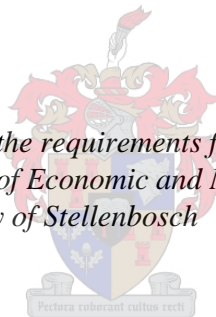


Exploring energy access and use trends in Tsumkwe, Namibia: an end-user perspective

by
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*Thesis presented in partial fulfilment of the requirements for the degree
of Master of Philosophy in the Faculty of Economic and Management
Sciences at the University of Stellenbosch*



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Declaration

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Abstract

The aim of this thesis is to establish a tangible metric by which to evaluate the impact of modern energy access on the livelihoods of rural Sub-Saharan African communities. The narrative is set in Tsumkwe, a remote rural Namibian location some 596 km north-east from the main capital city Windhoek.

Initiatives aimed at rural electrification and energy provision are expected to reduce poverty as well as contribute to the community's general wellbeing. However, determining the relationship between energy and development is quite a challenging undertaking. An analysis that is either exclusively quantitative or qualitative runs the risk of providing a skewed picture of the energy-development-poverty nexus.

In this thesis, quantitative data is embedded within qualitative data as an attempt to examine the nexus and to translate how intervention programmes are transformed into outcomes in order to gauge success of a project.

The transformative paradigm shaped the theoretical framework and informed the mixed-method research approach while the capability approach was used to analyse plurality and individualisation of policy impacts. Consequently, the role of *place* is positioned at the centre in gauging experiences of the poor vis-à-vis the importance of locating resources and *capabilities* to address socio-economic issues within a geographical location.

The injustice of energy poverty can be viewed as unequal access to energy services (i.e. distributional injustice) as well as an intervention that failed to *recognise* the needs of certain groups and potentiality offered by *place*. From this, the concept of an energy poverty penalty is qualitatively developed. It was found that the penalty, although it is more pronounced in the low income groups, is exacerbated by *choice* offered in an energy basket thus affecting non-income poor households too. Therefore, the energy poor are not necessarily income-poor.

It is finally concluded that while sustainable energy interventions offer the possibility to reduce energy poverty and the attendant human wellbeing index improvement they need to be grounded in a robust information base to track progress towards targets. Most existing indicators and composite indices assessing access to energy, the degree of development related to energy and deprivation of access to modern energy fail to account for the energy poverty trap.

Opsomming

Die doel van hierdie tesis is om 'n tasbare meting daar te stel om die impak to toegang to moderne energie daar te stel in landelike gebied in sub-Sahara Afrika te evalueer. Die studie is uitgevore in Tsumkwe, 'n afgeleë landelike gebied in Namibië, sowat 596 km noordoos van die hoofstad, Windhoek.

Daar word veronderstel dat inisiatiewe wat daargestel word om energie en elektrisiteit toeganklik te maak vir landelike gebiede en gemeenskappe, verarming sal teewerk en gemeenskappe kan ophef. Dit is egter moeilik om die verhouding tussen energie verskaffing and vooruitgang te bepaal. 'n Studie wat net kwalitatief of kwantitatief gebaseer is, sal nie die ware toedrag van sake uitlig nie.

In hierdie tesis is kwalitatiewe data verweef met kwantitatiewe data om vas te stel presies hoe effektief programme is wat daargestel is om energie aan landelike gebiede te lewer.

Die transformatiewe paradigma het die teoretiese raamwerk gevorm en gelei tot die kombinasiemetode navorsingsbenadering terwyl die moontlikheids benadering gebruik is om die pluraliteit en individualisering van die beleidsimpakte te ontleed. Gevolglik, is die rol van *plek* in die middelpunt van die ondervindings van die armes vis-à-vis die belangrikheid van die verkryging van hulpbronne en *vermoë* om sosio-ekonomiese kwessies binne 'n geografiese ligging te hanteer.

Die feit dat landelike gebiede verarm is wat energie en elektrisiteit voorsiening betref, kan toegeskryf word aan die volgende: ongelyke toegang to energie dienste, programme wat nie die behoeftes van landelike gemeenskappe aanspreek nie en die potensiaal van *plek* waar die program aangepak word is nie voldoende aangespreek nie. In die lig van hierdie potensiele oorsake van energie verarming is die konsep energie aarmoede boete kwaliteitsgewys ontwikkel. Dit is gevind dat die boete, wat meer van toepassing is op lae inkomste groep is, beïnvloed word deur die keuse wat beskikbaar gemaak is in terme van energie voorsiening. Hierdie keuse het ook 'n invloed op die "geen-inkomste" arm groep in 'n gemeenskap. Dit is dus duidelik dat diegene wat energie verarm nie noodwendig geldelik ook verarm is nie.

Die studie, ter opsomming, het tot die slotsom gekom dat hoewel tussenkomende programme wat daar gestel word om volhoubare projekte aan te bied vir energie voorsiening in landelike gebiede, energie verarming kan verminder, dit nie effektief genoeg is tensy dit opgevolg word met duidelike doelwitte nie. Die bestaanded aanduidings vir toegang tot energie, aanduidings wat energie toegang en vooruitgang evalueer is nie werklik effektief genoeg nie.

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Acronyms

AGECC	Advisory Group on Energy and Climate Change
CFL	Compact Fluorescent Lights
CSD	Commission for Sustainable Development
DRFN	Desert Research Foundation of Namibia
EDI	Energy Development Index
EISD	Energy Indicators for Sustainable Development
ESMAP	Energy Sector Management Assistance Programme
FBE	Free Basic Electricity
HDI	Human Development Index
HDR	Human Development Report
HPI	Human Poverty Index
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IEC	Integrated Energy Centre
ILO	International Labour Organisation
IPP	Independent Power Producer
kgoe	kilogram of oil equivalent
kWh	kilowatt-hour
LPG	Liquid Petroleum Gas
M&EED	International Working Group for Monitoring and Evaluation of Energy for Development
MEPI	Multi-dimensional energy poverty index
MET	Ministry of Environment and Tourism
MDG	Millennium Development Goal
NDP	National Development Plan
NGO	Non-governmental organisation
NHIES	National Housing Income and Expenditure Survey
NPC	National Planning Commission
NREP	Namibia Rural Electrification Programme
OGEMP	Off-Grid Energisation Master Plan
OPM	Office of the Prime Minister
PA	Practical Action

REDMP	Rural Electricity Distribution Master Plan
REEEI	Renewable Energy and Energy Efficiency Institute
RET	Renewable Energy Technology
SEER	Strength Enhancing Evaluation Research
SME	Small- and Medium Enterprise
SRF	Solar Revolving Fund
TEA	Total Energy Access
TEP	Tsumkwe Energy Project
TESCo	Tsumkwe Energy Supply Company
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
WIMSA	Working Group of Indigenous Minorities in Southern Africa
WPI	Worcester Polytechnic Institute

Chapter 1: Introduction

1.1 Background

Energy access plays an important role in public policy debates related to poverty reduction, sustainability and development at global and national levels. This realisation, dating back to at least the 1950s, culminated in the setting of time-bound goals such as the United Nations General Assembly declaring 2014 – 2024 as the “Decade for Sustainable Energy for All”, which is a Millennium Development Goal (MDG) initiative aimed at recognising the role energy, and specifically, renewable/sustainable energy plays in developmental processes. Other international assertions such as declaring 2012 as the International year of Sustainable Energy for All further underscore the link between energy, poverty and development. Another time-bound goal set by the United Nations Advisory Group on Energy and Climate Change (AGECC) making 2030 the target year to achieve universal access to modern energy access for all, energy efficiency and increase the share of renewable energy in the global energy mix. All these are aimed at catalysing policy efforts to challenge climate change, economic vulnerabilities and reduce energy poverty by increasing access to sustainable energy. Thus, there seems to be a consensus that affordable, clean and reliable energy services are pre-requisites for sustainability and development.

Modern energy services¹ entails access to electricity for the poor as well as clean cooking facilities (IEA, 2011) delivered through mini/micro-grids and decentralised options. Modern energy service is viewed as an enabler; it facilitates social and economic development, it offers opportunities for improved lives and a path to prosperity. Therefore, it is imperative to have decision support tools that measure progress and provide information to guide policy direction towards poverty alleviation efforts. Such a tool should reflect the understanding of energy access that is bound to *place* and time in order to appropriately and effectively measure and monitor access to energy. Additionally, measures of energy access that are produced at regular intervals are useful in describing and diagnosing trends and developments (Bhanot & Jha, 2012). Global organisations such as the United Nations Commission for Sustainable Development (CSD) and AGECC set quantitative levels to be achieved at the end – by 2030 – however, it is just as important, or perhaps more important, to have an evaluative focus on the progress made towards achieving set goals.

¹ A more comprehensive description of modern energy services refer to the utilisation of energy or the application of useful energy to tasks desired by the consumer , and ‘modern’ refers to the a relatively high degree of convenience in obtaining those services.

1.2 Framing the rationale for this study

Namibia is regarded as a middle-income country with an estimated per capita consumption of N\$13 813 and a GINI² coefficient of 0.5971 (Namibia Statistics Agency, 2012). It is relatively wealthy but with one of the highest unequal distribution of wealth in the world as outlined in Table 1 that illustrates per capita consumption by language group:

Table 1: Annual consumption by main language spoken in household (Source: Namibia Statistics Agency, 2012)

Language group	Population (%)	Per capita consumption (N\$)
San ³	1.3	6 392
Otjiherero	8.4	12 331
Oshiwambo	48.3	10 609
Afrikaans	7.2	45 509
German	0.4	144 911

In efforts to reduce this glaring inequality, poverty reduction is one of the mainstays of efforts. The link between poverty and energy is aptly captured by CSD (UN, 2001) stance that states that “to implement the goal accepted by the international community to halve the proportion of people living on less than \$1 a day by 2015, access to energy services is a pre-requisite”.

Challenges to increase access to modern energy services in Namibia are, inter alia, low population density and the vast distances that makes the extension of the national grid expensive. These challenges open the door for off-grid solutions such as the solar-diesel hybrid plants installed at the Gobabeb Research Centre in the Namib Desert and at Tsumkwe in Otjozondjupa region. The Tsumkwe Energy Project (TEP) is an initiative that sprung from the 2007 Off-Grid Energisation Master Plan for Namibia (OGEMP) whose main objective is to provide “access to appropriate energy technologies to everyone living or working in off-grid, pre-grid and ‘grey’ areas” (Schultz and Schumann, 2007:4) as a developmental intervention to reduce poverty. Grey areas are classified as locations where it is unclear how and if access to

² A GINI index measures the extent to which income distribution or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. Zero (0) indicates perfect equality.

³ The San peoples are made up of seven main traditional groupings, namely the Hai//om, Ju//hoansi, Kung, Khwe, !Naro, Barakwena and !Xu.

electricity will be provided (REEEI, 2008) and are prioritised in the Rural Electricity Distribution Master Plan⁴ (REDMP). Un-electrified urban informal settlements are excluded in the REDMP but are included in the OGEMP as these are areas of great population growth and are located in pre-grid areas. Off-grid areas “will not have access to electricity within 20 years” (Schultz and Schumann, 2007: 4).

There are 5 858 un-electrified rural settlements in Namibia and only 1 543 are scheduled for electrification in the next 20 years⁵ as most of these settlements are situated far from the existing transmission network. The remaining 3 886 comprise of more than 106 000 households and shown as red dots in Figure 1. The green lines and dots represent the envisaged expanded electricity grid network and electrified rural settlements after the 20 years elapsed.

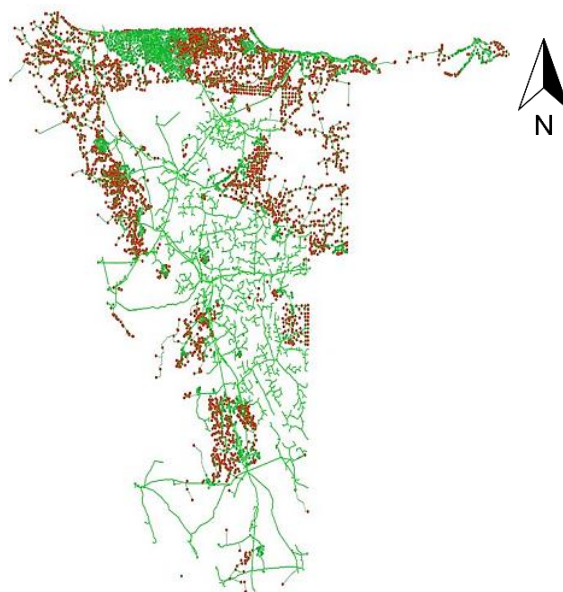


Figure 1: Un-electrified rural settlements and envisaged Namibia transmission network (Source: REEEI, 2008)

Tsumkwe, a small isolated settlement located in North-East Namibia and about 40 km from the border to Botswana, is the largest off-grid settlement in Namibia to date. The nearest urban centre (Grootfontein) is 306 km away, of which only 60 km is tarred.

⁴ The REDMP was compiled in 2000 and updated in 2005 (REEEI, 2008).

⁵ The OGEMP does not specify from which year the 20 years is counted from. Since the OGEMP was published in 2007, it is assumed that that's the year from which to count.

This settlement makes an interesting case as its economy is symptomatically underdeveloped and heavily depends on Grootfontein for goods and services. The San, specifically the Ju/'hoansi, forms the majority of the population of Tsumkwe. The San's Human Development Index (HDI) provides proof of the dire socio-economic conditions the San find themselves in. The incidence of poverty per language group shows that the San are perennially under the national average as per Figure 2:

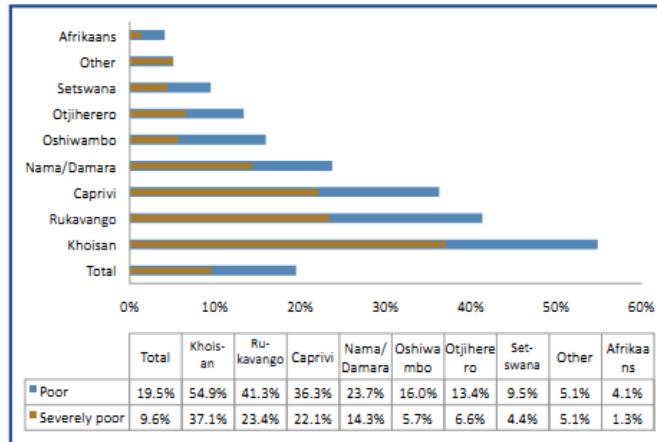


Figure 2: Incidence of poverty per language group (Namibia Statistics Agency, 2011: 64)

The gap between the San and other language groups indicates that a vast majority of the San are extremely poor. Even though there has been a slight decline of about 8% between 1993 and 2010 in poverty incidence of the San, it is the lowest among language groups (Namibia Statistics Agency, 2012). Their poverty gap of 29% is below the 8.9% national average (*ibid*).

Table 2 sets out the main sources of income for some language groups.

Table 2: Sources of income per language group (Source: NHIES, 2011)

Language group	Salaries and wages	Subsistence farming	Commercial farming	Pension	Remittances/grants	Drought/in kind receipts	Business	Others
San	47.2	3.7	1.9	20.1	2.5	19.5	2.0	3.1
Otjijherero	53.8	15.2	1.0	11.9	6.5	3.6	6.7	1.4
Rukavango	38.1	39.2	0.1	10.6	3.1	0.9	6.7	1.3
Nama/Damara	71.0	3.2	0.4	10.2	5.6	2.7	5.5	1.4

The Namibia Statistics Agency (2012) remarked that poverty is more intense among those whose main source of income is not salaries or wages and highest for subsistence farmers.

According to Suzman (2001: 18) close to half of San are “generational farm workers or are members of generational farm-working families” indicating the unskilled nature of employment. Hence, even though 47.2% earn salaries and wages, these are likely to be low.

The dilemma of the San has motivated the launching of numerous developmental projects attempting to break the cycle of poverty (Pfaff, 2003; Suzman, 2011; Ashton et al. 2012; Sylvain, 2005). The projects mainly pivot on agricultural activities (gardening, provision of farming animals, beekeeping) to artisan work (coffin making). Historically, development projects aimed at improving their livelihoods have not been successful (Hays, Hopson and Le Roux, 2010) making them heavily depended on state-run food and cash programmes. The replicative nature of hardship among the San is evidence of a poverty trap because a “high enough proportion of the population suffers strong enough barriers to access its human capital” (Mayer-Foulkes, 2007: 796). Todaro and Smith (2003) identify a poverty trap as a low level equilibrium where an economy, caught in a vicious cycle, suffers from persistent underdevelopment from one generation to the next and this inter-generational poverty is evident particularly in the San residents of Tsumkwe (Suzman, 2011).

García and Baratholomeé (2010) acknowledge that poverty is a major hindrance for sustainable development as it impinges on basic domestic needs as well as on public services such as the provision of health services and education. One way to address poverty is equal and equitable access to modern energy services (Bhattacharyya, 2006; Spalding-Fecher et al., 2005; World Bank 2005). Electrification, either through grid extension, micro/mini grids or stand-alone grids, has been disproportionately emphasised as a means of resolving the energy access problem by placing it at the apex of the energy ladder. The assumption is that primary energy carriers such as dung and fuel wood, would be replaced by more sophisticated energy carriers such as electricity (Sovacool, 2011) as a household’s economic well-being improves resulting in poverty alleviation and sustainable livelihoods. This linear argument is disputed by Bhattacharyya (2012) who argues that “despite some progress in enhancing energy access, the programmes promoting energy access are neither sustainable nor adequately contribute to development”. This inference culminated from a multi-dimensional sustainability analysis of energy access that suggests that meeting basic energy needs and moving up the energy ladder does not imply development, but rather energisation.

1.3 Scope and definitions

1.3.1 Defining and measuring energy poverty

It is crucial to understand how to define, measure, monitor, record and report energy poverty in order to effect policies geared towards poverty alleviation. The experience of poverty is undoubtedly real for the affected community or individual. However, attempting to define what poverty is can be an arduous task and thus, conceptualising what constitutes energy poverty is even more challenging. Thus, it requires an understanding as to recognise *who* is energy poor as well as *how* and *why* people are energy poor.

There is general consensus that energy poverty is a multidimensional concept that goes beyond identifying energy poor households based on the ratio of expenditure on energy to income or their lack/limited access to modern energy services. The United Nations Development Programme (UNDP) defines energy poverty as the *inability* to utilise modern energy services (UNDP, 2010). The Asian Development Bank (2010) includes *choice* or the lack thereof to access energy services in their definition.

Definitions and operationalisation of energy poverty can roughly be categorised in four groups. Firstly, international agencies literature such as the United Nations (UN) and the International Energy Agency (IEA) view energy poverty as the lack of energy services for cooking and lighting, also termed thermal inefficiency approach. This definition makes two assumptions: It recognises a causal relationship between lack of access to energy services and energy poverty, i.e. people without access are energy poor. The second assumption is that physical access to energy inevitably leads to consumption. This approach culminated in the development of a metric measuring physical access to energy termed Energy Development Index (EDI). This definition fits the aim of international agencies as their motivation is to meet targets set to measure the diffusion rate of energy. This approach uses indicators at country level such as electrification rate, number of people using solid fuels, per capita electricity consumption etc. A variation in these data over time depicts improvement, stagnation or decline in the provision of energy access.

The next three definitional approaches are more prominent at country level. The first being energy poverty characterised by physical energy needs. The aim is to quantify the minimum energy needed per household similar to the poverty line concept and resulted in an approach of measuring energy poverty analogous to consumption poverty measures (Barnes et al., 2010). Based on this, Modi et al. (2005) set the minimum energy needed at 50 kilograms of oil

equivalent (kgoe) per capita per year and Goldemberg (1990) at 32.1 kgoe per capita per month. The Department for International Development (2002) defines energy poverty in relation to the proportion of household income spent on energy. If a household spends more than 10% of their income then it is classified as energy poor (Barnes, 2005).

Energy poverty can also be defined by developing indices to measure and track progress in reducing energy poverty. The Practical Action group (2012) proposed the Total Energy Access (TEA) that focuses on the end-use of energy. The index is derived by using a range of indicators for cooking and heating, electricity and mechanical power. The drawback of this approach is that it blends end-uses of energy. Moreover, the “weighting scheme to measure energy poverty” is rather subjective according to Khandker et al (2012:3). Composite indexes such as multi-dimensional energy poverty index (MEPI) by Nussbaumer (2012) measure energy access, energy poverty as well as energy poverty intensity (see 1.4.4 for further discussion). The pros and cons of composite indices is that it provide summarised statistical information to policy makers, however, due to aggregation and normalisation, a substantial amount of information is masked and the voice of the severely affected is stifled.

The third approach is based on energy affordability. It leads to ask if an improvement in income will reduce energy poverty. Therefore, the discourse about affordability is discussed in relation to poverty (see for example Foster et al. 2000, Estache et al. 2002, Pachauri and Spreng, 2003). Estache et al (2002) differentiates between affordability of access and affordability of consumption and this is an important distinction to make in poor social groups. For example, the payment record of a household with access to electricity can be used as a measure of affordability of consumption to ascertain the level of household consumption and success of subsidy schemes or other social support programmes aimed at aiding the poor. Khandker et al. (2012) brings in a threshold point at which energy consumption begins to rise with an increase in household income and uses this as a definitional approach to energy access.

Pachauri and Spreng (2011) examined the link between amount of energy used and affordability. In this instance, energy poverty is monitored by observing energy-use and energy access patterns of a social group as it changes over time. This emphasis on energy services utilised underscores the complexity of the demand-side of energy as well as the role of “culture and social values in driving energy consumption” (Khandker, 2012: 3). Therefore, progress is measured by how far a social group has progressed or moved from a reference energy poverty line.

The focus of defining and measuring energy poverty ranges from monitoring energy access provision (international bodies' approach) to a continuous monitoring of outcomes resulting from the provision of energy (country level approach).

1.3.2 The energy poverty penalty

Can an increase in a household's income enable it to escape energy poverty? Furthermore, is energy poverty a distinct problem or is it a manifestation of poverty in general? Prahalad and Hammond (2002) stated that those at the bottom of the pyramid pay much more for most things than middle-class consumers. Similarly, people living in remote areas often pay an energy poverty premium due to physical and economic isolation from distribution systems.

The energy poverty penalty supposition infers that poor people spent more on energy services relative to their total income than comparatively wealthier people for a lower service quality (Groh, 2013). Potential reasons for the penalty are, inter alia:

- Limited choice and access that impinges on *capabilities*
- No affordability
- Lack of energy literacy
- Higher cost of decentralised technologies vs. centralised technologies
- Less production potential

Cost is overly emphasised in the identification of an energy poverty penalty and such an approach raises the question if it is a matter of income poverty rather than energy poverty as identified by Walker et al. (2013). If so, then subsidies, both implicit and explicit, for example in the form of free connections and reduced tariffs, are crucial to make energy access affordable to the poor to eliminate the penalty. However, cost alone does not explain an energy poverty trap. The existence of the penalty has noteworthy consequences as it may impact negatively on households and impede or delay development.

Hill (2012) developed recommended indicators to showcase the extent and *depth* of energy poverty in relation to income as shown in Figure 3:

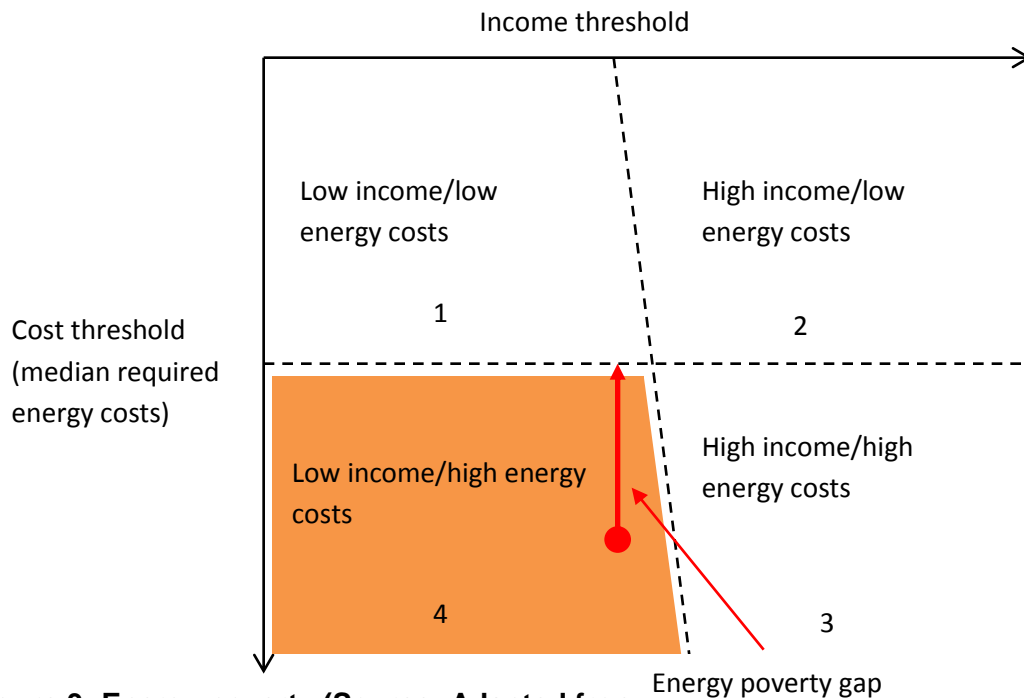


Figure 3: Energy poverty (Source: Adapted from

Households or micro-enterprises that are in quadrant 4 experience low income and high energy costs, and if they spent 10% or less of their income on energy, then they are energy poor and are potentially exposed to the energy poverty penalty due to their precarious situation. The *depth* of energy poverty varies among households and is represented by the energy poverty gap; the length of the vertical arrow represents the size of energy poverty gap. A longer arrow represents a bigger opportunity for the manifestation of an energy poverty penalty. The *depth* of energy poverty can be related to Nussbaumer's (2012) energy poverty intensity concept in the MEPI. However, the intensity indicator is at country level whereas the gap is at household level and is thus more responsive to small changes in a household's income, composition and electricity price.

1.3.3 Energy Access

Whilst there is some consensus about how to define what modern energy services entail, defining energy access is contested mainly because energy circumstances are contextualised; they differ from country to country, within individual countries, communities and households. There is a growing literature on approaches for defining energy access (see for example Bhanot and Jha, 2012; Pachauri, 2011; Brew-Hammond 2010; Bazillian et al 2010; Pereira 2010; Buzar

2007; Pachauri et al 2004; Saghi 2004; Reddy 2000). However, Pachauri (2011) asserts that most of these illustrate a uni-dimensional view of energy access. The phrase 'energy access' evolved from reporting on "mere availability" to include "affordability, acceptability, adequacy, reliability and environmental sustainability" (Bhanot and Jha, 2012: 65). This evolution challenges uni-dimensionality and makes it even more challenging to reach some consensus about the conceptual and operational definition of access.

Energy access as defined by the IEA (2011) focuses on incremental levels of energy quantity available for consumption to a household in such a way that a household has a "reliable and affordable access to clean cooking facilities, a first connection to electricity and then an increasing level of electricity consumption over time to reach the regional average". The term "access" as used in the explanation denotes physical availability. The Merriam-Webster dictionary defines access as the "*freedom or ability* (researcher's emphasis) to obtain or make use of something". The use of the conjunction "or" indicates an alternative (freedom or ability), thus making freedom and ability mutually exclusive to obtain or make use of energy. Sen (2009) argues that freedom is valuable for at least two different reasons. The first being that more freedom gives rise to more opportunity to pursue objectives, that is, the things we value. This aspect of freedom is more concerned with the *ability* to achieve what we value regardless of the process that brings about that achievement. The second reason according to Sen (2009) is that we may attach importance to the *process* of choice itself. That is, we would like to ensure that we are not being forced into some (undesirable) state due to constraints imposed by others or things. This means that freedom comprises of two distinct aspects: the 'opportunity aspect' as well as the 'process aspect' (for further reading, see Sen, 2009: 228-230). The concept of *capability* is closely linked with the opportunity facet of freedom.

