ECONSTOR
Make Your Publications Visible.

A Service of

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Ezeanya, Chika; Kennedy, Abel

Working Paper

Integrating clean energy use in national poverty reduction strategies: Opportunities and challenges in Rwanda's Girinka programme

WIDER Working Paper, No. 2016/23

Provided in Cooperation with:
United Nations University (UNU), World Institute for Development Economics Research (WIDER)

Suggested Citation: Ezeanya, Chika; Kennedy, Abel (2016) : Integrating clean energy use in national poverty reduction strategies: Opportunities and challenges in Rwanda's Girinka programme, WIDER Working Paper, No. 2016/23, ISBN 978-92-9256-066-9, The United Nations University World Institute for Development Economics Research (UNU-WIDER), Helsinki,
https://doi.org/10.35188/UNU-WIDER/2016/066-9

This Version is available at:
https://hdl.handle.net/10419/146216

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

UNITED NATIONS UNIVERSITY
UNU-WIDER

WIDER Working Paper 2016/23

Integrating clean energy use in national poverty reduction strategies

Opportunities and challenges in Rwanda's Girinka programme

Chika Ezeanya[1] and Abel Kennedy[2]

April 2016

In partnership with

JISEA
Joint Institute for Strategic Energy Analysis

United Nations University World Institute for Development Economics Research
wider.unu.edu

Abstract: The disappearance of Rwanda' forests and attendant change in climatic conditions prompted the government to explore clean energy alternatives such as biogas. Unlike at any other time in Rwanda's history, more and more Rwandans in rural areas are becoming owners of cattle because of Government of Rwanda's agricultural direct assistance and poverty reduction programme known as Girinka. This paper focuses on the various strategies employed by the government of Rwanda in achieving increased biogas use among the rural poor Girinka beneficiaries who use cow dung for their domestic biogas plants. Conditions necessary for successful implementation of clean energy pro-poor reforms in rural communities are explored.

Keywords: Rwanda, Girinka, biogas, clean energy, poverty reduction, household energy
JEL classification: Q24, Q28, R2, 138

Acknowledgements: The authors are grateful for the opportunity given, and the support received from the great team of UNU-WIDER staff that worked on the publication of the paper. The Swedish International Development Agency through the University of Rwanda College of Business and Economics post-doctoral research grant also provided much support for research activities. Grace Masanja (University of Rwanda), Nelson Ijumba (University of Rwanda), and Andrew Kagabo (Rwanda Agriculture Board) were instrumental in ensuring the successful completion of the research. Much appreciation goes to the data collectors that put in so much effort and displayed much commitment to the success of the project; Annet Uwase and Kabagambe Kevin deserve special mention.

[1] University of Rwanda, Kigali, Rwanda, corresponding author: chika@chikaforafrica.com; [2] University of Rwanda, University of Rwanda College of Business and Economics, Kigali, Rwanda.

This study has been prepared within the UNU-WIDER project on 'The Political Economy of Clean Energy Transitions'.

Copyright © UNU-WIDER 2016

Information and requests: publications@wider.unu.edu

ISSN 1798-7237 ISBN 978-92-9256-066-9

Typescript prepared by Leslie O'Brien.

The United Nations University World Institute for Development Economics Research provides economic analysis and policy advice with the aim of promoting sustainable and equitable development. The Institute began operations in 1985 in Helsinki, Finland, as the first research and training centre of the United Nations University. Today it is a unique blend of think tank, research institute, and UN agency—providing a range of services from policy advice to governments as well as freely available original research.

The Institute is funded through income from an endowment fund with additional contributions to its work programme from Denmark, Finland, Sweden, and the United Kingdom.

Katajanokanlaituri 6 B, 00160 Helsinki, Finland

The views expressed in this paper are those of the author(s), and do not necessarily reflect the views of the Institute or the United Nations University, nor the programme/project donors.

1 Introduction

Poverty reduction programmes set up by national governments and targeted at rural communities have experienced the twin challenges of dearth of adequate energy sources and the effects of climate change on the rural landscape such as forest degradation and increased household air pollution (Barnett 2000). Although the poorest segment of the global population contribute only about 10 per cent to total global emissions, they live in areas that are most vulnerable to climate change. Outside of the general impact of the harmful environmental footprints of the richest 1 per cent globally, which could be as much as 175 times that of the poorest 10 per cent, poor people, especially in rural areas often have to bear the direct consequences of their own natural resource use. Casillas and Kammen (2010: 1) assert that 'mitigating climate change, increasing energy access, and alleviating rural poverty can all be complementary, their overlap defining an energy-poverty-climate nexus'. SSA is a region with many rural communities whose energy use lead to impactful economic, health, and environmental consequences, especially on women and children (Banerjee et al. 2012). Governments across the region must work to reduce dependence on depleting and potentially harmful energy sources while tackling rural poverty.

Integrating clean energy use in poverty alleviation discourse is increasingly gaining global attention, mostly due to the established connection between high-level poverty and it economic, environmental, and health effects on poor communities. The United Nations Development Programme (UNDP) has connected the dots between energy, poverty, and sustainable development. In publications and in policy advice to national governments, UNDP emphasizes the need to focus on generating clean and modern energy that is sustainable, since it 'can be an engine for poverty reduction, social progress, equity, enhanced resilience, economic growth, and environmental sustainability' (UNDP 2015: 1). The International Energy Agency (IEA) notes that in 2014, more than 2.6 billion global citizens were without clean energy for household use and were utilizing fuelwood as well as other forms of resources that result in high levels of household air pollution with its attendant adverse effects; more than 95 per cent of this figure are either in sub-Saharan Africa (SSA) or in developing Asia and 84 per cent are in rural areas (IEA 2014).

