ASSESSING THE ECONOMIC AND SOCIAL IMPACTS OF THE NIGERIAN RURAL ELECTRIFICATION FUND (REF-1) PROGRAMME USING A GENDER COMPUTABLE GENERAL EQUILIBRIUM MODEL

RESEARCH PROPOSAL

Presented to

Partnership for Economic Policy (PEP)

By

Opeyemi Akinyemi

&

Temilade Sesan

Omobola Adu

Babajide Sokeye

Nigeria

September 2019
Before you begin
Please make sure you carefully review and understand the following:

- **Webpage** – for priority themes, eligibility criteria and application procedures
- **Guidelines** – for designing a research project proposal (in scientific terms - section III)
- **PEP requirements and strategy for policy engagement and research communication** (section IV)

Please note that:

- This template is mandatory
- Plagiarism is strictly forbidden – see note on “references and plagiarism” at the end of this document/template. PEP will be using a software program to detect cases of plagiarism.
- PEP encourages applicant research teams to submit proposals in English, but content (in text boxes below) may also be written in French or Spanish.

There are three main dimensions to all PEP-supported projects: **capacity building**, **research** and **policy engagement**. Each dimension must be considered with due care and attention as they will be assessed individually and concurrently to determine the overall quality of a proposal.

The PEP proposal template is structured in five sections:

1. Project overview and objectives
2. Capacity building – team composition and experience
3. Research – literature review, method and data
4. Informing policy - context, relevance, process and dissemination
5. Other considerations

**SECTION I – PROJECT OVERVIEW & OBJECTIVES**

1.1. **Abstract** (100 to 250 words)
State the main research question, the context and its relevance in terms of evidence-informed policymaking, in relation to PAGE priority issues. Complete with a brief description of the method and data that will be used.

Renewable energy deployment continues to be a viable tool for improving electricity access for rural communities through the deployment of off-grid and mini-grid solutions. This is partly due to their tough topography which makes grid connections technically difficult and expensive. Therefore, renewable energy solutions address this issue, thereby, enhancing their economic and social activities while also reducing carbon emissions. Additionally, it is viewed as a policy measure for alleviating rural-urban migration. In Nigeria, one of such policy initiatives by the government is the Rural Electrification Fund (REF-1) programme. It is targeted at improving...
electricity access to households, micro, small and medium scale enterprises in off-grid communities across the country through renewable energy sources. Assessing the potential impact of this initiative on the development of rural communities can support effective implementation by the responsible agency, Rural Electrification Agency (REA). The study asks the question: what are the potential economic and social impacts of alternative ways of implementing the REF-1 programme, especially for women employment? The PEP-1-t CGE model will be employed to achieve this objective using an updated 2014 Nigerian Social Accounting Matrix (SAM) where gender-disaggregated data are incorporated. The findings of the study will have important policy implications and provide useful insights for the implementation of the government’s Rural Electrification Policy. It will also guide the REA in designing the most effective rural electrification programme that significantly improves the quality of life in rural communities.

1.2. Main research questions (max 500 words)

Explain the focus (or key questions), including the gender-sensitive aspect, of your research and its relevance for policy.

The rough topography and peculiar characteristics of rural areas make rural populations often go without electricity or are forced to rely on traditional energy and unhealthy power sources. This invariably impacts negatively on their economic and social activities, especially women. Women are more likely than men to work in or near the home to enable them combine childcare responsibilities with their income-generating activities, making reliable energy doubly critical for them. Further, energy costs are a big expenditure item for businesses in Nigeria, and the prohibitive costs of running petrol/diesel generators often prevents women from starting businesses or keeps their businesses small. Men in the context also face the same constraints, but they generally have a higher starting point than women at similar socio-economic levels in critical areas such as access to finance, technical knowhow, ownership and control of assets, freedom of movements- and are thus, more resilient in responding to their energy access challenges. Research done in Kenya by Winther et al. (2018), for instance, suggests that centralised grid arrangements are less favourable for women than the flexible, decentralised renewable energy options that are available locally. This equally explain the link between electricity provision and gender inequality.

To address the energy poverty and insufficient access challenge, Renewable Energy Technology (RET) programmes are usually initiated. In Nigeria, one of such programmes is the Rural Electrification Fund-1 (REF-1) programme. The core focus of the programme is to support off-grid clean energy by providing an enabling environment for the power/energy sector to thrive. The scope of the programme is to support the increase in access to rural electrification by promoting fast and cost-effective expansion of electricity access in unelectrified rural areas in an even manner across the six geo-political zones of Nigeria (Rural Electrification Agency, 2017). This will be done through the deployment of partial one-off capital subsidy grant and/or technical assistance. Currently, the implementation of the US$3.3 million for the development of 12 mini-grids and Solar Home Systems is on course. The 12 Mini-grids being deployed would have the total installed capacity of 890kWp and targeted connection of about 6,000 new customers plus
another 19,000 Solar Home Systems across the six geo-political zones. Thus, the proposed study will examine the potential economic and social impacts of the programme on rural development, specifically its gender-differentiated impacts on employment of rural women. The main research question will be; what are the economic and social impacts of public spending on renewable energy in rural communities, especially for women? Specifically, we will ask:

a. How effective this government investment on rural electrification will be in enhancing productivity and overall economy of rural areas?
b. What is the potential impact of the rural electrification project in closing income gaps between the rural and urban areas to reduce rural-urban migration?
c. What economic opportunities or benefits are likely to open up to women and female-owned businesses in REF-1 project communities, and how can these opportunities be enhanced?

1.3. Main contributions (max 500 words)
Describe why and how you expect this research/evidence to contribute to addressing important knowledge gaps, both in terms of scientific contributions* and to inform policymaking.
For the gender-sensitive aspect, explain the potential usefulness of your work for gender-oriented policy.

*The literature review shall be detailed under “Research” (section III), not in this section.

Goal 7 of the United Nations Sustainable Development Goals (SDGs) emphasises ensuring access to clean, affordable, reliable, sustainable and modern energy for all. However, the geographical location and rough terrain of rural remote areas make it practically difficult to have them connected to the national grid. This impacts negatively on their economic and social lives making them depend on unsustainable and environmentally unfriendly energy sources to sustain their means of livelihood. Therefore, to support rural development and minimize rural-urban migration, the Nigerian government initiated rural electrification projects to deploy renewable energy solutions. Substantial studies exist on renewable energy and rural development (Hulscher & Hommes (1992); ADAS, 2003; Dyner et al., 2005; Sapkota et al., 2013; Afsharzade et al., 2016; Aceleanu et al., 2018), however, they most espoused the generic benefits that the deployment of renewable energy offer rural communities. There is little evidence based on the impact assessments of these projects and alternative approach to implementation. Where these kinds of empirical analyses are available, they are only for developed countries (United Nations Conference on Trade and Development-UNCTAD, 2010; Organisation for Economic Co-operation and Development-OECD, 2012; International Renewable Energy Agency-IRENA, 2016). Also, the methods adopted are either descriptive analysis, case study, econometrics or primary data analysis. The major limitation of these approaches is that their focus tends to be on a single macroeconomic variable, ignoring sectoral and economy-wide influences.