The intention of the IEA's definition is to be "supportive of the objective to conduct forward-looking projections" (IEA, 2012), however, such projections exclude variations in human behaviour and utilisation of energy based on gender, social customs, climate and culture (Bhattacharyya, 2012). Additionally, needs change over time, and thus consumption levels change too, making it a moving target which is even more challenging to attain. The definition also makes an assumption that a pre-set level is the desired and/or acceptable level of consumption, however, this might lead to "wasteful consumption and perpetuation of unsustainable lifestyles" (Bhattacharyya 2012: 261). The broad focus on a quantifiable value of energy access assumes that once the minimum threshold is reached, energy access has been achieved. Upon such achievement, incremental levels of access to energy service are the next

target as defined as by the AGECC Report (2010). This report sets the threshold level for rural households at 50 – 100 kWh/person/month. This progression-based approach to energy access makes it a challenge to establish and analyse inter-linkages between energy access and energy poverty.

The Practical Action (PA) group seeks to focus on the “number and quality of energy services that people enjoy and the quality of the energy supplies which people have to produce these services” (Practical Action, 2010). The attempt is to contextualise and view energy access from an ecosystem approach that enhances understanding of the dynamics of energy use. This approach relies on identifying patterns of energy use and shows various dimensions of access. Such a perspective recognises co-evolution and collaboration between members of an energy-using society and activities that utilises the generated energy.

The OGEMP operationalise energy access by focussing on the “number of households contained in localities” (Schultz and Schumann, 2007:11) and then providing an energy shop to “sell suitable, approved energy products and compatible appliances” (Schultz and Schumann, 2007:4) and thus provide access that is practical and “answers the end-user’s actual needs” (*ibid*). It recognises that consumers require a variety of energy options and therefore, technological options for Tsumkwe encompassed grid expansion and the implementation of energy efficient cooking appliances such as gas cooking stoves. There is no indication of how end-user’s needs were identified running the risk of pre-empting these needs based on or in the name of sustainability and energy efficiency.

1.3.4 The role of modern energy in development

The link between energy and development has been established by several authors (García and Baratholoméé, 2010; Bhattacharyya, 2006; Spalding-Fecher et al., 2005; World Bank 2005). However, just as Daly (1990) distinguished between weak and strong sustainability, the same conceptual and analytical distinction can be applied to poverty alleviation, especially in developmental efforts aimed at alleviating hardship by the poorest. Brekke (1997) defines development to be “*weakly* sustainable if the development is non-diminishing from generation to generation”. The presence of intergenerational poverty in the San is evidence of “sustainedness” (Pezzey, 1992) of poverty despite poverty alleviation programmes. Mayer-Foulkes (2008:776) refers to it as a “prolonged transition”, “where the poor needs generations to access high levels of human capital”.

The developmental perspective of 'weak' poverty alleviation does not acknowledge the complementarity of poverties resulting in the expectation that an improvement of one poverty dimension can compensate for the deterioration in another dimension (Scheidel, 2013). This is implicitly the case when the developmental role of energy is seen as a single aspect acting and reacting on all other dimensions (e.g. environmental, social and economic) at a point in time. Utility patterns of this 'acting and reacting' are then used to judge that development has taken place or not. The practical expression of this view resulted in focussing attention on providing energy access to the poor as a main strategy to poverty alleviation as seen in the declarations by global organisations to provide energy for all. This view is echoed by numerous authors who link energy to education, energy to nutrition, energy to health etc. as well as calls to make energy access one of the MDGs.

The paradigm of strong sustainability posits that capital is not substitutable but rather complementary and therefore has to be maintained independently. It is essential that 'strong' poverty mitigation efforts adopt analytical tools that can deal with non-trade-off cases. An improvement in energy access to relieve energy deprivation cannot substitute for the loss of opportunities that could in turn assist in the creation of *capabilities* in the long run. Scheidel (2013: 35) aptly captures it by stating that "on an epistemological level, this requires" acknowledging "the existence of non-equivalent and incommensurable types of poverties". Scheidel continues that "on a practical level, this suggests stepping back from single, aggregate indices and to adopt rather a set of multiple indicators that inform independently about the different dimensions of poverty" (*ibid*).

The capability approach assists to move beyond the "usual normative framework of individual resource allocation" that seems to permeate energy poverty alleviation intervention programmes (Ballet et al., 2001: 1 in Martins, 2011: 1). This implies that the provision of energy is only a *means* to well-being and is not the *end* that we are looking for. The capability approach takes factors that hamper conversion of resources such as energy into real opportunities that are valued by the individual. A co-evolutionary approach enables understanding of the dynamics of energy use that has the potential to lead to 'strong' poverty alleviation. It can also be used to recognise 'uneven' development within a setting and then identify entry points and strategies to implement change. The individualisation of analysis enhances our understanding of how individuals use resources available to create *capabilities* that are valuable to them.

Higher levels of electricity access and clean cooking energy are generally associated with higher HDI⁶ scores due to a high correlation between HDI and energy access (Bhattacharyya, 2012). The role of income in formulating HDI is as a “proxy measure for the choices people have in putting their *capabilities* to use” (Rodríguez, 2010). However, income is not a capability, rather, it is an input. Rwanda and Uganda with low levels of electricity have decent HDI scores as set out in Table 3. Therefore, utilising the HDI as a single measure of development raises concerns that energy is one of many drivers of development. Further evidence is set out in

Table 4. This points to a decoupling effect as noted by Sternberger and Roberts (2010), where poor countries achieve notable advances in human development with slight increase in energy consumption.

Table 3: HDI and energy access levels for some developing countries (Source: UNDP, 2013; IEA, 2012)

Country	HDI	Access to electricity (%)	Rural electrification rate (%)
Rwanda	0.434	4.8	1.3 (source: UNDP/WHO, 2009)
Kenya	0.519	18.1	4.8
Madagascar	0.483	17.4	7.7
Uganda	0.456	8.5	2.6
Namibia	0.608	43.7	22.9
Botswana	0.634	45.4	9.9
South Africa	0.629	76	56

Table 4: Mean schooling years and electricity access for selected African countries (Source: UNDP, 2013; IEA, World Energy Outlook, 2012)

Country	Mean schooling years	Electricity access
Botswana	8.9	45.4
Madagascar	5.2	17.4
Kenya	7.0	18.1
Tunisia	6.5	99.5
Zimbabwe	7.2	36.9

⁶ The HDI as a *capability* index captures three essential components of human life: a long and healthy life, access to knowledge and a decent standard of living.

South Africa	8.5	75.8
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Kenya's mean schooling years compares favourably to that of Tunisia even though Kenya has an electricity access rate which is more than four times lower.

Electricity and energy access has the potential to provide well-being, but “whether such a potential is exercised or not depends on context, or the existing set of relationships” (Martins, 2011: 3). Technological structures do not determine human agency and thus cannot “shape the boundaries of human freedom” (Martins, 2011: 3). Oosterlaken (2011) stated that it is rather the ‘*capability space*’ that is shaped by social, environmental and technological structures. This ‘*capability space*’ that opens up is subject to uncertainty and this makes reality (i.e. end-use of energy) an open system. Hence, an analytical framework is needed that not only takes openness of outcomes into consideration but also the *nature* of the link in the energy-poverty-development nexus especially in socio-technical systems.

1.4 Refining the research topic

1.4.1 Introduction

It took 18 months to develop this research topic. The first six months involved mainly desktop research about who the San are. One question that firmly set the researcher on the path of discovery was:

“How do foragers with no money in the bank, no grain in the larder and no meat and milk on the hoof secure themselves in times of social, economic and environmental upheaval?”

The San, specifically the Ju/'hoansi (pronounced Dju-kwa-si), have been subjects of mainly anthropological research notably by Sylvain (1999 and 2002), Suzman (1995, 2000, 2001a, 2001b), Hitchcock, Bieseles and Babucuk (2009) and Hitchcock, Bieseles and Ikeya (2006) amongst others.

The Ju/'hoansi settled in the Tsumkwe area about 40 km from the Namibia-Botswana border as shown in Figure 4 in the Otjozondjupa region. The incidence of poverty in this region is above the national poverty rate of 28.7% (Namibia Statistics Agency, 2012).

The settlement was originally founded by the South African army who exploited the indigenous skills of the San for tracking as well as their intimate knowledge of the bush to trail enemy forces. This attempt to change the nomadic lifestyle of the San to a sedentary mode inadvertently changed the fabric of the Ju/'hoansi culture.

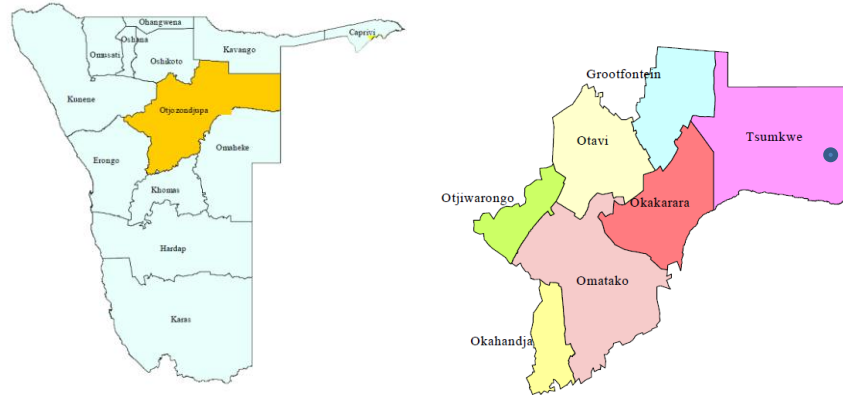


Figure 4: Location of Tsumkwe district and settlement (Source: NPC, 2001)

The San, specifically the Ju/'hoansi, forms the majority of the population of Tsumkwe, but many other tribes with their own language and culture also form part of the population. Afrikaans is the most commonly spoken language alongside Ju/'hoansi. Tsumkwe's population is difficult to measure because it is also home to migrating San that lives around the settlement. Studies done by the DRFN, noted that the population living on Tsumkwe's periphery increases the total population by two or three thousand (Ingalls, Hanlon and Eisenbach, 2009).

Tsumkwe district is divided into two sides, East and West. The Ju/'hoansi occupy the East and the !Kung the West. Although the Ju/'hoansi and !Kung speak related languages, are both San and both experience marginalisation, they are not the same group and have different historical lineages and different experiences of assimilation into the mainstream modernized society (Hitchcock et al, 2009).

The Ju/'hoansi are a particularly interesting target group because they managed to maintain most parts of their traditional lifestyle and this tenacious clinging result in almost confrontational, albeit well-meant, development interventions. The Office of the Prime Minister (OPM) coordinates development efforts aimed the San and over 25 non-governmental organisations (NGO) are recorded to be involved in developmental projects in Tsumkwe. However, despite all these efforts, their plight remains dire.

1.4.2 The human developmental discourse vis-à-vis indigenous people

The first stage of the research revolved around academic literature of what constitutes indigenous people development as the San identify themselves as indigenous or the first inhabitants.

“Indigenous peoples, in my context means: the first inhabitants of a geographical region and whose identities and cultures are inextricably linked to the land on which they live and the natural resources on which they depend.” - Job Morris (Indigenous Leadership and San values, 2011).

This stage sought to critically analyse the developmental path carved out by NGOs to highlight challenges and opportunities faced by indigenous people. To contextualise the developmental experience of the indigenous, theoretical frameworks used by indigenous academics and intellectuals are presented as well and how this framework informs research and developmental paradigms.

Developmental paradigms evolved from preoccupation with economic growth towards being people-oriented and contextualised. From here, the indigenous research paradigm was ushered into the development discourse, specifically ethno-development or development with identity. It rejects development founded on creating dependency as the main avenue to development and it operates at community level “as a process that perpetuate indigenous livelihoods locally via regeneration and strengthening of local and regional indigenous economies” (Corntassel, 2008: 119).

To understand some of the challenges faced by the indigenous people, the millennium development goals (MDG) indicators are used to compare levels of poverty between social groups. The trend is the same globally: when compared to the general population, the MDG indicators such as under-five mortality, malnutrition, literacy, net primary school enrolment and water deprivation are worse than population averages. Global development indicators such as the Human Poverty Index (HPI) and HDI for indigenous people supports the hypothesis that poverty and deprivation is most severe among this peoples and the trends over time show disconnect between indigenous people and national economies (Gundersen, 2008). However, there are dissimilarities in the experiences of indigenous groups between countries and within a specific country. Some thrive, and some appear not to.

Ample ethnographic and anthropologic studies exist for individual groups, and while these give insight to socio-cultural issues, they do not provide adequate data that can be used as “input to poverty-reduction monitoring and policy formulation” (Hall & Patrinos, 2010: 4). The relationship between being indigenous and experiencing economic inequality in developing countries has been acknowledged in development literature (Nopo, et al., 2007; Telles, 2007), however, little

investigation has been made into the techno-economic experiences of an indigenous group within a society. The majority of the work on the causes of indigenous poverty mostly documents physical and human capital disadvantages.

1.4.2.1 Indigenous people development and the capability approach

Sen's capability approach to development serves to extend existing understanding of poverty and development. Within the *capabilities* approach poverty is understood as deprivation of one or more fundamental *capabilities* that are essential for an individual to achieve minimum *functioning* within their society. As a framework it encourages us to focus on the information needed to make judgments about well-being, social policies etc. and consequently either reject or complement approaches that focus exclusively on tangible returns. The core concepts of the capability approach are *functionings* and *capabilities*. *Functionings* refer to the "beings and doings" of a person. *Capabilities* is "various combinations of *functionings* that a person" or society "can achieve" (Sen, 1992). To distinguish between the two central concepts Sen (1987: 36) states that "*functionings* is an achievement whereas *capabilities* are the ability to achieve". This essentially distinguishes capability-based approach from utility-based or resource-based developmental approaches that dominated developmental paradigms until the 1990s.

How does this approach affect indigenous people's development who are most often the poorest? Essentially, the capability approach contextualises and individualise development and thus discussion about development centres on a people's *capabilities* to function. Therefore, as an analytical tool it focus on individualisation and diversity within a social group. Research questions guided by the capability approach would consider whether the delivery of services is individualised, how much scope exists to take diversity of needs into consideration, to what kinds of (alternative) *functionings* access is being promoted, and possibly how much choice individuals have between those alternative *functionings* (Goerne, 2010). If everybody had the same opportunities to capitalise on the possession of a certain number of kWh or kgoe of energy/electricity, then one could stick with resource-based concept.

A multi-dimensional indicator of development, or lack thereof, could be valuably complemented by individualised insight supported by the capability approach to lead to 'strong' poverty alleviation. This would lead away from the measurement of averages of commonly or generally accessed benefits or services. Additionally, it would require breaking down recipients of services and benefits into sub-categories according to their different needs and risks, and address the question whether their different needs are met with differentiated, individualised

policy responses. This strategy can be expected to be especially useful either in areas where people with very different risks find themselves grouped into the same category, or, where a heterogeneous group of people with nevertheless similar risks are split up into different programmes and categories (Goerne, 2010). Hence, it is worth to investigate individualised responses/experiences rather than primarily analysing overall or average content.

1.4.3 Energy and development: measuring and focussing on what matters

The second stage of research analysed academic literature about approaches used in measuring energy access and/or energy poverty. The dominant developmental model of energy provision is focussed on achieving macro-economic growth resulting in assessment approaches and methodologies that treat consumers as a homogenous group and that assumes access means consumption. Aggregate figures masks significant disparities in energy access, consumption and benefits ensued between different social and income groups. Using a more representative measuring mechanism assists in not only improving availability of information about the impact and extend of actions but also helps in delineating and monitoring progress (Fransen et al., 2008). It also gives credibility to the effectiveness of policy implementation at national and local levels, because distributional inequities in access to energy do not happen by accident but are manifestations of exploitation based upon pre-existing institutions and socio-political structures.

Differential coverage of electricity grids as well as patterns of energy consumption partly explains disparities of energy access, hence, comparative statistics only tell part of the story of unequal energy access and its impacts. The disparity is more acutely visible and experienced between income groups within countries and between urban and rural areas as well as between socio-economic groups within a settlement. This impact of differentiated energy access is more pronounced at household level as the politics of social exclusion plays out between different social groups.

Literature that quantitatively analyse the relation between energy and development tend to look at development from an economic growth and related goals perspective. It is imperative to note here that correlation does not prove a causal relationship due to the presence of numerous drivers involved and, attempts to locate causality between energy and economic development provide mixed and conflicting results (Lee, 2005; Bhattacharya, 2004). Pachauri et al. (2004) describes it as an ambivalent relationship.

There is little historical evidence on a macro-level to prove causality between expanding energy access and development and poverty reduction (Saghir, 2005), however, Kanagawa and Nakata (2008) found that the consumption of electricity correlates with both the GDP and HDI. Countries with high per capita energy consumption achieve more economic activities and thus a higher HDI. Similarly, Ghali and El-Sakka (2004), Khandker et al. (2012) and Egoh et al. (2011) established that per-capita energy and electricity consumption correlates with economic development. The latter conducted an empirical study in 21 African countries for the period 1970 to 2006 and found that a “decrease in energy consumption decreases growth” (Egoh et al., 2011: 7419).

Niu et al. (2013) used electricity consumption as an indicator to reflect the level of development in a country and posits that the utilisation of electricity “not only releases people from hard work, but also saves much time for people” (*ibid*: 338) particularly the disadvantaged that spent hours collecting fire wood. Thus, time is freed up for people to engage in economic activities.

In 2010, the UNDP published the first non-income HDI, which is computed as the “value of the HDI computed from life expectancy and education indicators only” (UNDP, 2013: 147). Table 5 outlines both types of human development indices as well as per capita electricity consumption for selected developing countries.

Table 5: HDI, non-income HDI and electricity consumption per capita (Source: HDR, 2013; World Bank, 2013; IEA, 2012)

Country	HDI	Non-income HDI	Per capita non-residential electricity consumption (kWh per capita)	Per capita residential electricity consumption (kWh/capita)
Rwanda	0.434	0.476	20.26 (Source: CIA World Fact Book, 2012)	0.01
Kenya	0.519	0.588	155	0.04
Madagascar	0.483	0.601	46.9 (Source: CIA World Fact Book, 2012)	0.02
Uganda	0.456	0.511	70.0 (Source: Energypedia, 2013)	0.01
Namibia	0.608	0.611	1549	0.73
Botswana	0.634	0.596	1617	0.36
South Africa	0.629	0.608	4803	0.72

A comparison of the non-income HDI and per capita consumption of, for example, Madagascar, Namibia and South Africa shows that some countries managed to achieve the same or better non-income HDI with low per capita electricity consumption. Additionally, Figure 5 illustrates a decoupling between development and economic energy⁷ use especially for Rwanda and Uganda whose HDI scores are favourable if compared to Madagascar that has higher economic energy use.

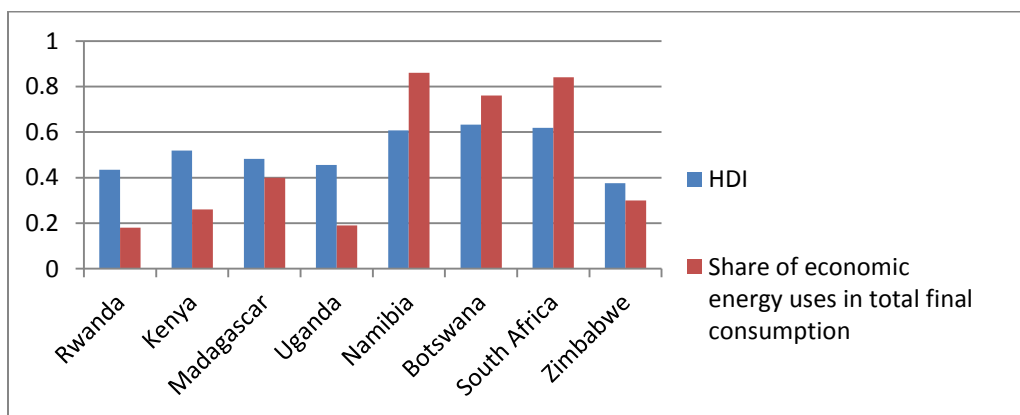


Figure 5: HDI and share of economic energy uses in total final consumption (source: IEA, 2012 and UNDP, 2013)

Hence, there is a non-linear relationship for poor countries that achieved significant human development with slight increase in energy consumption. Another non-linear relationship is highlighted in Table 6 showing Madagascar with only 3% access to clean cooking energy has a decent life expectancy compared to Namibia, Guyana and Trinidad and Tobago.

Table 6: Life expectancy and access to clean cooking fuels for selected countries (Source: UNDP, 2013; IEA, 2012; WHO, 2010)

Country	Life expectancy (years)	Access to clean cooking energy (%)
Madagascar	66.7	3
Trinidad and Tobago	70	>95
Guyana	70.1	89
Namibia	62.5	43.3

⁷ Economic energy use includes sectors such as industry, transport, services, agriculture/forestry and fisheries and excludes residential energy use and own use by the energy sector.

1.4.4 Analytical gaps in measuring and monitoring energy access

The consumption of energy is perceived to offer attractive and desirable outcomes that can be tapped by the poor to improve livelihoods. In the energy discourse, poverty is studied in relation to energy access, energy use, the natural environment and sustainable development. Thus, the discourse about poverty is actually dealing with different 'poverties' rather than poverty (Max-Neef et al, 1989 in Scheidel, 2013). For example, the often quoted figures of 1.2 billion people without access to electricity and almost 2.8 million people depending on solid fuels for cooking is indicative that there are energy poverties and that there are two dimensions of energy poverty. Which of these two dimensions deserve greater emphasis or priority? If the number of people with no access to electricity decrease has energy poverty fallen overall?

Two current practices of measuring energy poverty are the MEPI by Nussbaumer (2012) and energy development index (EDI) (IEA, 2012) that use composites. These indices are for cross-country level comparisons on the nature of energy poverty. The latter (EDI), designed by the IEA, serves to better understand the role energy plays in human development by tracking a country's or region's progress towards the use of modern fuels. However, the EDI⁸ still uses indicators based on physical access to energy (Bazillian et al. 2010). Khandker et al. (2012) observed that only one of four indicators used in the EDI is related to energy access and the rest are based on economic measures. Thus, even though the EDI is a multi-dimensional measurement tool, economic measures tend to dominate in its composite indices. Four indicators are selected that emphasise physical access. At the household level, the focus is on two key dimensions, that is, access to electricity as well as access to clean cooking facilities. At community level, per capita public services electricity consumption is the public service variable and the share of industry, agriculture, services, transport and other sectors constitutes the productive use variable. These four indicators constitute the EDI.

The MEPI⁹ is based on the concept of multi-dimensional poverty and is used to evaluate energy-related deprivations as well as determinants of energy poverty. The index comprises of two components: a measure of incidence of energy poverty and a quantification of its intensity (UN-Energy, 2013). The objective is to provide evidence-based information as an input to

⁸ An EDI score of 1 indicates a balanced contribution from all indicators, that is, share of population with electricity access and per capita residential electricity consumption as well as share of modern fuels within the residential sector. Other indicators at community level are per capita public sector electricity consumption and share of productive use in total final consumption.

⁹ Countries are classified according to the degree of energy poverty. A MEPI score of more than 0.7 indicates acute energy poverty and less than 0.3 a low degree of energy poverty.

policies that addresses energy poverty. The application of the MEPI to Namibia showed that in 2011 the country scored 0.53, however, the score was readjusted in 2013 to 0.47 (Nussbaumer et al, 2011; Nussbaumer et al, 2013). However, this masks the experience of the San and those trapped in poverty. For the poorest, electricity is less important; however, when it comes to multidimensional poverty analysis, it gains prominence. The focus of MEPI and EDI is on “how” to measure and not on “for who is the energy services provided for”. If the tool is be used to track progress of a country towards energy access then it is as important to measure from an end-user’s perspective for a more complete energy access and energy poverty snapshot.

By using the EDI and MEPI, the role that energy plays in human development can be better understood because these two indices are complementary and synergises with the HDI (Bazillian, 2012). The EDI measures progress towards modern fuels and the MEPI measures energy poverty. Specifically, MEPI measures deprivation as opposed to access as well as quantifies incidence (how many people) and intensity (how energy poor) of energy poverty. The EDI is useful to track a countries progress towards modern fuels and modern energy services, and, even though Khandker et al (2012) critique economic dimensions dominance, it does assist in better understanding the role of energy in human development as important additional indicators, such as productive use of energy, are included.

Table 7 sets out the EDI and MEPI as an attempt of providing a snapshot of energy situations across countries.

Table 7: Comparison of EDI, MEPI and HDI (Source: IEA and WEO 2012; Nussbaumer, 2013)

Country	EDI	Multidimensional Energy Poverty Index		
		MEPI	Headcount ratio	Intensity of energy poverty
Rwanda	0.06	0.88	1	0.88
Kenya	0.10	0.73	0.92	0.79
Madagascar	0.12	0.84	0.99	0.85
Uganda	0.07	0.87	1	0.87
Namibia	0.46	0.53	0.67	0.79
Zambia	0.14	0.74	0.84	0.87
Zimbabwe	0.19	0.66	0.72	0.92

The significantly lower MEPI score for Namibia, in comparison to other sub-Saharan countries, can be ascribed to a much lower headcount ratio, that is, fewer people are energy poor whereas

the intensity of energy poverty is not markedly lower. Even though Zimbabwe has a better MEPI score compared to Kenya, the intensity of energy poverty is more severe in Zimbabwe despite a higher headcount ratio for Kenya.

The HDI and MEPI can be compared to gauge the strength of the energy-development assumption. There is a negative correlation between these two indices as shown in Figure 6 showing a strong link between the two indices.

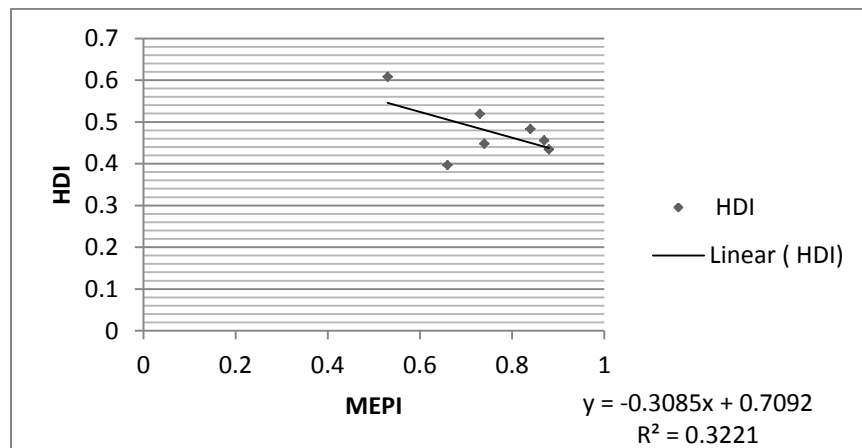


Figure 6: MEPI and HDI comparison of selected African countries (Source: Nussbaumer, 2013; UNDP 2013)

The MEPI moves away from counterfactual analysis of energy access of “have access/don’t have access” stance by giving information about the nature of energy poverty in a country. However, there is a question that the source, even though Bazillian (2012) claims it is sourced from micro-data in the form of surveys, from which indicators were derived (demographic and health survey databases) hides the reality on the ground as it aggregate a heterogeneous population. Birol (2007) in Sovacool et al. (2012: 715) argued that far less attention is given to the world’s poorest people in energy-economics. Therefore, how do we capture the experience of the poorest in relation to energy services?

