Political economy of the next wave of power sector reforms in Africa, driven by unprecedented innovation in enabling technology and business models

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“The talk is about the work, but it is not the work itself”

- Background
- Research Questions
- Methodology
- Results and discussion
- Future recommendations

Background

Sub-Saharan Africa's electrification challenge

Reform aims and elements of the standard model of reform

Structure of power sectors in Africa

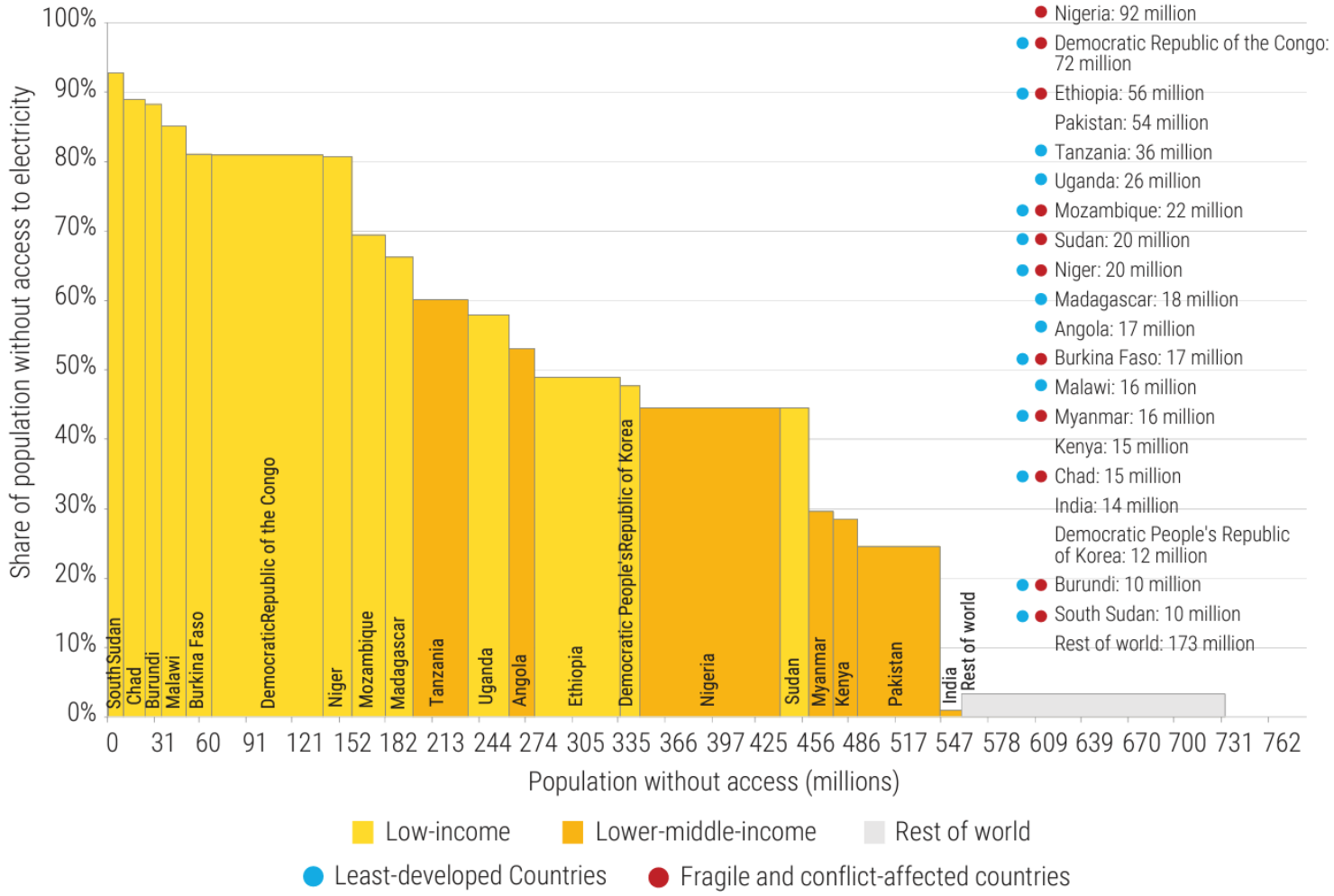
Governance and technical challenges in the power sector

Trends in new generation capacity

Sub-Saharan Africa's electrification challenge

15 out of 20 of the world's largest unelectrified populations are in Sub-Saharan

Share of population without access to electricity in top 20 access-deficit countries and rest of world, 2020

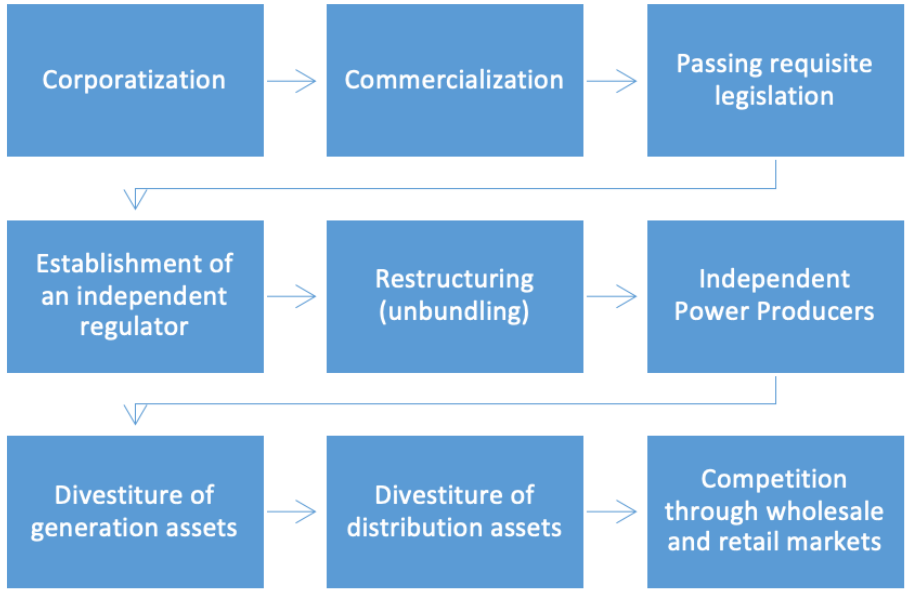


Source: World Bank 2022.