Our study will, therefore, address important knowledge gaps by providing empirical evidence of the potential economic and social impacts that the REF-1 programme will have on the development of rural communities in general and women employment in particular. It will make scientific contributions to the body of knowledge on the impacts of public spending on rural
communities and the overall economy in general. The unique qualities of the methodology to be adopted in the proposed study, makes this possible. Additionally, this modelling approach contributes to empirical literature through the simulation of alternative approaches of implementing the policy such as when electricity is used for household, social and economic uses. In terms of policy relevance, the findings of the study will inform policymaking by providing the REA with alternative ways of implementing the policy and identifying the most effective outcome. This will ensure that the objectives of the programme are achieved while also providing evidence support for the Rural Electrification Strategy and Implementation Plan (RESIP). The modelling approach adopted for the study equally makes this possible. Additionally, the results will highlight potential gender balance impacts of the policy which are important for gender-oriented policies. This is necessary because rural women suffer the worst impacts of energy poverty (Parikh, 2011) and the gender disaggregation of the model will support evidence on the potential impacts.

SECTION II – CAPACITY BUILDING

2.1. Team composition and experience

For each team member, please indicate (using the following tables – one per member):

1. Age, sex, and relevant training, experience and/or expertise (start with team leader).

   Note that:

   - Teams must be composed of both researchers and government officials/officers:
     - Four (4) researchers - including one senior/experienced researcher, acting as team leader and at least two researchers aged under 30 - with a sufficient academic and/or professional background in economic policy analysis. In particular, having a master’s degree/diploma or being currently enrolled in a master’s program is considered a minimum requirement (generally, team leaders should have a doctoral degree/diploma or be currently enrolled in a doctoral program). These members should describe their relevant training and experience in the issues and research techniques involved.
     - Two (2) government officials/officers from (and with their involvement sanctioned by) the institution in charge of the policy/program that the research aims to inform. These government-affiliated members must have a good understanding of the relevant policy processes and priorities but are not required to have research experience.

   - Applicant teams must be gender mixed, with female members representing at least 50% of all members (including the team leader) and contributing substantively to the project. PEP encourages teams with a female leader.
   - All members of applicant teams must be African nationals (and reside in Africa for the duration of the project).
- Priority is given to projects in low-income economies, and/or fragile or conflict-affected situations (LIE/FCS) but proposals are welcomed from all African countries (including North Africa).
- A researcher can be funded as a team member a maximum of three times by PEP (no more than twice as team leader) and should show marked progression over time.
- A researcher who is already involved in a funded project is not eligible to submit a new proposal before the approval of the final report of the currently funded project.
- Each listed member must post an up-to-date CV in their profile on the PEP website – refer to “How to submit a proposal” and the eligibility criteria on the call webpage.

2. **Benchmark and expected capacity building:**

   - Describe the capacities that each team member (and potentially her/his affiliated institutions) is expected to build through their participation in this project. This is an important aspect in the evaluation of proposals and should be presented in detail.

     - What techniques, practices, literature, theories, tools, etc. will each team member and her/his institutions learn (acquire in practice) or deepen her/his knowledge of?
     - How will these skills help each team member in their career (development) and/or professional responsibilities?
     - What is each team member’s current state of knowledge with regard to the project you are proposing?

3. **Task and contributions to project:** Indicate the specific tasks each team member would carry out in executing the project.

   Note that, in this particular initiative, while all outputs should be focused on the research-policy nexus and produced through a collective and coordinated effort, PEP will provide more specific training/support for:

     - *Researcher* team members to take the lead in developing a high-quality scientific research paper (i.e. reporting the process of and results from methodological applications).
     - *Government-affiliated* members to take the lead in developing a “policy paper” (i.e. positioning the research and findings within the country’s broader policy contexts and strategies).

### Team leader

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<tr>
<th>Name</th>
<th>Age</th>
<th>Sex (M/F)</th>
<th>Highest degree/diploma</th>
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<tbody>
<tr>
<td>Opeyemi Akinyemi</td>
<td>31</td>
<td>F</td>
<td>PhD Economics (specialisation in Energy Economics)</td>
</tr>
</tbody>
</table>

**Training and experience**

Opeyemi has a doctorate degree in Economics from Covenant University with specialization in energy policy and
environmental management. Her PhD thesis was on the assessment of fuel subsidy and environmental quality using a dynamic computable general equilibrium model. As an experienced energy policy researcher with over six years’ experience, she is skilled in the topic of the proposed project. She has attended seminars and conferences in different parts of the world where she presented findings from her research which had resulted in fourteen publications. She also had research visiting position in Sweden working on sustainable energy. She is currently a researcher and lecturer in the Department of Economics and Development Studies, Covenant University, Nigeria.

### Expected capacity building

Opeyemi has a strong understanding of the methodology in the proposed project and subject matter and the project will deepen her modelling skills in CGE modelling. She also expects to enhance her knowledge of energy policy focused on rural development which will support sustainable development. This is particularly important as it provides an opportunity to learn more about relevant current theories, studies, tools and methods within the context of energy policy, gender considerations and rural development. Specifically, she hopes to broaden her understanding on impact evaluation of policies that support growth, employment and income of rural communities. This is an important area of capacity building for her. She believes the experience that will be gained in building a gender-aware CGE model and database will be very valuable to her current research agenda. As a lecturer, she teaches undergraduate and postgraduate students of economics on macroeconomic theory and petroleum economics, and other economics-related courses. She also supervises final year projects of students, thus, the training, knowledge and experience that will be gained from the proposed project will also benefit the students and institution through knowledge transfer. Also, she can train more people on CGE modelling for energy policy and sustainable development analysis. Furthermore, she can share her training and experience at the bi-weekly seminar that holds in her department at her institution, which can be a viable medium for knowledge dissemination. Finally, the involvement of government officials in the proposed project to support policy engagement will enable her have practical knowledge in designing policy-oriented research which also involves key gender considerations.
**Contribution to project**

Opeyemi will be the team leader of the proposed project and will coordinate its execution. She will also be involved in the modelling exercise, simulation of the scenarios to achieve the objectives and preparation of the final report.

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**Researcher #2**

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<th>Name</th>
<th>Age</th>
<th>Sex (M/F)</th>
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<tbody>
<tr>
<td>Temilade Sesan</td>
<td>39</td>
<td>F</td>
<td>PhD Sociology and Social Policy</td>
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</tbody>
</table>

**Training and experience**

Temilade has a PhD in Sociology and Social Policy, with research expertise in the areas of energy, gender and the environment. She has previously used qualitative research methods to advance knowledge of the enablers and barriers to the widespread uptake of energy technologies in rural areas of Nigeria, Ghana, Kenya, Uganda, Tanzania, Malawi, Zambia, Mozambique and South Africa. She teaches postgraduate courses on renewable energy policy and research methodology at the Centre for Petroleum, Energy Economics and Law (CPEEL), University of Ibadan.

**Expected capacity building**

On this project, Temilade expects to benefit from the multidisciplinary composition of the team. In particular, she will develop a greater understanding of CGE methodology and economic modelling techniques in general. She will be able to use her newly acquired skills to strengthen the advanced research methodology course she teaches at CPEEL, thereby spreading the capacity-building impacts of the project to upcoming researchers at the centre and beyond.