The country of Rwanda in East Africa presents a good case in point where rising poverty levels is synonymous with fast depleting natural energy sources. In 2014, 85 per cent of Rwanda's population relied on wood as main source of energy, a figure that represents a 5 per cent decline from four years earlier when 90 per cent was dependent on fuel burning (FAO 2011; *The New Times* 2015). The high number of Rwandans using fuelwood has led to a recorded national deficit of 8.5 million trees per year, mainly lost to burning wood for household energy use. Forty-five per cent of Rwandans live below the poverty line, representing more than half of the current population dependent on fuelwood in meeting their energy needs (NISR 2012). By building in the adoption of clean energy use within poverty alleviation programmes, the government of Rwanda has strived to promote clean energy use among rural dwellers, with emphasis on the rural poor.

This paper focuses on the use of cow dung for domestic biogas among beneficiaries of the Rwandan government's agricultural direct assistance programme, known as Girinka. Girinka entails the gifting of pregnant dairy cows to the poorest of the poor of rural dwellers by the government. Under Girinka, beneficiaries, when they have a minimum of two cows in kraal, are strongly encouraged and assisted—materially and financially—to install domestic biogas plants that use dung and urine to generate energy. The government of Rwanda worked through the National Domestic Biogas Programme (NDBP) and the result has been the migration of a

number of rural dwellers who are Girinka beneficiaries away from fuelwood use to using biogas (Bedi et al. 2013). This paper aims to improve our understanding of the various strategies utilized by the government of Rwanda in achieving increased biogas use among the rural poor, with emphasis on beneficiaries of the Girinka programme. Understanding gained from this study will bring increased enlightenment on the conditions necessary for successful implementation of clean energy promoting pro-poor reforms in rural communities.

Questions guiding this analysis will centrally arise from two key political economy variables—institutions and actors. Along that line, the role of the government of Rwanda and donors as drivers of change in clean energy use among the rural poor will be discussed, and questions that will establish who the main actors are in the promotion of clean energy use among the rural poor in Rwanda will be answered. Other questions along that axis include: What is the current policy environment and what alignments exist with international frameworks. What political and economic factors were at play in the increased use of biogas by rural Rwandans? Further, this paper will apply the Power Analysis tool of political economy by raising questions around who is included and who is excluded from government of Rwanda's promotion of clean energy use for the rural poor. Finally, social inclusion approach to rural poverty or pro-poor policy-making requires that questions be raised on the perceptions of the rural poor regarding the whole exercise. This is extremely necessary since 'an effective rural development transformation programme that focus on the rural poor requires that a clear understanding of who the rural poor are, where they live, [their aspirations] and the challenges posed by the prevailing poverty levels in their respective habitats is known' (Ewang 2013: 11).

2 Rwanda: background information

Rwanda is the most densely populated country in SSA and covers a surface area of 26,338 km^2. Rainfall is plentiful in Rwanda and annual temperature average ranges between 16°C and 20°C, but with a 0.60 ha per household availability, arable land is scarce. According to the National Institute of Statistics of Rwanda (NISR), Rwanda's population density has increased from 321 persons perkm^2 in 2002 to 416 in 2012 (NISR 2012). Overexploitation is the result, accompanied by disastrous environmental consequences. Rwanda's protection areas consist of three national parks: Volcanoes National Park, Nyungwe National Park, and Akagera National Park. Combined, all three have lost more than50 per cent per cent of their original surface area in the past 40 years (Twagiramungu 2006).

The republic of Rwanda came forcefully and widely into global consciousness with the genocide of 1994 where an estimated 1 million, mostly Tutsi citizens were killed. At the root cause of the genocide is economic displacement, food, and land insecurity. The end of the genocide in Rwanda marked a transition to a post-conflict nation building stage where there is collaboration between government, private sector, international development partners, and interest groups to advance the interest of the majority poor citizen. Rwanda is classified among the poorest countries in the world; 166th out of 186 (UNDP 2012); the household poverty survey stood at 44.9 per cent in 2010–11 down from 58.9 per cent in 2000–01 (NISR 2012). Extreme poverty in 2012 stood at 24.1 per cent, down from the 40 per cent of ten years earlier (IFAD 2012).

Rwanda's 2003 constitution was specifically crafted to reduce poverty and to empower citizens economically (MINECOFIN 2007). Subsequent documents in support of the constitution include the Economic Development and Poverty Reduction Strategy (EDPRS), which came into effect in 2007, and is focused on the reduction of poverty in Rwanda from 64 per cent to 30 per cent, and increasing gross domestic product per capita from US$220 to US$1,240 by 2017 (MINECOFIN 2007). An agrarian country with approximately 90 per cent rural dwellers,

poverty reduction strategies in Rwanda, to be effective, must be structured for widespread appeal in rural agrarian settings.

Environmentally, Rwanda's ecosystem is at risk due to high population density and the heavy demand for natural resources. Rwanda's efforts in urban planning have been overtaken by massive post-conflict movements from rural to urban areas, which have placed significant stress on the environment. The nation's industrial sector is also expanding at an appreciable pace, bringing with it additional demands on the already overburdened environment. Deforestation was a serious menace until targeted efforts at reforestation began in 2010 through tree planting and support for cleaner cook stoves (EUEI 2009a). Between 2010 and 2014, Rwanda's sustainable climate management strategy has proved successful; an additional 10 per cent surface area in the country is now occupied by forests and 5 per cent less Rwandans use fuelwood for energy generation (*The New Times* 2015).