Reform aims and elements of the standard model of reform

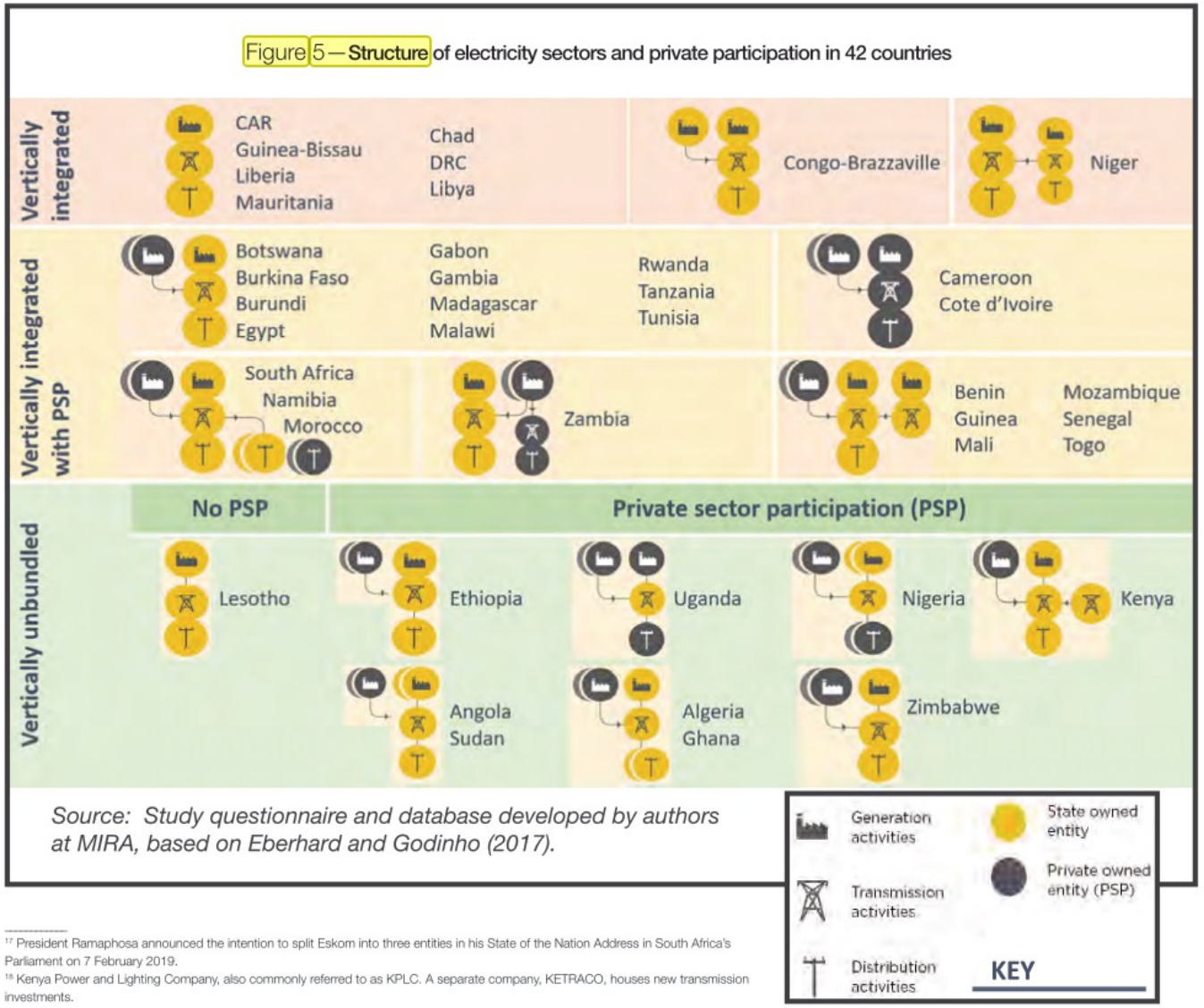
OECD countries	Non-OECD countries
Improve economic efficiency regarding price of power, thus lowering electricity tariffs	• Address poor financial management and technical inefficiency, thus raising tariffs to revenue sufficient levels. • Introduce private sector participation as public sector was no longer able to fund system expansion.

Standard model of reform emerged as a common approach to different problems



Structure of power sectors in Africa

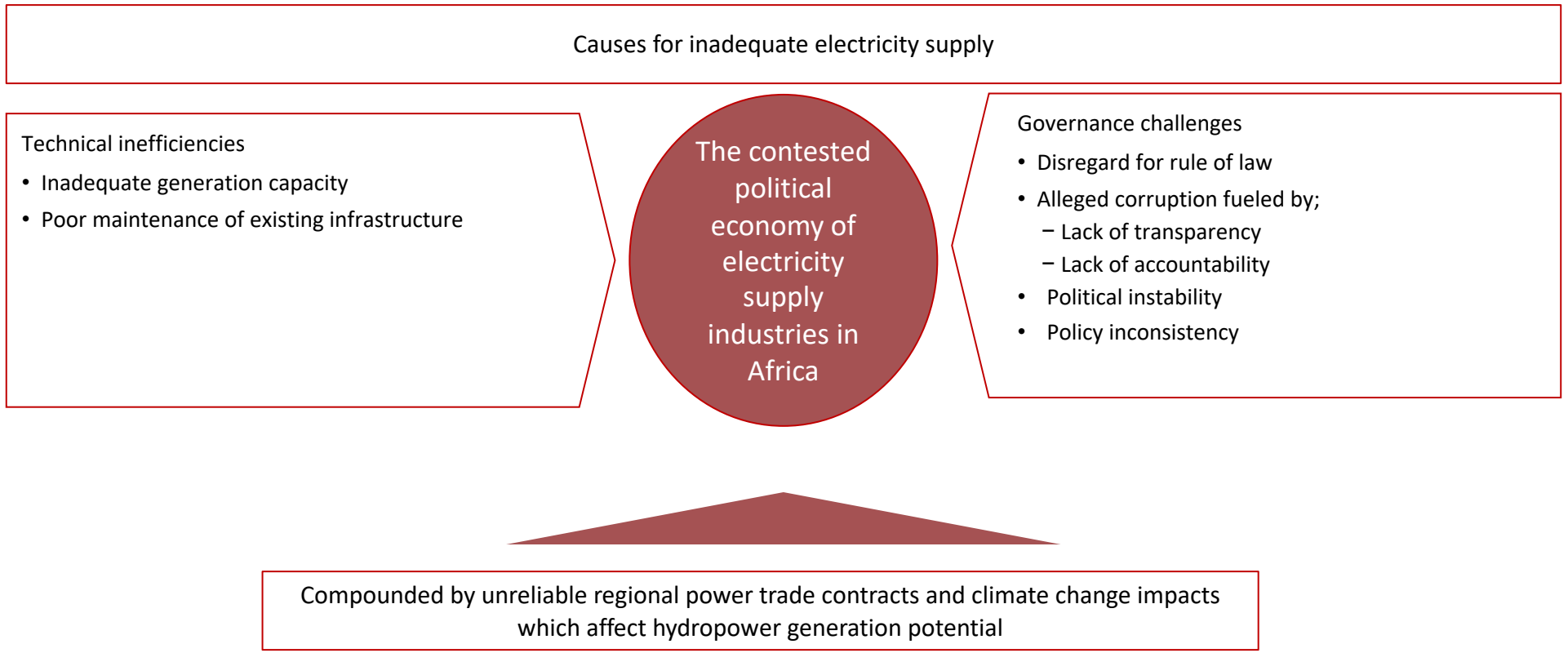
No wholesale power markets in, although third party wheeling is now permitted in a few countries