**Contribution to project**

Temilade will contribute her expertise in gender and energy research to shaping the direction and content of the present project. Her familiarity with the underlying concepts and discourses in the field will be instrumental to the generation and analysis of gender-disaggregated data on the project.

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**Researcher #3**

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<th>Age</th>
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<tr>
<td>Omobola Adu</td>
<td>26</td>
<td>M</td>
<td>MSc. Economics; PhD Economics (in view)</td>
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</table>

**Training and experience**

Omobola is a trained economist with a deep understanding of the macroeconomy. He holds a BSc. and MSc. degree in Economics from Covenant University and he is also currently a Doctoral student in the same University. His areas of research interest include macroeconomic analysis, labour
economics, renewable energy and financial & investment analysis. Omobola is interested in research directed at influencing public policy, community development, good governance and energy. In his academic journey, Omobola has published papers in several reputable international journals and has also attended conferences where he presented papers related to renewable energy and its linkage to the development of the Nigerian economy.

In addition, Omobola also has experience in the industry, as he previously worked as a research analyst at BusinessDay Nigeria, a reputable business newspaper in Nigeria, where he wrote several news articles published in the paper concerning renewable energy and how impact investing can transform the energy landscape in Nigeria. Omobola also works with Growth & Development Asset Management, an asset management company where he works with a team to develop impact investing financial products aimed at providing financial returns to investors and also creating an impact on the community. Omobola is a skilled data analyst and proficient in the use of basic data analysis software.

| Expected capacity building | By working with the other team members on the proposed project, Omobola will be able to broaden his knowledge, skills and experience pertaining to the evaluation of public policy. Furthermore, by interacting in an environment consisting of government officers, Omobola will have first-hand knowledge of how government policy decisions are carried out in Nigeria from a practical perspective. Also, through the interaction with the other team members, it is expected that there would be an improvement in the research skills of Omobola as he learns from the more experienced researchers. More importantly, due to Omobola’s interest in CGE modelling, this project would serve as a solid foundation as he will be exposed to public policy analysis and CGE modelling which will enhance his methodological competence. |
| Contribution to project | Omobola will contribute to the project in a number of ways which include: being responsible for conducting an extensive literature review for the research project; second, as a versatile data analyst, he will also contribute to the project via data collection and analysis of survey data for eventual use for the disaggregation of the SAM. |
**Researcher #4**

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<tr>
<td>Babajide Sokeye</td>
<td>25</td>
<td>M</td>
<td>MSc. Energy Studies, PhD. Energy Studies (In View)</td>
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</table>

**Training and experience**

Jide is a trained Chemical Engineer. He holds a B.Eng. degree in Chemical Engineering and a Masters degree in Energy Studies with specialization in Renewable Energy from the Centre for Petroleum, Energy Economics and Law (CPEEL) at the University of Ibadan. His PhD research, which he is also undertaking at CPEEL, is focused on interrogating the nexus (including the potential trade-offs) between food security and energy security. Furthermore, Jide is motivated in conducting research that can inform policy on rural development, energy investment, good governance, energy and environmental sustainability. He is proficient in the use of basic data analysis software.

**Expected capacity building**

Also, working with the other team members made up of economists, sociologist and government officials, Jide’s knowledge, skills and experiences on impact evaluation of public policy will be broadened. The project will improve Jide’s capacity in literature preparation and presentation and data management. As a PhD candidate at CPEEL with interests in the intersection of energy, food, policy, gender, and rural development, the subject matter of this project would serve as a solid foundation for his research. He would also be exposed to public policy analysis and CGE modelling. This will also enhance his methodological competence. This enhanced capacity will serve him well in his role as a Graduate Assistant at CPEEL, with responsibility for coordinating and overseeing the work of Masters-level students at the centre.

**Contribution to project**

Jide will contribute in two major ways amidst others. First, he would be responsible for conducting an extensive literature review. His work in this regard will be facilitated by the access he has to a wide range of academic resources as a student at CPEEL. Secondly, as a versatile data analyst, he will also contribute to the project via data collection and analysis of survey data for eventual use for the disaggregation of the SAM.

**Government official/officer #1**

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<tr>
<td>Mr Cyprian Longtar</td>
<td>51</td>
<td>M</td>
<td>BSc.</td>
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**Training and experience**

Cyprian is an engineer with extensive experience in conducting research on energy technologies and policies. He was a member of the inter-ministerial committee that developed the 2015 National Renewable Energy and
Efficiency Policy, one of the flagship policy statements driving the operationalisation of the Rural Electrification Fund’s REF 1 project.

**Expected capacity building**

This project is expected to hone Cyprian’s capacity to interpret and apply scientific findings to his work at the Rural Electrification Agency. As a manager in the agency’s research department, these skills will be relevant not only for him, but also for other members of staff working under his direction – creating the conditions for the institutionalisation of the capacity development gains enabled by the project.

**Contribution to project**

Cyprian will lead the Rural Electrification Agency’s engagement with the technical and policy recommendations expected to emerge from the research project. He will also be involved in the production of written outputs, especially technical briefs aimed at providing periodic inputs into ongoing decision-making processes.

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**Government official/officer #2**

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<tr>
<td>Ngozi Chimdi-Ejiogu</td>
<td>54</td>
<td>F</td>
<td>MBA</td>
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**Training and experience**

Ngozi is a chartered manager and seasoned financial expert, with extensive experience in both the public and private sectors. In her current position as Assistant Director in the Bilateral Funds department of the Rural Electrification Fund, she coordinates external inputs into various rural electrification initiatives led by the Nigerian government. She also collaborates with colleagues across departments within the agency to ensure maximum value for money and efficiency on public projects.

**Expected capacity building**

The project will provide Ngozi with a unique opportunity to collaborate with researchers outside of government and donor circles. The experience will increase her capacity to understand and measure the economic impacts of the investments she manages in the course of her work at the Rural Electrification Fund.

**Contribution to project**

Ngozi will provide the team with all the financial and investment data relevant to the project, and she will lead the analysis of this data from the government side. She will also be the key link between the project team and the development partners involved in the REF 1 programme. She will play a role in developing and disseminating written outputs from the research.
### 2.2. List of past, current or pending (non-PEP) projects in related areas involving team members, including resulting publications (If any)

Indicate the funding institution, the title of the project and related publications, and list the team members involved.

<table>
<thead>
<tr>
<th>Name of funding institutions</th>
<th>Title of projects and related publications (link)</th>
<th>Team member(s) involved</th>
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</table>
| ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) | **Title**: Household Energy Expenditures and Income Groups: A Gender Analysis from Nigeria  
| UONGOZI Institute (Institute of African Leadership for Sustainable Development) | **Title**: Green Industrialization in Nigeria and Ghana: Extents and Impacts from Firm-level Survey  
| The Nigerian Economic Summit Group (NESG) | **Title**: Potential Impact of the African Continental Free Trade Agreement (AfCFTA) on Nigeria  
Publication (reference): Report Submitted | Opeyemi Akinyemi |
| UK Department for International Development | **Title**: Understanding the barriers to the introduction and uptake of clean/improved cookstoves in Southern Africa  
| UK Department of Energy and Climate Change | **Title**: Understanding the barriers to the introduction and uptake of clean/improved cookstoves in Southern Africa  
https://climatefocus.com/sites/default/files/Boiling%20Point%2069%20Galt%20%26%20 | Temilade Sesan |
2.3. List of past or current PEP-supported projects involving team members, including resulting publications

<table>
<thead>
<tr>
<th>Project code (e.g. PMMA-12345)</th>
<th>Title of project and related external (non-PEP) publications, if any</th>
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SECTION III – RESEARCH, METHOD AND DATA

This section should be completed by the team leader and/or research members

3.1. Literature review (1000 to 1500 words)

Explain the specific gaps in the existing literature that your research aims to fill. You might want to explain whether this question has been previously addressed in this context (including key references), and if so, what you intend to achieve by examining the question again. Be sure to include literature that provides conceptual foundations for the gender analysis to be undertaken in your research.