Kusek and Rist (2004) posits that data captured serves to bring to the fore pertinent energy related issues as well as capture trends in energy consumption as determined by those who use it, that is, contextualised data captured in a specific space and time. Nissing and Blottnitz (2010) reiterated and echoed Bhattacharyya (2012) by stating that energy access data will be influenced by different contexts, the operationalisation of energy access and energisation. Thus, the underlying context is important as this will help policy makers to arrive at specific

targets and interventions to address special needs of a social group. One way is to use qualitative and quantitative methods to widen the scope of impact assessment.

The focus of energy at the point-of-use gives insight on commonalities and differences showing how the poor use, access and value energy. This bottom-up approach has the potential to inform policy makers as statistics do not reflect well how the poor use energy and it gives a voice to the people at the bottom of the pyramid. The Ju/'hoansi have been locked into poverty for too long, and research that has given them a platform to act on their own behalf proved to be successful (Hitchcock, 2009) and it is the hope that this research can contribute to establishing a similar platform for the Ju/'hoansi. Their testimonies are a crucial part of constructing an energy ecosystem as an attempt to identify and recognise entry points to alleviate energy poverty. The focus is on empowering people to achieve and define their own well-being (Mahat 2008; Chambers 2005) and not to transform the perceived underdeveloped into the developed. It is a major challenge to enhance energy access for the poorest and Pachauri and Cherp (2011) opined that there is a need in energy policy and policy analysis to institute an effective data collection system to appraise progress of such interventions. Namibia has a number of remote settlements with similar socio-economic characteristics as Tsumkwe, and, therefore, lessons learned from this study have the potential to be used to evaluate the impact of such interventions and make necessary policy adjustments.

1.5 Significance of this study

Sub-Saharan Africa has the least overall electricity access rate with less than 31% of the region electrified (IEA, 2011). The Desert Research Foundation of Namibia (DRFN, 2011 in Baker et al, 2011), found that only 13% of rural households in Namibia have access to electrical power compared to 80% urban households. National averages of biomass use shows that about 90% of rural households use wood, charcoal, coal and animal dung for cooking (NHIES, 2007). In Tsumkwe, 89.6% of residents were found to use wood or charcoal from wood as sources of energy for cooking, 0.1% use solar stoves/ovens and 3.8% use electricity (NPC, 2001).

The plight of the San was the main motivating factor when funding and support for the TEP was sought from the national government and international donor agencies (DRFN, 2006). The overarching objective stated in the grant application for funding by the DRFN to the EU was “to contribute to the reduction of poverty by providing an *enabling* physical infrastructure that is required to support increased and diversified socio-economic activities amongst the San people

of Namibia” (DRFN, 2006: 5). The socio-economic traits of the San and that they form the majority of the population made Tsumkwe the prime candidate for such a project.

The White Paper on Energy of 1998 is the guiding document for energy policy framework in Namibia. One of the main themes in the policy is the link between energy and economic development, hence the emphasis on social upliftment as well energy access for households.

On the 25th of January 2012, the European Union and the Government of Namibia inaugurated a solar-diesel hybrid electricity system to provide 24-hours stable electricity.



Figure 7: The inauguration plate for the Tsumkwe Solar-diesel Power station

The plant has 916 solar panels each rated at 240 watts and was set-up at a cost of R26 million of which the bulk (N\$24 million) came from the EU.



Figure 8: The solar field of the Tsumkwe Hybrid Solar-Diesel power station

The Tsumkwe energy project is posited as a pilot project aimed at improving access to modern energy services for poor, marginalised people in a remote or rural setting and therefore it provides a case study on appropriate delivery mechanisms for a comprehensive large-scale roll-

out of renewable energy technology and energy efficiency in Namibia. It is assumed that through increasing access to electricity and energy, the local community, in particular the San, will now have improved opportunities for small- and medium enterprise (SME) development and the diversification of income generating activities. In addition, the Tsumkwe Energy Supply Company (TESCo) will be established as an independent power producer (IPP) as well as the Tsumkwe Energy Trust in which the Tsumkwe community through its elected representatives and cooperation agencies, will be responsible for electricity production and consumption. TESCo will ensure that revenue generated is re-invested (DRFN, 2008).

TEP's main revenue is generated through the sale of electricity to the various customers as outlined in Table 8.

Table 8: Proposed tariffs for TEP customers [Source: Tsumkwe Business Plan (final draft 6 June), 2011]

Customers	Description	Envisaged tariff (N\$ ¹⁰ /kWh)	Implemented tariff (N\$/kWh)
Commercial users 1	Larger, more mature businesses	3.92	1.50
Commercial users 2	Smaller, immature businesses	3.14	1.50
Institutional users	Government facilities	5.30	1.50
Residential 1 users	Higher income earners	2.75	1.50
Residential 2 users	Lower income earners	2.37	1.50

The business plan sets out a stepped tariff structure whereby institutional and high level commercial users cross-subsidise poorer households and smaller businesses. Households were further disaggregated between higher income earners that are required to pay 70% of the N\$3.92/kWh generation and distribution costs while lower income earners are required to pay 60% of the cost. Tariffs before TEP were set at “unsustainable levels” of N\$1.90/kWh for credit meters (mainly institutions) and N\$1.00/kWh for prepaid customers. The generation cost then was N\$6.00/kWh and it was dominated by fuel cost for the generators followed by operation and maintenance of the generator. The tariff for 2013 is N\$1.50, up from N\$1.00 in 2011 and 2012.

¹⁰ One Namibia dollar (N\$1) is equivalent to one South African Rand (R1)

The reduction in the generation and distribution costs is a noteworthy encouraging outcome of the project; however, the current tariff is 61.7% below the generation costs.

The introduction of the system and appropriate thermal energy sources in Tsumkwe is anticipated to establish and enhance sustainable livelihoods. Energy efficiency interventions included the replacement of over 80 electric stoves with gas stoves, instalment of 80 solar water heaters, pre-paid electricity meters and compact fluorescent lights (CFLs). An energy shop would stock and sell approved energy products in order to cater to the needs of private end-users.

An end-user performance analysis of energy provision programmes and policies enables policy designers to track and monitor progress of developmental programmes aimed at reducing poverty. The end-users in this research are residents of Tsumkwe. This research builds upon the many ways of evaluating energy access impact in order to unpack experiences of the poorest with regard to energy provision.

An evaluation done by Namibia's National Rural Electrification Programme (NREP¹¹) found that rural electrification was successful in stimulating the "local economy" as well as improving the quality of life of many rural dwellers. There is no specification whether the "local economy" is at national, regional, community or household level. Also, in what ways was the quality of life improved? Current approaches to determine success of policies are largely based on energy provision and these policy outcomes are then used to direct the next step (Ndhlukula, 2012). The missing ingredient in Namibia's energy sector is an end-user based analytical framework. What is the situation after the 2012 implementation of TEP and related energy efficiency strategies?

¹¹ Emcon Consulting Group. (2008). *Impact Assessment of Norad-Funded rural electrification interventions in Northern Namibia*, Norad Collected reviews 1/2008, Oslo.

1.6 Research objectives

The assumption made by the TEP approach towards poverty alleviation is set out in Figure 9:

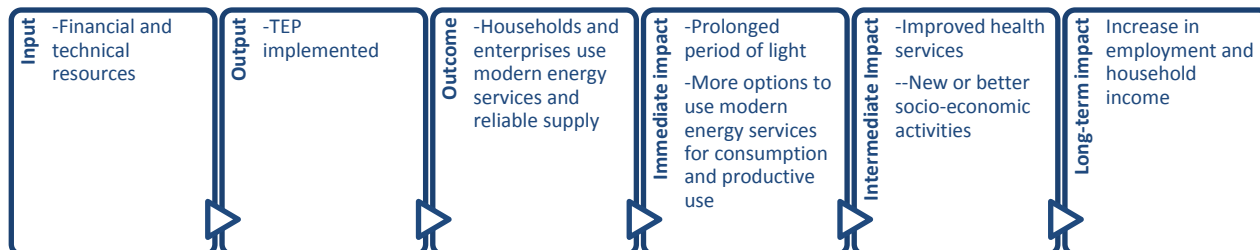


Figure 9: Implementation and intervention strategy of TEP

Hence, the objectives of this research are to:

- Evaluate socio-economic impact of TEP on the livelihoods of Tsumkwe residents specifically the Ju/'hoansi. The rationale is to move away from dualistic impact analysis towards viewing energy access as a continuum.
- Use the capability approach as a springboard for energy policy analysis with regard to potential offered by *place* in Namibia in order to identify what works and why.
- Scrutinise the relation between the existing poverty trap among the San and energy poverty, that is, is there any evidence of an energy poverty trap that can lead to an energy poverty penalty?

The research questions to be explored are:

- What is known or not known about the link between energy access, energy poverty and poverty alleviation in Tsumkwe?
- What is intermediate impact of TEP and how does this impact on the long-term objectives in terms of poverty alleviation and sustainability?
- What is known about consumptive and productive use of electricity in Tsumkwe that has the potential to lead to poverty alleviation?

1.7 Research approach

1.7.1 In search of a research paradigm

The complex nature of energy access, energy poverty, development and poverty warrants a paradigm stance that involves “mixing or combining quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study” (Johnson & Onwuegbuzie, 2004: 17). A monomethod approach that focuses on either qualitative or quantitative data is inadequate to directly “engage the complexity encountered” (Mertens, 2009: 10) when analysing the interactive link of energy, poverty and development. Therefore, a mixed-method approach forms the methodological basis in this research by using both “numeric information as well as text information so that the final database represents both quantitative and qualitative information” (Creswell, 2003: 20). Gorard (2004: 7) states that quantitative and qualitative data are complementary in that numbers can be “persuasive to policy makers whereas stories are more easily remembered and repeated by them for illustrative purposes”. Thus, the researcher is able to generate databases that “include information that has both depth and breadth” (Tedlie and Yu, 2007: 85).

The transformative paradigm “allows the application of both qualitative and quantitative research method” (MacKenzie and Knipe, 2006). Furthermore, this paradigm is a “meta-physical framework...that focuses on strengths that reside in communities...” (Mertens, 212: 3). One example of a developmental project that used this paradigm is the production of curriculum materials, a practical orthography, dictionary etc. of the Ju/'hoan language. A group of computer literate Ju/'hoan people have been trained as transcribers using solar- and part-time electricity powered laptops. In 2009, the Ju/'hoan folk tale book entitled: “*Ju/'hoan Folktales: Transcriptions and English Translations*”, was published. By the end of 2010 several hundred sound files ranging from folklore, oral history and healing narratives to records of local meetings were completed. This is aptly illustrated in the extract by Job Morris:

“We are not poor. Each one of us is a uniquely gifted person that can and wants to contribute to the lives of other people...The hunter's trophy becomes a gift to everyone in the community. Sharing with other people brings real happiness to us.” - Indigenous leadership and San values, 2011.

In such a society, man is satisfied as an end unto himself and others through relations. The question of energy access here is in relation to translating a society into a technical machine

that uses energy towards the satisfaction of an externalised end. Today, the Ju/'hoansi participate in a necessarily mixed economy of hunting and gathering as well as the cash economy within the context of capitalism and globalisation. This resulted in a socio-economical contradiction between the traditional egalitarian ethos emphasizing sharing, and the capitalistic nature of accumulation. Two schools of thought emerged in the 1980s from research done on the Ju/'hoansi. The incompatibility of these contrasting systems created a miasma of moral, spiritual, environmental and socio-economic decay.

1.7.2 The transformative paradigm

The development of mixed-method research approach came about over the past twenty years to complement existing mono-method approaches. Parallel to this development, the “search for an appropriate paradigm to provide a legitimation of the use of mixed-methods” developed (Hall, unknown). Mertens (2012) recognises that the transformative paradigm built on Guba and Lincoln (2005) early work and it has gained popularity as a third methodological movement in the last decade (Cameron, 2011). It has become an increasing methodological option for researchers (see for example Teddlie and Tashakorri, 2009; McKeon and Clarke, 2004; Onwuegbuzie and Dickinson, 2008; Pollon and Russel, 2008; Lee and Green, 2007; Onwuegbuzie and Collins, 2009). Combs and Onwuegbuzie (2010) analysed articles that used mixed-methods as an attempt to develop a meta-framework for mixed analysis techniques.

The search for a research paradigm was done against the backdrop of folklores of the San.

The philosophical postulates of the transformative paradigm include axiology, ontology, epistemology and methodology. In short, axiology refers to the significance of respect of and understanding the meaning of cultures and way of life:

“While a hunter’s child grows up, he is first taught to shoot using arrows that are harmless. It is only after he has proved that he has the skills of a proper, responsible hunter that he can be allowed to use the famous arrow of the Ncoa khoe.

Presenting his own personal arrow, a poisonous and fatal arrow even by a prick, as a gift is the utmost respect a man can pay to his child.” – Job Morris (Indigenous leadership and San values, 2011).

Presenting a poisonous arrow may be interpreted as giving a knife to a child which is frowned upon in some cultures. Mertens (2012: 4) suggests that the axiological assumption requires a researcher to “employ culturally and contextually appropriate methodology” that draws from the strength of community.

The ontology assumption recognises the uniqueness of culture and recognises that different versions of what is perceived to be real exist:

“Today it takes courage to survive people that think your own culture is inferior to theirs.

It takes courage to say NO to taking more than what you need. To live with courage is much more than needing to have power and control over your surroundings. – Job Morris (Indigenous leadership and San values, 2011).

Two schools of thought emerged in the 1980s from research done on the Ju/'hoansi. The Kalahari Debate (Hitchcock, 2009) discussed these two perspectives: one that the Ju/'hoansi are largely hunters and gatherers that are living under changing conditions but maintains an ancient but adaptable way of life and the other perspective that they have been greatly affected by “increasing interaction over time with other groups and by their incorporation into a global system of production, consumption and distribution” (Hitchcock, 2009: 176).

The interrogation of multiple versions of realities is of utmost importance. Which version of ‘poverty’ reality provides an understanding that will lead to ‘strong’ poverty alleviation? This requires exploring strategies to determine and evaluate multiple versions of reality, the issues related to those accounts and the making visible of the potential for (social) change connected with those different accounts of reality. Which definitions are meaningful in the particular context the research is conducted?

Nothing is freer and more fulfilled than this little bird – the Honey guide. If you know how to listen, you will hear that it calls you and that it tells you that it has found good honey that it wants to share with you. If you follow it you will soon find the honey. It is teaching us to share things with each other and to help each other. But you must not take all the honey...leave some for her

*so that she too must take to her little chicks” – Job Morris
(Indigenous leadership and San values, 2011).*

The epistemology postulate involves understanding socio-cultural and historical contexts as well as relationships that recognises power differences and trust. The role of the researcher is that of being supportive and reflective.

*“Most animals trek to follow the rain. They trek great distances where there are droughts to find food and water, it can become impossible to find meat for the people. Except for the steenbok. This little animal always remains home. It is always able to find enough water and plants to stay alive and to feed its children. When there is nothing else you can always trust that the steenbok will provide food for you and your children. There will be skins for blankets and strings for making bows and arrows and carry bags. One can only walk into the unknown when you know the people around you are trustworthy. Only when you trust someone can you walk into the desert to find water you were told would be reached at a specific place and time” - Job Morris
(Indigenous leadership and San values, 2011).*

This postulate requires the researcher to constantly be aware of the “complexity of building trusting relationships” (Downey, 2009 in Mertens, 2012). For the Ju/’hoansi, productive forces encompass social and technical relations of production and these constitute a historically specific mode of production which placed the application of human labour at the centre of development. However, capital (for example funding) is viewed as independent from other productive forces. This culminates in the notion that capital buys labour and gives it power to command human energy and labour-time. When inanimate things exert autonomous power over people, capital becomes increasingly more important than human cooperation and it devalues human labour and it can lead to abandonment of or half-hearted engagement in projects. Therefore, historically, intervention programmes/projects implemented to alleviate hardships faced by the San are not very successful.

The methodological assumption cogently follows the three other assumptions. The qualitative dimension in “methodological assumptions are critical in transformative research and evaluation

as a point of establishing a dialogue between the researcher and the community members” (Mertens, 2012).

“We have a long relationship with the eland - this most elegant of animals, the one that talks with its eyes. It tells us never to give up because the time of abundance will come again.

A most important dance is called the Dance of the Eland. It is dedicated to our women and symbolises times of healthy people, good rains, and lots of food.

Development must be seen from a healing perspective....every project must lead to better relations, an improved environment and better quality of life for all” - Job Morris (Indigenous leadership and San values, 2011).

Methodological choices are made cognisant of contextual and historical factors. The researcher is required to start with qualitative data collections moments to learn about the community and starts to create trusting relationships. Quantitative data from existent sources can then supplement qualitative data obtained. The implication is that data collection was not a once-off event, but it was rather iterative with data feeding into subsequent decisions how to use information to move research to the next level. Traditionally, data analysis and conclusions drawn from data is usually done without involving research participants. The researcher then attempts to draw parallels, establish and identify links as well as draw inferences based on data collected. However, the transformative paradigm methodological assumption has implications for every aspect of the research process, hence; the infusion of this paradigm’s assumptions at every step of the research process is also applicable during the analysis phase.

The need for a nuanced approach in conceptualising energy access and energy poverty has been established by Sovacool et al (2012). The transformative paradigm that supports a mixed-method methodology “provides the transformative research structure for the development of more complete and full portraits of our social world through the use of multiple perspectives and lenses” and allows “for an understanding of greater diversity of values, stances and positions” (Somekh and Lewin, 2005: 275). Combining qualitative and quantitative research techniques is not peculiar in this research. The approach has been used extensively in social impact research (Mertens, 2009).

1.7.3 Mixed-methods: Capability approach and the transformative paradigm

The capability approach, as a human development paradigm, was used as the normative foundation in the design of research instruments because it is an “explicit reminder that the distribution of resources is not a good indicator for assessing well-being states or policies directed at influencing them” (Goerne, 2010: 12). Maintaining the focus on human diversity, attention is directed to individualisation and primarily investigate questions whether resources are directed appropriately, taking the needs of the individual into account. Furthermore, the capability approach, much like the ontology assumption in the transformative paradigm, postulates plurality of approaches to research design. The overlap between the transformative paradigm and the capability approach is set out in Table 9.

Table 9: Central components in the transformative paradigm and capability approach

Central components	Transformative paradigm	Capability approach
Multidimensionality	√	√
Central role of freedom	√	√
Multidisciplinarity	√	√
Complementarity	√	√
Justice	√	√
Human diversity	√	√
Incompleteness	√	√
Value judgements	√	√

The emphasis on individualisation in the capability approach is off-set by the methodological assumption of the transformational paradigm that emphasise the community. Moreover, all research instruments, be they qualitative or quantitative, result from the same theoretical framework, hence, they can be utilised and analysed in relation to each other. The mixed method approach directed data collection as well as the preliminary research effort resulting in focusing on generating data that is representative of patterns of energy use in Tsumkwe.

1.8 Research design

1.8.1 Finding space in Tsumkwe

Tsumkwe is a haven for researchers so much so that it can be seen as a remote social laboratory. Before the implementation of TEP, the Worcester Polytechnic Institute (WPI) in conjunction with the DRFN conducted a number of research projects related to energy and energy use. The objectives of these theses ranged from a socio-economic impact evaluation (Ashton et al., 2012), an assessment of water supply and sanitation (Diemand et al., 2010) to energy skills assessment (Eisenbach et al., 2009). Other theses dealt with the role of knowledge and power structures (Emmel, 2011) and the resettlement and resource conflicts (Hitchcock, 2012) amongst others¹². For such a small, isolated area, it was quite possible that the people of Tsumkwe, specifically the San, might be research averse. The researcher initially selected a very small sample of five people to collect quantitative data and three people from the same sample to collect qualitative data by conducting semi-structured interviews.

Getting to and around Tsumkwe involved overcoming quite a number of obstacles including those depicted in these pictures.



Figure 10: Getting in and around Tsumkwe

1.8.2 Sampling

The capability approach created a conceptual space of how to select samples to obtain both qualitative and quantitative data. The sampling strategy utilised the probability and purposive techniques. Quantitative data was obtained through probability sampling and qualitative data through purposive technique. The rationale was to achieve representativeness (breadth) as well in-depth information. Other reasons for using probability sampling was to generate a sample

¹² For a synopsis of anthropological research, see Hitchcock, R.K., Biesele, M. and Babchuk, W. 2009. *Environmental Anthropology in the Kalahari: Development, Resettlement, and Ecological Change among the San of Southern Africa*. Explorations in Anthropology (9): 2, 170 – 188.

that can address research objectives by selecting cases that are collectively representative of the population of Tsumkwe. The focus in this technique was numeric data. Purposive sampling generated a sample that addressed research objectives qualitatively. Cases were deliberately selected to address specific purposes related to research questions. The focus was on narrative data to gauge the experience of people after the implementation of the solar-diesel plant. Another important consideration during the sampling process was to generate quantitative data in order to increase external validity as well as generate qualitative data to transferability (Tedlie & Yu 2007). Figure 11 shows the physical position of the Damara and Gauteng locations from where the sample was selected. SME owners are in located in Central Tsumkwe from which purposive sample was generated

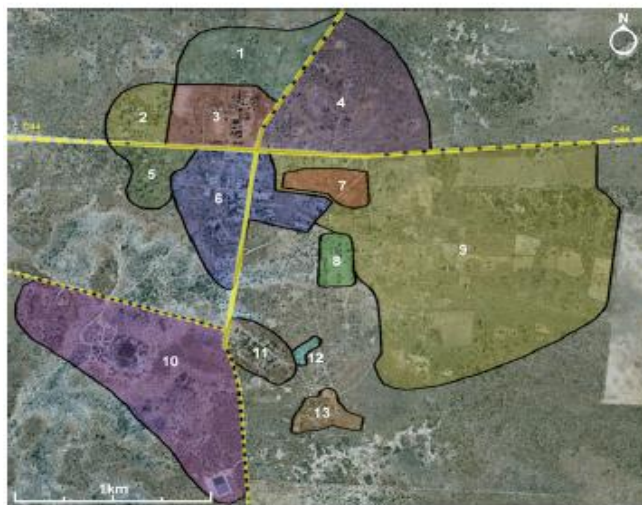


Figure 11: Various residential locations in Tsumkwe (Baker et al. 2011)

- | | | |
|----------------------|------------------------------|-------------------------------|
| 1. Tsumkwe North | 6. Central Tsumkwe | 10. Tsumkwe South |
| 2. Damara Location | 7. Herero Location | 11. Local Government Location |
| 3. Schools | 8. Sewe Huise (Seven Houses) | 12. MET Housing |
| 4. Tsumkwe Northeast | 9. Owambo Location | 13. Ilharas Location |
| 5. Gauteng Location | | |

The Damara, Gauteng and Ilharas locations each contain roughly seven to thirteen households. The San makes up the majority of these locations living with large extended families. The Seven Houses location originally contained seven houses that the government built for the San traditional authorities. The number of houses in this location increased to nineteen and is

populated by a diverse group. Central Tsumkwe contains mostly the businesses and few households while North and North-East houses a wide variety of ethnicities and various types of households. The local government and housing ministry's offices, which also serves as the administrative authority, are located in the Local Government location and the houses here are generally larger, suggesting that the wealthier people of Tsumkwe live here. A cluster of houses that the Ministry of Environment and Tourism (MET) provides its employees are in MET Housing location; South Tsumkwe contains a mining camp, the Tsumkwe Lodge and the oxidation pond.



Figure 12: Ministry of Regional and Local Government and Housing office

Most of the probability sample was taken from the Damara and Gauteng locations and purposive sample from SME owners operating from central Tsumkwe.

Both sampling techniques were used concurrently as this allowed the researcher to “triangulate results from the separate quantitative and qualitative components” (Crosswell et al., 2003: 229) thereby allowing confirmation, cross validation and corroboration of information.

1.8.3 Semi-structured Interviews

“The fire circle at night is where we expose our souls and where we can reach out to the fears and joys of one another. This is where most of the stories are told. Here we get the news and here we heal our sorrows. Fire circle is the symbol of the combined

wisdom of our people.” Job Morris, (Indigenous Leadership and San values, 2011).

As an outsider, the researcher identified a connection point in Tsumkwe. A teacher for Physical Science resigned from the secondary school and an opportunity opened up to teach and through this, a parent who owns and operates a hair salon located in the Craft Market in central Tsumkwe was identified as a potential participant. The selection of this particular SME owner was both random and deliberate. A survey conducted prior to the installation of the hybrid plant (Schultz, 2005) revealed expectations by SME owners of benefits that would arise from the TEP. The SME owner was part of the study conducted in 2005. This space-time continuum analysis allows monitoring and tracking of changes to assess and estimate changes in the situation of people.



Figure 13: Connecting with people in Tsumkwe

The interview process was used to gather narrative data from participants about their experiences pre- and post-TEP. The neighbouring SME next to the hair salon is a take-away and was also interviewed. The last interviewee was an institutional worker at the local secondary school who has an illegal connection of electricity and runs a micro-business from her house.

Results from these interviews impacted on quantitative data gathering instruments that were refined to better reflect context. A recorder was the sole means for collecting and storing data for later translation and transcription. This was done so that the flow of conversation was not interrupted through note-taking and also because the interviews were conducted in a local vernacular (Oshiwambo) as well as Afrikaans. The purpose for the interviews was to

individualise anticipated potentialities that are created and realised by energy access. Therefore, it entailed gathering information about functionalities hampered or enhanced by the provision of energy access. In addition, the researcher focused on intrinsically valuable aspects of energy provision in order to identify transformation over time. Two questions formed the skeleton of the interviews:

1. The first question was to complete this sentence by the interviewee:

Having received an electricity connection in my house, I think my options/opportunities created/hampered are... or what are you doing different after the implementation of TEP?

This question was aimed at giving a sense of self-evaluation of *capabilities* arising from increased energy access. What are the materialised options of a household or individual?

2. The second question explored *functionings* related to energy access.

What was the impact of provision of electricity in your household and/or business?

Functionings takes individual variation into consideration and recognises that different people/social groups require different commodities to achieve the same *functionings*.

1.8.4 Energy Access and Household Profile Questionnaires

This study relied on multiple sources of evidence and focused on the end-user's perspective, and therefore standardised questionnaires and direct interview methods were used. The household profile questionnaire dealt with socio-economic dimensions of energy access whereas the energy access questionnaire explored how energy access is translated into *functionings/capabilities* over the course of one year (2012 – 2013). The empirical work took place over the course of 4 months (April – July). The sample was selected based on information garnered from interviews.



Figure 14: Completing a questionnaire

Because development is viewed as a process to expanding freedoms or choices that are valued by people, a key aspect was to measure energy access in a manner that is comparable over space and time. Therefore, energy access was correlated with opportunities that are deemed to emanate from stable energy provision. Energy poverty dimensions may be causally interconnected with socio-economic aspects and thus the questionnaire contained the following indicators:

- Household composition/demography
- Education and literacy
- Economic activities including sources of income and
- Type of activities supported by electricity and energy

These are tangible indicators, and in addition, non-tangible indicators such as the perception that TEP improved economic activities in Tsumkwe were also included. The education section focused on all levels of education; be it formal or informal of the head of household as well as other adults within a household. Economic activities focused on types of jobs, duration of employment, nature of employment and in which industry. The last section under economic activities sought to identify the type of businesses (and jobs) that are in Tsumkwe, how many people it employs as well as how long the business have been in operation.

1.9 Limitations

Tsumkwe residents have been targets of a number of researchers which seems to have created community apathy. Consequently not many people were willing to participate and hence the sample size was small. Of the sixty questionnaires, only 20 were completed. One major reason given by residents was that researchers come and do research and nothing come of it.

The use of semi-structured interviews to gain views about TEP means that views expressed are subjective. Furthermore, the household level questionnaire overlooked dimensions such as intra-household and community factors that are also important in well-being of an individual household. Another limitation is whether a few questions are adequate to capture the complex nature of energy access and use.

