



**BBRM
GROUP**

Energizing Development & Connectivity

AI and the Digital Divide

IEEE Power & Energy Society GM

International Practices Sub committee Africa

25 -29 July 2021



Bai K Blyden
IEEE Smart Village Global Ambassador



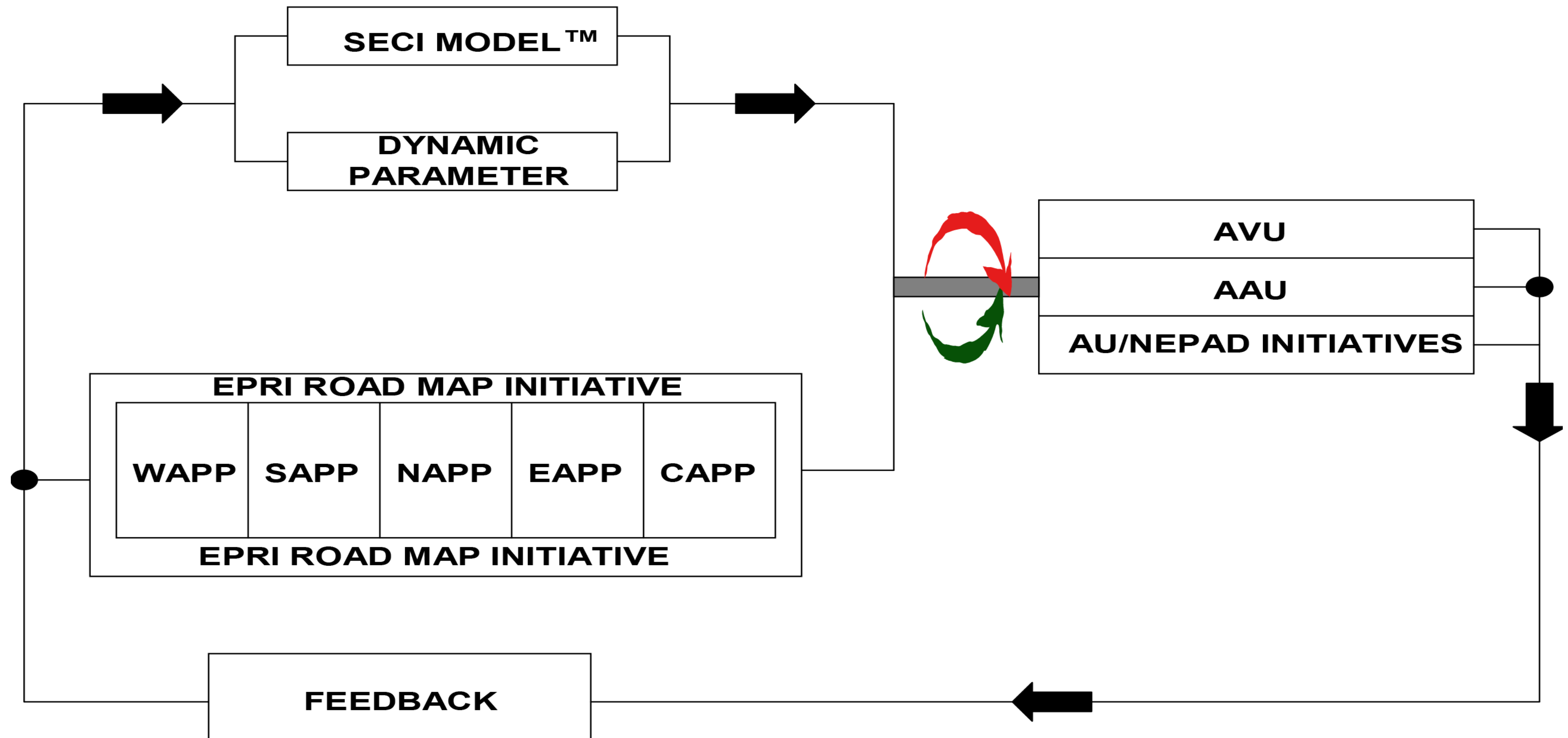
Bai K Blyden

IEEE Smart Village Global Ambassador

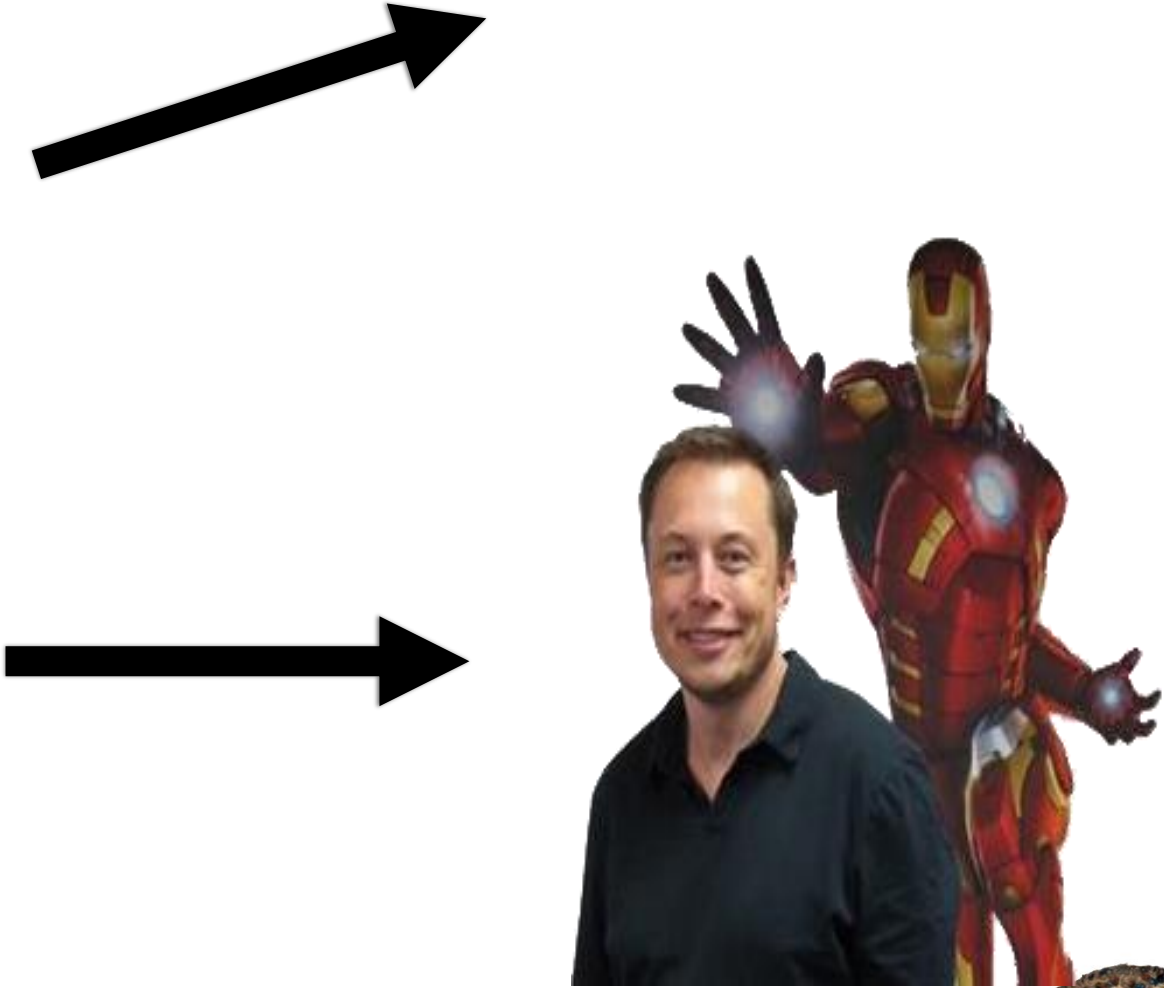
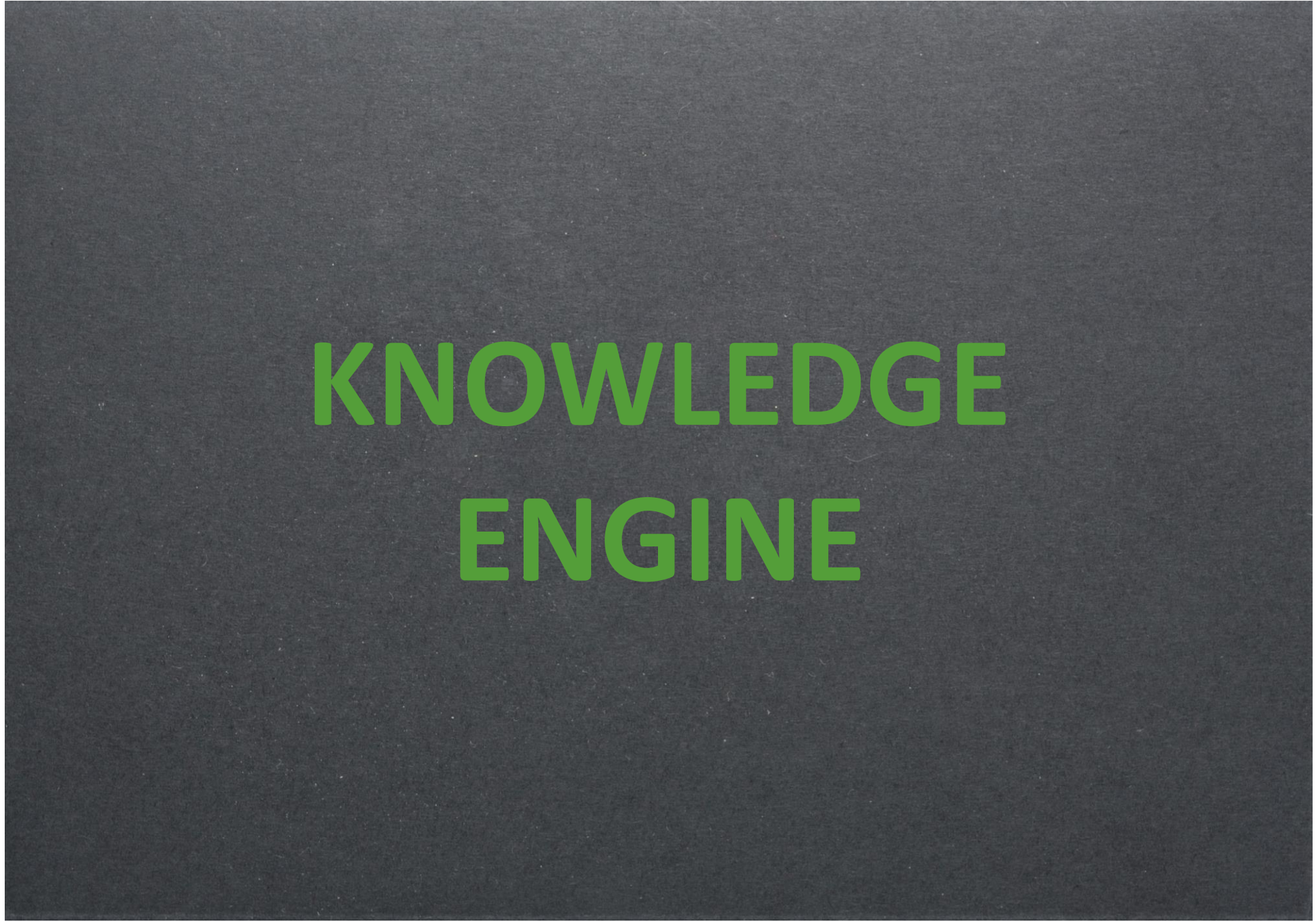