The connection between energy access and rural development makes assessing the potential impacts of rural electrification projects important. Lack of access to energy intensifies the multifaceted development problems of many rural poor dwellers and access to energy had been linked to sustainable livelihoods. Energy importance is clear as it is used by households, business and industries for heating, cooling, cooking and supporting productive activities which
promote overall development (Adeninkinju et al., 2012; Akinyemi et al., 2017). However, the rough topography of many remote rural areas which makes it expensive to connect them to national grids has led to the development of Renewable Energy (RE) solutions in such areas (Forest, 2018; Babatunde et al., 2019). This will reduce their reliance on traditional energy sources such as charcoal and firewood for cooking and heating which pose health and environmental hazards to them, especially women and children. It is established in the literature that there is a strong relationship between the lack of modern clean energy and persistent poverty (Bronicki, 2002; Cherni, 2004; Forrest, 2018). Thus, the deployment of RE solutions to rural communities can be an effective way of reducing poverty and promoting sustainable development (Akinyemi et al., 2016; Adeninkinju and Falobi, 2009). This is because the availability of reliable and modern energy will support economic activities and enhance living standards. Benefits of rural energy include improvements in energy access, education, health, income, environment and social harmony.

The Nigerian government over the years had outlined their commitment and plan for rural electrification in different energy policy documents. This ranges from the National Electric Power Policy (NEPP) 2001 to the National Energy Policy of 2003, Electric Power Sector Reform of 2005 to the Rural Electrification Policy of 2009. Within this policy framework, the main goal of the Nigerian Rural Electrification Programme is to expand access to electricity in an affordable and cost-effective manner. The policy documents outlined the government’s objectives, goals and implementation strategy regarding rural electrification. The federal government had set a target of making reliable electricity available to 75 percent of the population (rural and urban) by 2020 and at least 10 percent renewable energy mix by 2025, while equally striving to achieve 90 percent electricity access by 2030 (Federal Ministry of Power, Works and Housing, 2016). The plans and strategies for implementation of the rural electrification programme and the fund are documented in the RESIP which will be implemented by the Rural Electrification Agency (REA).

RE technologies can benefit women in particular by relieving them of the burden of indoor air pollution, long hours of search for wood energy and drudgery; thereby, encouraging their participation in productive and income generating activities (such as agricultural or business services) that help to strengthen and sustain their livelihoods. A number of studies have documented how lack of access to electricity can be a major constraint for women in engaging in productive activities. Findings from the study of Rathi and Vermaak (2018) in South Africa indicated that women engaging in productive activities benefit the most from electrification in comparison to men in terms of earnings gain. Thus, rural electrification can be a means of uplifting women out of poverty, especially in developing countries. Other studies such as Kanagawa and Nakata (2008), Coasta et al. (2009), Kooijman-van and Clancy (2010), Pereira et al. (2011), Eleri et al. (2012), Salmon and Tanguy (2016), Dutta et al. (2017), Winther et al. (2019), among others further described and evaluated how not having access to electricity specifically affects females. They also show how energy infrastructural investment in the rural areas can boost female employment. For example, Kanagawa and Nakata (2008) noted that the lack of energy access can have indirect effect on the opportunities of women to attend schools especially in the rural areas or participate in the labour market.
Relating to studies on the importance of gender dimension analysis, Nelson and Kuriakose (2017) found that RE policies are more effective when gender equality is taken into consideration. Further, Winther et al. (2018) show that the implementation and impacts of rural RE projects are likely to be more inclusive if the gender dimensions of energy access are explicitly acknowledged and factored into the project design (for instance, the ways that intra-household dynamics often result in conflicts between the control that men exercise over family resources and the agency of individual women). Even where energy interventions appear to have achieved a measure of success, however, a deeper look can reveal that benefits are skewed by gender. A classic example is a “successful” solar lighting project implemented in Bangladesh which enabled men to relax by watching television late into the night but also unintentionally increased women’s burdens by encouraging them to also stay up late mending their husband’s fishing nets (Wong, 2009). The fact that most of this work done by women is undervalued and largely unpaid (Dunaway, 2014) only serves to widen the socioeconomic gap between them and their male counterparts. These studies provide the conceptual foundations and importance of incorporating gender analysis in the deployment of RE for rural electrification. This study will address this by developing a gender CGE model following the works of Siddigui (2004) and Chitiga et al. (2010) where the models were gender disaggregated. This will highlight how the project implementation will, directly and indirectly, impact women given that they are the most affected with energy poverty.

There is a considerable amount of studies on the analysis of the impacts of public investment in rural electrification on rural development (e.g. Hulscher & Hommes, 1992; UNCTAD, 2010; Brown et al., 2011; OECD, 2012; Odeku, 2013; Kibria, 2015; Rahman et al., 2017; Sapkota et al., 2018; among others). Evidence from these studies suggests that Renewable Energy Technologies are essential and crucial in actualizing the development of rural areas and lifting them out of poverty. They also contribute to key macroeconomic variables such as Gross Domestic Product (GDP), employment and income. Using case studies from 16 regions within 10 countries, the OECD (2012) examined the economic impacts of renewable energy deployment to rural areas and concluded that while RE presents opportunities to promote the growth of rural economies; the development benefits are not, however, automatic. Overall, RE projects are able to address key development and social challenges of rural people by alleviating rural poverty, generating employment, supporting food security through agricultural productivity, improve quality of life and reduce air pollution (Kibria, 2015). Cherni (2004) pointed out that there is evidence that performance of energy systems in rural areas have fallen short of expectations and many benefits of RE deployment in rural areas may not be fulfilled in the long term if there is no strong institutional and policy framework to support it. This failure of policy is an important gap that our proposed study seeks to address.