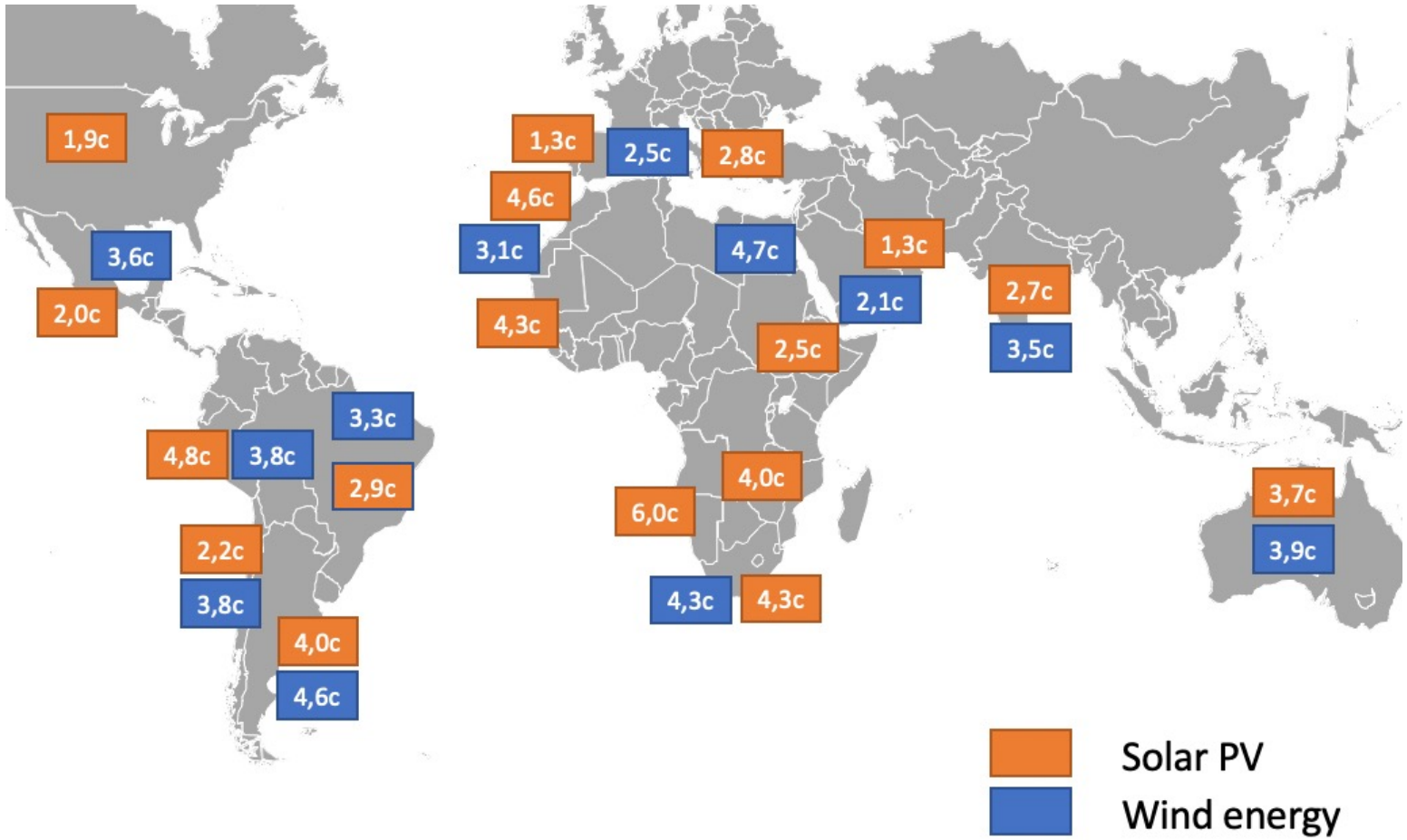
[17] President Ramaphosa announced the intention to split Eskom into three entities in his State of the Nation Address in South Africa's Parliament on 7 February 2019.

[18] Kenya Power and Lighting Company, also commonly referred to as KPLC. A separate company, KETRACO, houses new transmission investments.