Accelerating the Technical Skills Factor

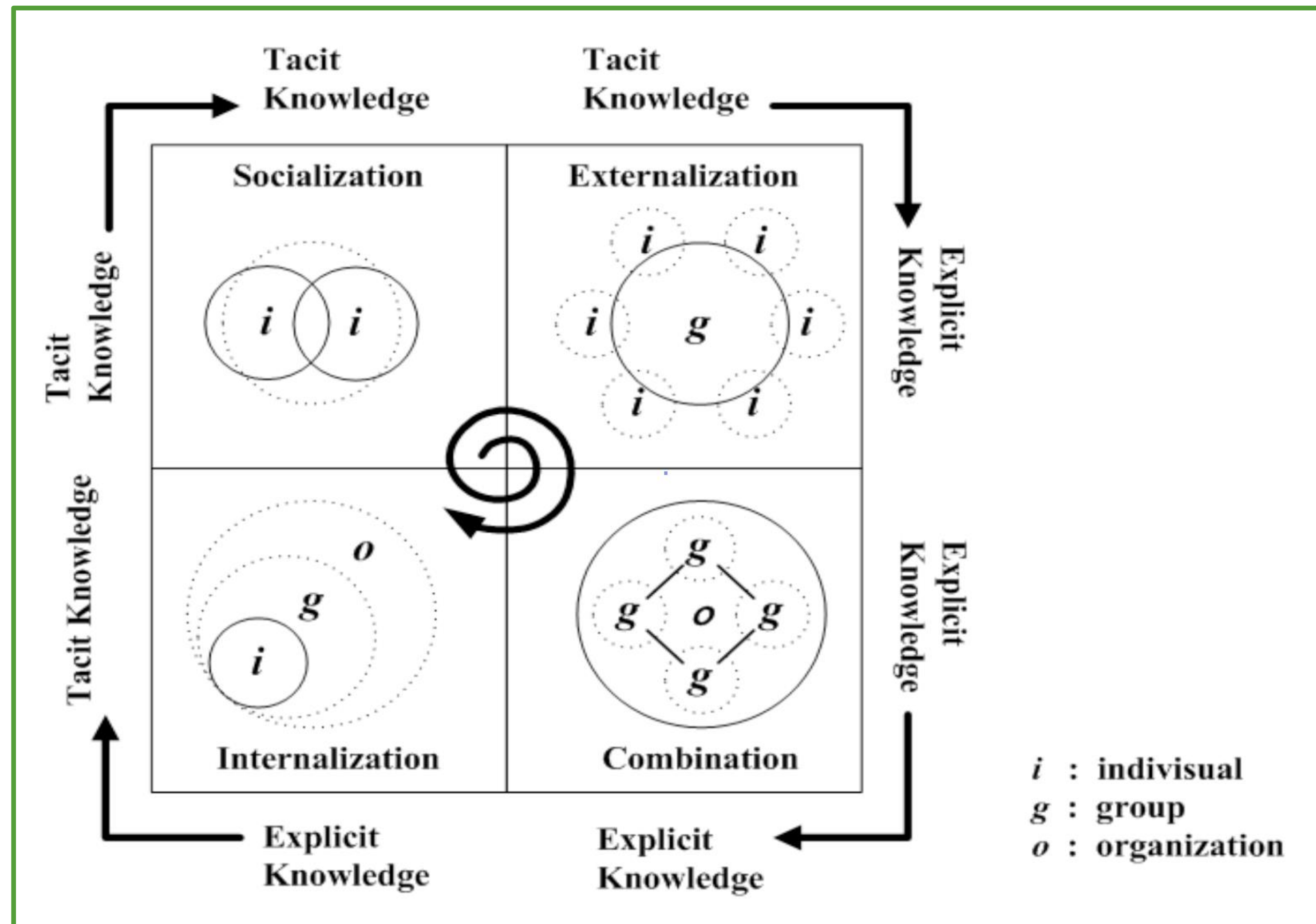
The African Energy Development Knowledge Engine™



Knowledge Engine Transformation



Knowledge Creation as a Self-Transcending Process



Source: Nonaka and Konno (1998)

Who's Doing What?