2.1 Household energy use in Rwanda

In 2010, Rwanda's Director of Forestry Field Programmes in the nation's National Forestry Authority warned of a real threat of desertification, with the revelation that in that year, only 533,000 hectares or 20 per cent of the country was covered by forests (FAO 2011). In response, the government of Rwanda embarked on a concerted policy effort aimed at reforestation. Seventy-six per cent of Rwanda's rural land (2,467,000 ha) is used for agricultural purposes, specifically for crops and animal production, while 16 per cent is forested. Currently, 1.6 per cent of Rwanda's rural land mass is designated as 'other land', and is neither used for agricultural purposes nor classified as a forested area, but includes barren, built-up, and wooded land (World Bank 2012: 7). Since firewood and charcoal usage record highest in the rural areas of Rwanda, ways were sought to introduce agricultural rural communities to alternative clean energy sources, with emphasis on biogas that runs on cow dung (FAO 2011).

As far as energy sources are concerned, biomass, including charcoal dominates other forms of energy in Rwanda. Down from 90–95 per cent in previous years, it is estimated that approximately 85 per cent of Rwandans depend on biomass for use in household cooking. The use of energy sources such as liquid petroleum gas or kerosene is insignificant. Over the past 15 years, energy demand in Rwanda has grown at the same rate as population growth, fast-paced urban expansion, and economic activities (FAO 2011). The increasing cost of petrol, low access to electricity, and the significant growth of industries have combined to place pressure on fuelwood as a reliable and inexpensive source of energy for most households in Rwanda. In the rural and urban areas, all but the wealthiest five per cent of households rely on firewood and/or charcoal for household cooking. Wood is sometimes used directly as fuel (57 per cent) or converted into charcoal for use in cooking (23 per cent) (FAO 2011). About six per cent of households use crop residues and peat to cook with, especially in rural areas (FAO 2011).

Annually, total fuelwood consumption in Rwanda is at 2.8 million tonnes, while it is estimated that charcoal, when converted into wood usage, accounts for up to 50 per cent of total wood-fuel consumption in the country (World Bank 2012). In all, Rwanda loses up to 35 per cent of wood used in charcoal making due to the conversion process (GTZ 2009).

Economically, fuelwood usage is also costly for the average Rwandan household. On average, households spend between 10–15 per cent of their monthly incomes on purchase of fuelwood and charcoal (FAO 2011). In 1991, the average consumption of fuelwood and charcoal in Rwanda was .33 kg per person per day (World Bank 1991); by 2000, the figure had risen to 1.93 kg per person per day, with an annual per capita consumption of more than 1 m^3 of wood for the entire population (GTZ 2009). The increase is directly proportional to growth in population.

In 1991, Rwanda's population stood at 7.1 million while in 2002, the figure was 8.1 (NISR 2016). Food and Agriculture Organization (FAO) estimates that in Rwanda, woodfuel consumption is estimated at 2.7 million t/year, out of which the urban capital accounts for an annual charcoal consumption of 120,000 t, equivalent to 1.2 million m^3 or 850,000 t of wood (FAO 2011). Rwanda's Ministry of Natural Resources projects that between 2009 and 2020, 'the consumption of charcoal and fuelwood in Kigali [Rwanda's capital city alone] will increase from 0.99 to 1.4 million tons' annually (GoR 2013: 18).

2.2 Domestic Energy Policy in Rwanda

The need to manage Rwanda's biomass and fuelwood production and consumption adequately has led to the formulation of policies and strategies, and the establishment of specifically mandated government agencies. Rwanda's Energy Policy is based on three major documents: the National Energy Policy, the National Energy Strategy for 2008-12, and the Biomass Energy Strategy (BEST) from 2008 (Bedi et al. 2013). One major reason for policy action on energy in Rwanda has been identified as 'economic growth, which in turn is seen as a prerequisite for tackling poverty' (World Bank 2012: 21). The National Energy Policy was drafted in 2008 as an update of the 2004 Energy Policy statement. With particular concern to this study, the policy among others, aims to, 'set the National Energy Policy within Rwanda's long-term development plans and strategies' and to focus on household energy requirement in addition to gender issues arising from such (EUEI 2009b: 1).

The Ministry of Infrastructure (MININFRA) and the Ministry of Environment and Natural Resources (MINIRENA), developed the Biomass Energy Strategy (BEST) in 2008–9. The BEST was designed to address four key areas: (1) To sustainably increase fuelwood supply including the establishment of new, and management of existing plantations, and the 'professionalization of the charcoal value-chain' (EUEI 2009a); (2) Improvement of energy use efficiency in Rwanda's households through the extension of all necessary support to manufacturers and importers to produce innovative materials that conserve biomass; (3) The promotion of alternatives to fuelwood, with particular emphasis on peat, papyrus, and biogas; and (4) Development of institutional capacity within government agencies to be in charge of biomass and energy within the short and medium terms (EUEI 2009a).

Rwanda's National Domestic Biogas Program (NDBP) was established in 2007 and was supported by development partners in Rwanda, specifically Netherlands Development Organization (SNV), and the German Aid Organization known as GIZ. The objective of the project is to improve the provision of biogas to meet the cooking and lighting needs of households that own a minimum of two cows. Rwanda's NDBP aims to install at least 15,000 biogas digesters in rural households, in addition to institutional digesters to be installed in prisons and schools (SNV 2012). Since inception, NDBP has installed domestic biogas in 4,600 households. NDBP is also involved in training of masons, and the project has trained 555 masons in household biogas constructions and maintenance, out of which 195 have registered businesses; 52 masons have been trained in the mechanics of institutional digesters construction and maintenance (REG 2014).