To get a more comprehensive scope of the potential of socio-economic impact of TEP, impact data should be collected over a relatively long period after completion of a project. This was not possible in this research due to the limited time available.

1.10 Thesis outline

This study is outlined as follows:

Chapter 2 critically evaluates literature related to impact analysis that revealed a dualistic approach towards assessing success or failures of intervention programmes in low-income and developing countries. Impact analysis with regard to energy access largely ignores indigenous people's experiences by relying heavily on quantitative data sets. This chapter connects the capability approach with impact analysis through individualised impact analysis and this fits in well with indigenous developmental experiences.

Chapter 3 review the energy and development link by using Sen's development as freedom as a foundation. Namibia's development documents as well as energy policy fall short in terms of development as freedom.

The transformative paradigm is the theoretical framework that connects indigenous impact analysis, capability approach and development is presented in chapter 4.

In chapter 5, results are presented and analysed by using data obtained in this research and connecting it to previous researches in order to connect time and space as well as create an energy access continuum for Tsumkwe.

Concluding arguments as well as suggested areas for future research are contained in chapter 6. Furthermore, a continuum energy access visualisation for Tsumkwe is presented as an attempt to move away from dualistic impact analyses.

Chapter 2: Literature review - Energy access impact analysis

2.1 Introduction

The objective of this literature review is to offer a synopsis of literature and reports vis-à-vis the impact of (renewable) energy interventions on the livelihoods of end-users, that is, individuals, households and small and micro enterprises in rural and remote areas in sub-Saharan African communities. These anticipated impacts are obtained from policy documents and programme reports. The following macro-variables are excluded: the effects on climate, people's health and education, the energy market and economic growth. Therefore no findings on these subjects will be presented.

Impact analysis of energy access and development largely focuses on quantitative variables. In order to determine success of an energy-related intervention, outcomes such as an increase in income, an improvement in income-generating activities or an increase in employment are used. For example, the displacement of traditional energy carriers is linked to improved household income, thus, income is used as proxy to measure adoption of new/better fuels and technologies.

Literature sources were selected using keywords related to renewable energy sources as well as energy efficient technologies (e.g. solar energy, clean cooking stoves) and keywords related to envisaged impacts:

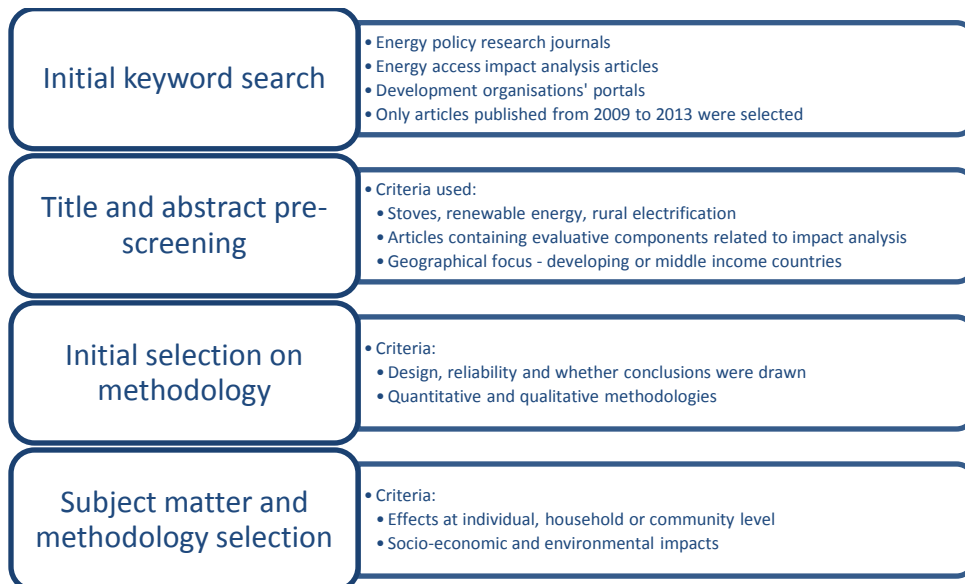


Figure 15: Sequence of literature selection

Policy documents and programme descriptions served as extractive sources for expected impacts and it provided a basis to analyse motives for energy access provision as outlined in Figure 16:

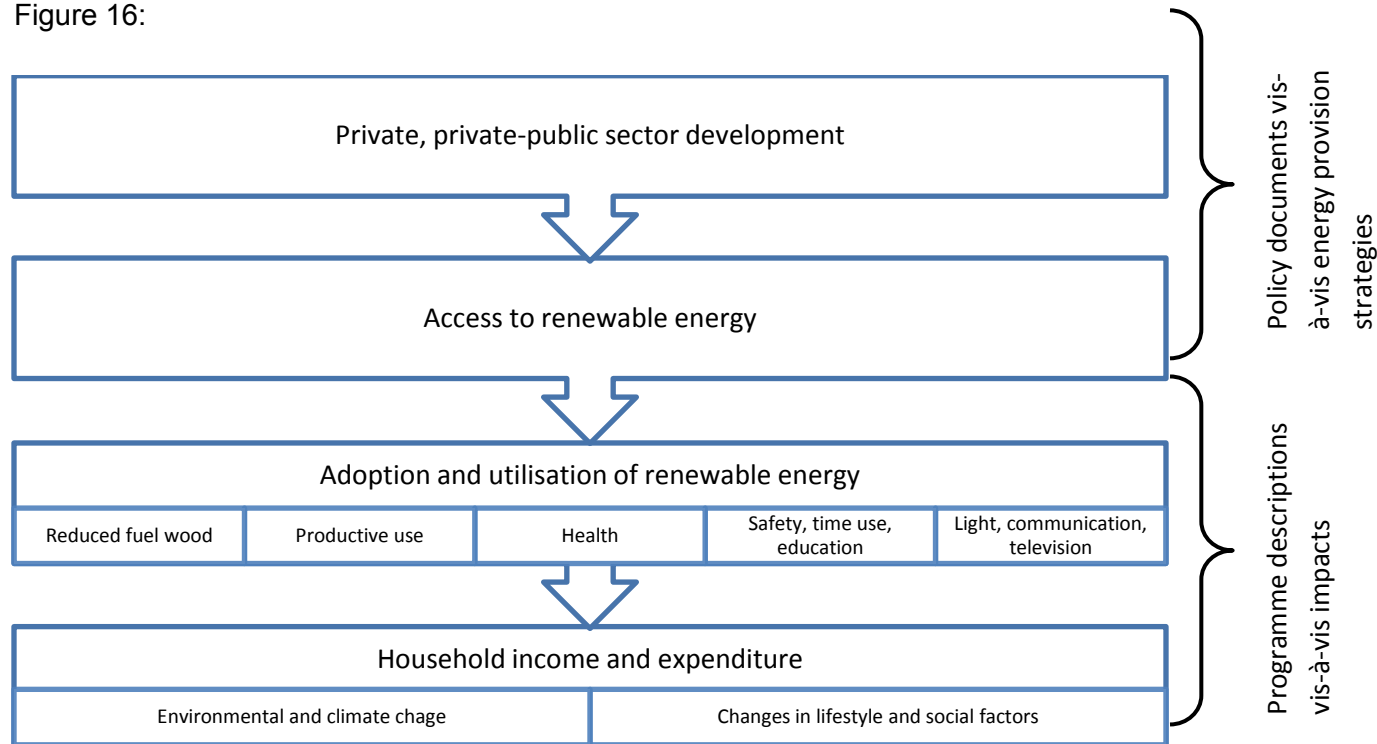


Figure 16: Envisaged results chain from RE source provision

Two points appear repeatedly:

- Energy access is considered imperative in poverty alleviation efforts.
- Human health and climate is impacted negatively by the continuous use of biomass. This can be abated by employing energy efficiency strategies and increased use of renewable energy technologies (RET).

Accessibility to or the provision of RETs is assumed to cascade into a decrease in biomass use, reduction in harmful emissions, more lighting hours for productive use etc. Additionally, increased efficiency reduces household expenditure on energy. This approach assumes that changes are solely due to energy access and not any other social, economic and political changes that occurred at the same time.

2.1.1 Socio-economic impact analysis

The International Working Group for the Monitoring and Evaluation of Energy for Development (M&EED Working Group) came to light as a platform to share experience, expertise and application in energy for development (Anneck, 2008) towards achieving MDGs. The principal concern was to develop and examine tools and methodologies to track implementation and project progress in order to learn from and design future projects better; the end goal being more effective reduction of poverty. Subsequently, methodologies were pursued to document the link between access to energy and development goals in order to show that access to energy makes a difference in poor people's lives.

Comparative impact evaluation studies can broadly be categorised into those that consider 'with and without', 'before and after' or single difference situations. The 'with-without' and 'before-after' comparisons are called the difference-in-difference method. Such an evaluation possibly will contemplate plausible spill-over effects to the control group that may reduce the difference between the 'with and without' groups. Moreover, difference-in-difference comparative impact analyses are dualistic and treat energy access as two opposite ends rather than as a continuum.

Articles that were analysed in this section are outlined in Table 10.

Table 10: Some impact evaluation studies in developing countries

Authors	Title of article	Aim	Methodology	Unit of analysis
Pereira, Freitas, da Silva (2011)	The challenge of energy poverty: The Brazilian case study	To evaluate efforts on reduction of energy poverty of government policies or the expansion of access to electricity	'before-after' using two samples of 'with-without' access to grid electricity	Households
GTZ (2009)	Impacts of Basic Rural Energy services in Bangladesh	An assessment of Solar Home System and Improved cook stove interventions to establish self-sustaining market for both technologies	'before-after' data to get insight into livelihood impacts	Households and small commercial enterprises
Adkins et al. (2010)	Off-grid energy services for the poor: introducing LED lighting in the Millennium Villages Project in Malawi	Enterprise development	'with-without' LED lantern	Households
Obermaier et al. (2012)	An assessment of electricity and income distributional trends following rural electrification in poor northeast Brazil	Analysis of rural electrification as a strategy for poverty alleviation	'with-without' electricity access	Households
Taele et al.	Grid electrification challenges,	Role of PV-technologies in sustainable	'before-after' grid	Community/village

(2012)	photovoltaic electrification progress and energy sustainability in Lesotho	development	electrification	level
Akpan, Essien and Isihak (2013)	The impact of rural electrification on rural micro-enterprises in Niger Delta, Nigeria	Impact of grid connection on profitability of micro-enterprises	'with-without' electricity	Owners of micro-enterprises
Daka & Ballet (2011)	Children's education and home electrification: a case study in north-western Madagascar	Analysis of the relation between access to electricity and school attendance and performance	'with-without' electricity	Households
Yadoo & Cruickshank (2012)	The role for low carbon electrification technologies in poverty reduction and climate change strategies: a focus on renewable energy mini-grids with case studies in Nepal, Peru and Kenya	Advantages and disadvantages of using RETs for rural electrification	'before-after'	Communities in Nepal, Peru and Kenya
Matinga & Annegarn (2013)	Paradoxical impacts of electricity on life in a rural South African village	Impacts of electrification on educational outcomes, gender and power relations, income generation, feelings of inclusion and exclusion and health	'with-without'	Households
Kooijman-van Dyk & Clancy (2010)	Impacts of electricity access to rural enterprises in Bolivia, Tanzania and Vietnam	Role of electricity on rural enterprises	'with-without'	Enterprises in villages
Malla (2013)	Household energy consumption patterns and its environmental implications: assessment of energy access and poverty in Nepal	Analysis of patterns of household energy use and associated air pollutant emissions	'with-without'	Community
Palit et al (2013)	The trials and tribulations of the Village Energy Security Programme (VESP) in India	Lessons that can be learned for policy makers launching rural energy programmes in developing economies	Single difference comparison	Village

The majority (57%) of these evaluations conducted in 14 countries are reviews of electrification impacts. The following general findings resulted from the review:

- The effectiveness of renewable energy interventions mainly refers to health aspects in relation to the use of improved stoves and the evidence is concentrated in a limited number of countries in specific localities.
- The impacts of RE interventions are context-specific especially in developing countries.
- Rural households cope with uncertainties by fuel-stacking rather than fuel switching. Thus, households step back and forth on the energy ladder.

- The effectiveness of energy interventions is impacted on by human behaviour rather than technology design.
- There is a bi-directional causal relationship between energy-use and income.
- Improved stoves and renewable energy sources have a positive impact on health.
- Human behaviour is gradually changed by the energy sources or appliances affecting social factors. As an example, light contributes to feelings of safety and enables children to study at night, thus, time management in households is affected.
- Studies on the productive use of renewable energy sources largely neglected cooking stoves as a means to generate income and largely concentrate on energy intensive agricultural processing.

2.1.2 Indigenising impact analysis

Impact analysis of developmental programmes aimed at indigenous people does not adequately describe or make the case for indigenous development outcomes. Standard evaluation approaches culminate in impact analysis that is overly limited to a quantitative focus and that present a narrow view of a programmes' dynamics. It overlooks holistic connections between people, and between people and the environment as well as the importance of relational processes.

Morelli and Matairea (2010) in *A Handbook for Strength-Enhancing Evaluation Research* recognise indigenous practice and sought ways to strengthen communities through collaborative research. They developed the Strength Enhancing Evaluation Research (SEER) as a methodology of evaluating intervention programme impacts on indigenous livelihoods. It uses metaphors and narratives as a means of enhancing evaluation and to document experiences. Researchers in this field use community-based participatory approaches as data collection tools. Narratives enable a discussion on a wide spectrum of topics such as ancestry, cultural background, how and where people grow up, life experiences, the pattern of day-to-day activities etc. The rationale is to establish relationships with *place* and people. This approach highlights that conventional impact analysis results in moulding data to fit narrow conceptualisations of success and the strengths of programmes going unrecognised. When well-being is associated with the provision or prescription of a resource it runs the risk of discounting and relegating relationships and displacing practices. Rather, data analysis should recognise strengths of people and *place* that brings together many ways of seeing, doing, knowing and feeling. Stark et al. (2010) asserted that narratives are the foundation of

qualitative research and several authors (Padgett, 2008; Loopie, 2007; and Quantz and Thurston 2006) explored and enriched qualitative methods using story-telling.

Narratives have the potential of forming the foundation of understanding how each intervention programme’s methods and action are translated into anticipated and envisaged outcomes. This is mainly due to the open-ended nature of narratives that offers data “rich in detail, variable in content, neither systematic nor standardised” (Morelli and Mataira, 2010: 9). Analysing such data is inherently challenging, but not impossible if the reason is to understand perspectives of end-users “without pre-determining those perspectives through prior selection of question categories” (Patton, 2002:20). Data collection tools such as purposeful questionnaires, used in parallel with qualitative datasets yield a more nuanced picture of the nature of the relationship between indigenous people and the material world.

2.1.3 Individualising impact analysis

The increasing focus on “empowering people to achieve their own well-being” implies that causal relationships leading to energy poverty are complex and thus require “cultural and critical sensibility” (Sovacool et al., 2012: 716) to advance universal energy access. Mass customising impact analysis runs the risk of masking underlying “patterns of injustice that create and maintain inequality in the delivery of energy services” and energy planning (Sovacool et al., 2012: 716). The capability approach makes it possible to individualise the impact of programmes and policies aimed at development. However, individualisation should not take precedence over collective agency. What takes centre stage is not the provision nor the consumption, but *capabilities* arising as a means to achieve *functionings*. The concern here is not how much resources are availed but whether it is appropriately directed. Table 11 outlines how plurality and individualisation can be applied to analyse impacts from a capability stance.

Table 11: Capability applied in policy impact analysis (adapted from Goerne, 2010)

Level of analysis	Purpose	Illustration
	Keywords	
Outputs	Evaluation of policies	Was diversity of needs considered?
	<i>Individualisation</i> <i>Plurality of options</i>	To what types of ‘beings and doing’ did the intervention/policy promote access? How much choice did individuals had access to?

Outcomes	Assessing inequality	Description of selected <i>capabilities</i> or <i>functionings</i> of individuals.
	<i>Capabilities</i> <i>Functionings</i>	Range and quality of attained or potentially attainable valued <i>functionings</i> . Set of alternative <i>functionings</i> an individual does or potentially can attain.
Processes	Evaluation of policies	Did outputs translate into outcomes? Have the policy/intervention translated into specific <i>functionings</i> ?
	<i>Effectiveness</i> <i>questions</i>	

The first row represents output analysis and provides a foundation to assess what is distinctive about energy policies or a configuration of such policies. Using the capability approach as a guide, questions such as to whether the provision of resources is individualised and how much scope is available to consider diversity of needs arise. The second row's main concern is assessing individual well-being and the third row focuses on policy effectiveness evaluation.

Assessment of interventions is compounded by differing definitions of energy access and energy poverty. Reconciling these views can be aided by considering the interaction between individual situations and collective resource limitations offered in different contexts. In this light, the capability approach offers novel insights through shifting the analytical focus from "point of connection for a household" to the *capability* space opened up or inhibited by energy access and the adjusting of needs to accommodate impact of energy provision.

2.2 Measuring energy access

2.2.1 Introduction

The number of single and composite indices to measure concepts related to development and energy are presented in this segment. This section also highlights the adequacy, shortcomings and applicability of existing instruments to measure energy poverty and energy access.

Within energy access analysis, tension exists between a desire to underscore multidimensionality and an insistence on conceptualising it in narrower terms centred on a core concept of resources (Hick, 2012). Multidimensional tools aim to cover additional terrain around energy access to better reflect reality, however, the lack of progress in identifying what is meant

by energy poverty and energy access makes it a challenge to determine what dimensions to include.

2.2.2 Measuring complexity

The contested definition of energy access necessitates inquiring as to what is the better approach to “represent complex phenomena and multidimensional realities” (Muro et al., 2012: 2)? As a result of contention, a variety of incomparable tools to measure energy access are devised. Hence, tools developed to measure successes of energy access programmes cannot be evaluated in general terms, but only in “relation to the specific definitions of the concept on which such tools are based” (Caselli, 2012: 19).

The change from measuring single dimensions to multiple dimensions represents a significant theoretical and methodological shift (De Muro et al., 2011). The shift led to the establishment of multi-disciplinary approaches to sustainability assessment of technology (World Bank, 2004; IAEA, 2005; O’Sullivan and Barnes, 2007) to account for the complex nature of the interaction between technology and society. Indeed, Nussbaumer et al. (2013) noted the proliferation of composite indicators is an attempt to increase policy efficacy. However, the loss of information via aggregation makes a hybrid approach attractive to capture underlying indicators in order to yield richer insight.

Implications of reform efforts are well-documented (World Bank 2003; Modi et al 2005). Such assessments were performed for renewable energy systems implemented in developing countries’ rural settlements (Athanas and McCormick 2013; Hong and Abe 2012; Bhide and Monroy 2011; Yadoo et al 2011; Brent and Rogers 2010; Thiam 2010; Kirubi 2009; Ilskog 2008; Martins 2005; Manibog et al 2003; Zomers 2003; World Bank 1996; SIDA 2002a). A number of authors qualitatively established the link between energy and its potential in attaining MDGs (McDade, 2004; Modi et al., 2005; Rockstrom et al., 2005; UN-Energy, 2005). Experiences from such assessments concluded that the majority of installations proved to be successful in the initial stages (García and Bartolomé, 2010; Rogers and Brent 2010; Skutch 1998), however, a multitude of challenges led to dissatisfaction of beneficiaries. Ilskog (2008) ascribes some of the failures to the lack of comparability of lessons learnt. The notion to better understand how a project performs in a certain settings is not peculiar to Ilskog as several manuals and toolkits for evaluation of rural electrification projects have been developed (World Bank 2004; ESMAP 2001, 2003, 2005; IAEA, 2005 and O’Sullivan and Barnes 2007). The broad focus of these methodologies is on a quantifiable value of energy access that assumes that, once the minimum

threshold is reached, energy access has been achieved. Upon such achievement, incremental levels of access to energy service are the next target as defined as by the AGECC Report (2010). This progression-based approach to increasing energy access makes it a challenge to establish and analyse inter-linkages between these uses.

Decision-supporting tools are already in use to monitor progress in energy provision, socioeconomic development and climate change; the same should happen for energy access impact as well (Hailu, 2012). The IAEA (2005) recognises the need for data that extend beyond statistics to give deeper understanding of main issues and to highlight vital relations that are not obvious when using basic statistics as the main analytical tool. As an example, the concept of \$1/day (now revised to \$1.25/day) has been widely used as a standard to appraise absolute poverty trends. Other trends, notably in nutrition, assumed a calorie intake of 2700 calories per day (adjusted from 2500 calories per day in 2004) as sufficient for both rural and urban conditions. However, the multifaceted nature of poverty is inadequately captured by the use of such methodology (UNDESA, 2009) and it gives the impression that such measurements originated from vague notions of poverty. In this instance as well as the “10% of household income spent on energy”, the economic dimension is overly emphasised.

A number of initiatives aimed at providing a “dashboard” of individual indicators (for example Nuusbaumer, 2012; IEA, 2009) and the United Nations Department of Economic and Social Affairs (UNDESA) suggested a set of indicators organised around themes and sub-themes representing development policy issues (UNDESA, 2001; UNDESA, 2007). A set of core energy indicators is used by the World Bank to evaluate the impact of its energy access projects. They include the type of connection, electricity losses, frequency of interruptions, number of people provided with access to electricity for grid and off-grid connections and new construction of grid infrastructure. The World Energy Assessment consists of 13 individual indicators that are specific to energy (UNDP, 2000). A collaborative effort between the International Atomic Energy Agency (IAEA) and the UNDP birthed more comprehensive Energy Indicators for Sustainable Development (EISD). Thirty individual indicators are categorised into three dimensions (social, economic and environmental) and further subdivided into themes and sub-themes. Mirza (2010) combined quantitative and qualitative elements to develop a new composite index to measure the degree of energy poverty among rural households in Pakistan. In order to investigate factors impacting on the welfare of rural households, they used a survey dealing with the availability of choices concerning energy sources including inconvenience to obtain such sources.

2.3 Concluding remarks

In the first part of this chapter we have explored approaches to socio-economic impact analyses. These analyses are undertaken to assess programmes, determine programme relevance as well as the effects of these programmes on individuals, households and institutions. It was found that the analyses are either overly quantitative or qualitative. Quantitative information permits detailed analysis, however, it does not adequately articulate the impact of interventions and consequences on, especially, the poor. It was found that impact analyses focusing on indigenous people are best served by the integration of qualitative and quantitative data sets that recognises links between people, *place* and technology. Furthermore, the capability approach offers possibility of individualising impact analysis as a means of avoiding homogenisation of experiences.

The second part of the chapter examined the rationale for developing composite indices to convey performance status of developmental projects in order to keep track of improvement and inform policy. It was found that it is imperative to consider the multidimensional nature of energy access and energy poverty in developing dashboard indicators. There has been progress in reducing energy poverty; however, data collections should not only focus on expenditure, but also on energy access opportunities, choice sets and energy service quality.

Chapter 3: Literature review – Energy and Development

3.1 Introduction

A literature review that simply narrates the history of development runs the danger to simplify and erode the challenges and opportunities faced by indigenous people. The history of development approaches as well as the relationship between indigenous people and development forms part one of this review. To contextualise the developmental experience of the indigenous, theoretical frameworks used by indigenous academics and intellectuals is presented as well as how this framework informs and influence research and developmental paradigms. A question such as what is the cost of being indigenous will assist in contextualising parameters of what constitute development.

Part two reviews literature on the role of equitable access to energy as a developmental tool or intervention in not only indigenous settings, but also among the poorest. Part three reviews Namibia's energy policy and development landscape. A critical overview of assessment tools is presented in part four.

3.2 Beyond a narrative of development: my development or yours?

“Development (or the predominant development paradigm) has been and is still a problem for indigenous people, not the solution” (Focus group discussion, New York, 2010).

Development, the central organising concept of today, is extremely vague and all-inclusive and appeals to various groups each with their own agenda. Related terms such as growth, modernisation and progress are less difficult to define and conceptualise. In simplest terms development denotes growth, maturation and advancement, but even then, the point from where this growth, maturation and advancement are supposed to start is a black box.

There is widespread acknowledgement that decades of development are fraught with numerous failures mainly attributed to mainstream development approaches; nonetheless, there is heightened self-criticism in development discourse and a constant search for alternative paths of development. The emergence of 'being alternative' is associated with the Dag Hammarskjold Foundation 1975 report, 'What now? Another Development', that formulates it in terms of development 'geared to the satisfaction of needs', 'in harmony with the environment' and

'endogenous and self-reliant'. Alternative development can be viewed in multiple ways, that is, as a critique of mainstream development, adjusting its position as the latter shifts its position; or as an alternative to the mainstream and thus implying a theoretical break. Recent trends in mainstream development shows a shift from economic growth to a people-centred approach to development.

A key point raised regularly in the alternative development discourse is that it is *development from below* or *from the grassroots* concerned with re-defining goals of development and introducing alternative practices. This includes, but is not limited to, "culturally sensitive" development based in approaches and process that are part of a culture (Hart, 2010). Pieterse (1998) observed that alternative development is frequently identified with development-by-NGOs in their attempt to distinguish themselves from the state and market. The methodology (participatory, self-reliant and endogenous) and objectives (geared towards needs) employed by NGOs are viewed as being alternative, however, being alternative here refers to alternative in relation to the state and market and not necessarily in relation to the general developmental discourse.

With the advent of "culturally sensitive" development, the indigenous research paradigm is ushered into the development discourse. This paradigm emerged as a result of the close relationship shared by the indigenous people with the environment. This relational view recognises diversity unified by the commitment to development and these relations are established between institutions, socio-economic processes, forms of knowledge, technological factors etc. (Naz, 2006).

In 1980, ethno-development or development with identity entered the development discourse. It refers to remediation of development policies and strategies that were deemed to threaten ethnic/minority identity and self-determination. It placed the needs of ethnic minorities and indigenous people at the centre of debate and it rests on four pillars, that is, cultural pluralism, internal self-determination, territorialism and sustainability. Ethno-development, self-development and development with identity became part of the new perspective to reconceptualise conventional and alternative developmental models. It builds on positive qualities of indigenous societies and as such, programs that enhance the "ability of indigenous organisations to design their own development strategies and formulate their own development projects" are at the forefront (Davis and Partridge, 1999:5). Indigenous activism and advocacy tend to focus on representation, recognition, resources and rights and they play out differently

across the indigenous spectrum. The rights issue features prominently in literature (see for example: Levi & Lewis-Maybury, 2010) as illustrated by the objectives of the Working Group of Indigenous Minorities in Southern Africa (WIMSA) that include supporting “the San in regaining their identity and pride in their cultures, thereby improving self-esteem” and to “support the San communities in fighting for recognition of their own traditional leadership structures”.

The UN Resolution on Indigenous Rights and the International Labour Organisation (ILO) Convention 169 working definition seeks to identify indigenous people rather than define who they are. This approach use self-identification as the main decisive factor while simultaneously emphasising commonalities shared by indigenous communities. At the core of indigenous identity are history, ceremony, language, land and communal relationships. The relationship to the land is spiritual, development from *it* would result in dislocation from space and time, i.e. from an existential context and thus from the *self*. Therefore, development cannot be delivered, it is a natural process and, as a discourse, it shares “structural features with other colonising discourses” (Naz, 2006: 64).

*“It is a sign of a broken society when people demand hand-outs and give up their independence and freedom to other people. Development is about getting the recognition and having the **freedom** to give others from the unique gifts (that) each and every one of us have.” Job Morris (Indigenous leadership and San values, 2011).*

To make it meaningful, self-determined development should be economically, culturally and environmentally viable as well as enhance the link between indigenous people and the natural world. It operates at community level “as a process that perpetuates indigenous livelihoods locally via regeneration and strengthening of local and regional indigenous economies” (Cornthassel, 2008: 119). Thus, a self-determined value-based development process can be used as means of restoring indigenous livelihoods.