Program for Infrastructure Development in Africa



The Challenges

Africa's Population Growth and SDG's



The IEEE Advancing Technology for Humanity

IEEE:

- More than 430,000 members in more than 160 countries, more than 50 percent of whom are from outside the United States 334 Sections in ten geographic Regions worldwide
- 2,116 Chapters that unite local members with similar technical interests
- 3,005 Student Branches at colleges and universities in over 100 countries
- 1,481 Student Branch chapters of IEEE technical societies
- 486 affinity groups; IEEE affinity groups are non-technical sub-units of one or more Sections or a Council. The affinity group patent entities are the IEEE-USA Consultants' Network, Young Professionals (YP), Women in Engineering (WIE), Life Members (LM), and IEEE Entrepreneurship
- Has 39 technical Societies and seven technical councils representing the wide range of IEEE technical interests
- More than 4 million documents in the IEEE *Xplore*® Digital Library, with more than 8 million downloads each month
- Has over 1,300 active standards and more than 600 standards under development
- Publishes approximately 200 transactions, journals, and magazines
- Sponsors more than 1,800 conferences in 98 countries while:
 - Partnering with more than 1,400 non-IEEE entities globally
 - Attracting more than 484,000 conference attendees
 - Publishing more than 1,700 conference proceedings via IEEE *Xplore*
- Data current as of 31 December 2017. This information is updated annually.



UN Sustainable Development Goals

A global focus on universal access to energy, increased energy efficiency and the increased use of renewable energy through new economic and job opportunities.



Africa Union Agenda 2063

It is a strategic framework for the socio-economic transformation of the continent over the next 50 years. It builds on, and seeks to accelerate the implementation of past and existing continental initiatives for growth and sustainable development.



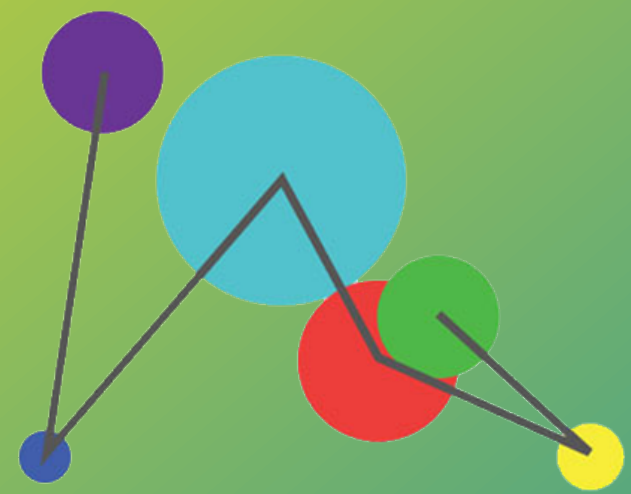
EPRI Electricity Technology RoadMap Initiative

The Electricity Technology Roadmap represents a collective vision for electricity to serve society in the 21st century. Destination goals are (1) Strengthening the Power Delivery Infrastructure, (2) Enabling the Digital Society, (3) Boosting Economic Productivity and Prosperity, (4) Resolving the Energy/Environment Conflict, and (5) Managing the Global Sustainability Challenge.



The Allen Institute for AI (abbreviated AI2)

AI2 was founded in 2014 with the mission of conducting high-impact AI research and engineering in service of the common good. AI2 is the creation of Paul Allen, Microsoft co-founder, and is led by Dr. Oren Etzioni, a leading AI researcher.



MIT IDEAS GLOBAL CHALLENGE

Beyond the Grid

US AID

Power Africa brings together technical and legal experts, the private sector, and governments from around the world to work in partnership to increase the number of people with access to power.



Global Challenge
M.I.T IDEAS

An ongoing MIT effort that proposes innovative solutions to global challenges in agriculture, water, environment, health, mobile, education and economic development.



USAID
FROM THE AMERICAN PEOPLE

**POWER
AFRICA**

A U.S. GOVERNMENT-LED PARTNERSHIP



Abuja Declaration
Of WFEO/FMOI

Assists in improving the functioning of professional engineering organizations in Africa, assists countries where there are no professional engineering organizations in creating such organizations, set up a Task Team to achieve the above goals, and combine their efforts to provide funding for this purpose.





General Electric (GE)

General Electric Company (GE) is an American multinational conglomerate incorporated in New York City and headquartered in Boston. As of 2018, the company operates through the following segments: aviation, healthcare, **power, renewable energy**, digital industry, additive manufacturing, venture capital and finance and lighting.

ABB

(ASEA Brown Boveri)

ABB is a Swiss-Swedish multinational corporation headquartered in Zurich, Switzerland, operating mainly in robotics, power, heavy electrical equipment, and automation technology areas.



SIEMENS

Ingenuity for life

SIEMENS AG

Siemens AG is a German multinational conglomerate company headquartered in Munich and the largest industrial manufacturing company in Europe with branch offices abroad.



The R400 Movement

Commemorating 400 years of transcending the Transatlantic Slave Trade, the R400 Movement – a consortium of individuals, faith based organizations, corporations, civil society organizations and governments– seeks to inaugurate a vision, a plan, and a movement that Reconnects, Reclaims, Reconciles, and Rebuilds a thriving Pan-African future for the next 400 years.