3 Girinka and domestic biogas use in Rwanda

The decision of the government of Rwanda to promote biogas use in the country is hinged on the rapid occurrence of deforestation and the availability of cow dung across rural areas of Rwanda. The disappearance of Rwanda' forests, in addition to the change noticed in Rwanda's climate because of greenhouse gas emissions, prompted the government to explore other clean

energy alternatives (EUEI 2009b). Biogas was seen as a veritable alternative since it is a renewable fuel cooking solution and is environmentally friendly (EUEI 2009b). Most important in the government's decision to expand biogas access in the country is that unlike at any other times in Rwanda's history, more and more Rwandans in rural areas are becoming owners of cattle. The rise in cattle ownership in Rwanda is a result of a government poverty reduction programme known as Girinka.

Girinka is a government poverty reduction strategy created exclusively for rural communities in Rwanda in 2006. Girinka entails the gifting of a pregnant dairy cow to selected poor and vulnerable households in rural communities by the government. Historically, Rwanda's culture, politics, and economy revolve around cattle. Cattle ownership has played a determining role in the state of Rwanda's economy; indeed, the genocide of 1994 could, in the final analysis, be summarized as a class and economic warfare between the owners of cattle and the non-owners (Mamdani 2001). Selection of beneficiaries for the Girinka programme are left almost entirely in the hands of communities who are given certain criteria from where eligible candidates are presented to the Rwanda Agriculture Board, through the districts. The basic requirements being that a person must be malnourished and destitute, but must be of good standing in community (i.e. not an alcoholic, gambler, or lazy person). The proposed recipient must also have a small patch of land where cattle shed can be built since the programme operates a zero-grazing policy (Ezeanya 2014).

As a modern poverty alleviation strategy, Girinka can be traced back to the ancient practice of richer, cattle owning Rwandans giving cows to their poorer neighbours. Within the Rwandan culture, heads of cattle are usually extended as goodwill gifts during such landmark events as births, deaths, and marriage, while exchange of cattle between previously warring factions often signify a successfully resolved conflict (Rwanda Governance Board 2013). Lifelong friendships are consolidated through the exchange of cows, while no form of recognition for service rendered to the state or a person is ever complete without the gifting of a cow to the recognized individual (Rwanda Governance Board 2013).

Rwanda's Girinka programme is an indigenous knowledge-based poverty alleviation strategy, which was widely accepted by rural Rwandans owing to the cultural significance of cattle. Girinka, which in its loose Kinyarwanda translation means, 'May you own a cow', was established to address the challenges of entrenched malnutrition and extreme poverty, which plagued several parts of rural Rwanda. The idea behind the exercise is that cows will provide milk for starving households, while at the same time; the sale from excess milk production could be beneficial in providing a means of income to very low-income households, usually subsistence farmers (Rwanda Agricultural Board 2013). Outside of the direct gift from government to poor farmers, cattle recipients are also mandated to give the second female offspring produced by the original dairy cow to another poor and vulnerable household within the community. Girinka has been supported by several organizations and high net worth individuals in and outside of Rwanda, thereby greatly reducing the burden of sustainability placed on the shoulders of the government.

From the time of its establishment until early 2015, Girinka has bestowed about 200,000 cows upon as many households. This is not inclusive of the mandatory requirement on recipients to pass on the second female offspring to another poor household in the community. The number of households that have received cows because of the Girinka programme is significant in a country of a little less than 12 million.

Among the achievements of the Girinka programme is the reduction in level of malnutrition among Rwandans in rural areas through increased milk production and consumption. In fact,

national production milk is recorded to have increased by 11.3 per cent, between 2009 and 2011, while beef production increased by an estimated 10 per cent (IFAD 2012).

3.1 Biogas use among the rural poor in Rwanda

When in 2007 the government of Rwanda established the NDBP, it was with the intention of harnessing the reality of cattle ownership being a growing phenomenon in rural Rwanda. In view of the establishment of the Girinka programme in 2006, there were hopes that more and more villagers would become cattle owners and be able to migrate away from fuelwood to using biogas in meeting household energy needs. A decade after the establishment of Girinka, several Girinka beneficiary households have started using biogas (Kagabo 2014).

Using mostly structured and unstructured interviews, including focus group discussions, the researcher sought to understand the reasons why some Girinka beneficiary households have adopted biogas use while others have not. The lead researcher also conducted interviews among policy makers to determine the efforts of the state, and other supporting institutions, and agencies in promoting the use of biogas across Rwanda.

A total of 130 households were interviewed drawn from three rural provinces of Rwanda: the Northern, Eastern, and Southern provinces. Across the three provinces, 59 Girinka beneficiary households that installed biogas and 71 Girinka beneficiary households that did not install biogas were surveyed. Sample size was selected based on the estimated number of Girinka beneficiaries vis-à-vis those among them who are using biogas within each province, and on the ease of accessibility of the researcher to biogas and non-biogas users. An interview conducted with the director of the Girinka programme in Rwanda, prior to going to the field, was essential in identifying possible respondents, since it was difficult to establish actual numbers of Girinka beneficiaries who are also biogas users. This absence of official records is due to a lack of coordination between the NDBP and the Rwanda Agriculture Board, a situation that shall be dealt with later in this paper

Respondents are household heads with mostly only primary education. Average monthly income is about US$15, while the average number of persons in a household is six. Ages of respondents across the provinces ranged from 25–72, while average cow ownership stood at two per household. Seventy per cent of those without biogas go to the forest to search for firewood, dry leaves, and splints, while about 30 per cent have to buy firewood or charcoal because of deforestation. A five-foot log of firewood costs about US$7, while a 23 kg bag of charcoal costs approximately US$12.