3.3 Development as freedom

The human development approach, underpinned by Amartya Sen’s conceptual framework of development as freedom (Sen, 1999), expanded existing understanding of poverty and development. Sen’s interdisciplinary *capabilities* approach challenges commodity-based understandings of poverty such as the human capital approach and the concept of basic needs.

Within the capability approach, poverty is understood as deprivation of one or more rudimentary *capabilities* that are essential for an individual to achieve minimum *functioning* within their society. This contextualises and individualises development within a societal setting. Five conceptual building blocks make up the capability approach as illustrated in Figure 17:

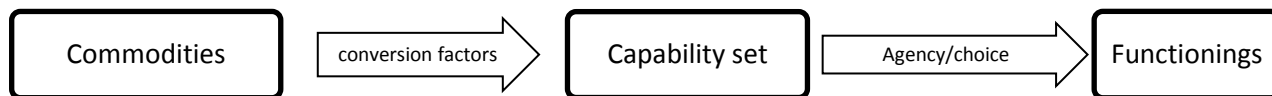


Figure 17: Conceptualising building blocks of the capability approach (Source: Goerne, 2010)

Conversion factors vary from personal, environmental and social settings that influence how energy provision can be turned into *functionings* that ultimately lead to development. The process of conversion of available resources into well-being is related to and dependent on individual and environmental factors. The focus of this approach is on what people are effectively *able* to do and *to be*, and on removing obstacles so that they have more freedom to live the kind of life they find valuable.

Well-being and development is discoursed in terms of people's *capabilities* to function, these *beings* and *doings* are called *functionings* of an individual. The researcher would like to extend individual *functionings* to that of a society because of communality trait of indigenous people. *Capabilities* is "various combinations of *functionings* that a person" or society "can achieve" (Sen, 1992). To distinguish between the two central concepts Sen (1987, p. 36) states that "*functionings* is an achievement whereas *capabilities* are the ability to achieve". The latter is more directly related to living conditions while *capabilities* are notions of freedom.

The capability approach to well-being and development evaluates policies according to their impacts on people's *capabilities*. It asks whether resources are available and accessible to realise these *capabilities*. For some of these *capabilities*, the input/resources will be financial, for some it will be political and for other it will be freedom of thought, religion, political participation or social or cultural practices, social structures, social institutions, public goods, social norms, traditions and habits.

As a paradigm, the capability approach operates on three levels:

- As a framework of thought for the evaluation of individual advantage and social arrangements.
- As a critique of other approaches to the evaluation of well-being and justice.
- As a formula to make interpersonal comparisons of welfare or well-being.

As a framework it encourages us to focus on the information needed to make judgments about well-being, social policies etc. and consequently either reject or complement approaches that focus exclusively on monetary terms as an example.

The developmental agenda utilised by the Working group of Indigenous Minorities in Southern Africa (WIMSA) is still largely aimed at preservation and sustainable utilisation of natural resources. Other areas of development centre on human rights, education and heritage/intellectual property rights such as the harvesting of devil's claw and the hoodia plant. It seeks to establish networks between the San and the 'external' world and not necessarily networks among the San. Gilbert (2012: 1) states that service provision models aimed at indigenous people "failed to draw on the strengths of communities" and advocates place-based approaches that resonates with relational ties of indigenous people with *place*.

"For decades the indigenous people worldwide have been dependent on their environment. It is this very environment that has given them the necessities of life. We as indigenous people have ties with our territories of our origin...For centuries; the good and perpetual use of our environment has been the result of good leadership amongst us. It is a definition that everyone in the society has a leading role to play, but on a consensus basis."
Job Morris (Indigenous leadership and San values, 2011).

Indigenous people usually inhabit rural and remote areas, or, if in an urban setting, are situated at the periphery. This *place-based* existence is a constant struggle against dispossession and deamination. The struggle to survive as a distinct people against state-created identities is a unifying factor that binds the world's indigenous people. It is not only their identities that are threatened, but also their socio-political structures are deemed inadequate to engage the state and compete with other segments of society. The imported models of engagement and

identities are the *products* of democratisation rather than a *process* of democratisation (Biesele, 2010). That is, instead of defining and implementing their *own* appropriate models and approaches, they are required to structure their representation based on pre-packaged models that are “not responsive to specific needs of a particular place” (CGRIS, 2011: 8). The capability approach in the context of place-based policies seeks to direct interventions to mesh and enhance local objectives at community level and to forward these objectives to the national level through offering an enriched bottom-up alternative. Locals are thus enabled to influence and shape policies that affects them and policies are then evaluated from a community perspective. Such a policy analysis would evaluate whether local actors and resources were used as assets in a collaborative process to address issues as they are experienced within a geographic space.

3.4 Energy intervention approaches in Namibia

3.4.1. Policy and data discord

There are disjointed approaches in the policies dealing with energy and sustainable development in Namibia. The Ministry of Mines and Energy is responsible for developing policies related to energy while the Ministry of Environment and Tourism develop policies related to sustainable development. The complexity and challenging nature of energy issues requires a holistic approach and does not allow for simplistic solutions. The goal of energy policies should be to simultaneously optimise and harmonise differing developmental objectives and functions under non-linear and uncertain conditions. Some of the functions are climate change (under the Ministry of Environment and Tourism), energy security, energy prices and costs and energy access (Ministry of Mines and Energy). In addition, there are several other ministries with varying degrees of involvement in the development of rural communities. They include the Ministry of Regional and Local Government, Housing and Rural Development, the Ministries of Health and Social Services (MHSS) and Education as well as the Office of the Prime Minister. Hence, recognising interconnectedness of many aspects related to energy makes it crucial to synchronise databases.

The supply-centric approach of policy has resulted in the provision of energy via a solar-diesel plant where all consumers, regardless of income, pay the same amount for electricity and LPG. The energy poverty alleviating approaches within this policy is very limited, and as a result, there is slow transition to cleaner fuels which exacerbated energy poverty at household and SME level. Therefore, the approach used to implement TEP cannot serve as a model for

replication in similar settlements in its current form. Place-based approaches embody a noteworthy advance on the traditional service system.

3.4.2. Energy policy landscape

The guiding development document for Namibia is Vision 2030, broken up into national development plans (NDP) with NDP4 as the current development plan (NPC, 2012). Energy is not considered as a key economic driver in Vision 2030 on which NDP4 is based, additionally, there is no mention of REs in NDP4 and there is also no Energy Act. The only guiding document on energy planning is the 1998 White Paper on Energy. Moreover, the Namibia Statistics Agency does not collect data to determine energy poverty.

NDP4 acknowledges the “rather shallow and resource-based” economic structure (NPC, 2013: 11) and to counter this, priority is given to “basic enablers” (*ibid*) to assist in addressing extreme poverty. The enablers are the institutional environment, education and skills development, a healthy population and public infrastructure. Efforts to eradicate poverty acknowledge the unequal distribution of income as well as creating sustainable job opportunities especially in rural areas. Additionally, social and financial protection systems are in place aimed at the poor and vulnerable as a buffer against high costs. Subsequently, the cost of electricity is subsidised in Tsumkwe as a policy measure to enhance the paying capacity of residents, however, energy for cooking, i.e. liquid petroleum gas (LPG) is not subsidised. There are also no “free kWh” units made available to residents such as the free basic electricity used in neighbouring South Africa. Free basic electricity (FBE) is defined as

“(T)he amount of electricity, which is deemed sufficient to provide basic electricity services to a poor household. This amount of energy will be sufficient to provide basic lighting, basic media access, basic water heating using a kettle and basic ironing in terms of grid electricity and basic lighting and basic media access for non-grid systems” (Department of Minerals and Energy, 2003).

The objective of the FBE policy is to bring relief to poor electrified households to address affordability issues and thereby ensure that socio-economic benefits from energy provision trickles down to poor households. It can be argued that the Namibian government already provide other schemes that benefit the poor such as state grants, feeding schemes and other social protection programmes and thus, there is no need to provide free basic electricity. Even

though electricity is subsidised, the blanket application of subsidy benefits the wealthier section of the population since it is “applied to the price of electricity...independent of individual level of income” (Rehman et al., 2012). It is questionable whether the subsidy in its current form has worsened, improved or maintained the status quo with regard to livelihoods of the poor.

Namibia’s energy policy is dominated by solar as the preferred technology for basic electricity supply and LPG for basic thermal supply (Schultz and Schumann, 2005). As a result, a Solar Revolving Fund (SRF) was established to reduce financial barriers for solar technologies such as solar water heaters, solar home systems and photovoltaic water pumping (Ndlukhula, 2012). The cost of such technology, with or without finance access, is prohibitively expensive for the poor. To increase energy access, a portion of the limited revolving fund money is reserved for “people who need it most – very low and low income families” (Schultz and Schumann, 2007). Thus, instead of reducing energy technology costs, funds are made available to increase access to such technology. This does not address the issue of affordability and can lead to the poor defaulting on their loan repayments.

Another initiative is the establishment of Energy Shops with the central aim of “providing targeted communities with access to appropriate energy technologies” (Schultz and Schumann, 2005: 17). Such energy shops sell and stock suitable approved energy products such as solar panels, LPG gas, energy efficient stoves as well as lanterns. It is envisaged that each region¹³ will have at least one energy shop and so far 10 energy shops have been set up. Services offered at these shops are:

- Stock and sell selected energy supplies.
- Take and process customers’ orders for energy technology and energy baskets.
- Recharge customers’ 12V batteries for a fee using SHS provided by the OGEMP.
- Consult with customers regarding their revolving fund applications.
- Assist customers to hire a certified solar technician when needed.
- Receive loan payments and pursue missing or late payments.

The driving force behind these energy shop services is to provide support to customers related to credit financing schemes such as the SRF. A similar concept utilised in South Africa is Integrated Energy Centres (IECs) whose main purpose to avail fuels, through bulk buying, at a “lower cost and thereby reduce the cost overheads associated with transport and multi-step

¹³ Namibia has 13 political regions (as of August 2013, the regions are 14), thus it is not clear whether political regions were used to determine the number of energy shops per region.

distribution chains” (Prasad, 2006 in Nissin and von Blitznitz, 2010: 2182). Therefore, energy services are brought closer to those who need it as a response to the recognition that electrification cannot be the only response to thermal needs of poor households. In contrast, the energy shops in Namibia mainly serve as a collection points for customers’ loan payments and provision of technical expertise. There are also little services related to the provision of information via energy shops. In spite of credit extension schemes, energy technology can still be perceived as being expensive in comparison to “non-monetised burning of biomass in traditional” three-stone stoves (Rehman et al., 2012). The close proximity of energy shops to the community makes them ideal to serve as a base for local energy planning instead of merely being used as service points

An analysis of policy documents shows that community mapping of current and potential resources are neglected in favour of identifying needs and what is needed to satisfy those needs. The “growth hypothesis” (see section 3.5 for elaboration) was the main motivating factor for TEP to use energy as a means to poverty reduction via economic growth. Policies are thus geared towards identifying entry points aimed at satisfying needs and not to develop and enhance *capabilities*. Energy has the potential to be a strategic driver if it is consistent with local needs and recognises linkages between individuals, families and circumstances. An example that recognises this linkage is charcoal production that started in 2000 in Namibia (Diekmann and Muduva, 2010) as a means of clearing invader bush.



Figure 18: Bags of charcoal along the road to Tsumkwe

On the way to Tsumkwe, the researcher observed bags of charcoal packed alongside the road ready for transport to other towns in Namibia. Little to none of these bags ends up in Tsumkwe which is less than 60km away from the production site.

The industry developed as a labour-intensive initiative to attract indigent and unskilled labour. The main charcoal production districts are shown in Figure 19 and Tsumkwe is within the charcoal production location.

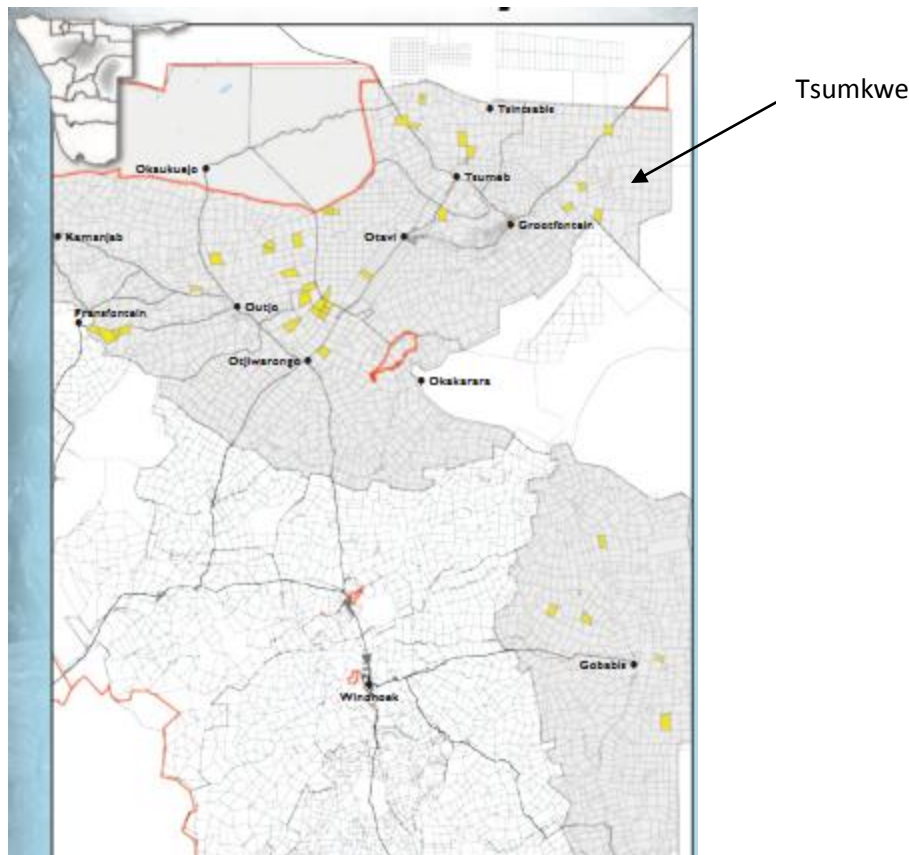


Figure 19: Main charcoal production sites (Source: Diekmann and Muduva, 2010)

The red lines shows protected areas, the yellow shows farms with existing charcoal production and the grey shows the main districts of charcoal production.

3.5 Exploring an interactive energy-poverty-development nexus

A number of electrification and energy access projects are located in areas regarded as having high levels of poverty and diminished access to health, education and other essential social services establishing the link between energy, development and poverty. When “poverty line” thinking is translated to energy it leads to assumptions about what energy needs constitute, the type of appliance the poor would be using and the type of energy service needed (Pereira et al 2010). There is a need to go beyond quantifying energy access and to consider the lived realities as well as to interrogate whether “strategies adopted to promote energy access are sustainable” (Bhattacharya, 2012: 261).

The lack of data and understanding of patterns of energy use by the poor shows a glaring gap in effectively addressing the issue of access to energy of the poorest (Pachauri and Cherp, 2011). These inequalities reveal significant gender, racial and class characteristics such that “energy is often a powerful indicator of poverty and social exclusion in general” (Newell, et al., 2011 :4). As such, the distribution of energy cannot be considered in isolation of other aspects of energy poverty and political and social marginalisation. The relationship between basic energy consumption and human development has been highlighted by several authors (Practical Action, 2012; Gaye, 2007). Globally, people experience costs and benefits from energy consumption unequally, placing questions of rights and justice at the forefront of development discourse. Unjust development practices pose key governance and policy framework challenges such as providing equitable energy access to those living in abject poverty.

A factor that impacts on household energy demand is energy pricing. This led Khandker et al (2012) to analyse whether “the energy poor” are “also income poor”. This assumption can be true if the causal relationship between income and energy access is uni-directional. The causality emanates from energy consumption to income making energy a driver of economic development and it is also known as the “growth hypothesis”. This hypothesis infers that “energy consumption plays an important role in economic growth both directly and indirectly in the production process as a complement to labour and capital” (Ozturk, 2010: 341). However, energy is a commodity that depends on conversion factors, as per the capability approach, to turn it into social and economic development. If the conversion factor is not regarded, then energy access is not development, but should be seen merely as energisation or energy provision.

The driver role of energy assumes that people are able and/or willing to use energy “actively as part of their income generating activities and processes” (Nissing and von Blitnitz, 2010). This bi-directional causal relationship also known as the “feedback hypothesis” implies that energy consumption and economic growth are mutually determined and affected simultaneously (Ozturk, 2010).

Existing policy frameworks and national energy policies in developing countries often do not respond to the needs and capacities of the poor (Florini, May 2010; Florini & Sovacool, 2009). Similarly, energy technology research, development and transfer as well as impact analysis approaches do not respond to their energy needs, realities and capacities. Ashton et al (2012) analysed the socioeconomic impact of electrification and energy provision in Tsumkwe by using

sustainability indicators. A pre-existing methodology developed by Illskog (2008) was used to assess the social impact by using four variables: socioeconomic impact, customer service relations, capacity strength and technical operation. They found that, overall, the provision of electricity was beneficial vis-à-vis development and establishment of small businesses utilising the expanded electricity. Their research treated the impact of electrification as uni-directional (running from energy consumption to economic growth) and assumed that Tsumkwe residents are able to use modern energy provision for income generation, disregarding conversion factors.

3.6 Concluding remarks

This chapter brought to the fore the alternative paradigm and how it emerged in development discourse when the focus changed from economic growth to people-centred contextualised development. There are a number of development paradigms claiming to be alternative such as, ethno-development and development with identity. All these approaches underscore relational aspects between people and *place*. The human development paradigm, originated by Sen, is an attempt to place people at the centre of development and is mainly concerned with recognising the impact of intervention programmes on human *capabilities*. Reconciling the human development paradigm with indigenous people can result in a bottom-up constructed information base has the potential to feed into national policies as means of giving voice to indigenous people.

Namibia operationalised human-centric development through financing RETs. As a result, energy shops were created to provide support services to access financing and RETs. The energy policy thus recognises energy pricing as the biggest hurdle that need to be overcome to reduce energy poverty.

Chapter 4: Methodology

4.1 Introduction

The inception of the human development approach has led to an increasing use of participatory research methods which allow those experiencing poverty to be involved in the conceptualisation of poverty and proposal of their own interpretation of well-being. In order to follow this paradigm, their input is central to forming an information base that provides data on how development affects them. Within the human development paradigm, energy can be considered as a commodity that has certain characteristics which make it of interest to people. The ultimate normative measure is not the *functioning* but rather the *capability* to convert opportunities presented by a commodity. Energy is an input, but its value depends on a society or individual's ability to convert it into a valuable *functioning* that in turns depend on personal, social and environmental structures and systems. The unit of analysis is thus the set of opportunities sprouting out of the commodity.

This research adopts a household-based lens and focusses on challenges and opportunities underpinned by place-based approaches. These approaches are seen as “collaborative means to address complex social-economic issues through interventions defined at a specific geographical scale” (Cantin, 2010: 7), thus asserting the primacy of *place* towards improved livelihoods. Inevitably, place-based realities operate within a realm of ambiguity due to the nature of open systems and it is thus challenging to capture and assess intervention impacts using traditional evaluation practices.

Just as there is no agreement about what sustainable development entails, there is also little agreement as to what energy access means. However, there is agreement that human “needs” take precedence and therefore, development of evaluation tools that are supportive of monitoring and tracking progress is essential to assess if current actions to eliminate energy poverty are keeping up with the pace and scale of population growth. Sen (2009) argues that seeing humans “only in terms of their needs” might lead to “a rather meagre view of humanity” (2009: 250) and thus he extends it to include what humans *values*. Thus, the importance of human lives goes beyond satisfaction of needs as captured by the Brundtland definition of sustainable development to include “sustaining people’s freedom and *capability* to have what they value” (*ibid*).

Energy access should be viewed as a pathway for people and communities towards better livelihoods,. The paths towards objectives are multiple and place-based initiatives seek to connect these paths through innovation driven by local opportunities.

4.2 Mixed methods

Mixed methods is defined as “research in which the investigator collects and analyse data, integrates the finding, and draws inferences using both qualitative and quantitative approaches and methods in a single study or program of enquiry” (Sage Publications, 2003 in Teddlie and Tashakkori, 2006: 15). Therefore, in this research, the mixed method impacted on research design as well as research instruments as an attempt to embrace difference and responses emanating from the unique context of place. TEP is a programme aimed at creating change, and therefore mixed methods is a means of assessing multi-dimensional responses towards and from TEP. Table 12 outlines the different approaches in research and locates mixed methods in these approaches.

Table 12: Comparison of research practices (Source: Galt and Pharm, 2009)

Quantitative	Qualitative	Mixed method
Theories or explanations are tested or verified.	The focus is on a single concept or phenomenon.	Both qualitative and quantitative data collected.
Variables to be studied are identified.	Personal values brought into the study.	A rationale for mixing is developed.
Questions and variables are related.	The context or setting of participants is studied.	Data is integrated at different stages of inquiry.
Validity and reliability standards are used.	Accuracy of findings validated.	Both practices of qualitative and quantitative practices utilised.
Information is measured and observed numerically.	Interpretations of data.	May present visual pictures of the procedures in the study.
Unbiased approaches used.	An agenda for change or reform created.	Collaboration with participants and between data sets.
Statistical procedures used.	Collaborates with participants.	

A purely qualitative or quantitative approach would have presented lived realities as either “something constructed by people” or “something objective and measurable” (PREST, 2004: 16). However, this distinction does not occur separately in lived realities. By drawing on the

strengths of both practices aids in contextualising and gives meaning to human lives and experiences for the purpose of inductive research while quantitative research instruments yield data for comparison. Mixing datasets results in better understanding complex issues such as energy access and energy poverty than relying on one dataset. This is because shortcomings in either datasets are compensated by the other (Creswell, 2006). Furthermore, mixed methods assist in answering questions that would have been inadequately answered by qualitative or quantitative approaches. In addition, it encourages collaboration across and, as Alkire (2005: 130) stated, operationalising the capability approach “may be a collaborative enterprise” on any level involving different players and using multiple data sources at the same time. The intended function of this research was *complementarity* to enhance or elaborate on findings from other researchers. Another rationale for using mixing methods was that it allows the researcher to observe paradoxes and contradictions emerging upon comparison of the two analytical strands.

4.3 Overall research design

The role of the transformative theoretical framework is not a design issue but rather purposive through focussing on tensions associated with developmental interventions. Table 13 outlines the normative framework.

Table 13: Normative framework of research process

Criterion used	Possible values for criterion
Number of methodologies used	Mixed method study
Number of data types to be used	Qualitative and quantitative
Time sequence of data collection	Sequential (Qualitative → Quantitative)
Priority of methodological approach	QUALITATIVE + quantitative (qualitative has priority)
Functions of research study	Complementarity
Theoretical perspective	Transformative
Stage of integration (level of interaction)	Parallel mixed analysis involving two distinct processes: - quantitative analysis of quantitative data - qualitative analysis of quantitative data
Link to other design components	Parallel mixed analysis linked to parallel mixed designs

The design presented in Table 13 embraces three research approaches: qualitative, quantitative and mixed methods because purely quantitative and qualitative designs were also used in this study. The quantitative strand included survey data from questionnaires and existing data bases such as the NHIES of 2011 while in-depth interviews make up the qualitative strand.

The study involved multiple phases from conceptualisation to inferential stage. In the initial data collection phase, both the qualitative and quantitative phases ran parallel. Initially, both strands were relatively independent; each with its own data collection instruments (questionnaires and semi-structured interviews respectively). Each strand yielded its own results and conclusions made from each were blended to create meta-conclusions at the end of the study. In the second stage, the quantitative dataset was embedded in the qualitative strand to analyse inter-linkages between people, *place* and poverty alleviation. By giving priority to the qualitative strand, quantitative data was adapted into narratives. This is how both sets of data were integrated during the analytical stage to answer different aspects of the same research questions.

The benefit of using mixed methods permitted posing confirmatory and exploratory questions based on trends that emerged from both data sets and in this way generates and verifies theory in the same study. The qualitative strand allowed for, but was not limited to, exploratory questions. The same approach was used for the quantitative strand that allowed confirmatory questions. Because data was collected sequentially, exploratory and confirmatory questions were approached in a pre-specified order.

The study involved two distinct phases. Participants in phase 1 were mainly from the Damara Location where the majority of inhabitants are the San. This phase had a more resource-based orientation aimed at capturing trends in uses of energy by the poor. The second phase involved two SME owners as well as two permanently employed inhabitants for semi-structured interviews. Their experiences in relation to electrification were the focus of the interviews. In addition, these participants completed the household profile and energy access questionnaires. This main aim of this phase was to capture qualitative data to ascertain realised opportunities arising from increased access to modern energy services.

5.3.1. Case study approach

Case studies allow the exploration and understanding of complex issues to provide in-depth explanations within a specific context as well as capture lived realities in detail. Development narratives from literature informed by the views of the San formed the foundation of the case study.

“Development must be seen from a healing perspective. Hands will always remind us about the fact that we should hold in our hands the things that are precious to us.” – Job Morris, (Indigenous Leadership and San values, 2011).

The first port of call was the human development indices per language group that glaringly showcased the huge gap between the San and other language groups. From there, a search of development interventions supervised by the Office of the Prime Minister revealed that over 25 NGOs are involved in Tsumkwe to alleviate poverty. The same office dedicated a comprehensive development programme¹⁴ solely to the upliftment of the San. The programme mainly focuses on resettlement, sustainable livelihood support programmes, education, land and income-generating initiatives for marginalised communities. Success of this programme is measured in the provision of land, livestock, education, clean drinking water, livelihood support goods, conservancies and better housing to bring these communities on par with the “mainstream population” in Namibia (OPM, 2005). Thus, access to amenities or provision is used as proxy to measure development.

The four interviews can be viewed as the point of interface, that is, the point at which qualitative and quantitative data merged. During the April 2013 pilot stage, the researcher collected both quantitative and qualitative data from a single participant in terms of opportunities that emerged from electrification. Results from this stage directed the researcher to approach this as a case study where quantitative data is embedded within qualitative data:

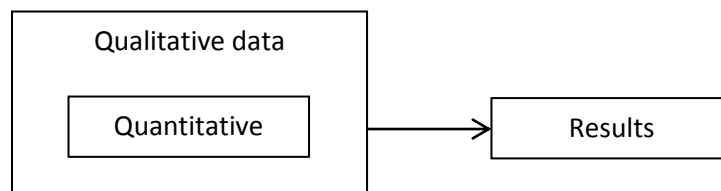


Figure 20: Embedding data

The rationale for embeddedness is to analyse whether energy policies take diversity into account and to what type of alternative *functionings* policies promote access to. Apart from policy analysis rationale, the case study allowed describing the range and *functionings* that were potentially made available following the implementation of TEP. Thus, the case study was used

¹⁴See <http://www.sandevlopment.gov.na/>

as a means to answer effectiveness questions related to translating inputs into desirable outcomes.

4.4 Concluding remarks

This chapter explored mixed methods approach and how this method allows researchers to capture experiences of people through qualitative and quantitative data sets. The implication of such an approach on methodology is for the researcher to engage in qualitative data collection moments that influence quantitative data in order to measure what people value. Energy services aimed at reducing poverty is not as much about technology but it is about better understanding the role of energy in people's livelihoods and how they respond to constraints in improving their lives. By integrating both data sets, that is qualitative and quantitative, the perceived boundary between lived realities and technology becomes blurred.

Chapter 5: Presentation of results and analysis

5.1 Introduction

This chapter presents results from the four interviews about realised opportunities resulting from electrification and energy access. Before the analysis, it is useful to cast a backward glance at the euphoria that sprung right after the commissioning of the Tsumkwe solar-diesel hybrid system:

“I could not open a tailoring shop in the past because I would not have the time. I have to wake up the children up in the morning for school, tend to the field and prepare food for the evening. I would have no time left over to do anything before the power would turn off, but now I have an extra four hours in the afternoon for my tailoring business” (Tsumkwe tailor in Ilharas location, 2012 in Ashton et al, 2012).

