administration and finance.
4. Procurement: execution of buying and tendering processes.

The PEVD would have three funding sources:

1. Budgetary provisions established within the Electricity Law N° 1604 for rural electrification (Articles 8, 32, 34 and 58).
2. Grants and donations from international cooperation agencies (bi and multilateral) that have current funding focused on supporting electricity coverage increase.
3. All resources fundraised by the government by multilateral and bilateral cooperation as well as domestic resources allocated for electricity.

Program Implementation

The PEVD would draw on three main guiding considerations:

1. An effective participation of Local Government should Include:

   - Definition of progressive coverage goals towards universalization in coordination with distribution companies legally stablished within their jurisdiction area.

   - Permanent information supply for the Ministry of Hydrocarbons and Energy on coverage increase.

   - Project design considering requirements stablished by the Public Investment National System and programs designed by the PEVD.

- Signing cofounding agreements to access resources from public investment provided by current regulation frameworks.

2. Participation of electricity companies: All distribution companies must include within their investment plans the annual goals for peri-urban and rural areas nearby the jurisdiction areas in tight coordination with Local Governments. The resources required for pre-investment studies should be included in the following period of tariffs actualization or, could be requested to the PEVD.

3. Environmental Regulation: All projects developed under the PEVD should comply with the Environmental Regulation Law N° 1333 and Law 27173 which defined that the environmental impact caused by electricity projects with Category IV, namely, grid extensions and densifications, SPV, Wind turbines and Micro Hydropower plants, are not required to undertake further environmental assessment.

Program Components

1. Extension of the national grid
2. Densification of existing grids
3. Decentralized renewable energy: would be implemented to provide electricity supply for at east 180 000 households due to the high level of dispersion across remote communities.
4. Social use of electricity: this component targets the electricity requirements of health and education facilities, but also government infrastructure, community markets, sport centres, etc.
5. Productive use of electricity: aiming to provide electricity as an input for productive processes such as micro irrigation, refrigeration, food processing and grain mills, among others. A productivity increase occurs hence, as a direct outcome of electricity access.

Subprograms

1. *Kreditanstalt fur Wiederaufbau - KfW*

   Funding: German Government cooperation

   Budget and technology: 5 112 918,81 Euros for 17 micro-hydropower covering a 75% or 80% of the overall cost and requiring the 25% or 20% remaining costs in charge of the Departmental Governments or Municipalities respectively.

   Development targets: households, health, education and productive activities

Beneficiaries: 4500 families by 2010.

Access to funding: Departmental Governments and Municipalities providing technical studies of identified and potential micro hydropower plants within their jurisdictions. The parts involved must sign a co-funding agreement and a local company for operation must be established.

2. *European Community - EUROSOLAR*

Funding: European Community

Budget and technology: European Community: 2 237 417 Euros and Bolivia counterpart: 590 000 Euros. Decentralized renewable energy solutions encompassing internet services, IP, satellite TV, community facilities, vaccines refrigeration, water pumps and batterie rechargers.

Development targets: poverty, enhancement of socio-economic conditions of indigenous population. This program included additionally the establishment of a local management committee, local capabilities training to operate and maintain the technologies and the implementation of complementary education programs for rural school and communities on the use of internet and applications on health, economy, etc.

Beneficiaries: 59 communities – 7962 families.

Access to funding: Municipalities that comply with predefined requirements (these are not mentioned whatsoever). The parts involved must sign a co-funding agreement and the European Commission proceeds with services procurement and a third company executes the project.

3. *German Technical Cooperation Agency* (GTZ for its acronym in German)

Funding: GTZ

Budget and technology: GTZ: USD 500000 and Bolivia USD 500000. Decentralized renewable energy solutions encompassing internet services, IP, satellite TV, community facilities, vaccines refrigeration, water pumps and batterie rechargers.

Development targets: integration of low-income households to the existing grid connections providing financial incentives for local distribution companies in order to subsidise any upfront cost related to connection of USD 20 per household.

Beneficiaries: 50 000 households located less than 100 mts away from the electricity grid.

Access to funding: Distribution companies can access to this program through densification projects. The VMEEA and GTZ evaluate and define the agreements with the distribution companies and resources are channelled through FONDESIF.

4. *United Nations Program for Development, Global Environmental Facility - PNUD/GEF*

   Funding: PNUD/GEF

   Budget and technology: GEF: USD 3 983 719 – Bolivia: USD 250 000, for 3000 SPV systems and 3 MCH.