All respondents attested to how Girinka has assisted in lifting them out of extreme poverty. Many could not afford one square meal and lived off corn porridge, but since receiving a cow from the Girinka programme, they have access to nourishing milk, and manure for their farms, leading to increased crop production. Profit from sale of excess milk has often been invested in purchase of health insurance, school fees payment, home improvements, agribusiness investment, starting small businesses, etc. Eighty per cent of respondents have experienced some sort of improvement in their economic situation since receiving cows from the Girinka programme. A few beneficiaries had sick and unproductive cows, but some were able to get replacements while others are still awaiting replacement.

3.2 Biogas use among Girinka beneficiaries in Rwanda: an analysis

Girinka beneficiaries who are biogas users noted numerous benefits starting with restoration of neighbourhood forests that were previously over-foraged for firewood. The economic benefit is

in a reduction in money spent on buying expensive firewood or charcoal. Although this might not be so in many rural communities across Africa, deforestation has caused some parts of rural Rwanda to become bare of bushes and forests where firewood can be foraged forcing the rural poor in such areas to buy firewood for cooking. A 72-year-old respondent who is not a biogas user notes the extent of deforestation within his vicinity; when asked how he sources firewood for cooking said, 'I just pick small splints and leaves. We no longer have a forest where to get firewood'. Biogas also provides manure for the garden saving money on fertilizers and boosting organic agriculture. This is because not all of the dung and urine are converted to gas, and the residue can still be useful in providing nutrition to plants.

Cooking with firewood and charcoal can take its toll on the health of household members. Respondents who use biogas note that their health is better since adopting biogas. This is mostly as result of the prevention of diseases resulting from smoke such as pulmonary heart disease, respiratory disease, etc. As a respondent from Eastern province said, 'I was suffering from asthma when I was cooking with firewood, but since I migrated to biogas, I am now OK'. In addition, cleanliness in the kitchen can be maintained more with biogas cookstoves than with firewood or charcoal, leading to improved sanitary conditions. Biogas has also resulted in improved household nutrition as one respondent said, 'We now drink milk, which was impossible before'. Safety wise, household fire incidents that usually occur with the use of firewood and charcoal can be prevented with biogas.

Much of rural Rwanda is yet to be electrified and biogas can provide light at homes without electricity. With biogas, many beneficiaries are able to charge their phones, iron their clothes, and carry out other such household activities that require energy usage. Improved lighting provided by biogas lamps has led to the availability of prolonged study time for children after sunset. With biogas unlike firewood, cooking can be done at any time of the day and any season in the year. With firewood, however, cooking can hardly be done at night since kitchens are located outside of the main building, are usually without electricity or security lock, and are not constructed to offer warmth during cold seasons. Additionally, cooking with firewood during rainy season can be a difficult endeavour once wood becomes wet and difficult to light, and charcoal is very expensive.

Children and women have saved much time that was previously spent on gathering firewood and on the cooking process, since biogas demands little attention during cooking time, therefore users are able to multitask. Cooking with biogas is cheaper and faster than any other method. Money and time saved from buying firewood and charcoal, from gathering firewood, or lighting charcoal can be invested in other more economically productive endeavours. This is more so when account is taken of time spent on gathering firewood, preparing fire hearth, scrubbing soiled pots and pans, and cleaning the kitchen are factored in. Using biogas is much simpler. As a respondent from the Northern Province said, 'Even a child can use it because it is convenient'.

Despite the noted benefits of biogas use, many households in rural Rwanda that wish to use biogas are unable to do so. For many of these poor rural households, the major reason for their inability to use biogas is the costs involved in its installation. Further questioning around this revealed discrepancies in government of Rwanda's financial requirements regarding provision of biogas to citizens across rural Rwanda. According to government sources, standard practice is for households to contribute RWF100,000 (US$150) and for government to provide RWF300,000 (US$450). In Rwanda's Eastern province, several respondents concurred that that they had to pay RWF100,000 to government before biogas plants could be installed. However, others interviewed noted that their contribution was only RWF50,000. The stated amount is in addition to RWF300,000 (US$450) provided by the government as subsidy in the form of material and technical support. However, in parts of the Southern and Northern provinces,

communal biogas plants were provided completely free of charge by government to clusters of families (five each). Some Girinka beneficiaries in the Eastern province who do not use biogas voiced their feelings of marginalization since, according to them, government provided biogas completely free for some, and why not for them as well. Although the general emphasis of the non-biogas users for not installing the plant is as a result of lack of funds, it appears the perceived sense of double standards is partly responsible for preventing some who can afford the co-pay not to have the willingness to contribute towards installation.

Differences in subsidy extended to rural dwellers for biogas installation, according to government sources, is linked to the provision of free biogas installation to clusters of households selected from the poorest of the poor in the rural areas who were previously living in forests and far flung areas. Providing free collective biogas is part of the incentive for attracting isolated dwellers to come together and live in villages, to make for easier provision of infrastructure. Regarding those who have refused to contribute towards installation of biogas in their households, government sources are of the view that many who can afford it are held back by a sense of entitlement. This is more so since these Girinka beneficiaries received cows free from the government and are very likely expecting to get biogas installed free. However, there is the need for consistency in dealing with beneficiaries in terms of how much subsidy to be paid to government for installation. The fact that some beneficiaries had their biogas plants installed entirely free of charge while others had to pay a certain amount might have discouraged those who wish to adopt biogas from making any financial contribution as they are convinced that by holding out a little longer, government will install biogas in their homes entirely for free. Part of the challenge for government could be the free installation extended to encourage forest dwellers or the plants used as pilots. Such issues should be addressed to prevent perceptions of marginalization and a passive resistance attitude toward co-payment for biogas installation by other equally poor citizens.