Optimal Solar (OS)

Optimal is a venture-backed, award-winning, minority-owned clean tech firm designed to lower the energy costs of its commercial and industrial clients by up to 70%. These savings are realized through its high efficiency solar modules and ML enhanced energy monitoring technology.



International Telecommunication Union

The International Telecommunication Union, originally the International Telegraph Union, is a specialized agency of the United Nations that is responsible for issues that concern information and communication technologies.



THE TONY ELUMELU
FOUNDATION

Tony Elumelu Foundation (TEF)

The Tony Elumelu Foundation (TEF) is an African non-profit organization founded in 2010 by Tony O. Elumelu and headquartered in Lagos, Nigeria, based on his belief that, with the right support, entrepreneurs can be empowered to contribute meaningfully to Africa's prosperity and social development.

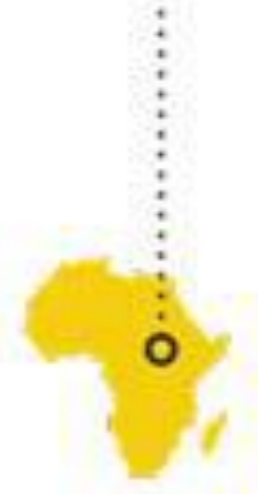


Electrical Power System Analysis & Operation Software

ETAP® is a full spectrum analytical engineering software company specializing in the analysis, simulation, monitoring, control, optimization, and automation of electrical power systems. ETAP electrical engineering software offers the best and most comprehensive suite of integrated power system enterprise solution.

Africa's Annual Opportunity

US \$3.4 BILLION:
Average yearly capital expenditure for electricity in six African countries



\$7 BILLION:
U.S. government investment in Power Africa



\$14 BILLION:
Private investment, such as loan guarantees, in Power Africa



\$300 BILLION:

Estimated need to provide all sub-Saharan Africans access to electricity by 2030

The IEEE Advancing Technology for Humanity

IEEE:

- More than 430,000 members in more than 160 countries, more than 50 percent of whom are from outside the United States 334 Sections in ten geographic Regions worldwide
- 2,116 Chapters that unite local members with similar technical interests
- 3,005 Student Branches at colleges and universities in over 100 countries
- 1,481 Student Branch chapters of IEEE technical societies
- 486 affinity groups; IEEE affinity groups are non-technical sub-units of one or more Sections or a Council. The affinity group patent entities are the IEEE-USA Consultants' Network, Young Professionals (YP), Women in Engineering (WIE), Life Members (LM), and IEEE Entrepreneurship
- Has 39 technical Societies and seven technical councils representing the wide range of IEEE technical interests
- More than 4 million documents in the IEEE *Xplore*[®] Digital Library, with more than 8 million downloads each month
- Has over 1,300 active standards and more than 600 standards under development
- Publishes approximately 200 transactions, journals, and magazines
- Sponsors more than 1,800 conferences in 98 countries while:
 - Partnering with more than 1,400 non-IEEE entities globally
 - Attracting more than 484,000 conference attendees
 - Publishing more than 1,700 conference proceedings via IEEE *Xplore*
- Data current as of 31 December 2017. This information is updated annually.



The Allen Institute for AI (abbreviated AI2)

AI2 was founded in 2014 with the mission of conducting high-impact AI research and engineering in service of the common good. AI2 is the creation of Paul Allen, Microsoft co-founder, and is led by Dr. Oren Etzioni, a leading AI researcher.

Where's the DATA??

IT'S ALL OVER !!!!!!!

THE QUEST TO POWER AFRICA

A CONTINENT IN SHADOWS

IN TERMS OF POPULATION AND LAND MASS, AFRICA IS THE SECOND LARGEST CONTINENT IN THE WORLD, TRAILING BEHIND ONLY ASIA. BUT, AMAZINGLY, A MAJORITY OF THE BILLION PEOPLE LIVING ON THE CONTINENT SURVIVE EVERY DAY WITH LITTLE TO NO ACCESS TO ELECTRICITY. IN THE MIDST OF ECONOMIC, SOCIAL, AND GEOPOLITICAL TURMOIL, MANY OF THE POOREST NATIONS IN AFRICA ARE UNABLE TO SCROUNGE UP THE MONEY, RESOURCES, AND GENERAL KNOW-HOW TO BRING ELECTRICITY TO THEIR PEOPLE.

79 %

of people living in Third World African nations have no access to electricity.

1.5 BILLION

(25% OF THE GLOBAL POPULATION)

people in the world have no access to electricity—they are mostly concentrated in Africa and southern Asia.



In 11 countries in Africa, **MORE THAN 90%** of people go completely without electricity.

