Advancing grid-connected wind and solar energy adoption in Nigeria: exploring the dynamics of socio-technical transitions.

ADEDOKUN, R., STRACHAN, P. and SINGH, A.

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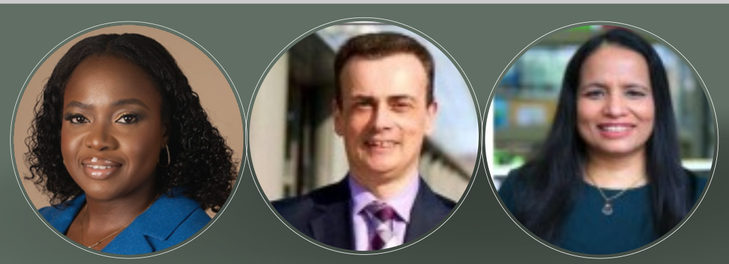
ADVANCING GRID-CONNECTED WIND AND SOLAR ENERGY ADOPTION IN NIGERIA: EXPLORING THE DYNAMICS OF SOCIO-TECHNICAL TRANSITIONS

Research Team

Dr Racheal Adedokun r.adedokun1@rgu.ac.uk (Presenter)
Prof Peter Strachan p.a.strachan@rgu.ac.uk
Dr Anita Singh a.singh13@rgu.ac.uk

Aberdeen Business School

Robert Gordon University



Overview

About Me

- Lecturer in Management at Robert Gordon University,
  - Chartered manager at the Chartered Management Institute.
  - Fellow of Higher Education in the UK.
  - Fellow of Institute of Management Consultant.
  - Certified Management Consultant at the International Council of Management Consulting Institutes (ICMCI).
  - Certified Management Specialist from the London Graduate School.
  - Associate Member of the Energy Institute, UK.

- PhD in Management, focusing on the Strategic planning process and governance with the role of accountability and transparency of energy transition, Master's in Business Administration, UK and a bachelor's degree in Accounting, Nigeria.

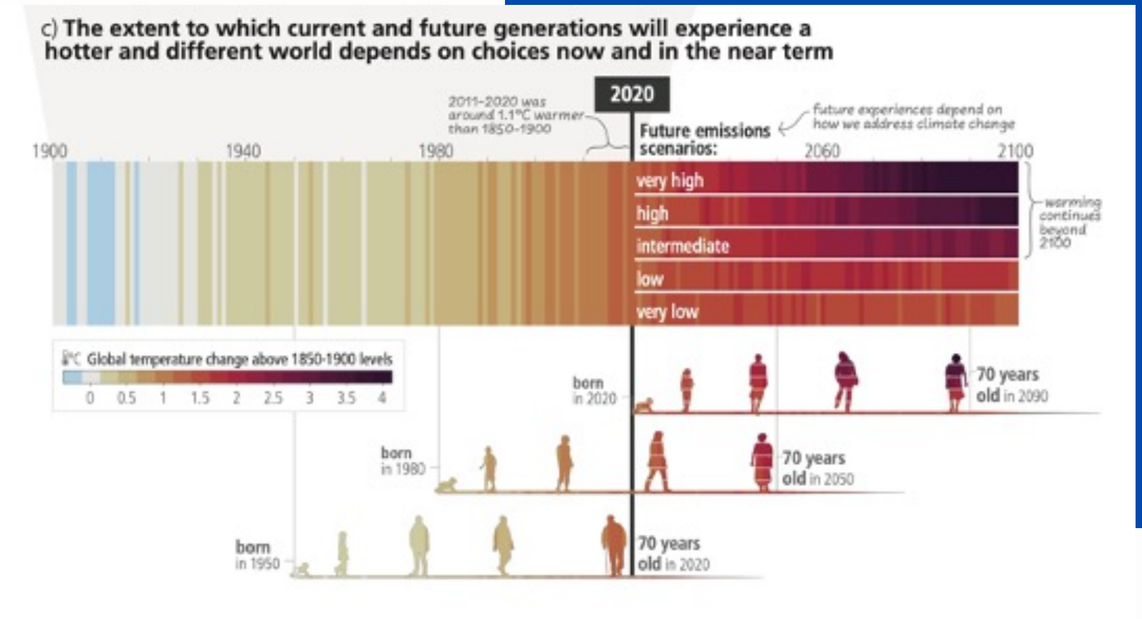
- Over 10 years of industry and education experience.

- Member of the Board Governor and Academic Council at Robert Gordon University (2019–2022).