Several Girinka beneficiaries who are not biogas users claim that they have made payments to the agency in charge of biogas installation, but as of yet do not have their biogas plants installed. This is in addition to several broken down biogas plants, but for which nothing has been accomplished after months of reporting the fault. Other challenges being faced by users of biogas include difficulties and costs of getting technical support and spare parts in the case of breakdown of biogas plants. Respondents note that they end up going back to cooking with firewood or charcoal until such time when a technician can be found and they can save money needed for spare parts purchase. Additionally, some respondents complained that their plants were not well installed and that it leaks gas. This is a dangerous situation as it can result in household fire incident. In response, government agencies note that the biogas project was stalled as a result of loss of interest on the part of donors who previously funded the programme. At the beginning of the biogas project, donors such as SNV and GIZ actively supported the government of Rwanda in setting up biogas plants in parts of rural Rwanda. However, as most donor funds are short term and project based, the two donors did not continue to renew funding for the project after the term expiration leaving the government to bear the full burden of biogas installation and maintenance. Government of Rwanda is dependent on donors for up to 40 per cent of its annual budget (World Bank 2016a); when donors pull out of development projects, progress slows down and such is the case with the biogas installation among the rural poor in Rwanda. The government of Rwanda by itself is not without sufficient funds to continue with the programme, thereby affecting the expansion and sustainability of domestic biogas among Rwanda's rural poor. The result is shortage of materials, equipment, and technicians to install and maintain biogas plants. At fewer than 5,000 installed domestic biogas plants in Rwanda, the government of Rwanda is presently short of the projected estimate of 15,000 installations (SNV 2012; REG 2014).

However, despite the acute shortage of funds to continue with the programme, government of Rwanda has organized training of technicians with the help of other donors not initially involved in the project. The former situation where only one technician was assigned to a district is being changed. Three technicians are currently being trained per district and two masons per sector. There are plans to train several technicians in each district. In addition, the previous method of a centralized biogas programme implementation is gradually being reversed. Technicians, for instance, are being trained and are working at the district level. When technicians are available, government is convinced that other related issues such as unavailability of biogas plant spare-parts will be taken care of, since the raw materials used in manufacturing biogas plants are 100 per cent sourced from Rwanda. The problem of faulty installations will also be solved by availability of technicians, as there is one-year post-installation warranty on repairs. Donors are also assisting government on a short-term basis to train trainers with trainees being biogas users who are instructed to train others within their communities. Indeed, five per cent of respondents in the Eastern province indicated that they travelled to Kayonza district office to be trained on the use of biogas. Others say they were neither adequately trained nor briefed prior to installation of the plants. However, there is no indication that information gained from these trainings was passed on to their neighbours as many stated that there was no formal training before they began to use biogas. Even prior to initiation installation, there is need to enlighten Rwandans on the benefits of biogas use since about 50 per cent of non-biogas using respondents did not understand the need for biogas installation although they had heard that it is beneficial. Efforts ought to be invested into making Rwandans aware of the dangers of firewood use, through widespread awareness campaigns. This will be useful in expanding national biogas reach, through for instance; encouraging citizens who can afford the full price for biogas installation to cooperate with the government in its procurement.

In crafting pro-poor policies, it is important that government finds out what the rural poor really need and what can work best in their environment. It is important for local knowledge to act as the foundation to development policies, this inside-out, rather than outside-in model has been developed into many frameworks and approaches including the participatory development model (Zewde 2010). Another approach known as Participatory Rural Appraisal (PRA) is gaining acceptance within scholarly and development circles, and refers to all methods that 'emphasize local knowledge and enable local people to make their own appraisal, analysis, and plans' (World Bank 2016b: 1). Inability of government and donors to engage fully and actively rural communities in crafting pro-poor policies can result in several challenges. Under the biogas project such challenges include the fact that the variant of biogas plants installed in rural Rwanda usually come with open ditches to collect dung. Children in villages play around the compound and are not always watched due to the very low crime rate and other cultural factors. There are risks that a child can fall in the ditch and die, and in the Eastern province, respondents noted that a child had fallen in a biogas ditch and died. Government response to this is that the open ditch model is the cheapest and most affordable variety for rural dwellers. There are safer varieties that use covered tanks but that is not within budget. Part of the biogas installation instruction is to locate ditches away from access areas and to cover it with wood planks or other such materials to prevent accidents. However, the possibility of poor rural dwellers to locate biogas open ditches away from access areas is limited due to inadequate living spaces as Rwanda's high population density makes land a coveted commodity across the country.

Other related challenges centring around adequate consultations with the rural poor include that biogas cannot be used to cook foods that take too long to tenderize such as dry beans (a very affordable staple in rural Rwanda). The daily portion of biogas in the plant does not usually carry the number of hours needed to boil dry beans. Biogas plants need water for cleaning and for mixing with dung in case of insufficient urine. During dry season, there is usually shortage of

water in Rwanda and this requires the purchase of water tanks, which could be too expensive for most rural farmers interviewed. Many respondents have large families and have to use large pans to cook. However, such pans cannot be used on the type of biogas cookstoves provided by the government. According to a respondent from the Southern province, 'yes, I still use charcoal and firewood because I have a large family, because we cannot use large pans on the small biogas stoves'. Response of the government official interviewed is that the model being produced at this time can only accommodate smaller cook pans and that is what is available for distribution to all users of biogas.