Furthermore, the assessment of the potential impacts of rural electrification policy for rural development is limited in the literature and where they exist, they cover mostly developed countries (Bronicki, 2002; ADAS, 2003; UNCTAD, 2010; Brown et al., 2011; OECD, 2012; Cata, 2013; Nelson and Kuriakose, 2017). Also, there are pieces of evidence for Asia (Ku, Baring-Gould & Stroup, 2004-China; Sapkota et al., 2013-Nepal; Kibria, 2015-Bangladesh); Middle East/Latin America/European Union (Cherni, 2004-Colombia, Cuba and Peru; Afsharzade et al., 2016-Iran;
Rahman et al., 2017-Pakistan; Aceleanu et al., 2018-Romania) and Sub-Saharan Africa (Odeku, 2013; Adetunji, Akinlabi & Joseph, 2018-South Africa). Also, the methods adopted in these studies are mainly descriptive analysis, case studies, primary analysis and econometrics. Even though these methods provide useful evidence, they are limited in providing economy-wide policy implications and linkages. For example, it may not be able to assess how the implementation of a rural electrification project can close the income gap between the rural and urban areas, thereby alleviating rural-urban migration. The Computable General Equilibrium (CGE) modelling approach helps to overcome this limitation. Its dynamic version which incorporates time dimension unlike the static model, makes it most suitable to assess future potential impacts of policy implementation. As an economy-wide model, it is commonly used in the economic, social and distributional impact analysis of energy policies (Adenkinju & Falobi, 2009; Adenkinju et al., 2012; Akinyemi et al, 2017; Willenbochel et al., 2017) and renewable energy development (Seung & Kraybill, 2001; Kancs, 2007; Wianwiwat & Asafu-Adjaye, 2010; Borojo, 2015). Its characteristics enable the simulation of alternative scenarios resulting from the implementation of the REF-1 policy by the Nigerian government; thereby supporting informed policy.

Thus, the proposed study will fill existing gaps in empirical literature in a number of ways. First, the REF-1 project is a new government initiative and to the best of our knowledge, no study has examined its potential economic and social impacts on rural communities. Second, many studies on impact assessment of rural electrification ignore gender components despite the evidence on the importance of gender dimensions in rural energy projects. Finally, the methodological approaches often adopted are not able to provide alternative approaches to implementing the projects. This study will fill these gaps in the existing literature.

3.2. Methodology (1200 to 1600 words)

Present the specific techniques that will be used to answer the research questions and how exactly they will be used to do so.

- Explain whether you will use a particular technique normally used in other contexts or whether you intend to extend a particular method and how you will do so.
- Explain if these methods have already been used in the context you are interested in (including key references).
- Explain how these methods incorporate and/or are appropriate for addressing gender considerations in your research.
- For PMMA (microeconomic analysis) proposals only: It is generally expected that the proposed methodology aims to empirically estimate a causal relationship. In such a case, you should explain potential sources of endogeneity in the context of your research and how the proposed technique(s) would allow the identification of the relevant parameters. You are strongly encouraged to discuss the potential impact mechanisms i.e., the channel(s) through which the “treatment” impacts on your outcome(s). Also, make sure you clearly present the outcome(s), the “treatment” and the sample used in the analysis.
The objective of the proposed study is to examine the potential economic and social impacts of alternative ways of implementing the rural electrification project by the government on rural communities. To achieve this objective, the Dynamic Computable General Equilibrium (DCGE) modelling approach which follows a macro-micro policy simulation is proposed. The CGE modelling approach is well suited to providing answers to the research questions as it is able to simulate possible outcomes from different scenarios of implementing the policy. In addition to showing economy-wide and sectoral impacts of the policy, it will provide evidence on how rural-urban migration can be reduced. It had been widely applied in empirical literature for simulating the effects of public investment spending generally (Seung & Krabill, 2001; Thurlow *et al.*, 2007; Lofgren & Robinson, 2008) and on energy in particular (Borojo, 2015; Willenbockel *et al.*, 2017). As an economy-wide model, it is able to simulate the response of the economy to policy shocks and identify patterns of sectoral linkages. The model can be static or dynamic. One of the advantages of CGE is the single base year data it uses compared to other econometric models where data for a number of years are needed. The dataset for CGE which is the Social Accounting Matrix (SAM) is based on macroeconomic data for the economy for a particular period of time, usually one year. This advantage works well for developing countries where sufficient statistical data are limited (Hosoe *et al.*, 2010). In addition, this category of models incorporates different sectors and their linkage to other parts of the economy, thereby, allowing for more in-depth and extensive analysis. It usually consists of simultaneous mathematical equations that explain the flow of relationship among economic agents, namely households, firms, government and the external world (Benin *et al.*, 2008).

It is commonly used in the analysis of renewable energy and climate mitigation policies (Willenbockel *et al.*, 2017). It is preferred to qualitative, econometric and partial equilibrium analysis commonly employed in the impact assessment of government investment or policy. Other econometric approaches are limited with their inability to capture indirect effects and sectoral linkages within the economy, covering single variables of interest (Seung & Kraybill, 2001). Also, the CGE model is able to treat many macroeconomic variables as endogenous, compared to econometrics and partial equilibrium models where they are treated as exogenous, emphasizing the importance of relative prices (Adenikinju & Falobi, 2006; Benin *et al.*, 2008). Limitations of the CGE models relates to its use of data for one reference year which can portray a static picture of a dynamic economy where parameter estimates can be sensitive to that particular year (Hosoe *et al.*, 2010). These shortcomings are addressed by introducing dynamic features into the model which is then, able to capture dynamic interactions of economic activities within the model. This dynamic element makes it possible to estimate long-term impact, given that investments take time for their effect to be observed.

In terms of modelling the impact of government investment in rural areas and assessing the policy, the study will adapt the assessment technique for CGE models by Benin *et al.* (2008). The model will be able to link production with the development of rural electrification through effects on households’ income, employment and productivity. Figure 1 depicts the theoretical framework for CGE analysis on the linkages among government spending, economic growth and poverty alleviation. On the left-hand side, it shows the production linkage while the right-hand side depicts the consumption linkage of household agents. The proposed study will focus
on the agricultural sector given that the sector is the main employer of labour in rural areas. Also, the demand for the factors of production is modelled as a function of public investment as the REF-1 is a government initiative that seeks to subsidize mini-grid energy solutions in rural areas. The main agent in the model is the government who spend on public investment from revenues collected from the other agents in the model. Thus, the model is able to capture the spending or benefit effects and financing/cost component simultaneously (Benin et al., 2008). Also, the CGE model will combine data at the micro level with the aggregated macro data in order to adequately estimate employment and income variables of rural households; thus, making the model a macro-micro simulation model. This will also be useful in achieving the objective of how government investment in rural electrification closes the gap between rural and urban incomes, thus, reducing rural-urban migration. The impacts of policies such as increase in government spending for rural electrification are quantified within a CGE model by simulating various policy scenarios. The changes in the economy due to these policy shocks are then compared with the initial baseline scenario of the model before any change was introduced.