- Most recent projects:
  - Decision-making in the Front-End Loading Stage of Project Management in the UKCS Oil and Gas Industry sponsored by the Engineering Construction Industry Training Board (ECITB).
  - British Council/International Science Partnership Fund sponsored a multi-national symposium on clean energy for a resilient planet, which included researchers from the UK, Japan, and India.

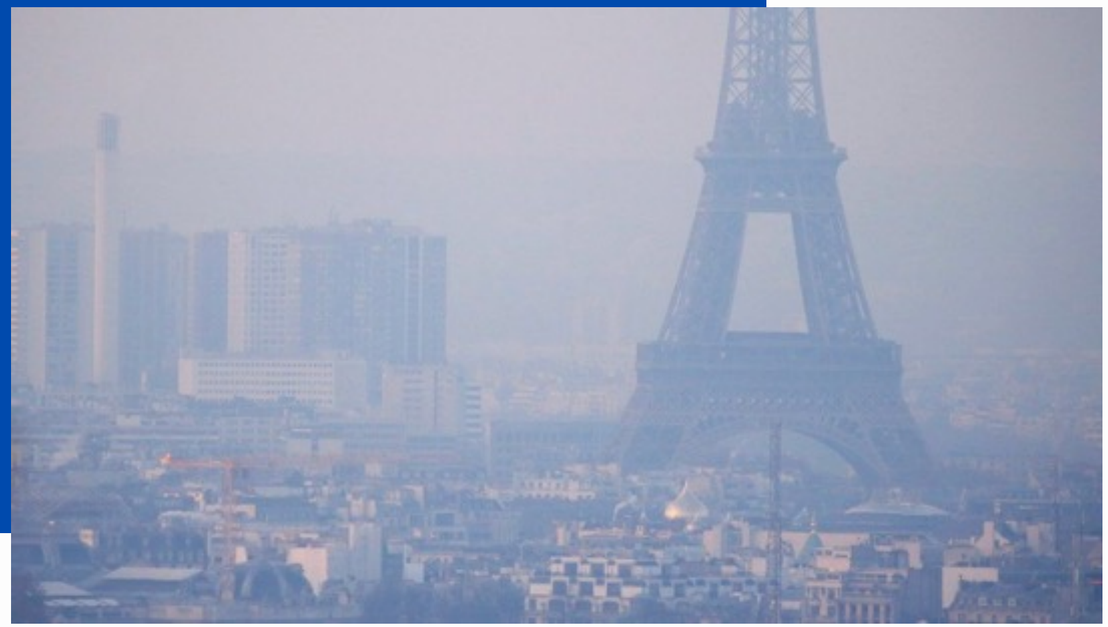
- Recent Publication:
  - Investigating the Strategic Planning Process and Governance to Promote Grid-based Renewable Energy Development in Nigeria.
  - Naturalistic Decision-making and Decision Drivers in the Front End of Complex Projects
  - Socio-technical Transition - Technology Roadmap for Accelerating Grid-based Renewable Electricity Sector Transitions in Nigeria.

Background



Climate change issues

Source: Climate Synthesis Report 2023 by the Intergovernmental Panel on Climate Change



Air Pollution

Source: World Health Organisation 2023

- Almost all of the global population (99%) breathe air that exceeds WHO guideline limits and contains high levels of pollutants.
- 7 million premature deaths annually from the combined effects of ambient air pollution and household air pollution .