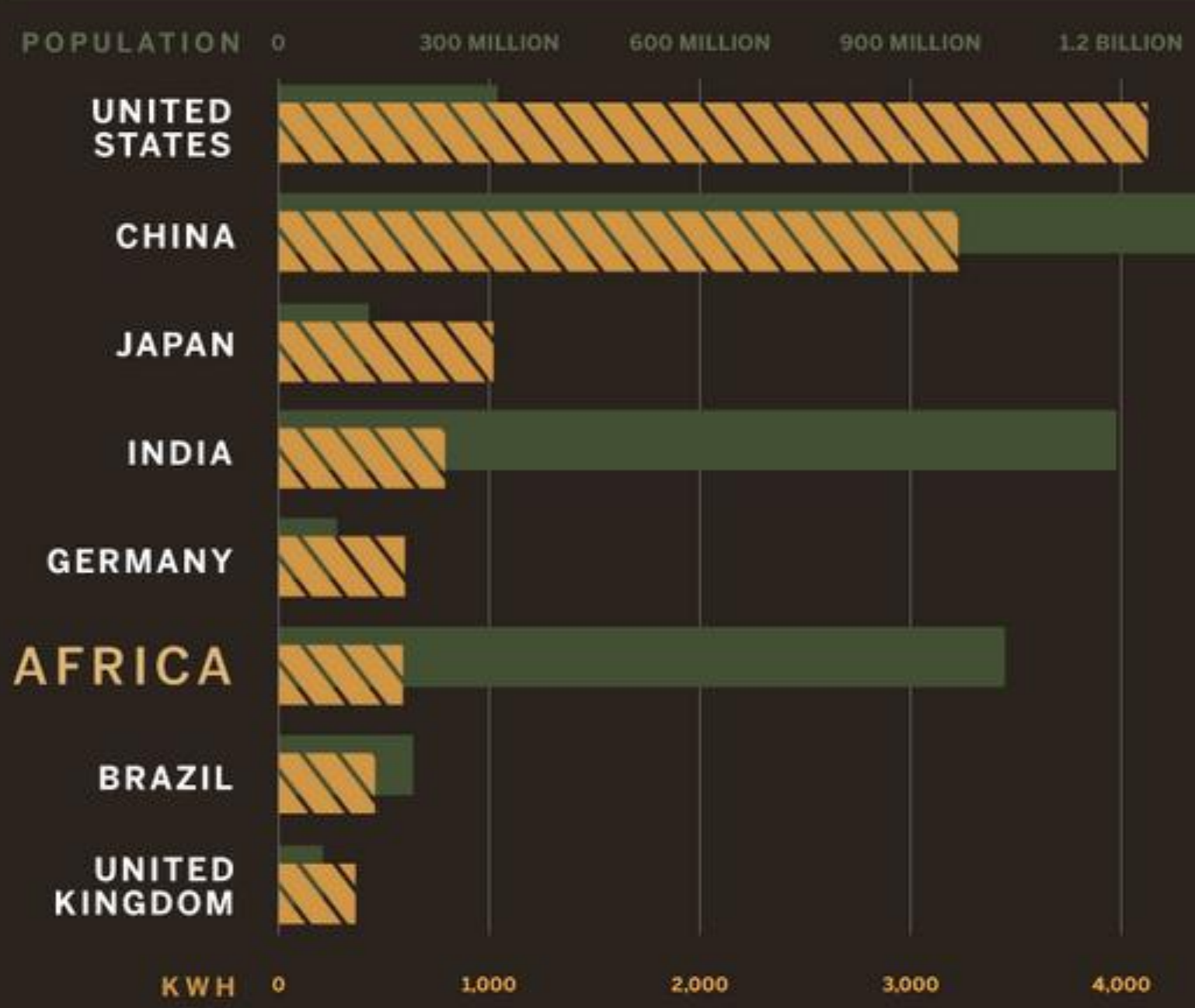
In Burundi, Chad, Central African Republic, Liberia, Rwanda, and Sierra Leone,

3-5 %

of people have easy access to electric power.

Africa has the **LOWEST** PER CAPITA ENERGY use of any continent.

ELECTRICITY GENERATION AND POPULATION BY REGION



Each day, New York City consumes the same amount of electricity as all sub-Saharan African nations combined, excluding South Africa.