In light of this, the PEP-1-t recursive dynamic CGE model developed by Decaluwe et al. (2013) is proposed for the study. This model represents a standard CGE model for a single country that is recursive and takes into account the time dimension. This model will be calibrated based on a recent Nigerian SAM dataset and implemented with the GAMS software. Also, given that the PEP 1-t is a standard model and does not reflect energy as a factor of production, an adjustment will be done to reflect the renewable energy component of the study. Therefore, energy will be incorporated following the approaches adopted in Wianwiwat and Asafu-Adjaye (2010), Adenikinju et al., (2012) and Akinyemi et al., (2017) where capital is a composite of capital-energy in the factors of production. The graphical structure of this relationship is presented in Figure 2. Following the nested structure of production of the PEP 1-t dynamic model of Decaluwe et al. (2013), the output is disaggregated into value-added and intermediate consumption through a Leontief function which equally disaggregates intermediate consumption into the different products. Value added is decomposed into composite capital-energy and labour by a Constant Elasticity of Substitution (CES) function. This CES function further decomposes labour into skilled and unskilled, and capital-energy composite into capital and energy composite. The model incorporates gender considerations by disaggregating labour based on gender and skill categories. This is in line with the approach for gender modelling in CGE models documented in Siddigui (2004) and Chitiga et al. (2010). The information for this disaggregation is available from the Nigerian Bureau of Statistics (NBS). Finally, the energy composite is disaggregated into fossil fuel and renewable source of electricity through a CES function.
Figure 1: Economy-wide Linkages of Public Spending in a CGE Model
Source: Benin et al. (2008)
Summarily, the study will make the following modifications to the existing standard PEP 1-t model. It incorporates energy into the production structure which is not included in the PEP 1-t CGE model. It also further divides the energy composite to separate electricity generated from renewable sources. This is crucial in assessing how the rural electrification fund will impacts employment of women in the rural areas where the programme will be introduced. This enables the modelling of effects of electric energy on the Total Productivity of the factors of production.
Also, the model of the proposed study will answer the gender dimension question by disaggregating labour, not only based on gender (labour provided by men and women); but further incorporating data on Time use, that is time spent by men and women on energy use. Also, to model the rural-urban migration impact of the programme, this can be done in two ways. First, it can be through modelling of rural and urban labour, where it is assumed that as rural income increases, incentives for rural-urban migration reduces. Secondly, a migration variable can be developed which will depend on difference between urban and rural wages. Thus, the lower the gap, the less the incentive to migrate.

The simulation scenarios involve making various assumptions about the policy shocks to be implemented within the model. It makes important contributions to the body of knowledge by simulating alternative scenarios of the implementation strategies for the rural electrification project and the best possible outcomes. The policy scenarios that this study will simulate include:

a. Scenario 1: assume REF-1 project focus on providing electricity for lighting and households' social uses (investment boost energy for rural household consumption).

b. Scenario 2: assume REF-1 project focus on providing electricity for productive activities (we assume that energy input would be increased)

c. Scenario 3: assume a 50:50 combination of simulation 1 and 2 above

d. Scenario 4: assume an efficiency of private investment is higher than public investment by introducing an efficiency parameter to public investment. This assesses the impact of approaches for delivering the project, whether private providers or public provision.

Note: Scenarios 1 and 2 are to evaluate whether electricity should be for social uses or to support economic activities so as to guide REA in designing the most effective rural electrification programme.

Scenario 1 models social uses in the model by increasing household consumption on energy which can increase household welfare. Scenario 2 models productive uses in two ways. It assumes an increase in efficiency factor (using Total Factor Productivity) as proxy. Thus, the higher the TFP, the more output that is derived from same level of inputs. Alternatively, the capital-energy input can be increased by certain percentage, say 50 percent.

3.3. Data requirements and sources (1000 to 1300 words)

This is a critical part of the proposal. Explain the reason for you choice of particular databases. You must establish that they are ideal for the policy question you wish to address (including in terms of gender analysis) and that you have or will have access to these data before your project begins. Please consult the “Guide for designing a research project proposals” for more detail.

The dataset for the methodology proposed in the study is a Social Accounting Matrix (SAM) which is a square matrix containing the flow of income and expenditure of all economic agents in an economy, usually for a year. It consists of rows and columns which explains the linkages and flow of transactions from firms and households to the government and external sector, and
vice versa. It organises data and information for the economy which serves as the statistical basis for a CGE model. The SAM also represents the database of the CGE model and is designed to capture the microeconomic and macroeconomic structure of the economy with its key characteristics (Nwafor et al., 2010). As a matrix, it connects aggregated data in a coherent and organized form that can be useful for policymakers in policy-making and planning. The double-entry accounting principle in a SAM requires that for each account, total revenue (row total) must equal total expenditure (column total). The entries indicate the flow of goods and services from the agents and the corresponding flow of payments.

The proposed study will use the 2014 Nigerian SAM based on the 2010 Supply and Use table with data and statistics from the National Bureau of Statistics (NBS) which was developed by a team of experts at Equilibria Consult, Nigeria. It is important to note that some members of the team including the team leader, were part of the development of the SAM. The existing 2006 data was developed with data from the publications of key government agencies such as the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), and Federal Ministry of Agriculture and Water Resources (Nwafor et al. 2010). This SAM was developed for a dynamic CGE study on agricultural growth and investment options for alleviating poverty in Nigeria and represented the economy in 2006. It contained sixty-one (61) activities/sectors which were majorly agriculture-related, sixty-one (61) commodities, three (3) factors of production-land, labour and capital; twelve (12) categories of households representing the rural and urban households from the six (6) geopolitical zones of the country, four (4) tax categories-direct, indirect, activity and import, one firm, one government and one rest of the world.

The 2014 SAM is, however, more recent as it was built to reflect the Nigerian economy after the rebasing exercise which is more realistic. The SAM was also used for a study on the potential impacts of the Africa Continental Free Trade Agreement (ACFTA) on the Nigerian economy recently. This 2014 Nigerian SAM contains twenty-five (25) sectors and commodities which includes crop production, livestock, forestry, fishery, extractive industry, oil refining, food and beverage, textile, wood, chemicals, motor vehicles, other industries, electricity, other utilities, construction, trade, transport, telecommunications, entertainment, finance, real estate, education, health, other services and public administration. The SAM equally has two (2) factors of production (labour and capital), four (4) categories of household (rural poor, rural rich, urban poor and urban rich), one (1) government, one (1) firm, fourteen (14) countries and regions representing Nigerian trading partners which makes up the rest of the world, and four (4) tax categories (direct, indirect, export and import).

In order to address the specific objectives of the proposed study, the 2014 Nigerian SAM will be updated and re-aggregated. Thus, the SAM for the proposed study will contain nine (20) sectors and commodities which include crop production, livestock, forestry, fishery, agro-processing, mining, textile, wood, food and beverage, other industries, electricity, renewable energy, other utilities, retail and distribution services, trade, finance, construction, transport, other services and public administration. This re-aggregation is based on the relevant sectors and commodities that are predominant in rural areas and form the bulk of its economic activities. It is to ensure the focus of the modelling aligns with the objectives and only relevant sectors or predominant
activities in the rural areas are reflected in the sectoral aggregation. In order to account for the gender dimension of the model and answer the research question 3 of the study, the study will obtain data on time use of men and women on energy. This will be obtained from the Times New Survey for Nigeria. In addition, there will be two (4) household categories based on geographical location and income-rural poor, rural rich, urban poor and urban rich; also, there will be three (3) factors of production, land, labour and capital, four (4) tax categories which consists of direct tax paid by households and firms to the government from their income, indirect tax paid on commodities such as sales tax, and export and import taxes paid on imported and exported goods; one (1) government, one (1) firm, and one (1) rest of the world. The inclusion of land as one of the factors of production is because it is an important asset of rural households.