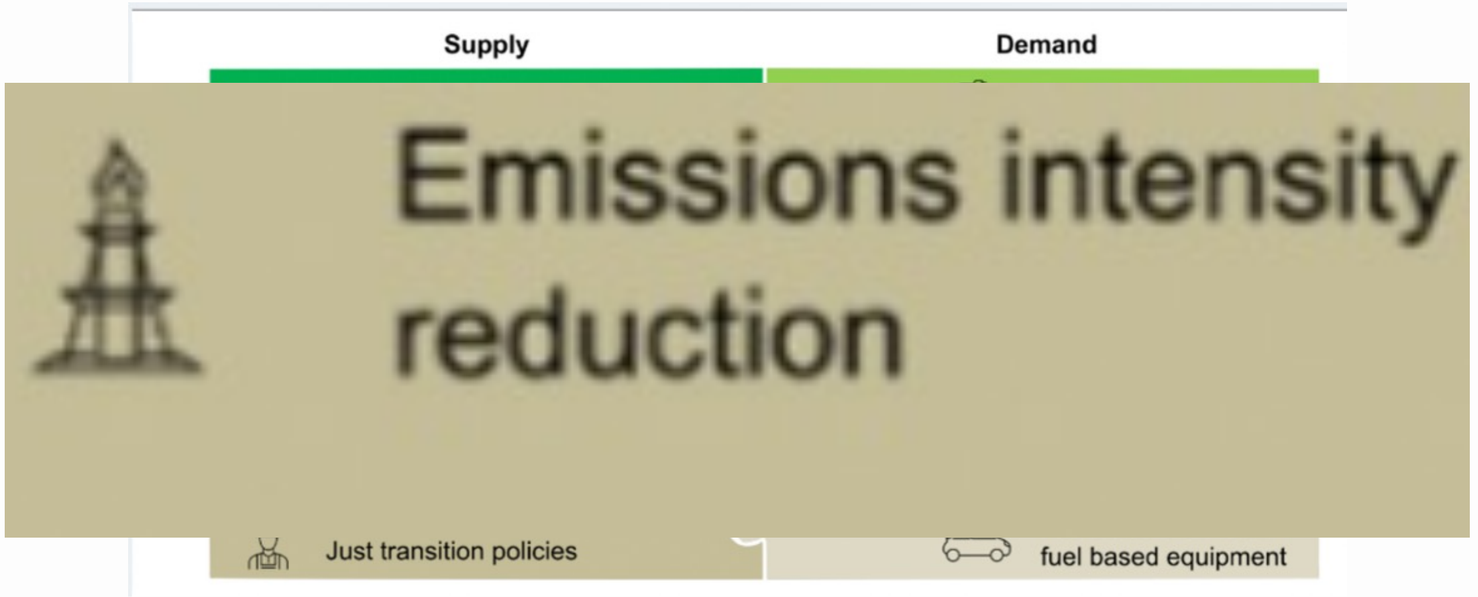
Background - Global Context

Limit the global average temperature increase to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

Source: United Nations 2015

- Global transition is necessary to address climate change and air pollution issues.
- 194 countries signed the Paris Agreement with Nationally Determined Contributions in place.
- The net-zero targets are set by 146 countries.
- COP 28 concluded with an emphasis on the “beginning of the end for the fossil fuel era”

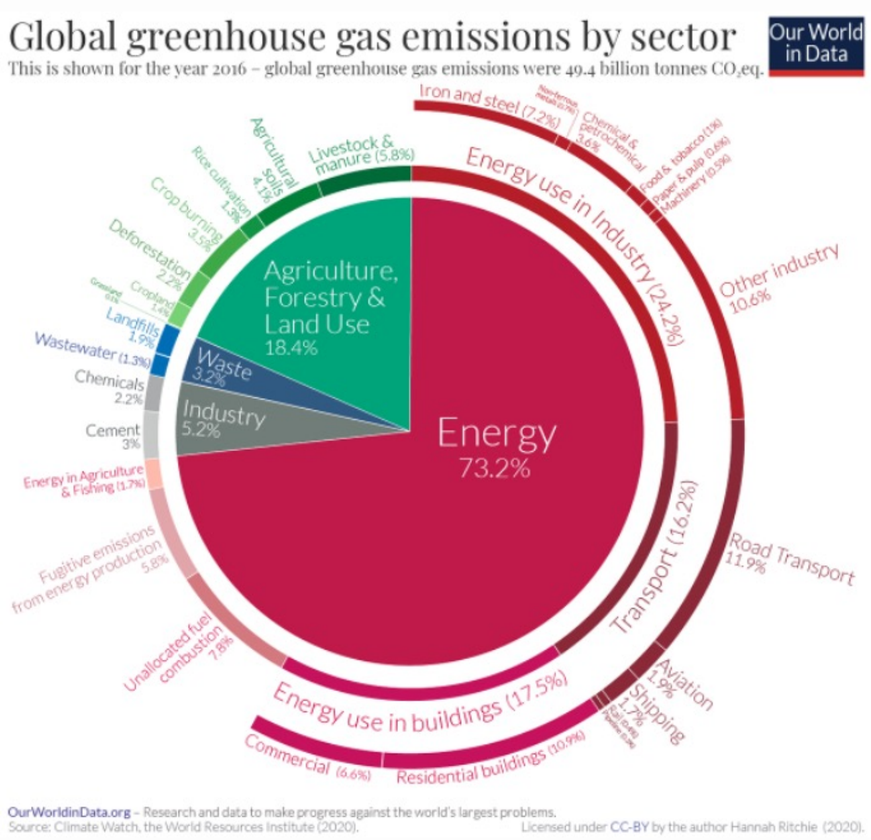
Background - Global Context



Examples of Policies to Scale-up Demand and Supply of Clean Energy.