Further, government of Rwanda's efforts in providing clusters of households with free biogas as an incentive to move them away from isolated forest living appears well intentioned, but some questions needs to be addressed. It is important for government to note that some of these communal owners of biogas plants are dissatisfied with the situation, and perhaps if they were properly consulted prior to installation might have a different perspective on the issue. Some beneficiaries of communal cow sheds and biogas plants say it is a disadvantage as they do not get enough dung and urine as a community, while some say it is an advantage as it makes sure they do not lack dung and urine. It depends on the availability of cows within each commune interviewed. In addition, there were complaints about co-owners of biogas plants reneging on agreed usage times, and stealthily using and finishing off biogas during periods the plants were supposed to be shut down. These are issues to be taken seriously in further expansion of plans by the government of Rwanda. So while it would be beneficial to strengthen biogas 'cooperatives' in order to provide members who individually have few cows the opportunity to pool resources and own biogas, the cooperatives must be structured in such a way that there will be tight control over gas plant usage.

4 Implications for a transition to a clean energy economy

Exploring Rwanda's experience with integrating clean energy use in national poverty reduction strategies offers several implications for nations with a high number of rural poor. First, the government of Rwanda's dependence on donor support for the success of the programme has brought about a situation where progress is slow due to cutback in funding from donors. Nations intending to integrate clean energy use may plan well ahead using sustainable sources of funding such as domestic revenue mobilization or other more reliable funding options. Donor funding, of course, could provide initial start-up capital including the necessary publicity generation and the funding of some pilot projects, but it is important that medium to long term planning on biogas not depend on donors. There is a need to explore further the possibility of public private partnerships in the installation and maintenance of biogas plants, but this should be done with the full consideration of the economic situation of the rural poor.

Another case to consider seriously is the dependency syndrome, whereby many rural poor interviewed who have yet to pay for biogas installation are convinced that with the passage of time, government will change its mind on the co-pay requirement and extend biogas plants to them free of obligation. Several reasons can be advanced for this belief, including previous experiences with direct assistance from the government and lack of awareness creation on the part of the government.

There is a need for coordination between the government agency in charge of the concerned poverty reduction programme and the government agency in charge of biodiversity. Although many Girinka beneficiaries have biogas installed, there is no structure or platform in place to address specifically or actively promote biogas use among Girinka beneficiaries. Girinka beneficiaries are lumped together among the poor rural dwellers in need of biogas. When request

was made for information regarding the number of Girinka beneficiaries who use biogas, it was discovered that information was not available within the government office in charge of Girinka. In such settings, however, it will do well for several reasons including promotion of biogas, ensuring compliance, and monitoring progress, for a clearly designated platform of coordination between poverty alleviation strategies that have incorporated clean energy use.

There is a need to make biogas installation grassroots-driven. From 2007 until 2014, the promotion of domestic biogas use in Rwanda was championed mainly by the central government. The provincial and district governments, both of which are closest to the rural poor, were not active in the drive to increase biogas usage among that segment of the population. However, by 2015, this situation was gradually being reversed. There is a need, therefore, for central government, from the onset, to generate and maintain the support of the lowest tier government and if possible, ensure it plays a major role in integrating clean energy use in national poverty alleviation strategies.

5 Conclusion

Governments around the world in search of strategies to reduce poverty within their borders must of necessity, consider the integration of clean energy in such policy action. Clean cooking is an 'energy issue, a health issue, an environmental issue, a women's empowerment issue, and in many countries—a social and cultural issue' (Calvin and Venkataramanan 2015: 1). The search for policies that represent a nexus between poverty reduction and environmental preservation should collaborate with the masses; it should be fashioned within existing cultural, social, and economic realities of the poor. Rwanda, through the Girinka programme, has tried to leverage the cultural acceptance and prestige attached to cattle rearing to integrate biogas in household energy use of the rural poor, thereby reducing dependence on firewood and charcoal. Through the NDBP, the government of Rwanda is encouraging Girinka beneficiaries to install domestic biogas plants that would use cow dung and urine to generate methane for cooking and lighting. Biogas is much cheaper, easier, convenient, and better for the user and the environment to use than firewood or charcoal. While some Girinka beneficiaries have opted to install biogas and report an appreciable level of satisfaction, many have yet to install biogas plants due to several reasons. Mostly financing, and perhaps an additional feeling of entitlement, is at the centre of why many Girinka beneficiaries in rural Rwanda have yet to install biogas. On the side of the government, a dependency on donor funding has crippled the progress and slowed down the drive towards extensive coverage of rural communities with domestic biogas plants. Inconsistencies in government policies regarding funding of biogas plants also appears to be sending the wrong signal to the rural poor, leading to a cautious response to government's call for co-pay prior to installation.

For developing countries wanting to expand the rural poor's access to clean energy use, there is a need to be careful about a dependence on donor funds from the policy-making process down to implementation. The need for strong political will on the part of the government is necessary, in addition to a harmonization of policies regarding provision of biogas plants. Decentralization and appropriate communication of the entire process will be helpful in ensuring grassroots ownership and more widespread coverage.

The 17 UN Sustainable Development Goals approved in September 2015 and in place for the next 15 years has clearly indicated the need for national development agendas to be inclusive of eradication of extreme poverty, promotion of inclusive economic growth, and environmental protection. Ambitious as that may appear, if concerted efforts are made by governments towards

the integration of clean energy use in national poverty reduction strategies, there is a strong likelihood that much progress will be made towards reaching the SDG goals by 2030.