Furthermore, the electricity sector in the 2014 SAM will be disaggregated into electricity produced from fossil fuel (traditional sources of energy) and renewable energy in line with the production structure of the model. The gender considerations of the study will be incorporated into the 2010 SAM by differentiating labour based on gender following gender-CGE studies such as Siddiqui (2004) and Chitiga et al. (2010). Studies on gender incorporation SAM provide explicit considerations for non-market activities and gender decomposition as evidenced in Chitiga et al. (2010). Other studies such as Siddiqui (2004) which modelled gender dimensions of economic reform impacts, incorporated time spent by women in market work, household activities or leisure. In other words, the SAM is gender-based by differentiating between male and female labour with associated income from the labour supply. The data for this gender-differentiated employment will be obtained from the NBS and the World Bank Living Standards Measurement Survey (LSMS). In addition, the structure of the SAM will enable the possibility of assessing the potential impacts of the REF-1 programme on rural-urban migration. Additional data required for the disaggregation in the SAM will be sourced from the Rural Electrification Agency database, Africa Household Survey Databank and the Energy Commission of Nigeria. The 2014 SAM for the proposed study is already in the PEP format and the proposed study will update it with current data from relevant sources such as the NBS, Central Bank of Nigeria, World Integrated Trade Solutions, World Bank World Development Indicators, among others.

**SECTION IV – INFORMING POLICY**

This section should be completed by the government-affiliated members, and validated by the head of their institution (to be confirmed in the required acknowledgement letter).

**4.1. Government affiliation**

a) Name the government institution at which you are employed, and describe its general mandate

N.B. This does not engage the institution itself to sanction, take part in and/or sponsor the proposed research project, other than authorizing the employees identified in section 2.1 (and below) to take part in the related work on a personal basis.
The Rural Electrification Agency (REA) was set up in 2005 to expand rural electricity access in Nigeria. The Rural Electrification Fund (REF), a Directorate under the REA, is operationalizing the Rural Electrification Strategy and Implementation Plan (RESIP), which has a mandate to increase access by 90 percent through renewables-based off-grid projects.

b) What is/are your specific role(s) (as employees) in the institution

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4.2. Describe the policy context and needs

a) Describe the specific policy issue(s), questions or needs faced by your institution and that the research project aims to inform - both in terms of socioeconomic outcomes (identify the target/beneficiary population), and the related policy processes (whether it is at the stage of debate, decision, design, implementation, review, reform, etc.).

Explain why the evidence to be produced with this research is important/useful to inform decision-making, especially with regard to your institution’s specific mandate and strategies.

An ongoing concern within the Rural Electrification Fund (REF) is how we can apply evidence to better inform policy and processes for improved electricity access in Nigeria. Our work targets the 74 percent of rural communities in the country that currently lack access to electricity. We are eager to learn how evidence from economic modelling, such as the approach proposed by this project, can inform our implementation strategy and enable the realisation of our targets in poor rural areas.

The REF-1 programme forms part of a package established by the Nigerian government to provide an enabling policy environment for private investment in mini-grid and off-grid electrification. By our calculations, developing off-grid alternatives to complement the grid could create market opportunities worth US$ 9.2 billion (NGN 3.2 trillion) and savings worth US$ 4.4 billion (NGN 1.5 trillion) per year for Nigerian homes and businesses.
However, what we do not know is how these potential earnings and savings will be distributed across the population, especially in poor rural areas where baseline electrification rates are lowest, and among male versus female populations. By anticipating and rigorously testing different access scenarios for various segments of the population, the proposed project will help to clarify some of the uncertainties surrounding the operationalization of the Rural Electrification Strategy and Implementation Plan, the policy framework guiding the REF 1 project in the study.

b) What are the current policy options/scenarios, faced by (or available to) decision-makers - in terms of potential interventions, approaches, etc. - in relation to this particular issue?

If possible, also provide a brief history of policy initiatives (and related reforms, if any) implemented in the past to address the issue, indicating generally what worked and what didn’t (i.e., why is this still an issue?).

The Rural Electrification Fund (REF) aims to test the viability and overall effectiveness of off-grid and mini-grid solutions against that of centralised grid connections that have historically been the mainstay of rural electricity provision in Nigeria. Within the remit of decentralised solutions, the REF is faced with a range of technical options (including various configurations of renewable energy technologies) and business/funding models, involving a mix of publicly funded grants, private debt and equity. The need to carefully assess the ramifications of these options is especially great in light of the troubled history of privatisation of the power sector in the country.

The Rural Electrification Agency itself emerged in 2005 to protect vulnerable rural populations from the worst impacts of the market reforms ushered in by the Electric Sector Power Reform Act enacted in the same year. The impacts of the reforms in the country have generally been below par, but those living in rural areas are least able to cushion themselves against the social and economic losses associated with lack of electricity.

The renewed push by the REF through the 2016 Rural Electrification Strategy and Implementation Plan (RESIP) is an acknowledgement of this, but that recognition also means the stakes are now higher for both the government and the people. Furthermore, the short- to mid-term economic policies articulated by the federal government in its 2017 Economic Recovery and Growth Plan place a lot of emphasis on rural activities such as farming and mining; activities which need reliable energy inputs to thrive. Rigorous analysis of the ongoing RESIP and REF 1, such as that proposed by this project, is essential for improving the government’s understanding of the benefits and trade-offs that might be associated with its current emphasis on a decentralised rural electrification strategy – and how those relate to its broader goals for economic development.

The RESIP was developed in service of the goal of the Nigerian government to increase electricity access to 75 percent and 90 percent by 2020 and 2030 respectively, from the 2019 rate of 59 percent. Renewable energy is expected to play a role in this plan, with at least 10 percent of total power output to be generated from renewable sources by 2025. The main features of the RESIP are: diversification of the country’s electricity supply options to include grid and off-grid plans; increased local participation and accountability in rural electrification
programmes; increased public and private investment in rural electrification; and, importantly channelling increased electricity access towards economic productivity and growth in rural areas.

The REF-1 is a component of the RESIP. The plan comprises a wide portfolio of projects, including grid extension, isolated mini-grids, isolated micro/nano grids, interconnected mini-grids and stand-alone systems. Mini-grids are the solution mostly deployed in rural areas, which generally have high demand for lighting but low demand for energy for productive uses. Regardless of the particular technology deployed, it is mandatory that at least 30 percent of the power generated under the RESIP is from renewable sources - in practice, mostly solar energy. A total of US$ 3.3 million has been allocated for the development of 12 mini-grids and 19,000 solar home systems, spread across the country’s six geopolitical zones. The mini-grids alone will have a total installed capacity of 890 kWp and connect about 6,000 new rural customers to electricity. Private-sector developers have begun working with the REF to build and install these projects, with three of those projects nearing completion in three states (Kebbi, Kogi and Akwa Ibom).

Also, relating to governance issues of the agency, it is important to keep in mind that the Rural Electrification Agency (REA) is a creation of an act of the National Assembly: S.88(1) of the Electric Power Sector Reform (EPSR) Act, 2005. Furthermore, its activities are supervised by a seven-man Board constituted by the Honorable Minister of Power, while the Minister of Power is responsible for the formulation of policies relating to rural electrification, the Managing Director/CEO is responsible for the day-to-day implementation of these policies and to effectively implement these policies, the RESIP was developed as a strategy in 2016.

In view of the above, there is no doubt that the REA can likely be affected by governance issues that may arise from frequent changes in government when there is a new election. Since a subsequent government is likely to introduce new policies, that means rural electrification policies can change with strategic plans. However, there is some level of independence as the REF-1 is a directorate under the REA and led by an Executive Director (ED) who is a subject expert rather than a career civil servant. Also, the implementation strategy documented in RESIP and the agency’s operational guidelines for REF-1 is expected to be followed from one transition to another, and may only require updating.

c) How do you expect this evidence will be used/assimilated effectively into the relevant policy decision/advisory processes? Be as precise as possible, indicating the specific decisions or recommendations that have to be made by your institution.