Source: The Oil and Gas Industry in Net-Zero Transitions by IEA 2023

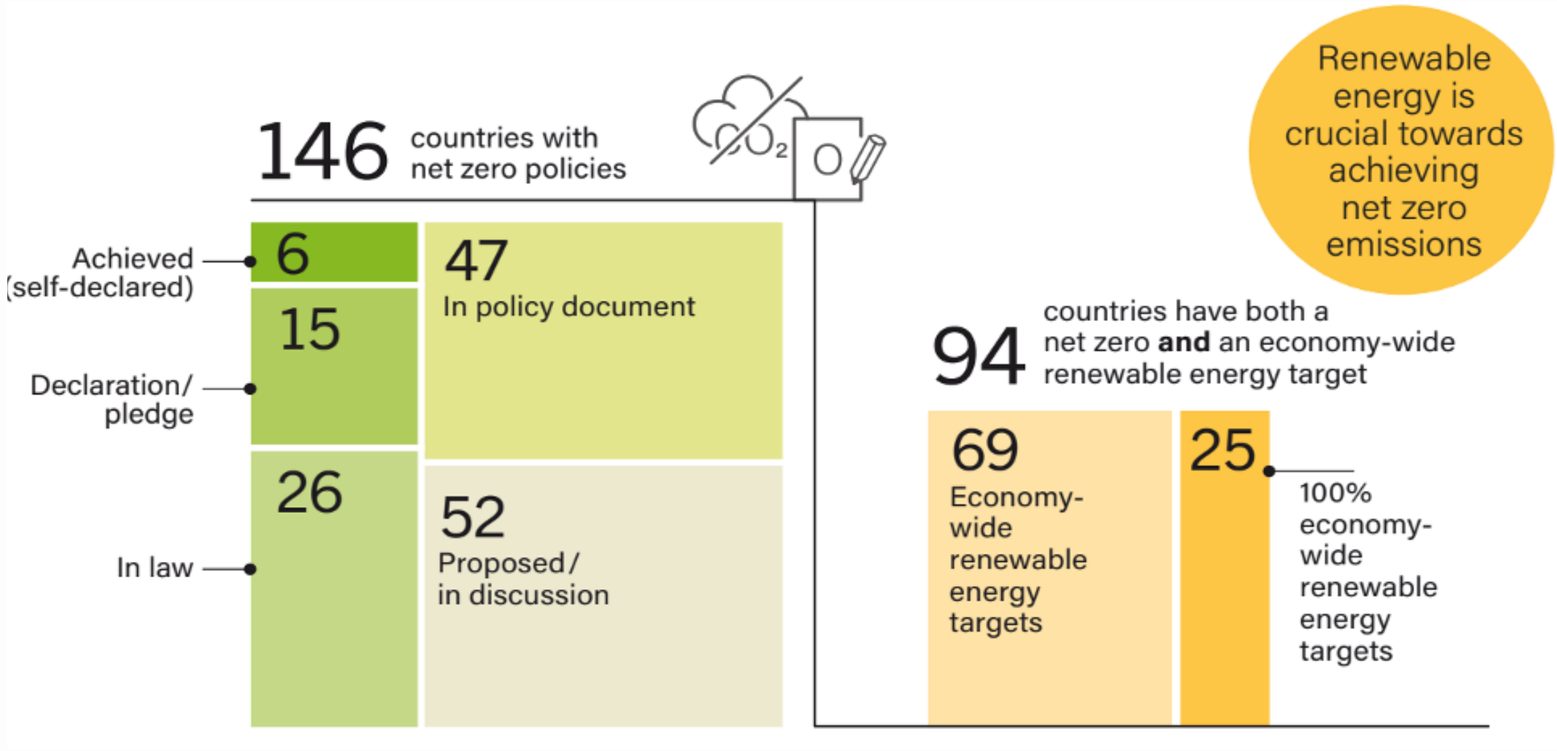
Background - Global Context



Sectors with high emission intensity

Source: Climate Watch by the World Resources Institute/Our World in Data 2020

Background - Global Context



Countries with Net-Zero and Renewable Energy Targets 2022

Source: Renewables Energy Global Status Report 2023 by REN21

Background - Nigeria Context

Energy access

85 Million Nigerians are without access to electricity [IEA 2019].

Urban area

35% of the urban area has no access to electricity (residential and industrial) [IEA 2019].

Energy and supply gap

4,000MW of electricity was supplied compared to 6,000MW demand in 2019 [IEA 2019].

Industrial energy

75% of industrial areas are off-grid, and Nigeria is the largest importer of fossil fuel-based generators in the world [IEA 2019].

Nigerian Population

The Nigerian population is projected to double by 2050, and energy demand is projected to increase [Cookson 2019].