References

Banerjee, M., S. Siddique, A. Dutta, and B. Mukherjee (2012). 'Cooking with biomass increases the risk of depression in pre-menopausal women'. *Social Science & Medicine*, 75(3): 565–72.

Barnett, A. (2000). 'Energy and the fight against poverty'. Livelihood Sector Report. London: Department for International Development (DFID).

Bedi, A.S., L. Pellegrini, and L. Tasciotti (2013). 'Impact evaluation of Netherlands supported programmes in the area of energy and development cooperation in Rwanda: Impact evaluation of Rwanda's national domestic biogas programme'. Baseline Report. Rotterdam: International Institute of Social Studies, Erasmus University.

Calvin, K., and R. Venkataramanan (2015). 'Africa: "how?"– not "how much?" to fight poverty'. Available at: http://allafrica.com/stories/201510271866.html (accessed on 29 October 2015).

Casillas, C., and D. Kammen (2010). 'The energy-poverty-climate nexus'. *Science*, 330(6008): 1181–2.

EUEI (2009a). *Biomass Energy Strategy (BEST) Rwanda*. Brussels: European Union Energy Initiative, Partnership Dialogue Facility (EUEI PDF).

EUEI (2009b). *Update of the National Energy Policy and the Associated Implementation Plan Rwanda 2008-2012*. Eschborn: European Union Energy Initiative. Available at: http://www.euei-pdf.org/sites/default/files/files/field_pblctn_file/FF_EUEI%20PDF_Rwanda_National%20energy%20policy%20update_May2008_EN.pdf (accessed on 6 March 2016).

Ewang, P. (2013). 'Political economy of Africa's rural transformation'. Inaugural Africa Rural Development Forum (ARDF) 02–04 May. Cotonou: NEPAD.

Ezeanya, C. (2014). 'Indigenous knowledge, economic empowerment and entrepreneurship in Rwanda: The Girinka approach'. *Journal of Pan African Studies*, 6(10): 241–63.

FAO (2011). 'WISDOM Rwanda: Spatial analysis of wood-fuel production and consumption in Rwanda: Applying the wood-fuel integrated supply/demand overview mapping methodology (WISDOM)'. Rome: Food and Agriculture Organization.

GoR (2013). *Rwanda Supply Master Plan for Fuelwood and Charcoal.* Kigali: Ministry of Natural Resources Rwanda.

GTZ (2009). *Biomass Energy Strategy (BEST)*. Volume 1–4. Bonn: Deutsche Gesellschaft für Technische.

IEA (2014). *World Energy Investment Outlook 2014*. Special Report. Paris: International Energy Agency.

IFAD (2012). *Enabling Poor Rural People to Overcome Poverty in Rwanda*. Rome: International Fund for Agricultural Development.

Kagabo, A. (2014). 'Girinka beneficiaries and biogas use'. Interview by Chika Ezeanya on 5 March 2014.

Mamdani, M. (2001). *When Victims become Killers: Colonialism, Nativism and Genocide in Rwanda*. New Jersey: Princeton University Press.

MINECOFIN (2007). *Economic Development and Poverty Reduction Strategy*. Kigali: Ministry of Finance and Economic Planning (MINECOFIN).

NISR (2012). '2012 population and housing census'. Kigali: National Institute of Statistics of Rwanda.

NISR (2016). 'How many are we in Rwanda?'. Kigali: National Institute of Statistics of Rwanda. Available at: http://www.statistics.gov.rw/publications/article/how-many-are-we-rwanda (accessed on 7 March 2016).

Rwanda Energy Group (REG) (2014). 'Rwanda Energy Group: Energy Development Corporation Limited'. Biogas Project Brief. Available at: http://www.reg.rw/images/Documents/Biomass_project_brief.pdf (accessed on 21 September 2015).

Rwanda Agricultural Board (2013). 'Girinka program: A success story'. Kigali: Rwanda Agricultural Board.

Rwanda Governance Board (2013). 'Documentation of home-grown initiatives and solutions for policy makers, researchers and the public'. Volume 1. Kigali: RGB.

SNV (2012). 'Domestic biogas newsletter'. Issue 7. The Hague: SNV Netherlands Development Organization.

The New Times (2015). 'Local leaders allay fears over charcoal-burning'. 5 February 2015.

Twagiramungu, F. (2006). 'Environmental profile of Rwanda'. Kigali: Government of Rwanda and European Commission.

UNDP (2012). *Human Development Index*. New York: United Nations Development Programme.

UNDP (2015). 'United Nations Development Programme'. Available at: http://www.undp.org/energy/ (accessed on 12 October 2015).

World Bank (1991). 'Rwanda-commercialization of improved charcoal stoves and carbonization techniques: Mid-term progress report. ESMAP Paper ESM141. Washington, DC: World Bank.

World Bank (2012). 'Establishing a green charcoal value chain in Rwanda: A feasibility study'. Washington, DC: World Bank.

World Bank (2016a). '2016 Rwanda country overview'. Washington, DC: World Bank. Available at: http://www.worldbank.org/en/country/rwanda/overview (accessed on 27 January 2016).

World Bank (2016b). 'Participatory rural appraisal'. Available at: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALDEV/0,,contentMDK:21233809~menuPK:3291499~pagePK:64168445~piPK:64168309~theSitePK:3177395~isCURL:Y~isCURL:Y,00.html (accessed on 27 January 2016).

Zewde, A. (2010). *Sorting Africa's Developmental Puzzle: The Participatory Social Learning Theory as an Alternative Approach*. Maryland: University Press of America.