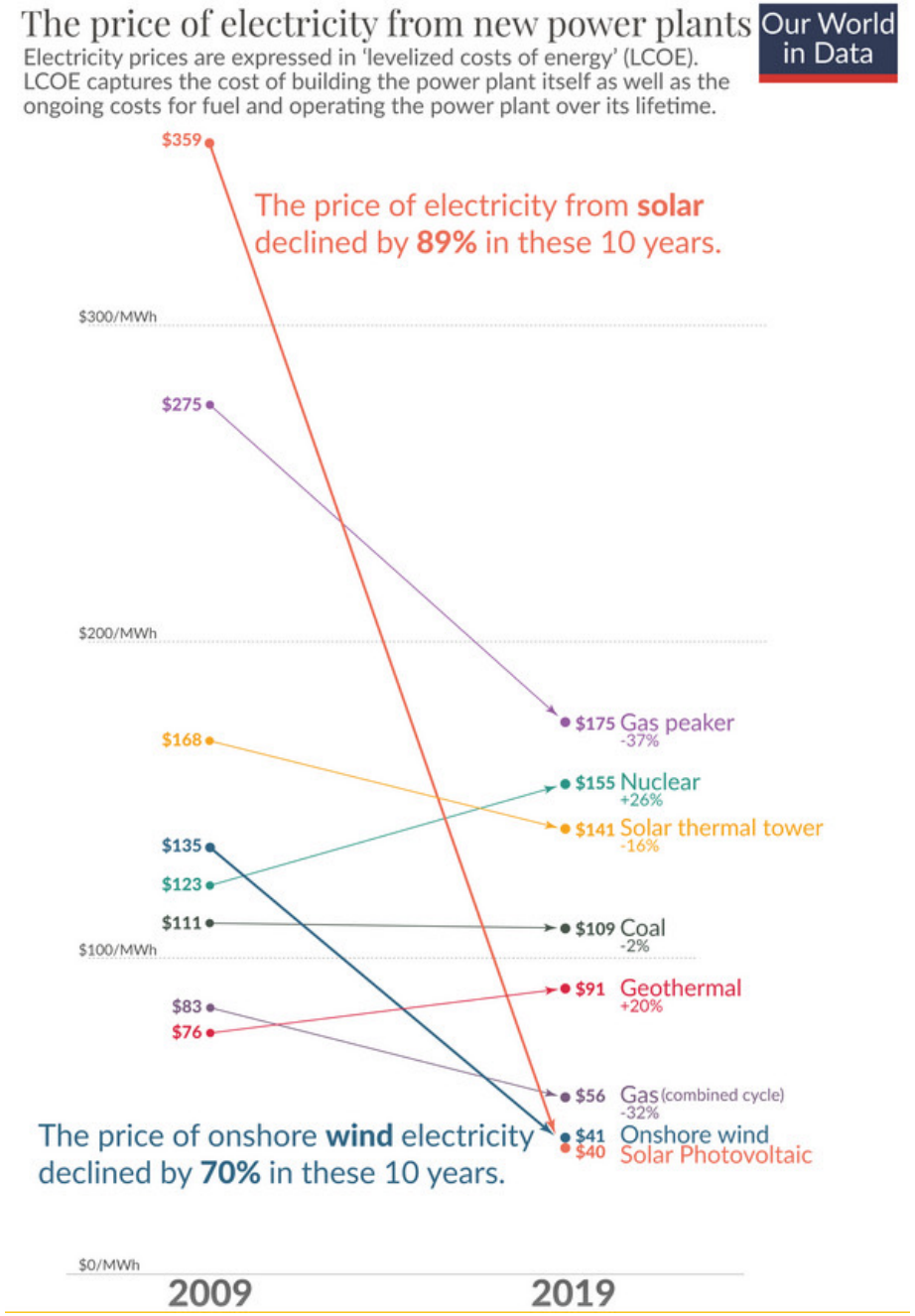
Governance and technical challenges in the power sector



Trends in new generation capacity



Source: Power Futures Lab



Study objectives

Problem context

Main research question

Subsidiary questions

Analytical framework

Problem Context

There is need to explore how the political and economic context of African countries will shape power sector reform in order to balance affordability, security and sustainability of supply, in line with the objectives of the energy transition.

Power sectors in Africa are today dominated by **vertically integrated state-owned utilities** which exhibit poor technical and financial performance with the consequence of **insufficient investment in power, poor system reliability** and **low access levels**.

The growth of variable renewable energy, due to reduced costs and country commitments to reduce emissions, has been accelerated by the emergence of new business models and disruptive innovation in enabling technologies.

Changes have implications for power market design and system operation.

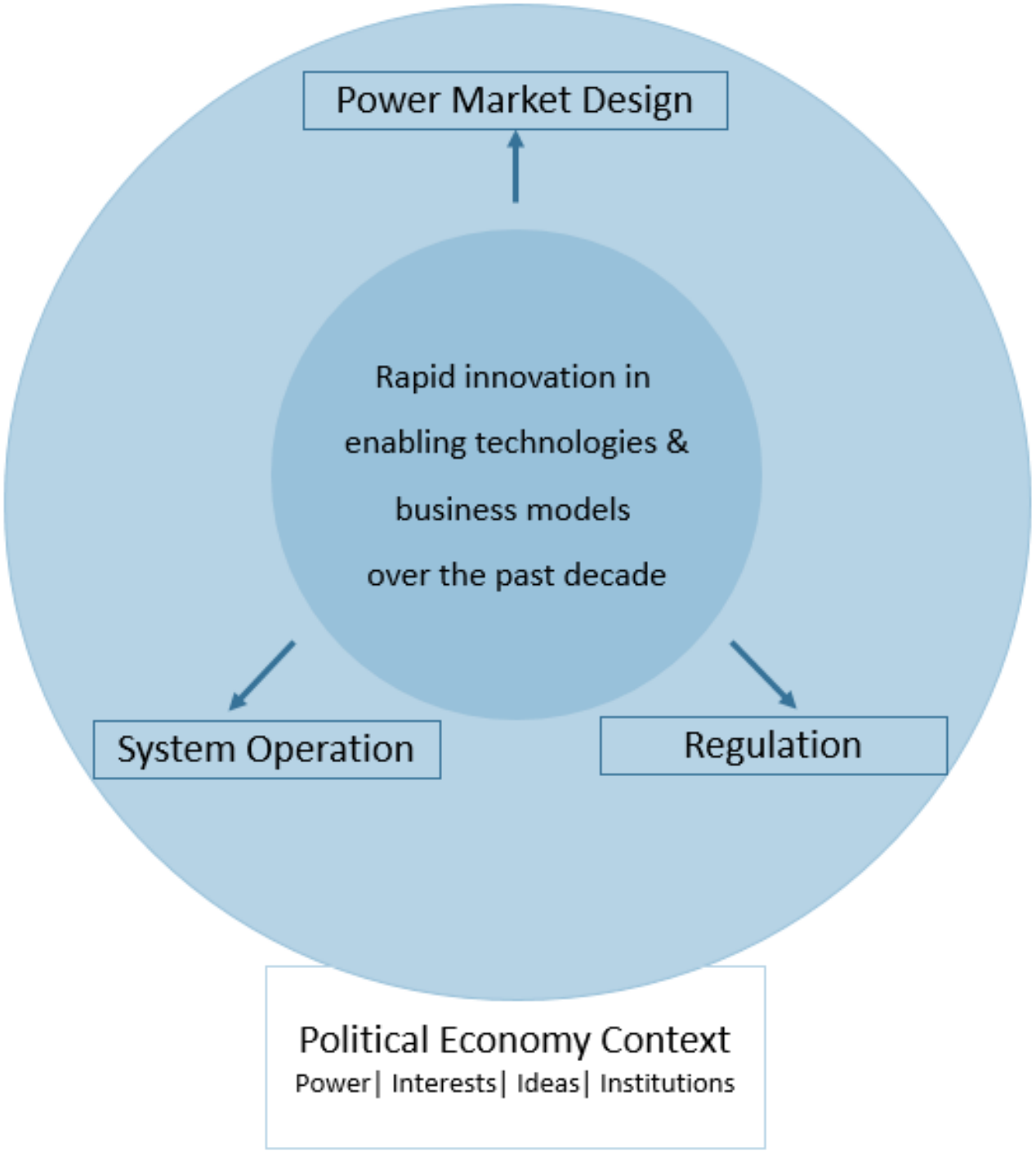
Inadequate regulatory frameworks could impede the growth of distributed energy resources.