Electricity Challenge

Electricity challenges have had devastating economic implications, with an annual loss of $26.2bn, about 2% of the country's GDP [World bank 2020].

Background - Nigeria Context

Source: 10 Countries most threatened by Climate change in 21st century

Nigeria Policy landscape

Renewable energy will account for 30% of a planned 30GW by 2030

National Renewable Energy and Energy Efficiency Policy (NREEEP)	2015	The energy access to rural areas is low, and further development of the grid system will not cater for all the rural communities that are hitherto unreached. Hence the NREEEP provides a comprehensive renewable energy policy for urban and rural areas, i.e., grid and off-grid development.	1. set-up a framework to address energy access and security.2. Increase the proportion of energy generated from renewable sources.3. Incorporate energy efficiency in the energy plan.4. Develop an integrated resource plan (IRP).	At least 10% of hydroelectricity always.At least 3% solar energy by 2020 and 6% by 2030.

Source: Author

Problems

Problem 01

Renewable energy (RE) sources (off-grid and grid-based) have been identified as a remedy to address energy poverty and climate change issues and boost economic and sustainable development.

Problem 02

The National Renewable Energy Action Plans targeted renewable energy accounting for 30% of the planned 30 GW generation by 2030, i.e., available electricity. Energy access will increase from 65% (2016) to 75% (2020) and 90% (2030) [NREAP 2020]. However, significant milestones have been missed, with projections looking unattainable for the 2030 target [SE4ALL 2016].

Problem 03

While the off-grid segment has had notable success, no new RE technology has been incorporated into the national grid.

Problem 04

Given the huge economic cost, we want to understand the difficulties of actualising grid RE (solar and wind) strategies and assess the governance and planning process (actors' involvement and RE instruments).

Concepts in this Study

Governance of transition

Governance arrangements to facilitate and accelerate the transition process.

Grid-based renewable energy

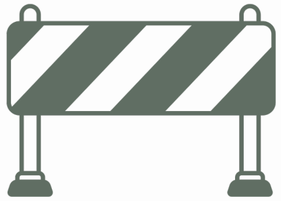
Utility-scale renewable energy (RE) that feeds into the national grid

Strategic planning process

Route for developing and implementing RE strategies, policies, plans, and projects

Aim/Objectives

Investigate the renewable energy planning process and governance for implementing grid-based renewable energy strategies in Nigeria to identify barriers, enablers and drivers for transitions.



Objective 01

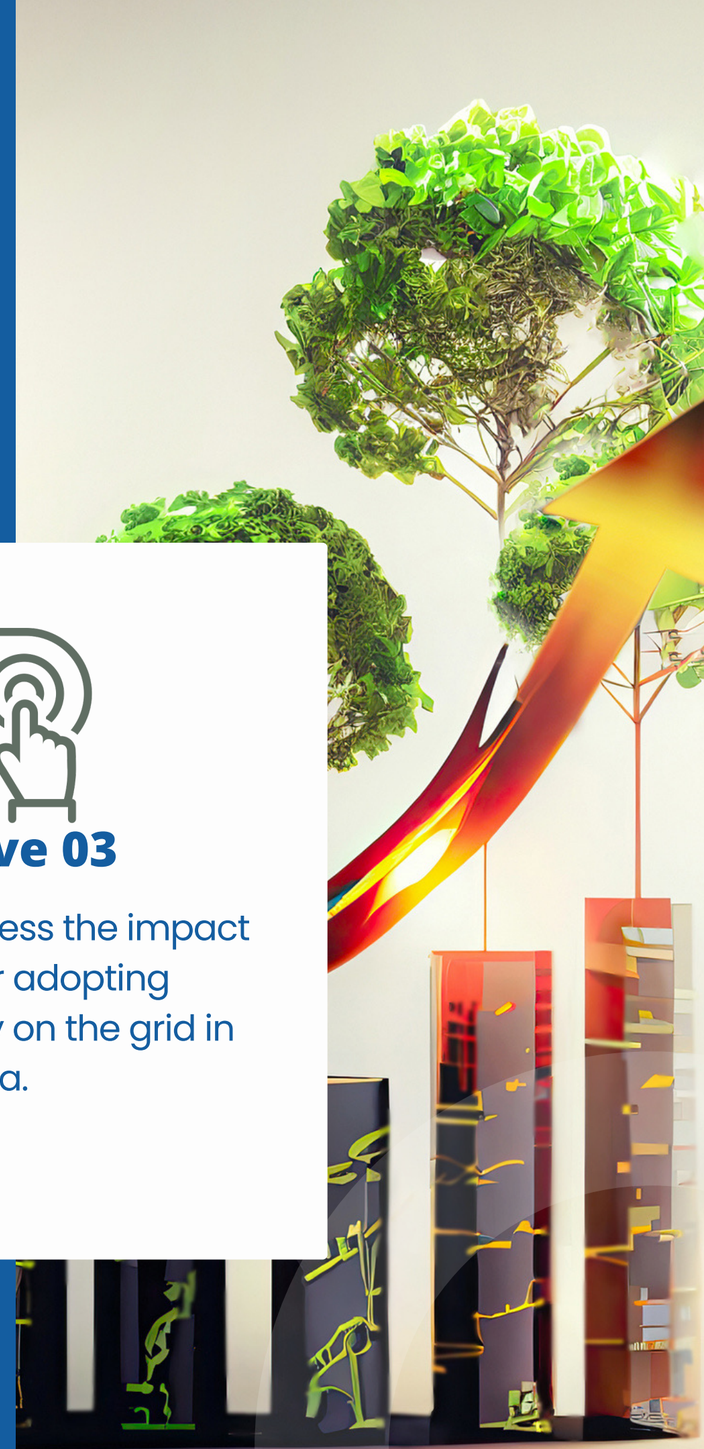
To identify and analyse the barriers to Nigeria's grid-based renewable energy strategies implementation process.