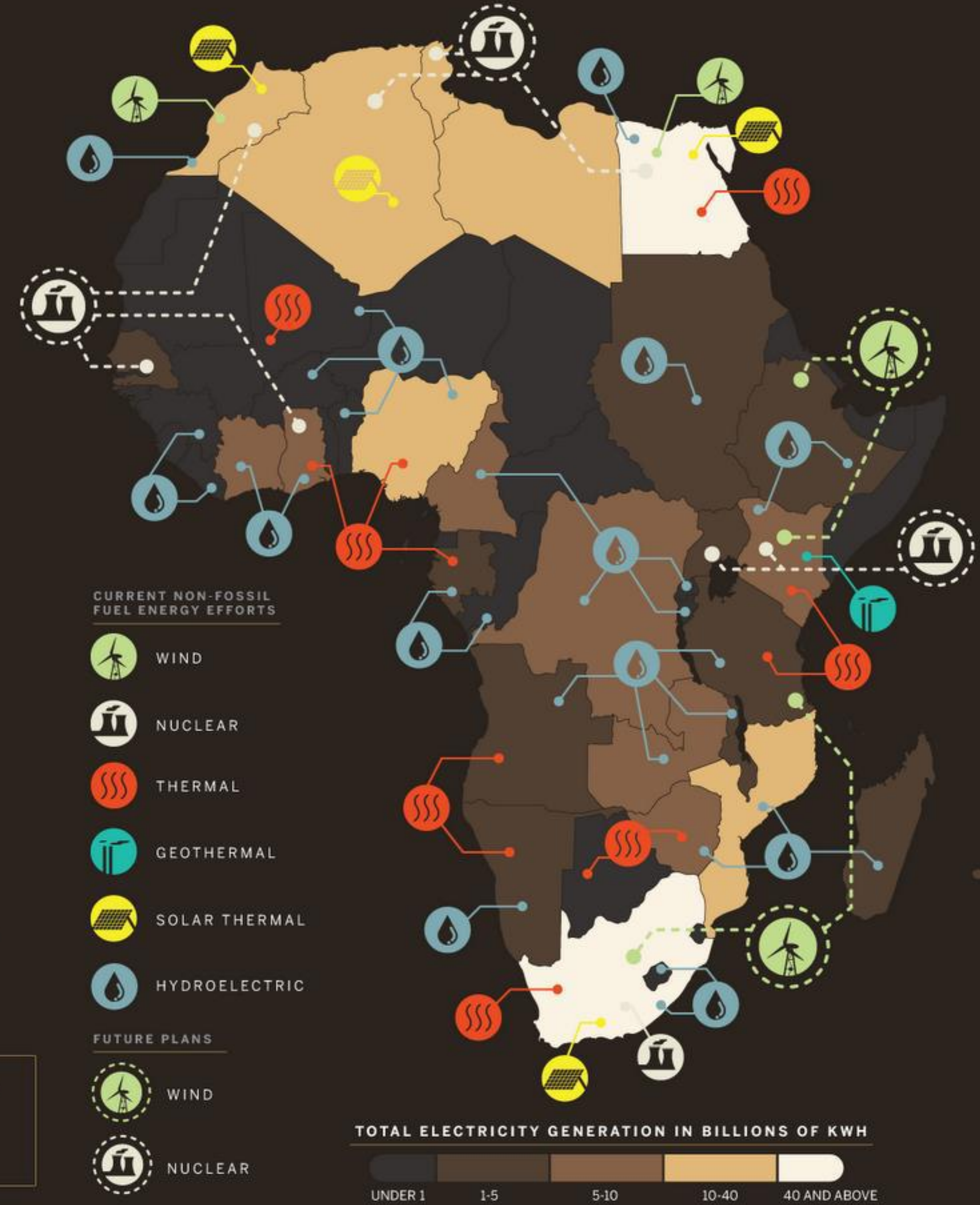


African soil contains an estimated **18 %** of the world's recoverable uranium

The two reactors in South Africa account for **5 %** of its energy generation

"This [crisis in Africa] is very bad and is something that the energy community and others should be ashamed of"

- FATIH BIROL, IEA'S CHIEF ECONOMIST



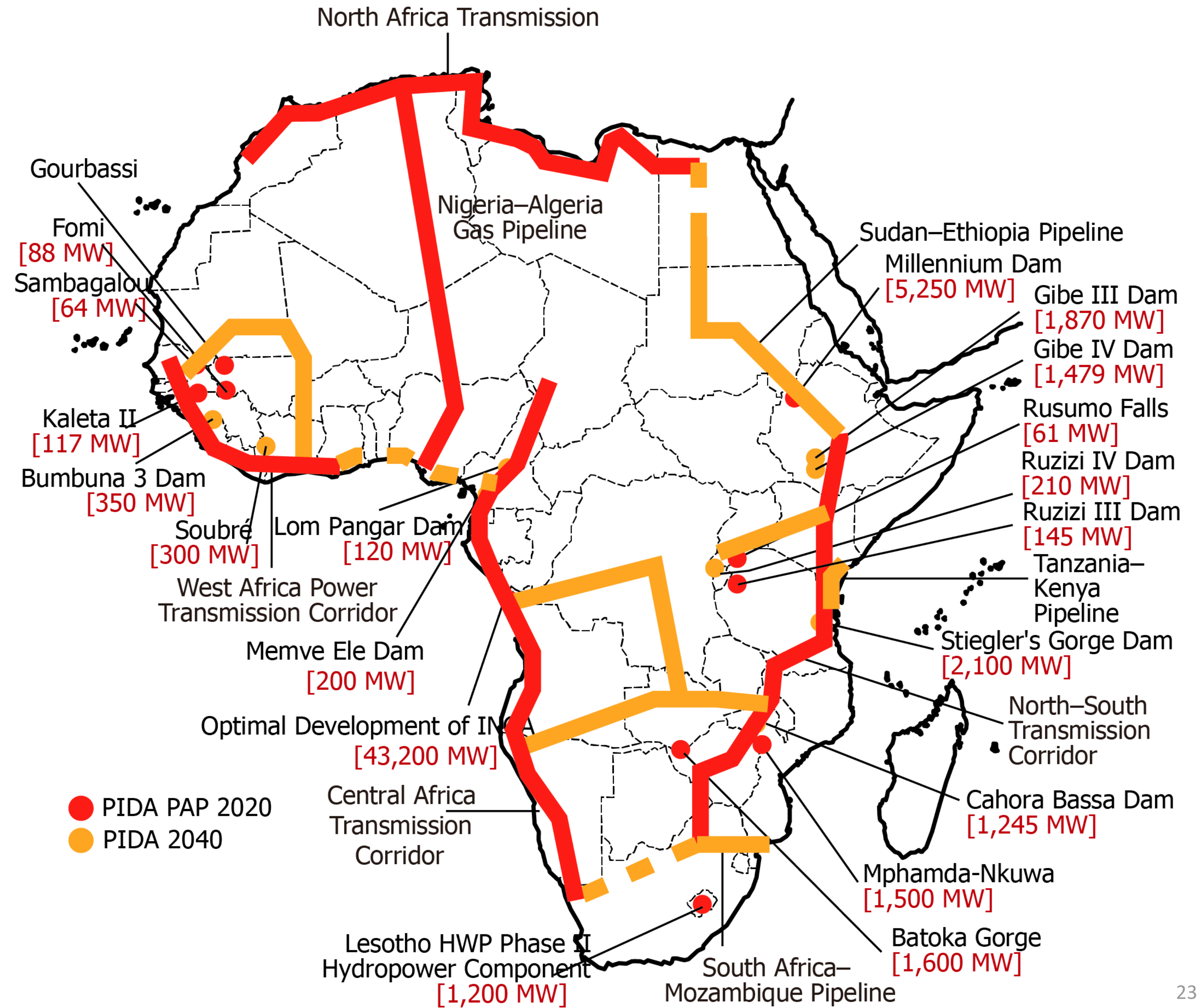
2019 DATA – BY PROPORTION OF THE POPULATION