   Development targets: institutional structures to enhance electricity access based on decentralized technologies based on renewable energy[14].

   Beneficiaries: 4 726 families respectively for each SPV system installed and 11 communities provided with MCH and PCH.

   Access to funding: IMFs were entitled to access such funding in once allied to any private company that supplied decentralized electricity solutions based on renewable energy through FONDESIF. Funding would create a portfolio of microcredits for potential users of decentralized electricity solutions to access. Likewise, IBNORCA would be responsible for the certification of technical minimum standards for SPV.

5. *Infrastructure Project for Decentralized Rural Electrification* (IDTR for its acronym in Spanish)

   Funding: World Bank

   Budget and technology: Grant of USD 24.29 MM to be covered in 40 years at an average annual interest rate of 0.25% and the year period of grace.

   Development targets: electricity and telecommunications systems for rural households and communities, enhancing social and productive uses. The program covers both on-grid and off.grid solutions.

   Beneficiaries: 17 761 rural households in Oruro, Potosi, Cochabamba, Santa Cruz and Chuquisaca by 2016.

   Access to funding: Both on-grid and off-grid solutions are up to concessions for private suppliers of technology and distribution companies. The latter would be in charge of local capacity building and operation and maintenance of technologies for four years. For grid-extensions, similar conditions than those applied to the GTZ Program.

6. *Donation Agreement with the Global Partnership Output Based Aid* (GPOBA-World Bank)

   Funding: World Bank and UK Cooperation Agency for Development.

   Budget and technology: Donation USD 5170 MM to develop electricity infrastructure through SPV systems.

[14] Based on the Projecto BOL/97/G31 established in 1999 "Program Rural Electrification with Renewable Energy through the Popular Participation Process", as an agreement between the Bolivian Government and GEF (Law 29635,2008).

Development targets: electricity and telecommunications systems for rural households and communities, enhancing social and productive uses. The program covers both on-grid and off-grid solutions.

Beneficiaries: 7000 households across La Paz, Beni, Pando and Tarija by 2010.

Access to funding: Both on-grid and off-grid solutions are up to concessions for private suppliers of technology and distribution companies. The latter would be in charge of local capacity building and operation and maintenance of technologies for four years. For grid-extensions, similar conditions than those applied to the GTZ Program must be considered.

Appendix 5: PEVD georeferenced projects in 2018

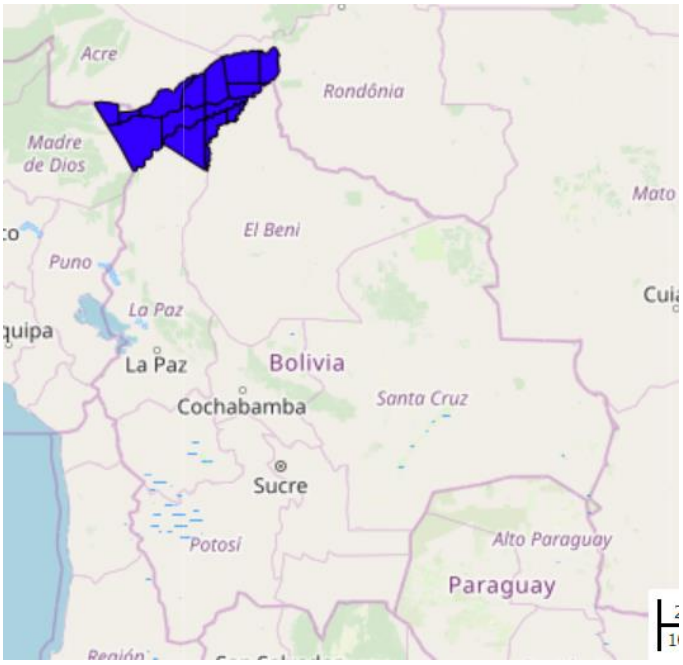

Figure A.1 Projects of modern energy sources focused on the northern area of Pando Department. Source: Geoportal PEVD (2019).

Figure A.2 Rural households that requested SHS in 2018. Source: Geoportal PEVD (2019).

Figure A.3 Small SPV systems for schools and health facilities demanded in 2018. Source: Geoportal PEVD (2019).

Figure A.4 Solar heating systems for school and health rural facilities demanded in– 2018. Source: Geoportal PEVD (2019).