“Several businesses have developed as a direct result of TEP. The Local Government officials noted an increase in the number of residents filing business applications at the office” (Ashton et al, 2012).

“Now that there is 24-hour power, big businesses will want to come to Tsumkwe, there is a demand for them to come here. They can make money here” (Mr Tjombuua in Ashton et al, 2012).

The retrospective approach was used to qualitatively analyse the changes experienced one-and-a-half years after the implementation of TEP. What has changed? What contributed to these changes? What hampered change? Which expectations were not met?

5.2 Results from interviews

5.2.1 Interview 1

Since the inception of the solar-diesel hybrid power plant in 2012, not all residents are connected to the mini-grid. This slow pace of connection resulted in a number of residents making illegal connections in order to have electricity in their homes. Those who allowed illegal connections from their houses are benefiting by requiring the illegal connectors to pay a fee. Monica lives in the Damara location with her family of five members and has an illegal electricity connection from a San neighbour. She is permanently employed and spends about N\$500 per

month on electricity which she uses to light three bulbs, a refrigerator, television and fan. This seemed a high amount of money spent considering what it is used for. She explained that:

“...these people make me pay. If I buy units for N\$100, we put it in the meter but I still have to pay an additional N\$50.”

Both households both make use of the electricity units resulting in the owner spending a negligible amount on electricity. To supplement her income, Monica runs a microbusiness selling sweets.

“This whole location...only a few people got electricity. Mainly the San, so many people here did like I did. The problem is that those people take a long time to come put in electricity in our houses.”

For cooking and heating, she uses wood on a traditional 3-stone fire. The average time spent to collect fire wood is 10 minutes indicating how freely available wood is. She does not own a gas stove citing that it is expensive to acquire as she did not have own an electric stove before TEP.



Figure 21: Three-stone fire

5.2.2 Interview 2

Another interview with a SME owner shows that the impact of electricity provision is minimal to non-existent. She reiterated that business is the same as it was before. It was anticipated that with the provision of a stable 24-hour electricity supply businesses will be able to expand, however, it is not the case. The SME owner highlighted the critically short supply of cooking gas (propane) from the local supplier. Two months can pass with no cooking gas available. As a result, she uses an electric stove to prepare food as she has no other means. She is aware

that it is not allowed, but because it is dark when she gets home, there is no time to collect firewood to cook. Additionally, she feels that cooking with firewood is polluting and unacceptable as “*clothes smell of smoke*”. She owns both an electric and gas stove. She expressed her dissatisfaction with solar-diesel system that prohibits the use of electric stoves:

“They came here telling us to exchange our electric stoves for gas stoves...I did not give my electric stove...The gas gets finished. ...Sometimes three months pass without the supplier having gas available”

“We have kids in our houses, kids have to eat and then you don’t have gas to cook with”.

“You must see how far Grootfontein is. It is not always possible for us to go to Grootfontein. We don’t always go to the town. And it is not always that you find someone who is going. It is difficult to get a lift. We have kids in our houses and they need to eat, with what do you cook for the child to eat?”

“I arrive after sunset at home and there is no time to collect wood.”

The expectation from TEP that there would be fewer blackouts as a result of switching off diesel generators to minimise generation costs was met.

“But during the rainy season, it’s a bit problematic. Then there is no power... Sometimes the diesel gets finished. Then they have to run around to get some.”

It is peculiar to note that the only cooking fuel suggested and implemented was LPG with full cognisance that the supplier of gas, although local, gets his stock from 306km away.

“There is no reliable gas supply. And that is where I see the problem lies. At the beginning they gave us gas.”

“Sometimes you just struggle to get someone who is going to town at the end of the month”

“It (the supply of gas) was not better (before TEP), but now because they told us not to use electric stoves we feel it more. One is scared to use the electric stove but we have no choice. If you use the electric stove, then they get angry.”

“Even yesterday they wrote letters saying that those who use electric stoves...their stoves will be taken away”

An observation made is that those who occupy teachers' houses on the school premises use electric two-plate stoves to cook, even though there is cooking gas pipes installed. Upon enquiry, the teachers stated that they never use the gas due to its unavailability.

A neighbouring SME owner, residing in Owambo location, stressed that whenever she approaches the local government houses to enquire about getting electricity, she is either informed that the pre-paid meters are out of stock or that they did not receive any. She expressed her frustration with the selectivity of only some houses connected to the grid. She uses biomass for cooking and candles to light, however, she doesn't feel safe using these fuels as the risk of a fire starting is high.

“...those people just came and gave electricity to those people who live in nice houses and the San electricity.”

“I went to the Local Government offices but they just say there are no pre-paid meters...they just decide who must get electricity and we are left out.”

Even this year when I went there they just say they got some pre-paid meters but now they are finished”

A previous survey (Eisenbach, Hanlon and Ingalls, 2009) showed that the majority of residents wanted to have a supermarket, butchery, bank and a clothing store in Tsumkwe.

“About business, I did not see any improvement or deterioration. What was happening before is what is happening now.”

It was expected that these businesses would be easier to set up once there is a stable electricity supply. A cursory observation showed that instead, some of the shops closed down since 2009.

5.2.3 Interview 3

A catering business owner who had a permanent job before, opted to return to permanent employment as her catering business did not pick up as expected.

"I got a job now at the school hostel that's why I don't really cook and sell anymore."

During an interview with Eisenbach et al (2009) the caterer stated that electricity is hampering the expansion of her business. She retrospectively reflected that:

"The business is not doing that well. It's better to have a job where you know how much money you will get every month."

It was heartening to note that she buys her vegetables supply from the local gardener and does not travel or lament the distance to Grootfontein to obtain vegetables. She also uses gas to cook at home and in her catering business.

"...but the gas just gets finished and then you have to wait for a long time to get or drive to Grootfontein"

In the absence of gas she uses wood in a traditional 3-stone fire.

"Wood is available around here. We just go and pick up wood."

The cost per kWh increased by 50% in October 2012 to N\$1.50/kWh.

"Before when I buy for N\$100 I used to get 100 units, but now I only get 63 units for N\$100."

The rationale to increase the price is to increase the revenue from the sale of electricity to cover operational costs of running hybrid plant as well as to purchase 16 000 litres of diesel at a cost of about N\$160 000 every third month.

5.2.4 Interview 4

The local radio broadcasts around Tsumkwe as well as the surrounding areas. An employee at the Namibia Broadcasting Corporation (NBC) stated that the types of programmes that airs on the radio centre around issues such as drug and alcohol abuse as well as the abuse of children.



Figure 22: The local radio station logo

It only broadcasts in the Ju/'hoansi language. When asked what she talks about these issues she reiterated that she *"...just gives advice"*. Before, she taught at a village school and cited the high dropout rate of learners among the San.

"I used to teach at a village school, and the kids drop out. Sometimes the parents would come and take the children out of school."

One reason given is that chilly morning temperatures contribute to small children missing school. The hope is that with better energy services, !Ha radio station can meaningfully contribute to socioeconomic upliftment of the San. All these hopes and expectations pegged on improved energy services give rise to a myopic stance about efforts aimed at improving the plight of the poor. The researcher suggested requesting the school principal to start classes later in the day when it is warmer. The response from the interviewee was *"I never thought about it. We can suggest that in our next programme"*.

A San student who attends a tertiary institution explained that:

"Only the strong ones survive to the end. The weak ones simply drop out and go back to their roots where they feel welcomed and regarded as human beings and taken care of."

The NBC employee has electricity at home and cooks with gas. In her case, she does not have any problem with getting gas on a regular basis because *"the work car goes regularly there so I get my gas each month."*

5.3 Results from questionnaires

5.3.1 Household size and language groups

Figure 23 shows the language groups that made up the sample.

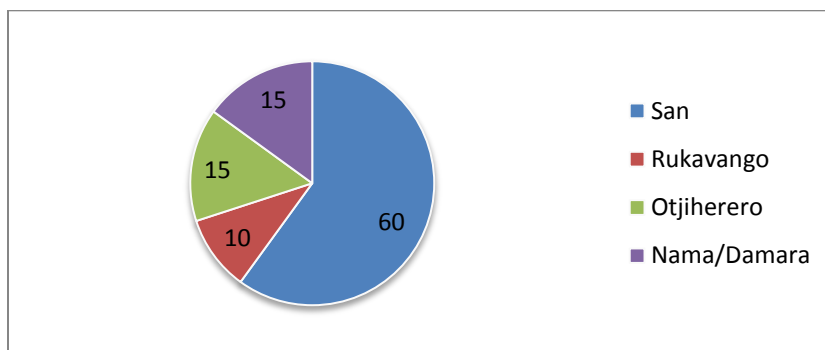


Figure 23: Representation of language group in sample

25% of the sampled households consisted of 8 members with 10% having 13 members. The language groups and the number of members per household are shown in Figure 24.

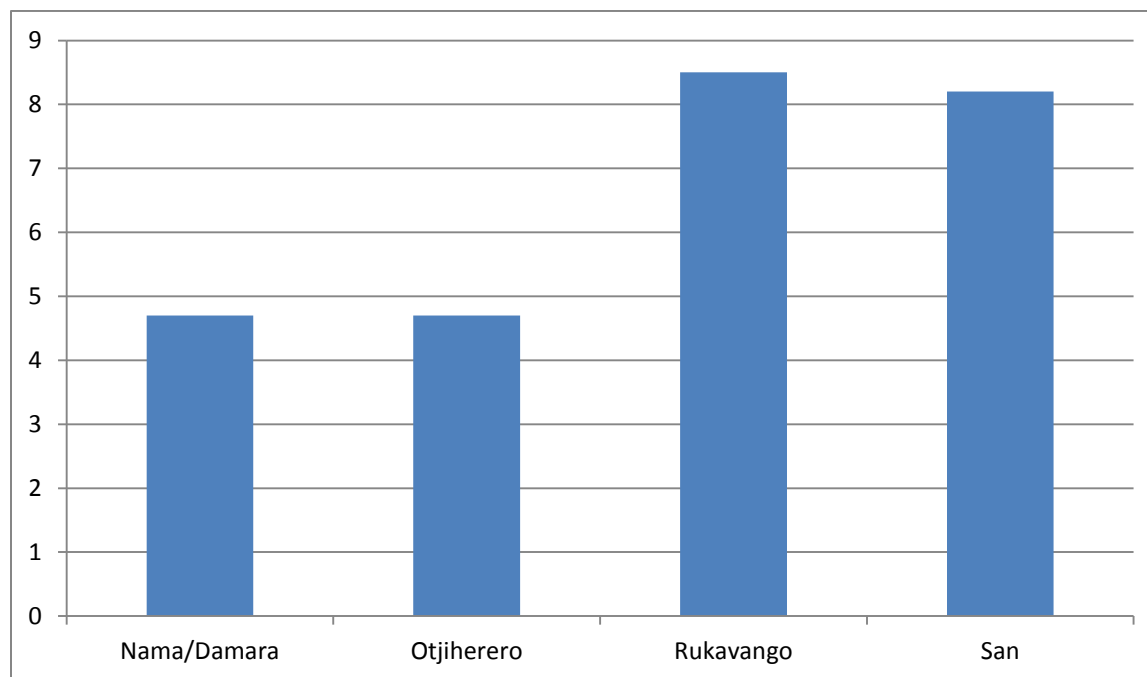


Figure 24: Household size per language group in sample

5.3.2 Level of education and employment

The education profile from the sample shows that 45% have a grade 10 or lower qualification with an equal figure having a grade 12 qualification. 10% did not complete any grade. The employment status and wage structure is shown in Figure 25.

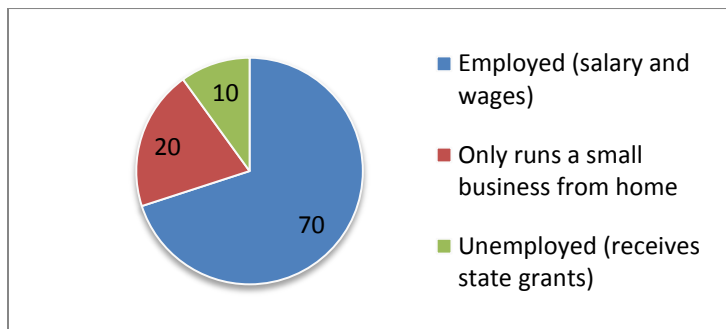


Figure 25: Employment situation of sample

The biggest employer is government with 50% of the sample working as public servants.

Disaggregation of the head of household employment status per language group shows that 67% of the San are unemployed; 55% did not look for employment in 2013 with 30% citing that they believe there is no work available.

Figure 26 shows the education levels of respondents.

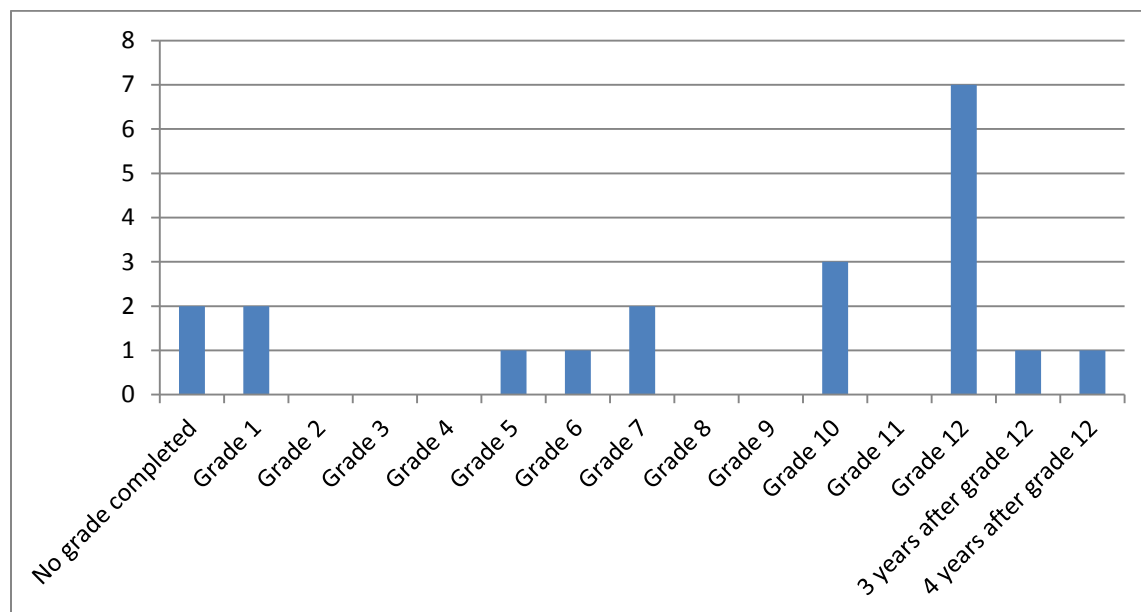


Figure 26: Grade levels of respondents

The education level of the San is outlined in Table 14 showing that 66.7% have a grade 7 or lower.

Table 14: Education level of the San in the sample

Level completed by head of household	Percentage
No grade completed	16.7
Lower primary (grade 1 – 4)	16.7
Upper primary (grade 5 – 7)	33.3
Junior secondary (grade 8 – 10)	25
Senior secondary (grade 11 – 12)	8.3

5.3.3 Energy sources used for cooking, heating and lighting

In order to gain better understanding about the impact of TEP on residents in Tsumkwe, the following research instruments were used:

- Community profile
- Household profile questionnaire
- Energy access questionnaire

Each of the research instruments provided data that allowed the researcher to compile a more complete picture of residents and how they interact with the energy situation as they go about their daily routine. Twenty households completed both the household profile and energy access questionnaires. The community profile was completed using existing databases of 2001 and 2011 National Housing Income and Expenditure Surveys (NHIES) in order to correlate demographic data obtained from the household questionnaire and to make a 'before' and 'after' comparison.

The community energy profile is outlined in Table 15.

Table 15: Tsumkwe sources of energy for cooking, heating and lighting prior to TEP (Source: NHIES, 2001¹⁵)

Energy service	Electricity (%)	Paraffin (%)	Wood/charcoal from wood (%)	Gas (%)	Charcoal-coal (%)	Solar (%)	No cooking/heating/lighting (%)	Other (%)
Cooking	3.8	1.4	89.6	2.6	1.2	0.1	0.2	0.3
Heating	3.5	1.4	70.9	0.6	1.7	2.0	18.7	0.4
Lighting	6.2	27.5	27.7	0.2	1.7	34.8	1.2	0.7

80% of the respondents listed lighting as the biggest advantage of electrification, with charging mobile phones, watching television and listening to the radio as the next big advantages. Figure 27 shows the energy ladder specific to lighting.

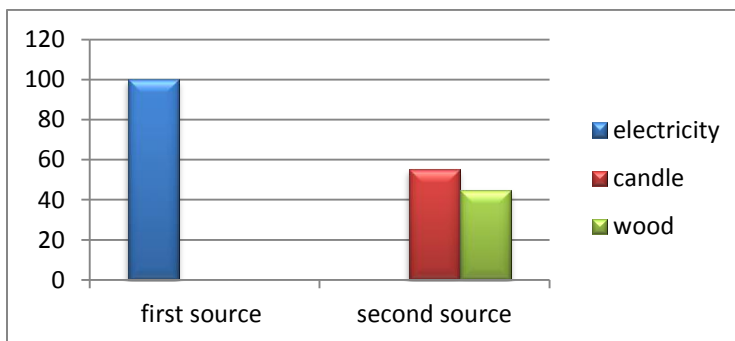


Figure 27: Sources of lighting

The energy efficiency approach of TEP was to have 100% of electrified residents to utilise LPG for cooking. However, Figure 28 paints a slightly different picture with regard to cooking fuels especially when it comes to the second and third source for cooking.

¹⁵ The 2011 NHIES does not disaggregate data per settlement but rather per region. Thus, data with regard to energy source used for lighting and thermal use are not shown from the 2011 survey.

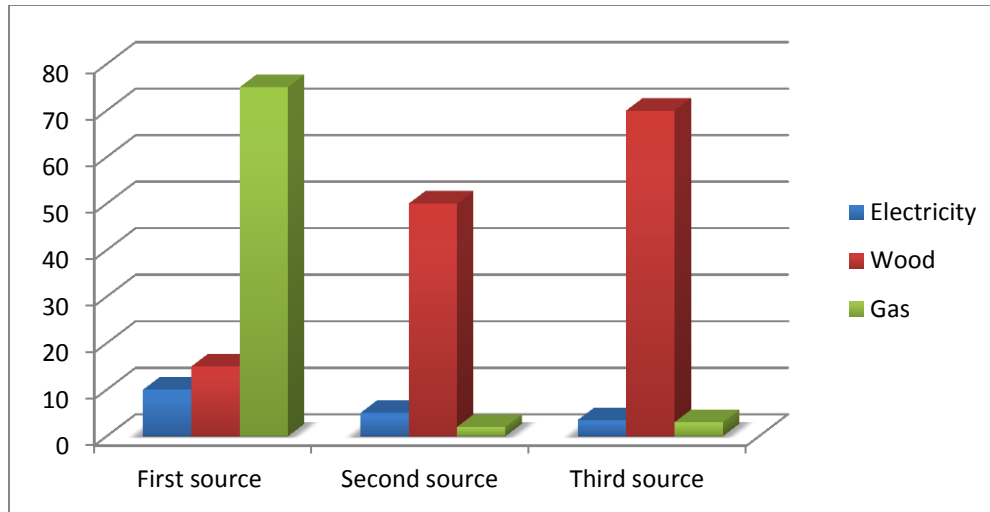


Figure 28: Sources of energy for cooking

LPG is the dominant fuel used as a first source for cooking, especially by households where at least one member is employed. However, the duration it takes in obtaining LPG places wood as a major second source used for cooking. The methods to obtain fuel reinforce this observation as set out in Table 16.

Table 16: Methods of obtaining cooking fuel

Method used to obtain fuel	Percentage (%)
Gather	56.25
Purchase	20.85
Gather and purchase	22.90

Additionally, the time it takes to gather wood was 30 minutes or less on average, compared to 4 – 7 hours it took to obtain gas. The reason for fuel switching is not income, but rather unavailability that increases time cost.

5.3.4 Energy related expenditure for households

On average, residents in the Damara location spent N\$176.50 per month on electricity. This is equivalent to an average consumption of 117.7 kWh per household. However, aggregation masks the spending pattern of the poorest who spent N\$50 or less (33.3 kWh) on electricity per month. The lowest amount recorded was N\$20 (13.3 kWh). Figure 29 shows the monthly

amount spent on electricity and cooking fuel. The San household size is included to illustrate disproportionality with kWh consumed per month.

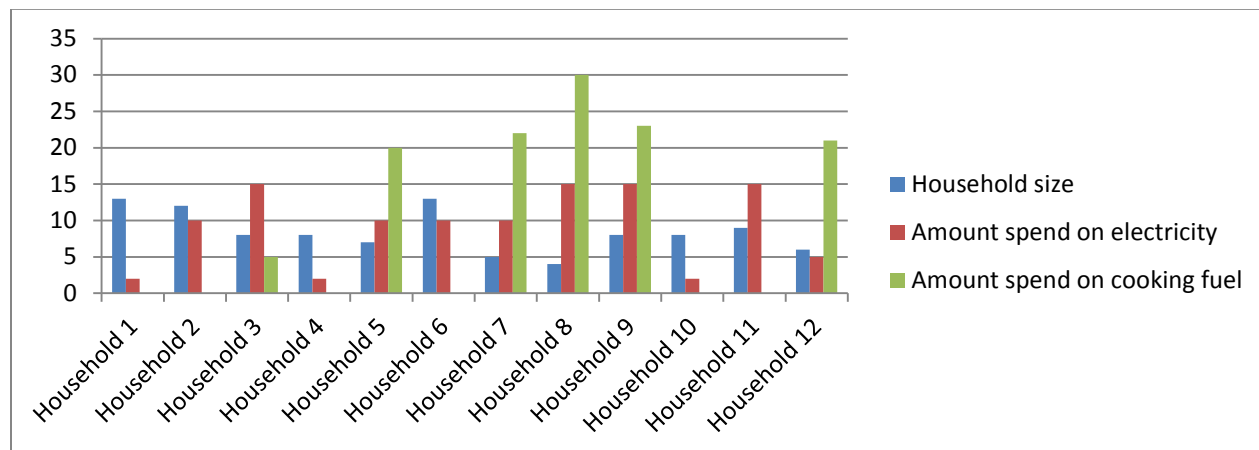


Figure 29: San households monthly energy expenditure¹⁶

Households 1, 2 4, 6, 10 and 11 (50%) solely use wood as a thermal source. Furthermore, the aforementioned households, except household 11, purchase disproportionately less electricity compared to the number of household members as shown in Table 17.

Table 17: kWh/person/month for electricity used in San households that use wood as the only source of cooking

Household number	Number of household members	kWh/person/month
1	13	1
2	12	6
4	8	2
6	13	5
10	8	2
11	9	11
Average	10.5	4.5

The San households that use LPG as the main source for cooking shows this trend as set out in Table 18 for electricity consumption.

¹⁶ The amount spent on electricity and cooking fuel was divided by 10 to better illustrate the relationship between household size and expenditure on electricity and cooking energy.

Table 18: kWh/person/month for electricity used in San households that use LPG for cooking

Household number	Number of household members	kWh/person/month
3	8	13
5	7	10
7	5	13
8	4	25
9	8	13
12	6	6
Average	6.3	13.3

Consumption of electricity per month in relation to household size for other language groups is shown in Figure 30.

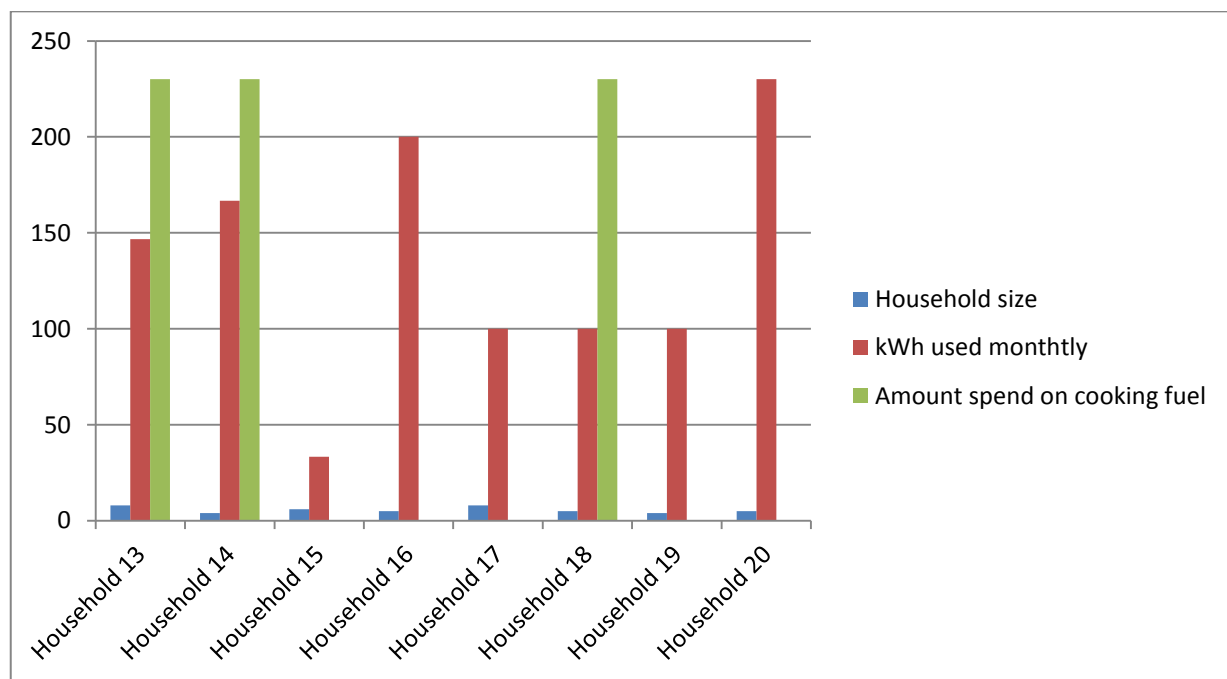


Figure 30: Household size vs. monthly electricity consumption for other language groups except the San

Table 19 outlines the kWh/person/month for households that uses wood and/or LPG as a thermal energy carrier.

Table 19: kWh/person/month for other language groups in Tsumkwe for electricity used

Household number	Number of members in household	kWh/person/month
13	8	18
14	4	42
15	6	6
16	5	40
17	8	13
18	5	20
19	4	25
20	5	46
Average	5.6	26.1

Households that use LPG have either one or two permanently employed members bringing the percentage of those who own such a stove to 70% with only 20% of those employed owning a vehicle or have access to regular transport to source LPG from Grootfontein.

Table 20 and

Table 21 show the ratio of amount spent on cooking fuel to electricity for San households. The ratio was then correlated with the method of obtaining fuel.

Table 20: Ratio of cooking energy costs vs. electricity cost for San households

Household number	Ratio	Method of obtaining cooking fuel
1	0	Gather
2	0	Gather
3	0.3	Gather and purchase
4	0	Gather
5	2	Gather and purchase
6	0	Gather
7	2.2	Purchase
8	2	Gather and purchase

9	1.5	Gather and purchase
10	0	Gather
11	0	Gather
12	4.2	Purchase

Table 21: Ratio of cooking energy costs vs. electricity cost for other language groups

Household number	Ratio	Method of obtaining cooking fuel
13	2.4	Purchase
14	2.1	Gather and purchase
15	0	Gather
16	0	Gather
17	0	Gather
18	3.5	Purchase
19	0	Gather
20	0	Gather

All households that exclusively obtain cooking fuel through gathering use the inefficient traditional 3-stone stove for cooking.