Objective 02

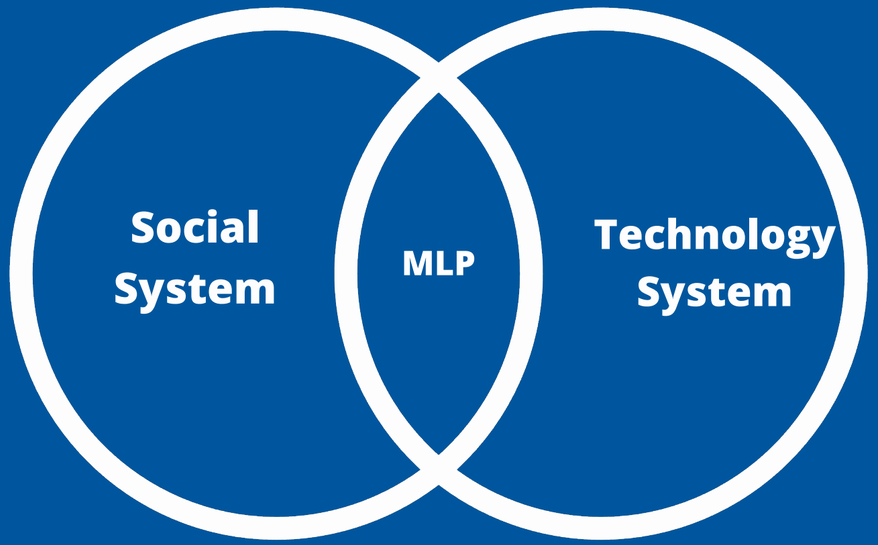
To critically evaluate the drivers for the energy transition in Nigeria.

Objective 03

To identify and assess the impact of enablers for adopting renewable energy on the grid in Nigeria.



Approach



- Research Philosophy - Interpretivism
- Research Approach - Inductive
- Research Strategy - Case study
- Methodological Choice - Mono method - Qualitative
- Data collection - 31 Semi-structured interviews (conducted between April and Dec 2021)
- Time Horizon - Cross-sectional
- Data Analysis Technique
- **Duration of the online (Zoom and Teams) semi-structured interviews: 28 to 107 minutes.**

Participants Categories

Energy and Non-energy Industry Actors

- 12 → Public authorities
- 1 Research and development institute
- 1 Association
- 2 Climate change movement
- 1 NGO
- 2 Universities
- 7 → Electricity Value Chain
- 1 Renewable energy investment company
- 2 Independent researchers
- 2 Renewable energy businesses

Public authorities	Regulatory	2
	Policymaking	6
	Government ministry and parastatal	4

Electricity Value Chain	Electricity generation companies	2
	Electricity distribution companies	3
	Electricity transmission company	2

Interview Questions

1

Lead Questions

- **What are the drivers and enablers for the development of renewable energy on the Nigerian national grid?**
- **What do you think are the inhibitors/barriers of renewable energy development on the national grid?**
- What are the determining factors for the successful planning process of grid-based renewable electricity generation?
- What are the renewable energy planning process and governance for sustainable development in Nigeria?
- What are the objectives and visions for introducing renewable energy on the grid?
- How do Nigerians perceive this energy mix initiative? What is the outlook of Nigerians towards this plan?
- What is the strategy or pathway for their actualisation? In your opinion, what strategy or pathway can be adopted to achieve renewable energy on the grid?
- Who are the major actors/stakeholders in renewable energy governance relating to the grid?
- What role does the government play in facilitating stakeholder alignment, and how is this done?
- Which stakeholders are involved in implementing the strategy of grid renewable energy?
- What support mechanisms are you aware of for grid renewable energy development?