Are you aware of any cost- or budget-related considerations that should be taken into account in the context of these policy decision/advisory processes?

Also, justify the timing of the proposed research project - how does it fit with the calendar of the related policy decision/advisory processes?

The evidence emerging from this project will be used by the Rural Electrification Fund in three ways:

1. To inform decisions regarding the relative merits of specific technological configurations, e.g. solar home systems versus isolated mini-grids, for different segments of rural populations (e.g. men versus women, agro-processing versus other uses).
2. To inform decisions regarding the **optimal mix of public-private funding** required to achieve equitable electricity access among poor rural populations.

3. To inform future **reviews of the Rural Electrification Strategy and Implementation Plan (RESIP)**, with a view to optimising social and economic returns on public and private investment.

Specifically, the expected results of the study will be:

1. To inform the ongoing implementation of RESIP by the REF, so as to iteratively incorporate elements shown by our modelling scenarios to be conducive to increased employment/productivity outcomes for women. The actors that will benefit directly from this outcome are the REA, the ECN, and the Ministry of Power, Works & Housing.

2. To enhance cross-sectoral collaboration between relevant government departments (especially agriculture, power and women affairs) and subsequently facilitate joined-up policy making among them, in the process promoting a more holistic vision of rural development at the national level.

3. To forge stronger links between the worlds of policy and academia, and create enduring institutional mechanisms for feeding evidence into agricultural and rural development policy. This is expected to result from deep engagement between the government agencies mentioned above and the university partners represented on the project throughout its duration.

The federal government has limited funds available for rural electrification, and private actors are often discouraged from investing in this area because returns can take a while to materialise. Donor agencies and venture capital firms fill some of the funding gap, but a large deficit remains. This state of affairs will influence what is possible in reality, and the role of the evidence generated by this project is expected to be contingent on this and other factors in the policy sphere, some of which are difficult to pre-empt.

Elements of the RESIP are expected to continue up until 2023 – an opportune timeframe given that the date coincides with the year of a scheduled regime change – and so there is a considerable window of time within which it will be practically and politically viable to apply the evidence generated by this project to policy review.

### 4.3. Stakeholder mapping and dissemination

List all other potential stakeholder institutions, i.e., institutions that you consider as potential users of the same research evidence (other than your own). These can include other ministries and government agencies, as well as civil society organizations, NGOs, private sector, etc.

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<thead>
<tr>
<th>Name of institution/organization #1</th>
<th>Energy Commission of Nigeria</th>
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<td><strong>List the key representatives or target research users (policy makers or influencers)</strong></td>
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<tr>
<td>- Professor Joseph Dioha, Director, Renewable Energy Department</td>
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</tr>
<tr>
<td>- Dr. Abubakar Malah, Director, Policy and Planning Department</td>
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<tr>
<td><strong>Describe briefly why and how you believe this institution could use the evidence</strong></td>
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<tr>
<td>The commission is responsible for the coordination and supervision of all energy-related activities and functions in Nigeria, in line with its mandate and therefore, findings from the project will be relevant to a number of its activities and operations. Specifically, the evidence will be useful to their energy and rural development programme and their renewable energy department. They</td>
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</table>
can also use these findings to advise the government on policy relating to renewable energy as the commission is the apex government organ empowered to execute all energy sector planning and policy implementation.

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<thead>
<tr>
<th>Name of institution/organization #2</th>
<th>Federal Ministry of Science and Technology</th>
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<tr>
<td><strong>List the key representatives or target research users (policy makers or influencers)</strong></td>
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<tr>
<td>- Mr Abbas Gummi, Director, Renewable and Conventional Energy Technologies Unit</td>
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<tr>
<td>- Mrs Deborah Rugbereg, Gender Desk Officer, Renewable and Conventional Energy Technologies Unit</td>
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</table>

**Describe briefly why and how you believe this institution could use the evidence**

One of the functions of this government parastatal is supporting the socioeconomic development of Nigeria through the development and deployment of technology. This makes them work with the Energy Commission of Nigeria (ECN) on the assessment of renewable energy technologies for rural electrification. The proposed project will provide scientific evidence on how the government’s renewable energy deployment in the rural areas affects the economic and social realities of rural dwellers. This is vital, as the evidence can be used to support the ministry’s engagement with external funding agencies.

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<thead>
<tr>
<th>Name of institution/organization #3</th>
<th>Federal Ministry of Power, Works and Housing</th>
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<tbody>
<tr>
<td><strong>List the key representatives or target research users (policy makers or influencers)</strong></td>
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<tr>
<td>- Mr Faruk Yabo, Director, Department of Renewable and Rural Power Access</td>
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<tr>
<td>- Mr Temitope Dina, Assistant Chief Electrical Engineer, Department of Renewable and Rural Power Access</td>
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</table>

**Describe briefly why and how you believe this institution could use the evidence**

The results from the proposed project will be useful to the Department of Renewable and Rural Power Access as well as the Department of Planning, Research and Statistics. These departments are interested in learning about how power projects can improve the incomes and living standards of rural people. In particular, the Social Accounting Matrix (SAM) that will be developed on the project will be useful for some of the standard analyses carried out by the departments.

**Other Relevant institutions and organizations**

Other relevant stakeholder agencies and institutions include other ministries and government parastatal that work with these agencies and others who may find the results of the proposed study policy relevant. These include the Federal Ministries of Agriculture and Environment, private renewable energy private investors and recipients of the agency’s capital subsidy for renewable energy deployment in the areas under the REF-1 programme.

**4.4. Outline your engagement/dissemination strategy**

Describe how you intend to engage with these other stakeholder institutions (listed in 4.3) to ensure that they:

1) Contribute to informing the research work (i.e. consultations)
2) Are kept informed of the research progress and findings
The dissemination strategy for project results will begin with an initial consultation with relevant stakeholders to discuss the ideas, scope and objectives of the project to ensure they also align with the policy needs of the stakeholders. Following this, there will be a technical meeting with specific stakeholders that are directly involved in the Rural Electrification Programme (such as the Energy Commission of Nigeria, Ministry of Power and Ministry of Science and Technology). This is intended to discuss technical aspects of the project and go more in depth with these specific stakeholders. Then, an interim report will be prepared to report the outcome of the technical meeting with the stakeholders and progress achieved so far. When the draft report is ready, a validation meeting/workshop will be held to present the initial results of the project to the stakeholders and harvest their comments. This can be done during one of the meetings of the relevant stakeholders such as one of the Energy Commission Meetings. Finally, after the final report had been prepared, a dissemination workshop (at National level) will be held to discuss the findings of the project and the policy brief to a wider stakeholder audience. In addition to this, research papers from the project will also be presented at the PEP Annual Conference and another international conference. The revised version of the conference papers will be published in peer-reviewed Journals.

SECTION V – OTHER CONSIDERATIONS

5.1. Describe any ethical, social, gender or environmental issues or risks that should be noted in relation to your proposed research project.

There are no known ethical, social, gender or environmental issues or risks that relate to the proposed research project.

5.2. References