5% of households indicated that they engage in microbusinesses from home selling sweets, cigarettes and other related items. Figure 31 and Figure 32 show for which purposes households and SMEs use electricity.

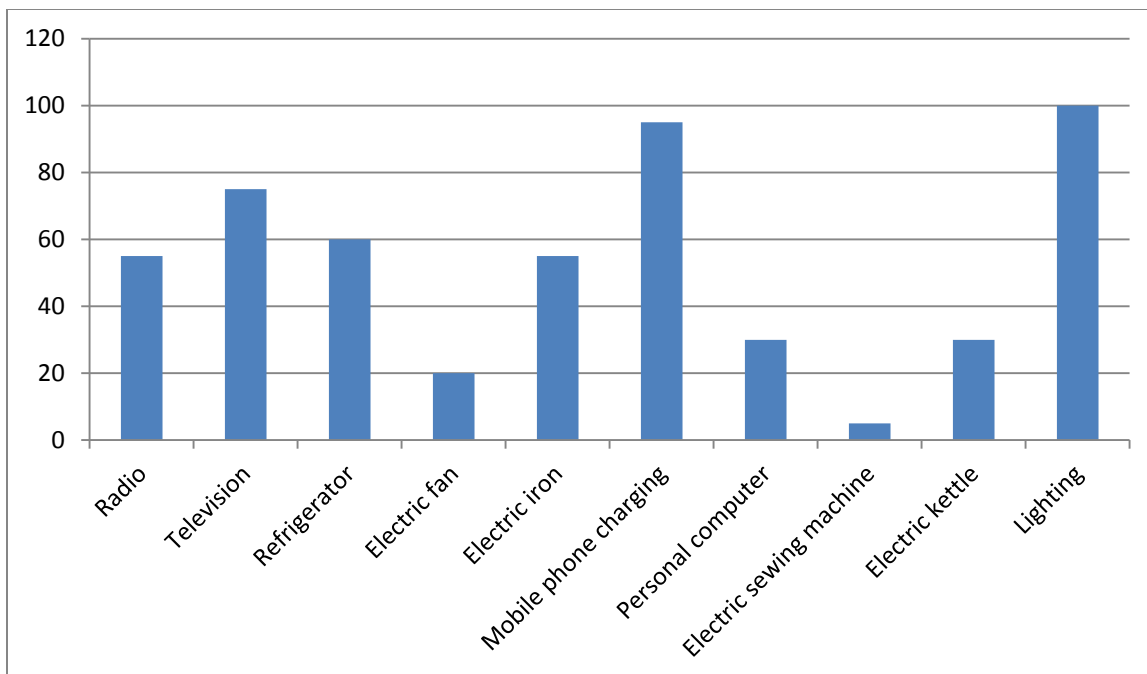


Figure 31: Asset ownership and major uses for electricity in Tsumkwe households

Of these uses, mobile phone charging, refrigeration, personal computer and the electric sewing machine can be potentially used to generate income from home.

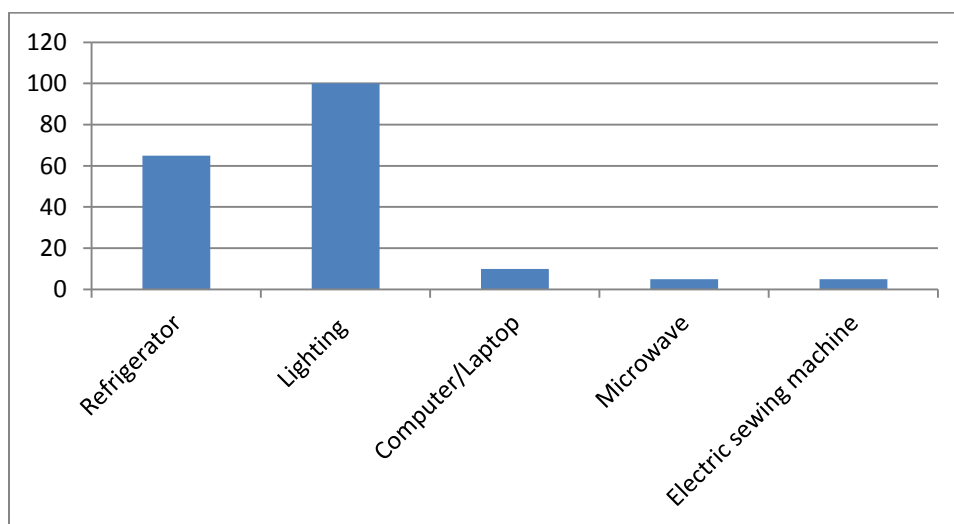


Figure 32: SME asset ownership and electricity uses

Comparing data from the 2001 NHIES survey shows an increase asset ownership for households and thus an increase in the possibility of earning an income from assets.

Table 22: Asset ownership in 2001 (Source: NPC, 2001)

Asset	Percentage (%)
Television	5.3
Radio	37.9
Telephone	5.1
Personal computer	1.5

Acquisition of assets cannot solely be attributed to stable electricity supply as there other factors that might contribute to owning assets such as an improvement in the economic status of a household. However, it is worthwhile to notice that residents' assets have improved and with it, the potential to engage in entrepreneurial activities.

All participants claim to have a legal electricity connection obtained from TEP. The electricity sales office records show that 170 houses and 20 businesses (including NGOs and government institutions) have electricity connection points.

5.4 Data analysis

5.4.1 Introduction

A sequential data analysis was performed in which trends from qualitative data were compared to and complemented by quantitative data trends. This was the point of interaction of both sets of data. The analysis was case-oriented focusing on selected cases to “analyse and to interpret meanings, experiences, perceptions or beliefs of one or more individuals” (Combs and Onwuegbuzie, 2010; 6) within a wider setting.

Deprivation in Tsumkwe is two-fold:

- The poor are unable to afford electricity at the higher price resulting in it being primarily used for consumptive and little productive purposes.
- The inaccessibility of LPG with high associated time cost causes households to engage in fuel switching towards inefficient energy carriers.

The thermal energy results chain due to LPG inaccessibility can be visualised in Figure 33.

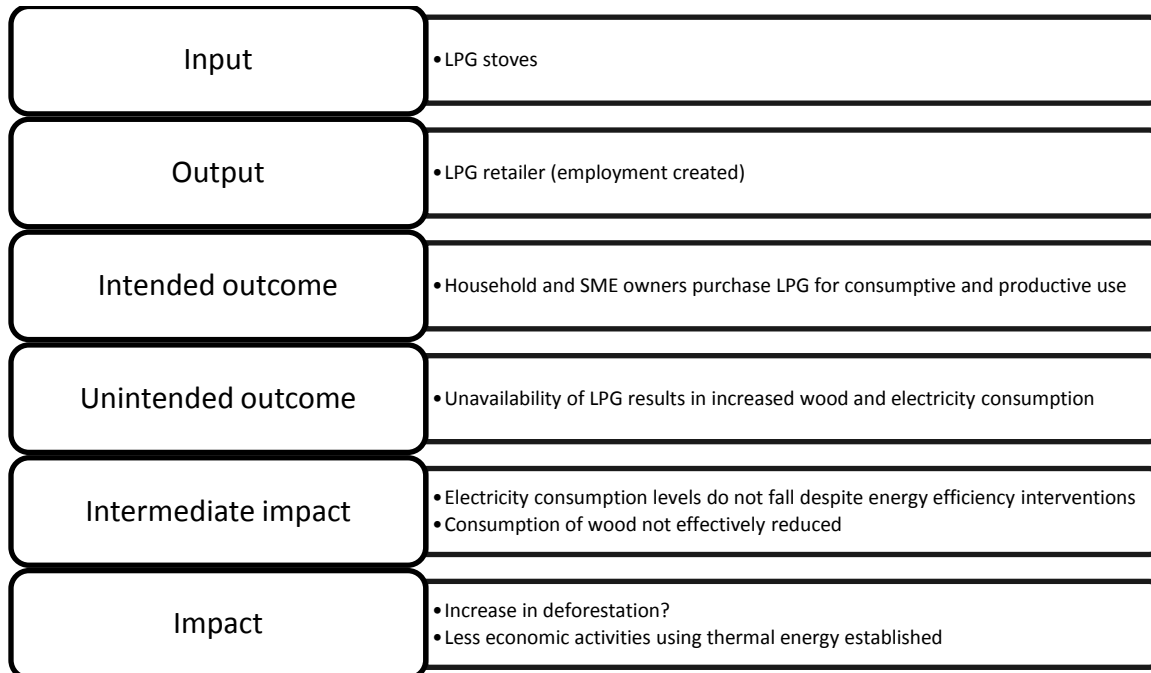


Figure 33: Results chain for thermal energy for Tsumkwe

Figure 34 shows the results chain for electrification:

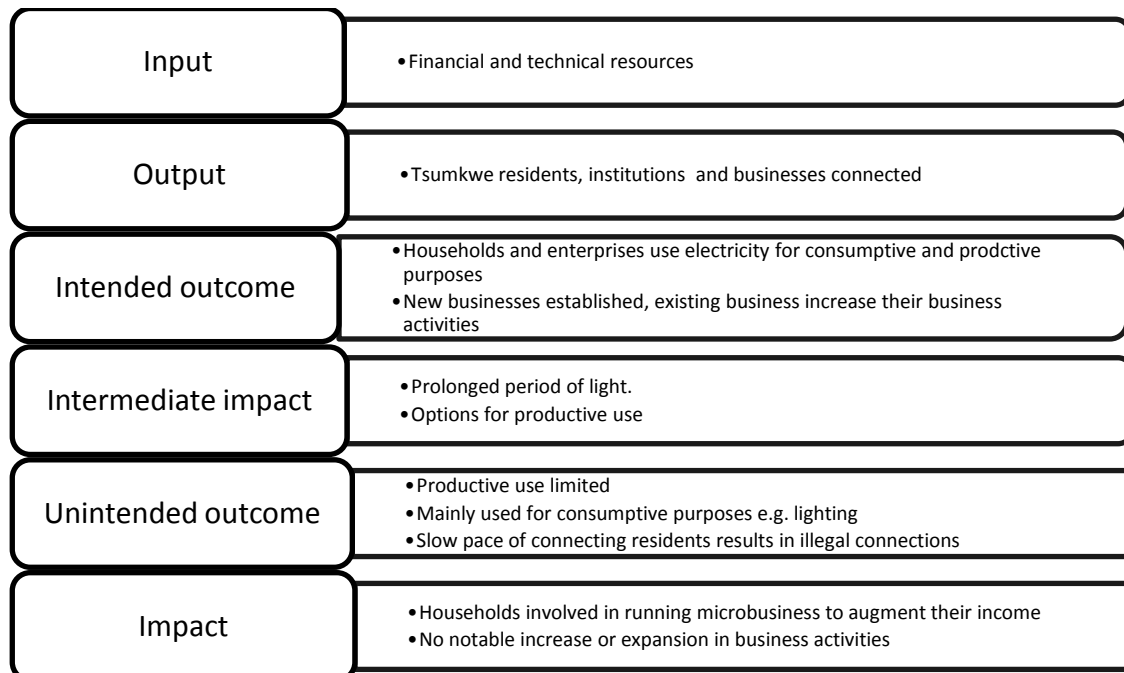


Figure 34: Tsumkwe's electrification result chain

The resulting energy use matrix for Tsumkwe is outlined in Table 23.

Table 23: Energy use matrix for Tsumkwe

Energy options	Non-electrified households	Electrified households
Thermal use		
Traditional 3-stone stove	Cooking, heating and lighting	Cooking and heating
LPG	Limited cooking and productive use	Limited cooking and productive use
Lighting		
Paraffin, candles and wood	Lighting	Used as back-up for lighting
Grid electricity	Not used	Mainly for lighting, entertainment and communication Limited cooking and productive use
Productive use		
LPG	Limited productive use	Limited productive use
Grid electricity	Not used	Limited productive use

Both electrified and non-electrified households use the traditional 3-stone stove for cooking and heating regardless of employment status. Residents were required to exchange their electric stoves with gas cookers and not with wood efficient stoves; this illustrates policy determination towards achieving pre-defined goals.

5.4.2 Adoption and access

The provision of energy and electrification in Tsumkwe, although welcomed, did not enhance the *capability* of the poor because, structures in place, i.e. conversion factors, were not used to facilitate the potential transformative role of energy into *functionings*.

The highest amount spent on purchasing electricity obtained from the quantitative dataset was N\$400. However, in the interview, Monica revealed that she spent N\$500 on electricity because of the illegal connection that she has from her San neighbour. Half of the amount is not used to purchase electricity, but rather to pay for the 'service' she receives from her neighbour. The neighbour revealed he mainly uses electricity for lighting and his household's day-to-day activities require little to no electricity. He uses wood as a thermal source and this also provides light in case his electricity units run out.

All questionnaire participants showed that they all had a legal connection to the grid, but this is disputed by the qualitative research instruments that revealed a number of illegal connections with the same aforementioned transaction arrangement.

A purely quantitative analysis using sales of pre-paid units reveals that the San are purchasing a considerable amount of electricity units. The purchasing record of a household with access to electricity can be used as a measure of affordability of consumption to ascertain the level of household consumption and success of subsidy schemes or other social support programmes aimed at aiding the poor.

The current situation is that there is no stepped tariff structure implemented with all consumers paying the same amount regardless of economic status. Thus, the poor engage in income generating activities to be able to afford consumption of electricity for lighting and entertainment and very limited productive use.

The electricity access supply configuration for Tsumkwe is illustrated in Figure 35.

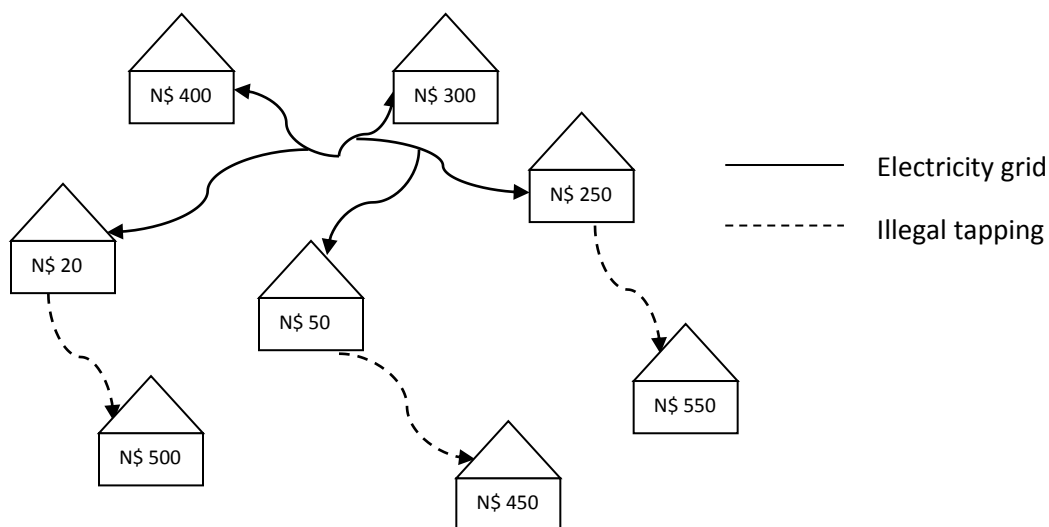


Figure 35: Electricity supply configuration for Damara Location

A number of households in the Damara location, notably unemployed or low-income households allowed an illegal connection to their pre-paid meters. The amount spent by households with an illegal connection is disproportionately high. Such households run micro-businesses from their homes to supplement their income.

5.4.3 Using place-based solutions for income-generation

5.4.3.1 Charcoal production and utilisation: a missed opportunity?

From a resource-based view, Tsumkwe can be regarded as a locality that has a sustainable competitive advantage derived from the possession and utilisation of invader plant species. *Capabilities* are often “complex and difficult to change over time” (Korhonen and Niemelä,

unknown: 14), and, together with resources, they make up the assets that can be controlled from *within*.

Charcoal production involves harvesting of bush invader species followed by carbonisation as shown in the series of pictures in Figure 36.



Figure 36: Charcoal production process (Source: Diekmann and Muduva, 2010)

The intimate knowledge of the San can be utilised to ensure that only species identified as invaders are utilised in the production of charcoal. Diekmann and Muduva (2010) stated that three to four tons of wood produces one ton of charcoal. After carbonisation, the charcoal is bagged and the workers' spouses can help in packaging and sewing these bags. The charcoal can then be sold and used in a clean burning stove.

Figure 37 illustrates how skills and resources can be embedded as a place-based approach towards development within the capability framework as well as transformative paradigm:

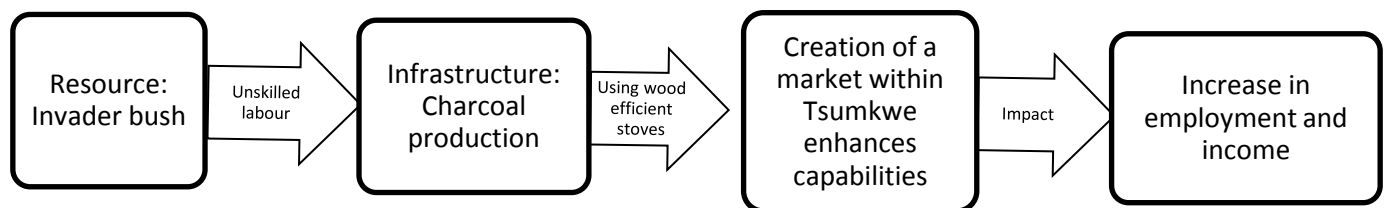


Figure 37: Embedding place-based capabilities

This approach transforms skills and *capabilities* of *place* in order to develop and deploy resources within Tsumkwe as a means of establishing internal economic networks and thus reduce dependency on Grootfontein. *Capabilities* emanating from charcoal production are industry-specific and are thus influenced by the market. For example, if charcoal sales are dominated by the leisure market, seasonal variations impact on sales as charcoal is mainly used for barbequing. However, if charcoal is used as thermal energy for household cooking, seasonal variations would have little or no impact on sales.

This section illustrated that, through proactive development of *capabilities*, energy provision has the potential to drive income generating activities through sustainable harvesting of invading bush that consistently maintain value over time.

5.4.3.2 The role of place-based solutions

Several research studies highlighted the physical distance between Tsumkwe and Grootfontein as a hindrance of getting goods to Tsumkwe, yet, the TEP proposed and implemented gas stoves as an energy efficiency strategy that uses LPG sourced from Grootfontein. The isolation that resonates in Tsumkwe is more than just the physical remoteness; it is also isolation from strategies, resources and institutions that fail to recognise locational advantage. One of the interview participants noted that “*wood is available everywhere*” however, this resource was relegated to the backseat in the search for appropriate technologies. *Place* matters. The decision that required residents to exchange their electric stoves with gas stoves showed that it was based on a single type of data to inform the opportunities that are available. The effort involved in obtaining gas for cooking forced some residents to use electric stoves reinforcing a broken system that might derail the objectives of TEP. By focusing on place-based solutions, it fosters relationships that could catalyse changes within a community.

Severely affected social groups require multi-pronged developmental approaches. As one interviewee noted: “*...they just came and told us that those with electric stoves should exchange them*”, however, the proposed solution was not responsive to community need pointing to an implementation gap. By using place-based solutions, strong local networks, as demonstrated by the SME catering business owner who purchases her fresh produce from the local garden (San to San cash transaction), are established and have the potential of creating jobs and enhance *capabilities* of people and *place*. Such transactions are however rare.

A resident remarked in an interview that there is a lack of community response to economic development initiatives. A research study observed that “women can be seen making hand-made crafts” (Eisenbach et al, 2009: 14). Crafts have for so long been proposed as one of the ways to earn an income, however, this transaction is based on power dynamics. Buyers usually purchase the crafts from the San at low prices and then re-sell them at substantial profits (*ibid*). Strong local networks among social groups that face persistent poverty are essential precondition because internal networks operating on an equal footing are created limiting exploitation. Place-based solutions are but one avenue to build such internal networks within the *place* instead of creating and relying on external networks.

5.5.6 Energy for productive use

Productive energy use can be defined as any use that assists in generating income for the end-user. However, not all uses need energy as an input.

The novelty of electrification in Tsumkwe can be seen in the number of business applications at the offices of local government and housing. From the interview it can be inferred that the majority of these business applications never came to fruition and some that managed to start, discontinued soon afterwards. This shows that energy is not the only, nor an essential factor that impacts on micro-enterprise growth. Businesses that seem to thrive after electrification are those that utilise refrigerators.

Eisenbach et al. (2009) conducted a survey of SME owners and identified energy-related constraints for SMEs as set out in Table 24.

Table 24: Energy related constraints for SMEs

Type of SME	Energy related constraint	Expected outcome
Hair salon	Unstable electricity supply interrupted water supply and caused delay to customers	Stable electricity supply will ensure continuous water supply. No delay for customers and thus more customers resulting in more income earned
Take away	Not able to provide new services limits expansion	Prepare food the night/day before can be heated using a microwave oven
Grocery shop	Unstable supply prevented refrigerators from working continuously and perishables got spoiled. Additionally, refrigerators broke down frequently	Perishables will not spoil and refrigerators will not breakdown as much
Automobile mechanic	Unable to expand and train others	Extended working hours resulting in more business
Local bakery	Unable to expand	Extended working hours resulting in more business

Agroforestry	Unable to expand	Better water supply as the water pumps can work for 24 hours
--------------	------------------	--

Energy was given as the overriding factor limiting business expansion, however, lack of customers and access to supplies and resources also limits expansion. The usual suggestions to aid economic growth in Tsumkwe emphasise better linkages with Grootfontein to ease access to supplies.

Comparing data from the 2001 and 2011 NHIES survey shows that the number of jobs increased over the 10 year period while business decreased:

Table 25: Trend in source of income over a 10 year period (NPC, 2001; Namibia Statistics Agency, 2011)

Source of income	2001	2011
Salaries and wages	25.4	47.2
Pension	20.1	5.0
Cash remittance	2.6	2.5
Business	5.0	2.0

A resident in the Ilharas location who, in 2011, indicated that she would open a small tailoring shop managed to do so. She uses an electric sewing machine to mend and make clothes. However, other business owners who, immediately after electrification, invested in electrical equipment had to abandon using the equipment as it increased operation costs without improving turnover. One such owner is the automobile mechanic who closed his SME in 2012. The hair salon owner indicated that business activity has not picked up as expected.

Residents indicated that the number of jobs did not increase from pre-existing and newly established businesses since the expansion of electricity even though the census figures in Table 25 depicts an opposite trend as to what is observed. 30% of respondents cited that there are no jobs available. Indeed, the catering business owner interviewed opted to return to formal employment as it offers certainty of fixed income. In this way, she is able to operate her catering

stall on a part-time basis to supplement her monthly wages. No large commercial companies were established in Tsumkwe post-TEP despite expectations set out in the project proposal.

5.5.7 Consumptive use

What savings were realised from the provision of reliable electricity supply and LPG use for households? Employment creation and SME growth did not materialise as a direct or indirect outcome of TEP and this can be interpreted as non-improvement in a household's income. Exploring the relationship between energy expenditure (electricity and LPG/wood) and household monthly income shows that there is no direct correlation between a household's income and share of biomass use. This can be attributed to the time component to procure LPG as it takes up to 7 hours to obtain resulting in wood becoming the preferred choice cooking fuel. Thus, a household's choice for energy carriers is impacted more by physical distance to source LPG as well as misguided policy direction that offered only one option for cooking fuel. Instead of a decline in biomass fuel, households 'step back' (use wood) or 'step up' (use electricity) the energy ladder due to limited choice. Both situations are undesirable as increase wood use can impact negatively on the natural environment and using electricity to cook can deplete the solar-generated electricity resulting in running diesel generators for longer that may in turn impact on generation cost. The number of families collecting firewood did not decrease as a result of TEP. Can those who 'step back' on the energy ladder be termed as 'energy losers' due to the low efficiency of using wood and the associated stove for cooking and heating?

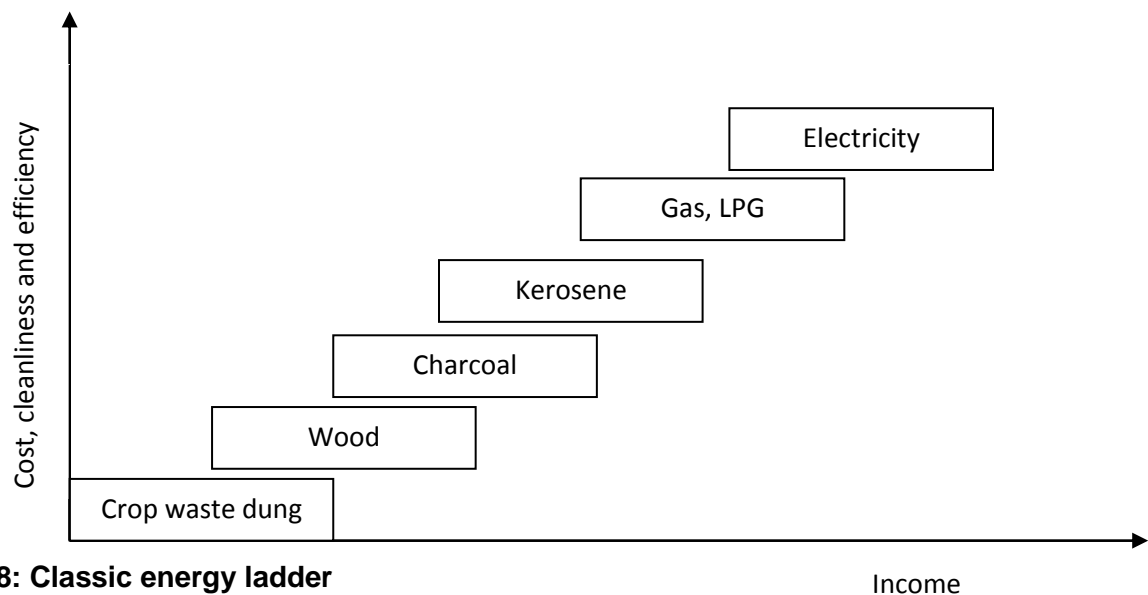


Figure 38: Classic energy ladder

Based on the classic energy ladder in Figure 38, the results from policy implementation shows that those that resort to using wood for cooking and heating are 'energy losers', not due to

deterioration in income, but due to inaccessibility. A possible consequence of this is that wood extraction from the environment might increase especially if the number of households in and around Tsumkwe increases.

Households in Tsumkwe are going back two steps on the energy ladder (from LPG/electricity to wood). The leapfrogging approach adopted in energy policy, from traditional forms of energy to modern sources, indicates that investments made in acquiring LPG stoves are not fully utilised. In this instance, the deprivation is the unavailability of appliances such as wood/biomass efficient stoves to make use of readily available energy carriers. Therefore, the dimensions of energy poverty in Tsumkwe are the lack of physical access to alternative efficient appliances apart from LPG stoves as well as energy inconvenience related to time cost.