Main research question

How will **political economy contexts** shape the adoption in Sub-Saharan Africa of **unprecedented innovations in enabling energy technologies** and **new business models**, that have emerged over the past decade, and the **resultant nature and pace of a new wave of power sector reforms on the continent**?

Subsidiary questions

1. How will the **unique political and economic context of African countries** be relevant to the next wave of power sector reforms?
2. How will **regulation** evolve to meet challenges created by the growing share of grid-tied variable renewable energy technologies and distributed energy generation?
3. How can **power markets be redesigned** in response to innovation in new business models and enabling energy technologies in sub-Saharan Africa?
4. How will **system operation be adapted** to ensure operation of distributed energy resources and accommodate variability of renewable energy technologies?

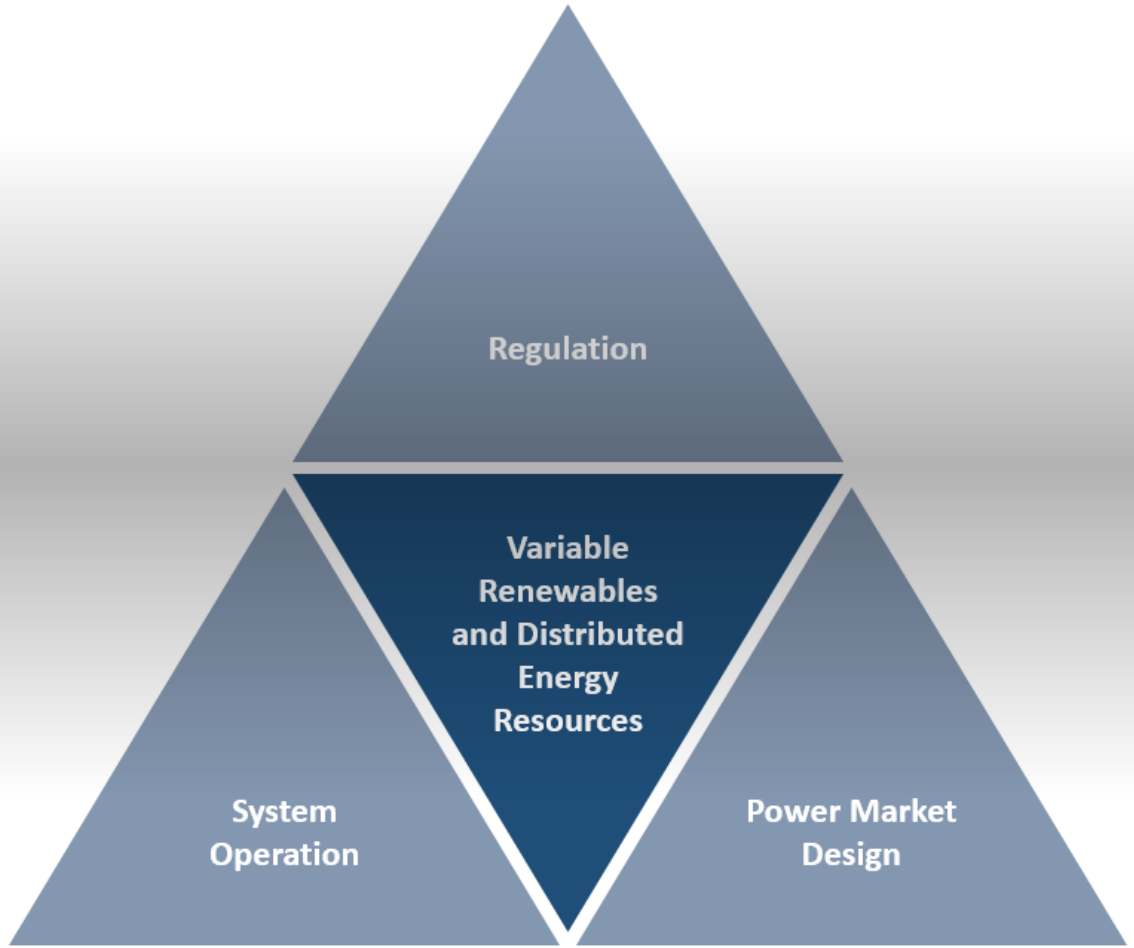


Analytical framework

- The thesis draws on three bodies of literature –
  - **standard power sector reform** models,
  - current **innovations in the sector** inducing a new wave of reforms, and
  - **political economy** as applied to the power sector.

Level of analysis

Regulatory frameworks
Reform-Governance Index
Power Sector Reform Index
Access (Electrification Rate)
Affordability (Tariff design, Ability to pay, Willingness to pay)
Energy Security (Generation adequacy, Energy mix)



System reliability (SAIDI)
Flexible System Operation (Demand side & Supply side)
Integration of variable renewables
Ancillary services

Competition
Private sector participation
Capacity markets
Market integration of variable renewables and distributed energy resources.
Electricity market time granularity
Electricity market spatial granularity
Regional markets

Gap in literature

The African power sector faces a new global wave of innovation in enabling technology and business models.

- **Unclear how the next wave of reforms will unfold**
- **Unclear which issues will influence the adoption** of reforms
- **Role of political economy context** in shaping the next wave of power sector reform.