2

Lead Questions Contd.

- How effective are these support mechanisms in fostering development?
- In your view, what support mechanisms should be introduced?
- What are (or should be) the procedures for the implementing renewable energy on Nigerian national grid and how is/should this have been enforced?
- In your view, what should the process of planning for renewable energy on Nigeria national grid entail?
- Who are the major actors/stakeholders in the planning of renewable energy on the grid?
- In your opinion, which important stakeholders were excluded in the process of planning for grid renewable energy?
- What role(s) does the incumbent energy generating players play in the development of grid renewable energy?
- Are you aware of any ongoing renewable energy projects or experiments on the grid?
- What can you say about the direction of the projects/experiments?
- Who are involved in this projects/experiments? key actors or stakeholders?
- In your view, what is (or should be) the process of monitoring and reviewing these projects/experiments? Is the learning from these processes effected or how can it be effected?

3

Lead Questions Contd.

- How accountable are the processes?
- What is your view about the level of transparency in planning, governance or implementation of renewable energy on the national grid?
- In your opinion, what role does transparency play in actualising the goal of renewable energy on the grid?
- Who should be responsible for ensuring the entire process is transparent?
- What can be done to ensure the process is more transparent?
- What are the similarities and differences in the comparison of on-grid and off-grid generations?
- Are the challenges of introducing renewable energy on the national grid similar to the off-grid issues?
- Is the planning and governance of renewable energy on the national grid similar or dissimilar to the off-grid process?
- How do the stakeholders/actors' involvements compare with the off-grid and grid-based electricity generation projects?
- How does the societal acceptance of renewable energy on the national grid project compare to the off-grid project?
- In your opinion, what could be the impact of the Covid-19 pandemic on RE development in Nigeria?

DATA ANALYSIS PROCESS

Phase 1: Familiarising yourself with the data

Raw Interview Data

1

2

Phase 2: Generating initial codes

- Barriers to renewable energy development.
- Drivers for the development of renewable energy.
- Enablers of grid renewable energy implementation.

Phase 3: Searching for themes

112 codes were collapsed and some made redundant.

3

4

Phase 4: Reviewing themes

Phase 5: Defining and naming themes

5

6

Phase 6: Producing report

RESULTS

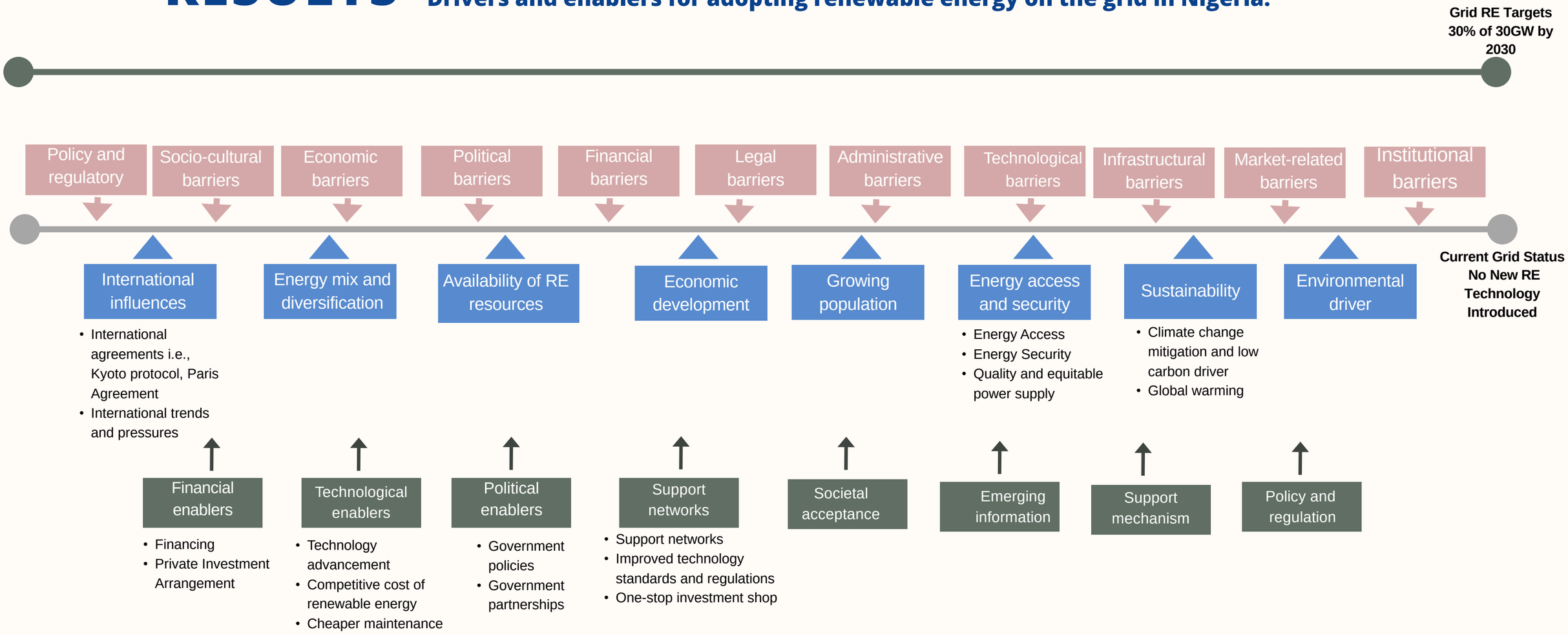
Barriers to Nigeria's grid-based renewable energy strategies implementation process.