5.6 Modelling the energy poverty penalty in Tsumkwe

Using the 10% proxy, the penalty is measured as follow in this thesis. Firstly, an energy poverty ratio (Hill, 2012) was calculated as:

$$\frac{\text{Consumption} \times \text{Price}}{\text{Income}}$$

A ratio that is greater than 0.1 indicate an energy poor household. Figure 39 illustrates the scenario for households that use LPG and wood as cooking fuel:

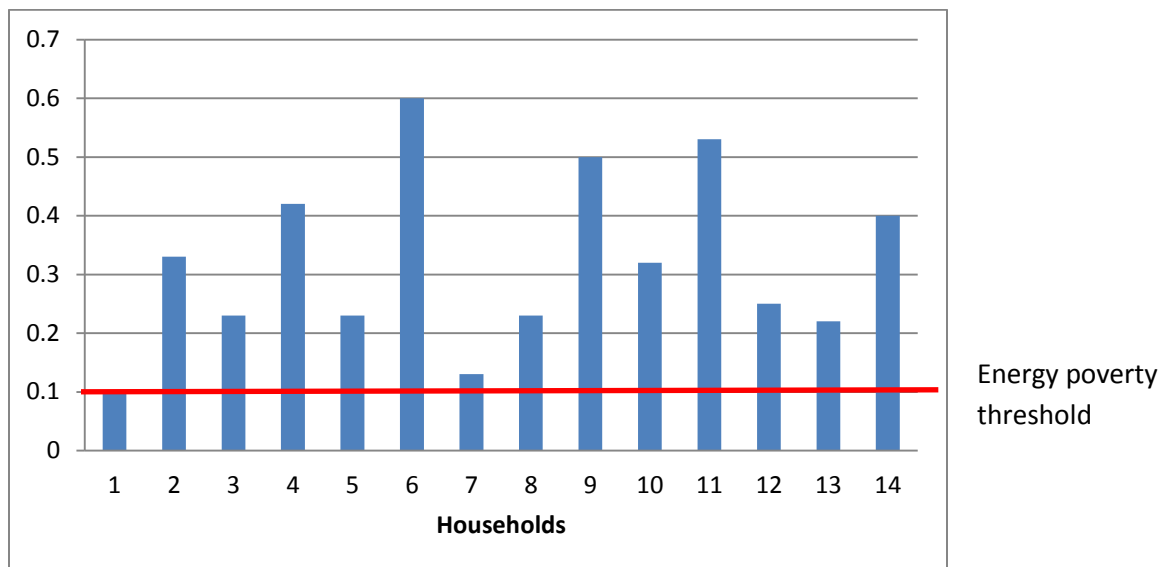


Figure 39: Energy poverty ratio for households using LPG and wood as cooking fuel

Figure 40 is for households that solely use wood for cooking.

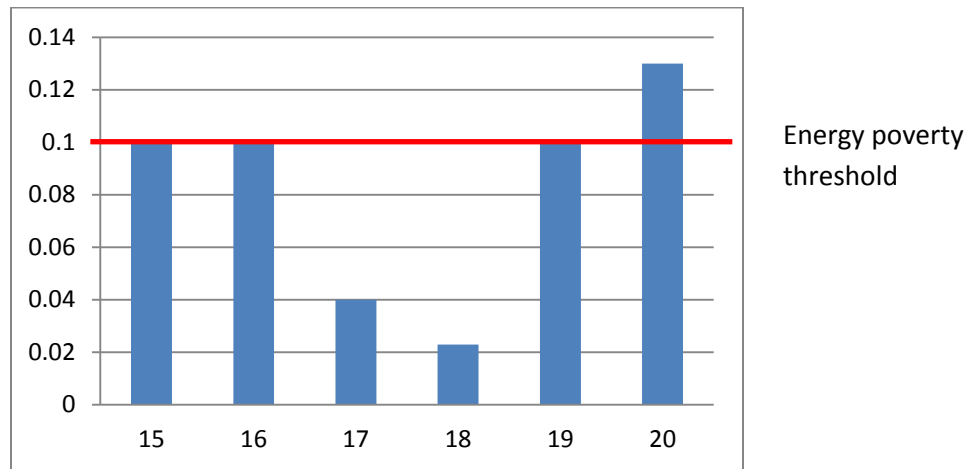


Figure 40: Energy poverty ratio for households using wood as cooking fuel

The NHIES does not show expenditure on energy in annual consumption expenditure average for households, thus it is assumed that the 10% concept is useful as the threshold for energy poverty.

Secondly, to locate the depth of energy poverty of each household the difference between the energy poverty ratio and the energy poverty threshold of 10% was used as an attempt to define and locate households running the risk of an energy poverty penalty. The results are shown in Figure 41.

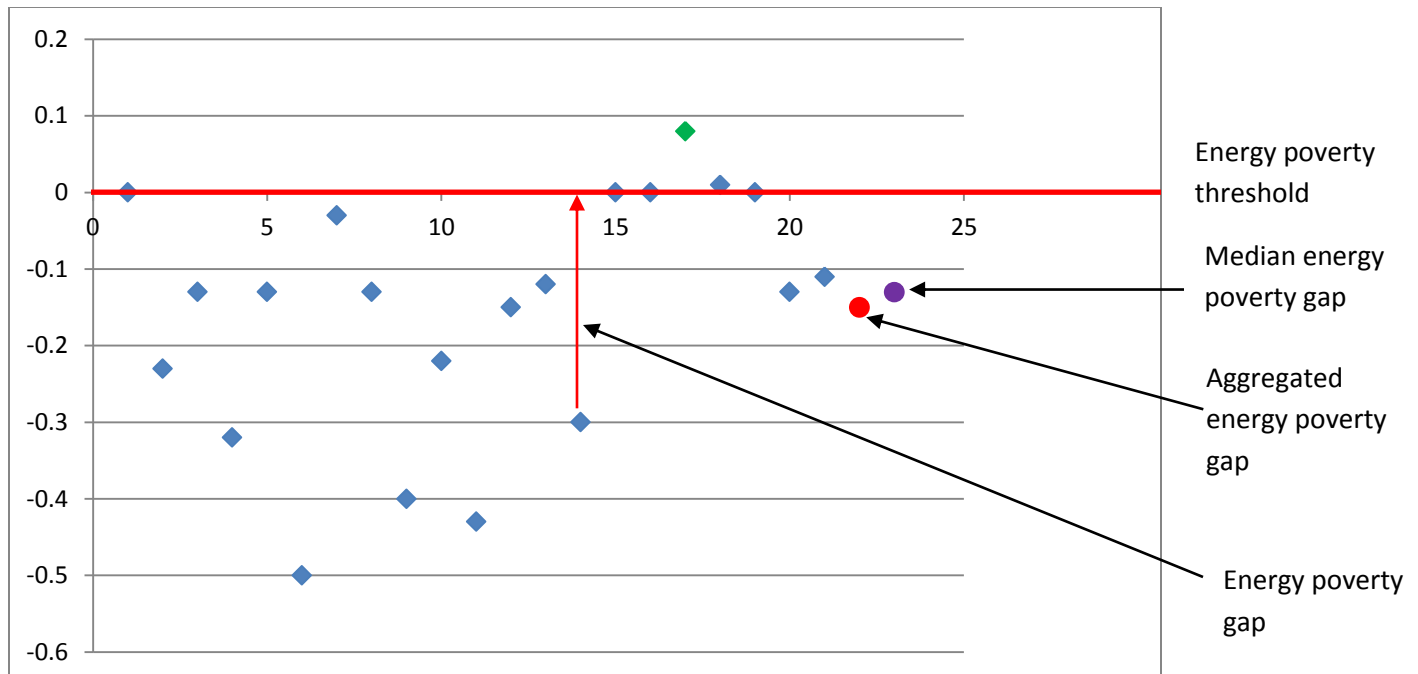


Figure 41: Depth of energy poverty for households in Tsumkwe

Four types of households were derived from the sample:

- Households that are most affected by the energy poverty penalty due to the large energy poverty gap.
- Modest energy poor (spent more than 10% of income on electricity, rely on wood as cooking fuel).
- Modest non-fuel poor (they pay less than 10% of their income on energy costs; however they are still under financial strain).
- Low-income (spent less than 10% of income on energy costs, but a small loss of income could make them energy poor).

The energy poverty gap for each household was summed to give an aggregate of the energy gap. Similarly, the median is also shown in Figure 41. Both values provide an understanding of the scale of the problem in Tsumkwe. By using the 10% as proxy and assuming uni-directional causality between income and energy access, an increase in household income may help reduce the energy poverty ratio and thus eliminate the gap and move households from the low income-high cost quadrant. Additionally, decreasing the cost of electricity and by using energy efficiency measures might have the same effect.

The sales of electricity units is seen as a major avenue for generating funds to cover operation and maintenance of the TEP hybrid plant as well as reduce subsidy costs incurred by the regional council. This has motivated the increase in 2012. A bi-directional causal relationship is illustrated using household 18 as an example. This household uses the stable electricity to operate a tailoring business from home to generate income in addition to the head of household's wage.

Household 18 spent N\$100 on electricity per month in 2012 and uses only wood for cooking that they gather for less than 10 minutes per day. They use an electric sewing machine and the stable electricity supply extended the working hours of the tailor. Their energy poverty depth is +0.08 (green marker in Figure 41 and Figure 42), and is one of only two households above the energy poverty threshold. The 50% increase in the price of electricity will increase this gap by 0.013 to 0.07, assuming a 5% increase in household income, and no increase in energy consumption.

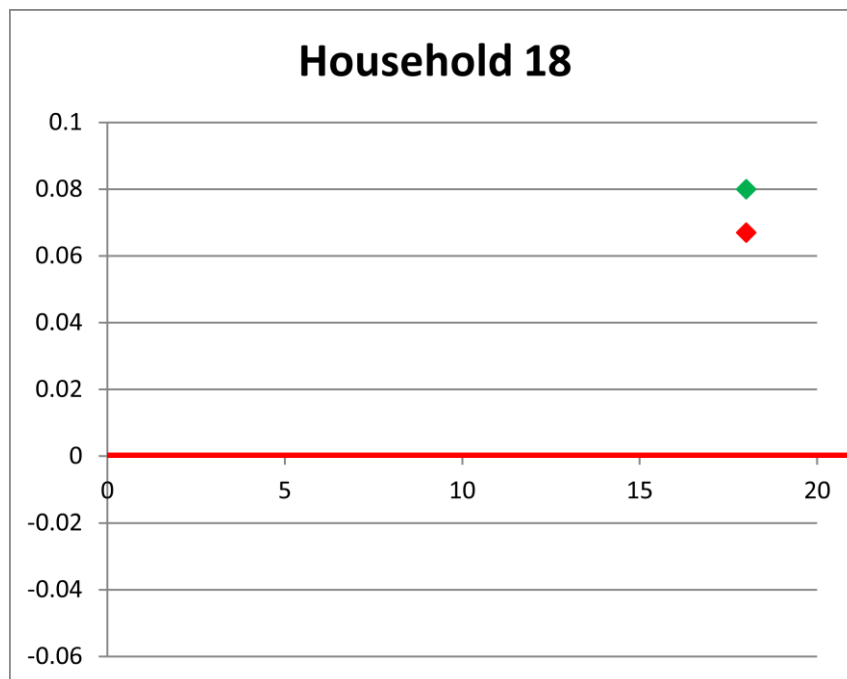


Figure 42: Impact of the 50% increase in electricity price on household 18

Locating the *depth* of energy poverty at household level underscores that this household is caught up in a low income-high energy costs conundrum. Spending on electricity leaves them with little residual income and are forced to make trade-offs regarding bills. This points to a 'weak' poverty alleviation strategy of TEP.

The increase in cost makes it more challenging for households to move above the energy poverty line and those already in energy poverty, will move further down increasing the depth/intensity of energy poverty. This points to an energy poverty trap based on affordability and Figure 43 shows how low income and energy costs overlap.

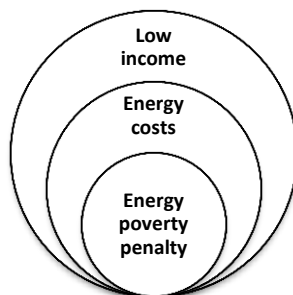


Figure 43: Locating the energy poverty penalty within poor households

Qualitative evidence garnered from interviews shows that households and SME's engage in micro-businesses that operates from home to generate income. The need for additional income is to enable the poor to afford electricity. Groh (2013) stated that consumption of electricity increases with income, however, in this case, income increases to enable continued consumption of electricity that is substantially below the 50 – 100 kWh/person/month. Strategies engaged in to increase income are:

- Allowing an illegal connection
- Microbusiness selling consumables

Therefore, the drivers of energy poverty in this instance are:

- Low income
- Electricity prices
- Policy cooking fuel options offered

The application of these in policy is three-fold:

- The type of energy access policy: Is the policy addressing energy efficiency, income or prices or any combination of two?
- Who pays for the policy? Is it the consumers in terms of increasing electricity costs or is it tax payers? Consumer-funded payment can be the selling of carbon emission reduction (CER) in addition to electricity sales to generate funds.

- Who are the beneficiaries? That is, is it energy poor households or all households? Individualisation of policy options comes to the fore in this instance.

Using cost threshold as an indicator of energy poverty creates a moving target as stated by Bhattacharya (2012) making the eradication of energy poverty almost impossible and hampering sustainable development.

5.7 Impact of TEP on sustainability

To evaluate if primary and secondary energy needs were met in a sustainable manner, requires embedding the TEP approach towards sustainability and energy efficiency into environmental, social and economic dimensions. This has the potential to aid in understanding the implication of the current energy policy pathway for Namibia. The resulting pathways stemming from TEP intervention are depicted in Figure 44.

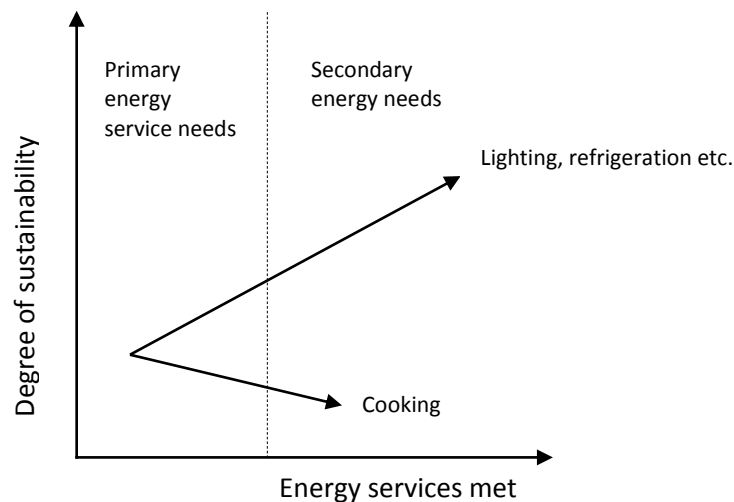


Figure 44: TEP sustainability pathways towards meeting energy service needs (adapted from Nissing and von Blottnitz, 2010)

The x-axis represents social and economic dimensions of sustainability whereas the y-axis represents the environmental dimension. The sustainability pathway for lighting, refrigeration and other related energy services excluding cooking has a positive slope indicating that these needs are met in a sustainable manner. Moreover, the length of this pathway is longer and extends well into secondary energy needs indicating the potential of these services to generate income. On the contrary, the pathway for cooking energy services have a negative slope and does not extend far into the secondary energy needs. This indicates that there is possibility of

regression or stepping back on the energy ladder in terms of increased use of biomass and reduced efficiency.

This study did not determine the gradient and starting points of both pathways to locate the value of the ratio of degree of sustainability and energy services met.

5.8 Concluding remarks

This chapter examined the policy implementation strategy of TEP and found that it does not lead to sustainable development especially when the preferred energy need carrier for cooking has a high time cost. Households that utilise LPG for cooking spent more than 10% of their income on energy costs, thus, an increase in electricity price further erode their residual income compared to those who use wood for cooking. An unintended outcome is that the natural environment is at risk due to increase in biomass use as a strategy that households might engage in to curtail rising electricity costs.

Although TEP is a welcomed development by residents, they are unable to reap its full benefits due to reinforcing loops such as low income, low skills and education as well as the lack of employment opportunities, especially for the San. Integrating these feedback loops into a *place-sensitive* policy has the potential to lead to sustainable livelihoods and to reduce the possibility of an energy poverty trap emerging. It was found that meeting energy needs is done in such a way that benefits are outweighed by negative impacts.

Chapter 6: Conclusion and areas for further research

6.1 Introduction

This study is concluded by linking the research objectives set out in Chapter 1 with results. The objectives of this research were to; firstly, evaluate the socio-economic impacts of TEP on the livelihoods of Tsumkwe residents by utilising the capability approach as a springboard for energy policy analysis in Namibia. Secondly, it is to move away from a dualistic impact analysis towards viewing energy access impact on a continuum in order to identify entry points through which additions and adaptations can be made. Thirdly, to qualitatively establish if there is any evidence of an energy poverty trap that can potentially lead to an energy poverty penalty.

6.2 Impact analysis

Energy access is complex and therefore, a research paradigm that exclusively focuses on either qualitative or quantitative data does not present a full picture of energy end-user experiences. The transformative paradigm complements existing mono-method approaches and in this research, it was combined with folklores of the San to identify commonalities between the paradigm and the way of life of the San. The capability approach was used as a normative foundation to illustrate that “lifting all boats” does not occur in reality and that individualisation of policy action is paramount especially when development is aimed at the poorest.

Impact analyses that are dualistic in nature tend to be overly quantitative and overlook holistic connections between people and between people and *place*. Additionally, indigenous research that only utilises narratives is overly qualitative. The combination of both quantitative and qualitative enhances complementarity between the two data sets and yield a more complete picture in terms of socio-economic impact of energy provision. Tsumkwe residents remain in a state of energy deprivation due to the myopic approach towards poverty alleviation. The South African free basic electricity subsidy enabled transition to cleaner fuels and such an approach, coupled with sustainable utilisation of natural resources can result in alleviating poverty. The absence of choosing alternative thermal energy sources has a direct impact on increased wood use.

6.2.1 Visualising TEP impact

Multiple realities are difficult to capture by utilising dualistic analyses. It is more acquiescent to examine dualities within approaches that look for shared qualities and differences. When energy access is viewed on a continuum, it allows considering individual experiences as

degrees of energy poverty due to multiplicity of factors, thus facilitating consideration of multiple realities. Additionally, if measurement approaches treat data as gradual transition from one condition to another through end-use variations, a continuum view illustrates that actions cannot be separated from context and that activities pass into each other. This energy access continuum as a time-space construct brings action and structure together in ways that make interconnectivity and complexity prominent. Moreover, it suggests that integration of actions and reactions at all stages from energy policy formulation to implementation are interrelated thus forming a continuum in which both ‘receivers and givers’ are involved in varying degrees. Separating ‘with’ from ‘without’ or ‘before’ from the ‘after’ is a weakness in impact analysis as the focus is on the perceived boundaries.

The continuum model consists of four dimensions: generate, capture, organise and pluralise as shown in Figure 45.

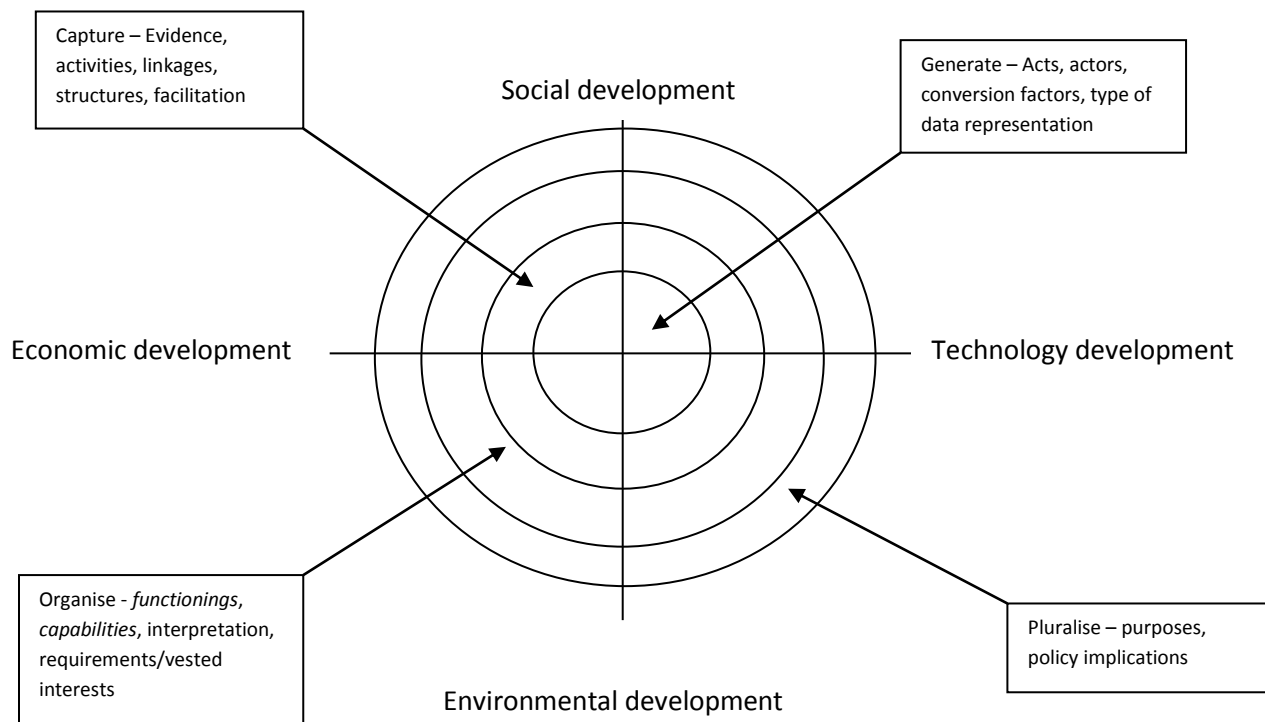


Figure 45: Energy access continuum

The first dimension ‘generate’ represents the locus of all action and interaction with energy. It is a space in which all action takes place, be it consumptive or productive use of energy. Things within this dimension are in the process of formation and there is potential to move beyond the

locus of location, however this potential is embryonic as some elements required to utilise energy may be absent. Additionally, conversion factors might not have developed yet to fully utilise the *capability* space that has opened up.

The second dimension, 'capture' signals the beginning of the journey for utilising energy. Energy use is then viewed as connected through relationships with other sources of energy. The emanating characteristic energy use patterns from the second dimension, attest to evidence of action through energy access that can be distributed, accessed and understood by others involved in the same space. The transition to the second dimension occurs at consumptive and/or productive energy use level. Additionally, the transition can be made deliberate through policy. In this dimension, context or *place* plays a crucial role.

The third dimension, 'organise' represents an aggregation of actions of individuals, businesses or households. In this dimension, an individual action joins other actions to create a pattern of energy use. At policy implementation level, this dimension affects the 'create' and 'capture' dimensions. The fourth dimension opens up a 'pluralised space' where actions and reactions of *place* and social groups are communicated. In this dimension, the impact of energy provision can be reviewed, accessed and analysed beyond Tsumkwe.

The continuum axes of environmental, economic, social and technology development act in tandem. Each of the axes and dimensions are inter-dependent as energy use is present across all dimensions.

6.3 Qualitative development of the energy poverty penalty

It can be deduced that energy poverty is interplay between low income, high energy cost and the disregard of potentiality of *place* that has the potential to keep households in Tsumkwe locked in energy poverty. Figure 46 shows how neglecting potentiality of *place* results in a number of reinforcing loops that can hamper sustainable development.

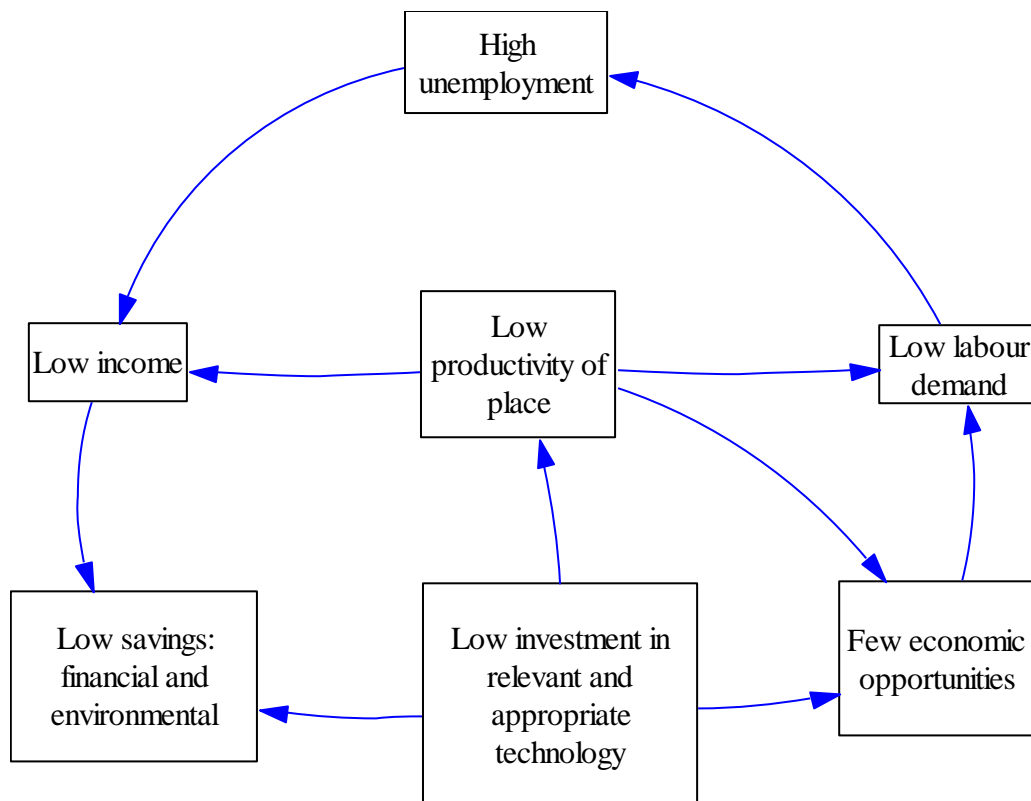


Figure 46: Interplay of factors that hamper poverty alleviation in Tsumkwe

The low degree of adapting energy-related interventions to *place* and people's specific needs and circumstances contribute to the creation of an energy poverty penalty that can worsen a people's poverty situation. As Velumail (2011) noted in Sovacool (2012: 279), existing programmes "keep people where they are and do not make them better off". The existence of the energy poverty trap in this research is attributed to the assumption that causality is bi-directional. Tsumkwe residents engage in more effort to access the same quality of energy services especially for cooking. Thus, policy options offered in TEP made energy poverty an *additional* problem for the poor and thereby create the penalty. This penalty they incur can result in aggravation of their poverty circumstances. Thus, the developmental journey of the poor is hampered and the MDGs are unlikely to be realised.

6.4 Areas for further research

During the course of this research it became apparent that the provision of a stable source of electricity was the overriding approach towards poverty alleviation. This research did not quantify the economic impact of TEP to quantitatively indicate its impact. The ethnic composition of Tsumkwe changes seasonally as the San that reside in surrounding villages

migrate. The researcher did not establish the percentage of the population that is transient or permanent. The spending patterns of residents are not known and this impacts on energy use or the type of energy carriers. If this is known, it would lead to better understanding of economic growth and development in the settlement. It could include how economic value and revenue streams are created within Tsumkwe, what type of economic networks exists and how value is created and enhanced/hampered by energy provision.

Namibia's tax and investment incentives do not specifically promote RE ventures and this can be an area of further research to examine how the tax and investment regimes could be reconfigured to stimulate investment in this area. Furthermore, since TEP is a clean development mechanism (CDM) project, what are the possible revenues that can be generated through CERs? How will the CERs impact on maintenance and operation costs and how will this impact on the price per kWh? The objective of the World Bank's Community Development Carbon Fund is to target small-scale projects located in underprivileged communities with the aim of fostering broad sustainable development benefits while simultaneously seeking to reduce unequal distribution of projects. The fund purchases CERs from such projects.

An energy convenience index for poor households can be computed that can feed in into an index for energy poverty that takes into account the following:

- Collection or buying frequency
- Distance covered
- Mode of transport used
- Household involvement
- Time spent
- Household health
- Children involvement

Such an index offers a rich set of indicators that can be used to widen or contextualise energy intervention programmes and can also be used in projecting energy poverty vis-à-vis the impact of individual policies

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