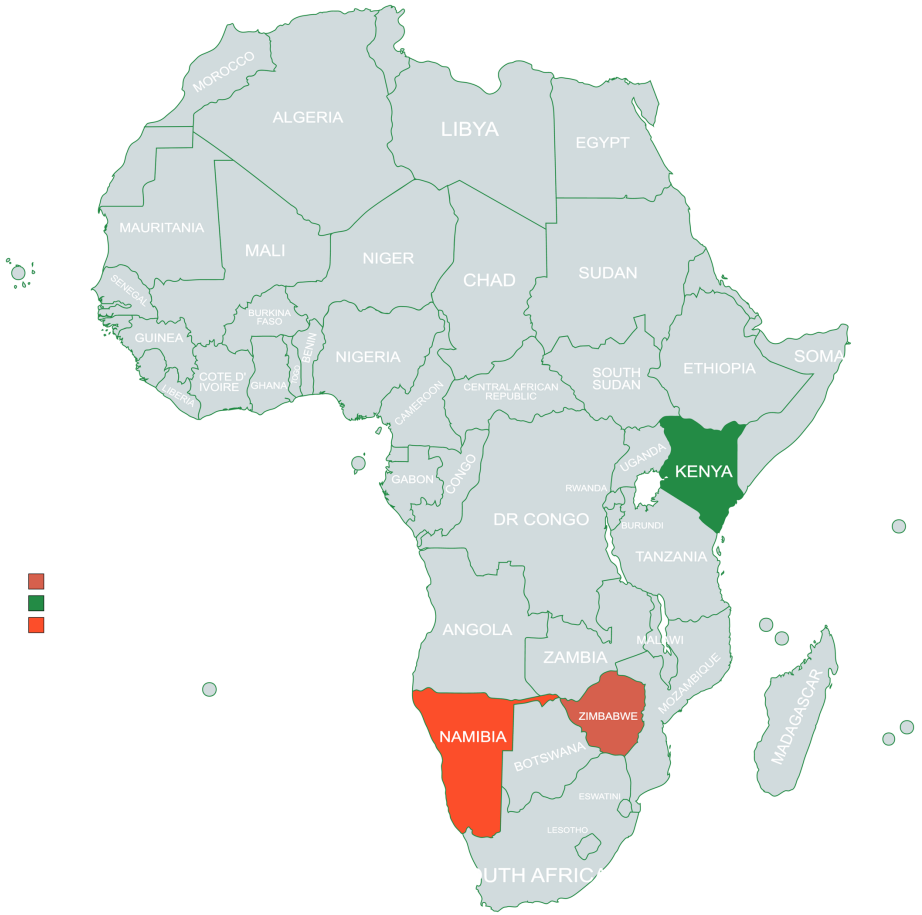
Research Methodology

Case selection

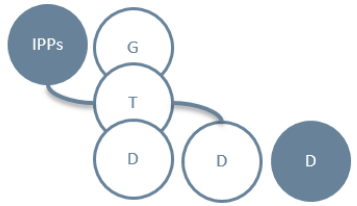
Levels of analysis

Data collection

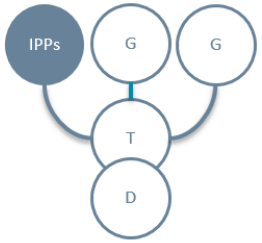
Case selection



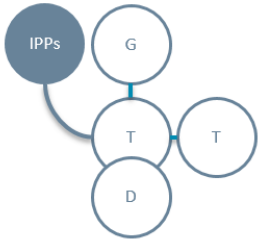
Namibia



Zimbabwe



Kenya



Key

- State owned
- Private owned
- G — Generation
- T — Transmission
- D — Distribution
- IPPs — Independent Power Producers

Data collection

Semi-structured in-depth interviews

Document review

Preliminary results and discussion

Restructuring of Zimbabwe’s power system

Kenya

Namibia’s quest for self sufficiency

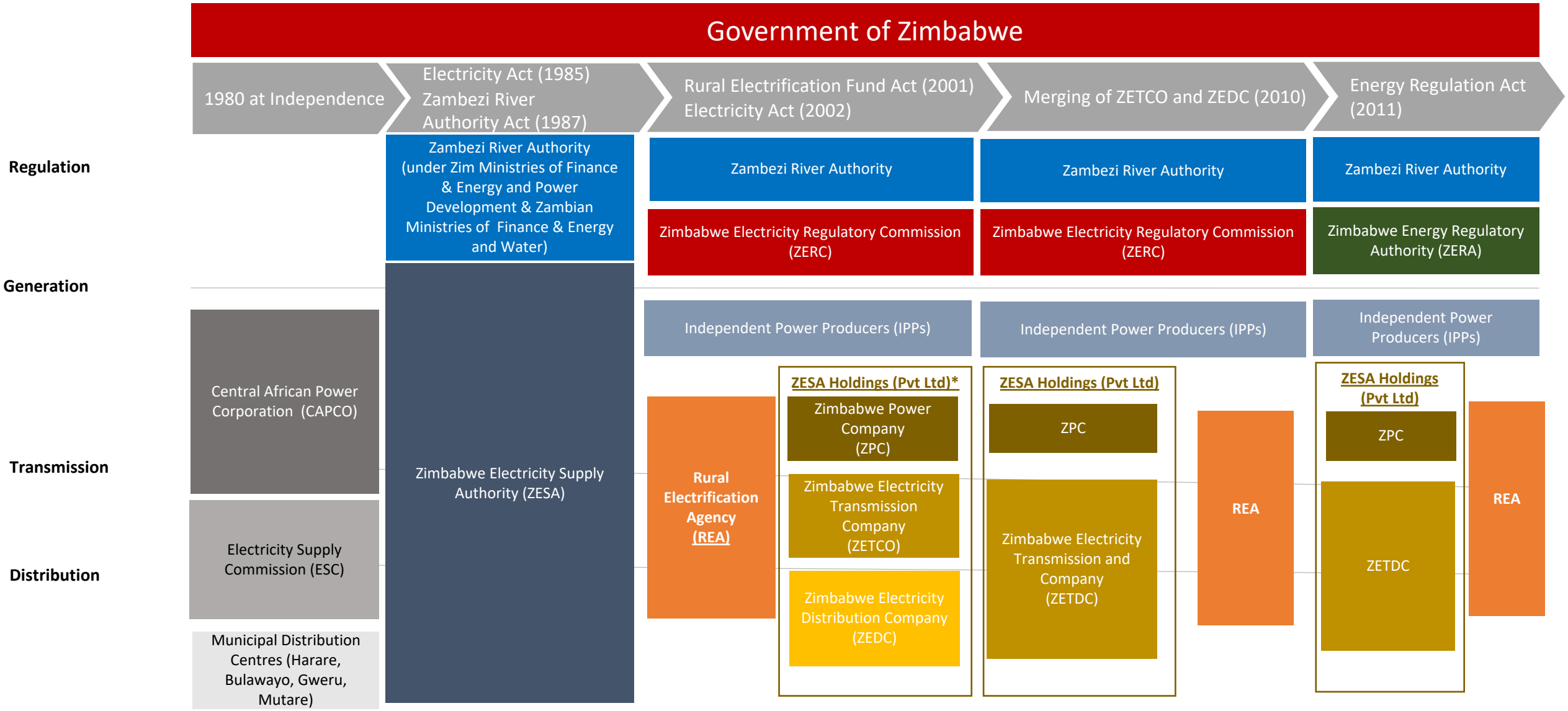
Reform activities in Zimbabwe, Kenya and Namibia