PROBLEMS IN GRID-NETWORK ELECTRICITY PROVISIONS AND RENEWABLE ENERGY DEVELOPMENT RELATED CONCERNS

Grid-Network-related	Determining Factors	Renewable-Energy Development-related
	Policy and Regulatory	Lack of continuity in policy Lack of deep thinking in the policy and strategy formulation No clear policies and implementation action plan for the policies
Distrust in management of the national grid Insecurity (kidnapping, banditry and vandalism)	Socio-Cultural Barriers	Lack of awareness of benefit Land use issues
Social budgeting	Economic Barriers	Economic decline and slow down Impact of national debt
Corruption	Political Barriers	Lack of government synergies and fragmentation in political decisions Lack of government commitment and political will Political risk and influence
Existing bureaucracy Management challenge	Administrative Barriers	
Existing financing and market structure of the power sector	Financial Barriers	RE Investments drawback
	Institutional Barriers	Lack of institutional synergy or mandate overlap Too many agencies need institutional leadership/Lack of specific agency for grid renewable energy
Pre-existing industry agreements Resistance and sabotage from current energy producers Liquidity challenge (ineffective revenue collections)	Market-Related Barriers	Lack of cost-reflective tariff
Technology maintenance	Technological/Technical Barriers	Lack of expertise and RE technology capacity in the sector Unreliability of the renewable energy technology Cost of technology Narratives from off-grid systems Technology implementation challenge Limited storage capacity Lack of research and development initiative
Grid unreliability Obsolete infrastructure Grid expansion challenge (grid capacity) Transmission line and distribution challenges Metering	Infrastructural barriers	

RESULTS

Drivers and enablers for adopting renewable energy on the grid in Nigeria.



Conclusions

- Inefficiencies in the electricity sector need to be addressed to deploy renewable energy in the Nigerian grid system.
- However, the inefficiencies can create windows of opportunities for renewable energy development as they are factors causing deviation and misalignment in incumbent electricity regime configurations.
- A business model that puts energy access and supply issues at the centre to resolve the country's energy poverty issue is promising as government’s spending has been channelled to essential development needs.
- The political regime needs to fully embrace the shift to renewable energy for environmental and sustainability goals.
- Support mechanisms need to be implemented to encourage private-public partnerships with improved data availability systems.
- Positive perceptions and attitudes of the population towards the technologies should be leveraged through community and societal engagement by introducing smart grid systems and government partnerships.
- Synergy is crucial at the Federal, State, and Local governmental levels.
- For transition to occur, the investment community, political actors, and existing electricity generating and distribution players, amongst others, need to be at the table.
- Countries with a socio-technical, techno-economic, political, and energy poverty issues similar to Nigeria's.

NEXT PROJECT

Development of Policy Brief

PROJECT 1

A bottom-up approach through community engagement to understand the dynamics of transitions on the grid system

PROJECT 2

Further research should focus on the dynamics of the regime in a transition pathway where incumbent regime systems are inefficient.

PROJECT 3

Development of a Business Model in the developing countries context that embraces energy access, supply, affordability and sustainability dimensions.

PROJECT 4

ROBERT GORDON UNIVERSITY ABERDEEN

Racheal Adedokun
r.adedokun1@rgu.ac.uk

For more information on our research kindly contact us below:

Please scan the barcode.

@Racheal Folake Adedokun

@Adedoku2Racheal

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