Reform activity	Zimbabwe	Kenya	Namibia
Regulation	Regulatory authority, Zimbabwe Energy Regulatory Authority (ZERA)	Regulatory authority, Energy and Petroleum Regulatory Authority (EPRA)	Regulatory authority, Electricity Control Board (ECB)
Restructuring	Partial vertical unbundling	Partial vertical unbundling with horizontal unbundling in generation	Vertically integrated with partial horizontal unbundling in generation and distribution
Private Sector Participation	Private sector participation in generation only	Private sector participation in generation only	Private sector participation in generation and distribution
Competition	Single buyer model with Independent Power Producers	Single buyer model with Independent Power Producers	Monopoly with Independent Power Producers

At a glance

	Zimbabwe	Kenya	Namibia
Population (Million)	14.44	51.39	2.45
Land size (km^2)	391,000	569,140	832,290
% Electrification	41	70	55
GDP (USD million, 2017 PPP)	31.0	87.9	14.5
Total installed capacity (MW)	2,394	2,929	662

Restructuring of the Zimbabwean Power System



*ZESA Holdings Pvt Ltd also includes PowerTel and Zesa Enterprises | Based on World Bank 2000, ZERA and AfDB

Namibia's quest for self sufficiency

Local generators		
NamPower	**GWh**	% of total supply
Ruacana Hydro	39	12.68
Van Eck (Coal)	0	0
Anixas (Diesel)	0	0
Total	39	0.02
IPPs	**GWh**	
Installed Solar PV (150 MW)	24.52	7.90
Installed Wind (5 MW)	1.44	0.46
Total	26	
Imports		
Eskom	119	38.38
ZESCO	66	21.39
STEM (SAPP)	26	8.24
ZPC	34	10.93
Total	245	

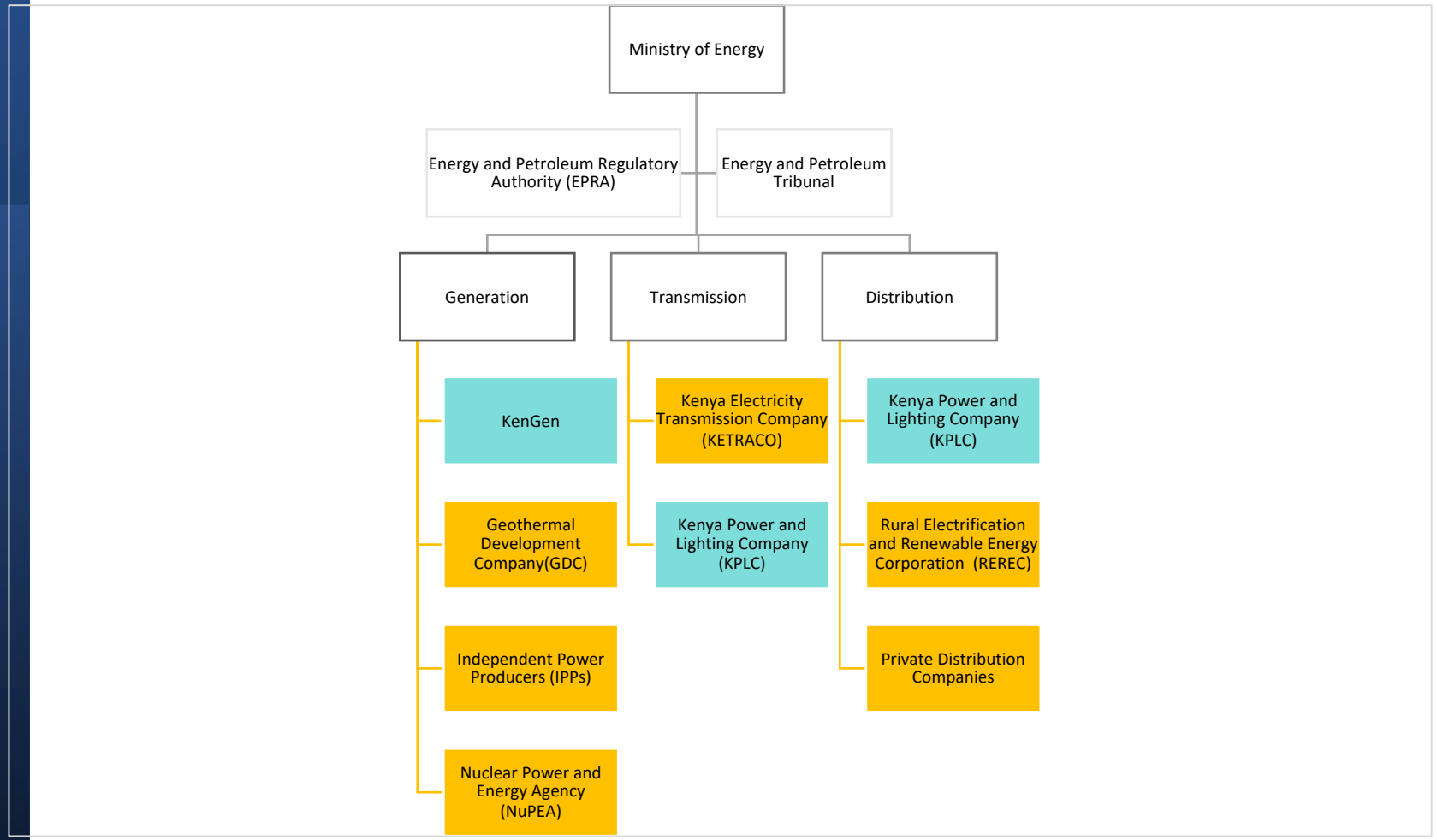
Namibia monthly energy profile for February 2022 based on ECB report

	MW	% of total capacity
NamPower	489	74
18 IPPs (Renewables)	160	24
3 DER IPPs (Renewables)	13	2
Total installed capacity	**662**	

	MW	% of total demand
Net Metering (Rooftop) DER	60	9
Maximum demand	640	

Namibia’s quest for self sufficiency

Kenya



Source: Min of Energy

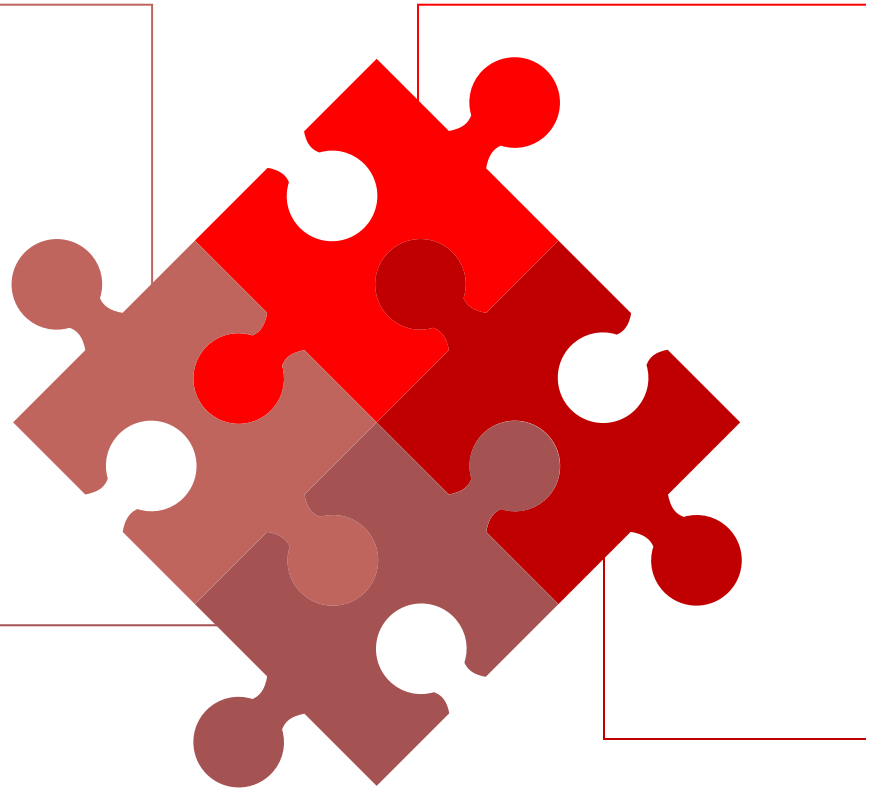
Discussion

Political economy analysis

- Vested interests
- Formal and informal institutions
- Power
- Ideology

Regulation

- Instruments of regulation which avoid privatization but include private sector participation e.g. concessions
- Satisfy ideology but achieve good performance
- Tariff design to provide greater spatial and temporal granularity



Adaptation of system operation

- System operation will become more demanding and sophisticated
- Co-operation between transmission and distribution system operators

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Power Market redesign

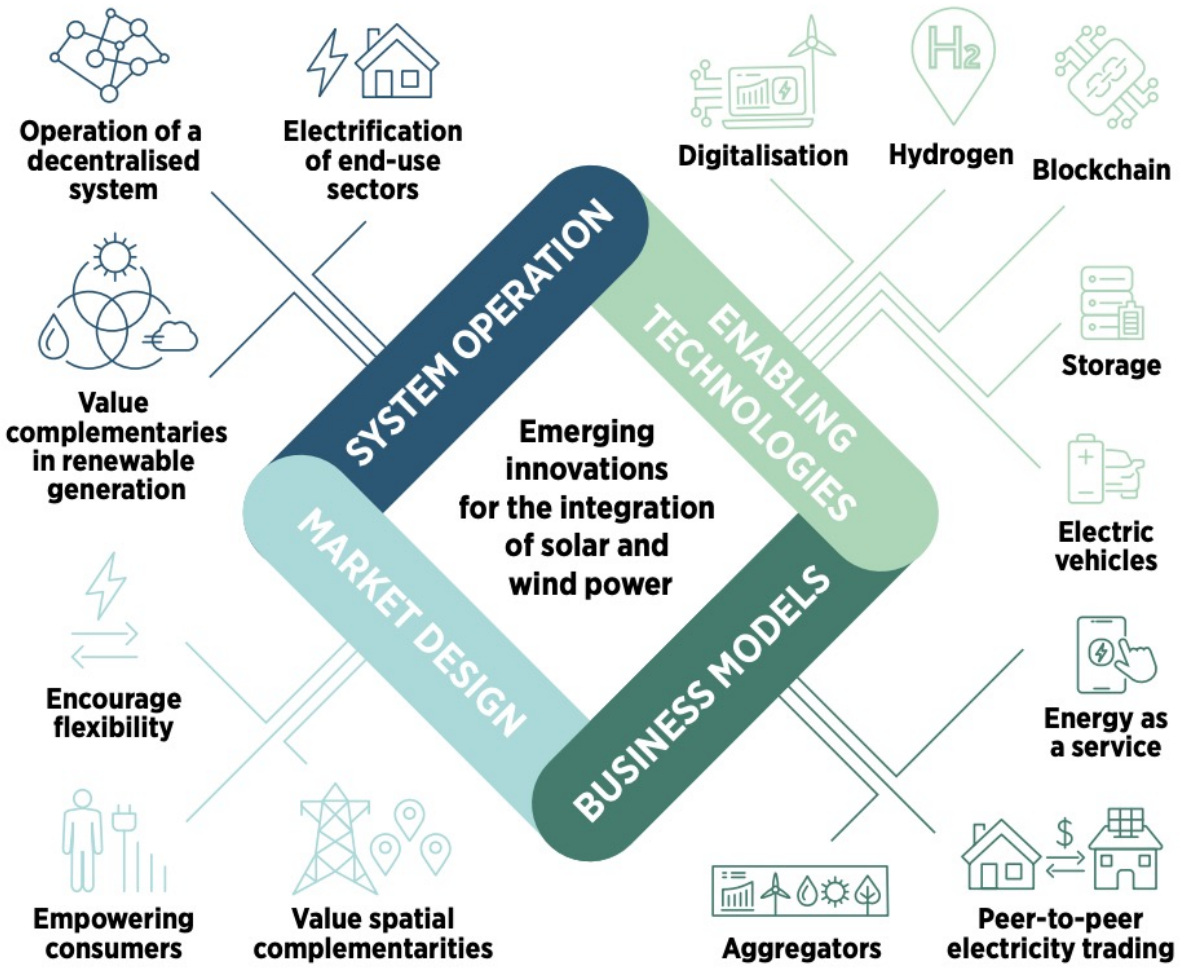
- Regional markets allow wholesale markets in small countries
- Regional interconnection
- Potential for sector coupling (including EVs, battery storage and green hydrogen, ammonia etc)

.

Evolving role of Distributed System Operator

- With with the growing share of variable renewables and DER, DSO will assume new roles;
  - Network congestion management
  - Peak load management
  - Reactive power support to Transmission System Operators
  - Voltage support

Innovation landscape



Source: IRENA

Future recommendations

Applying a geopolitical lens would broaden the scope of the research given the interdependency global energy markets.

Energy security vs Energy transition

Thank you for your attention

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