Access to electricity in Africa

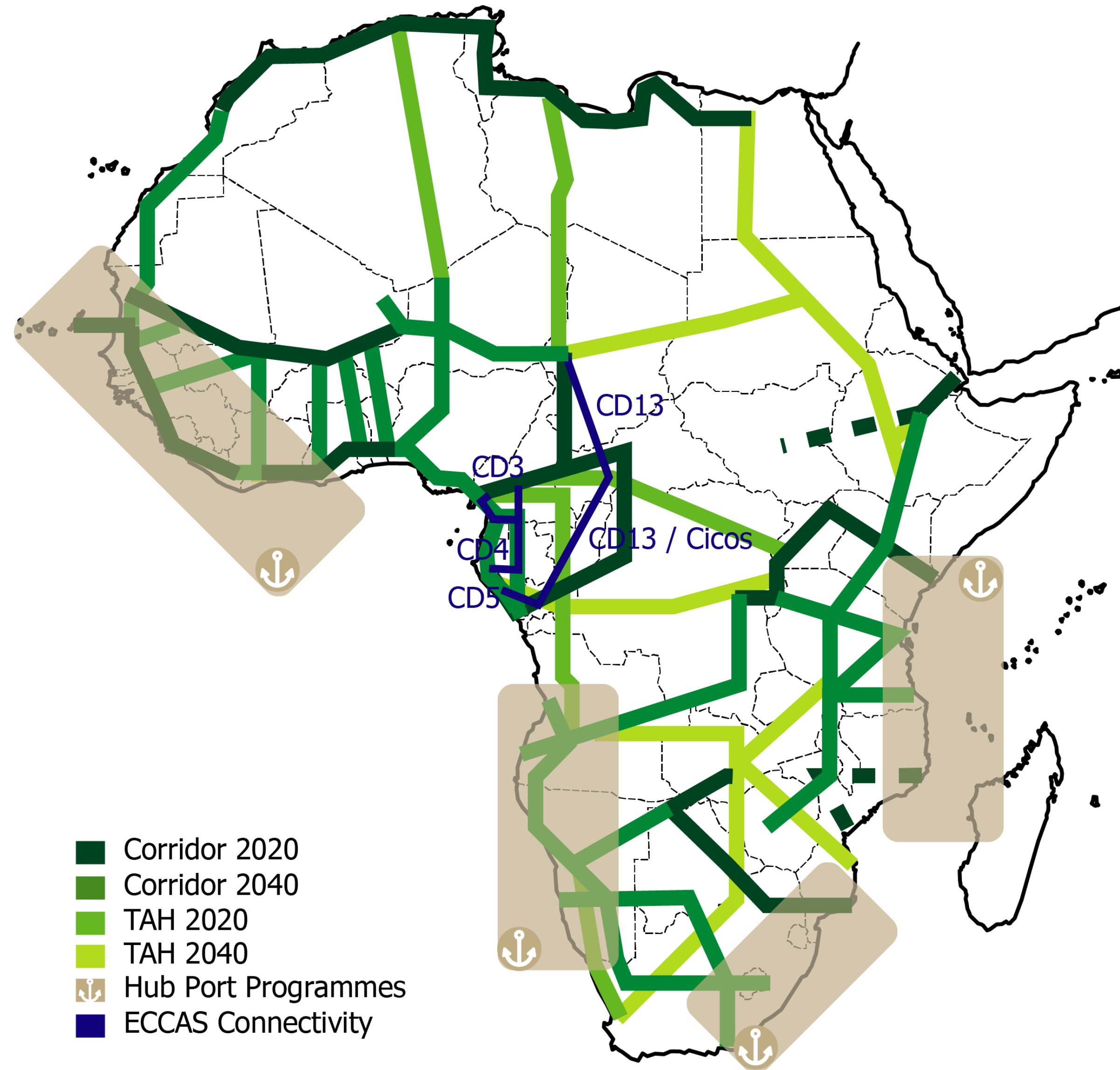


efisha

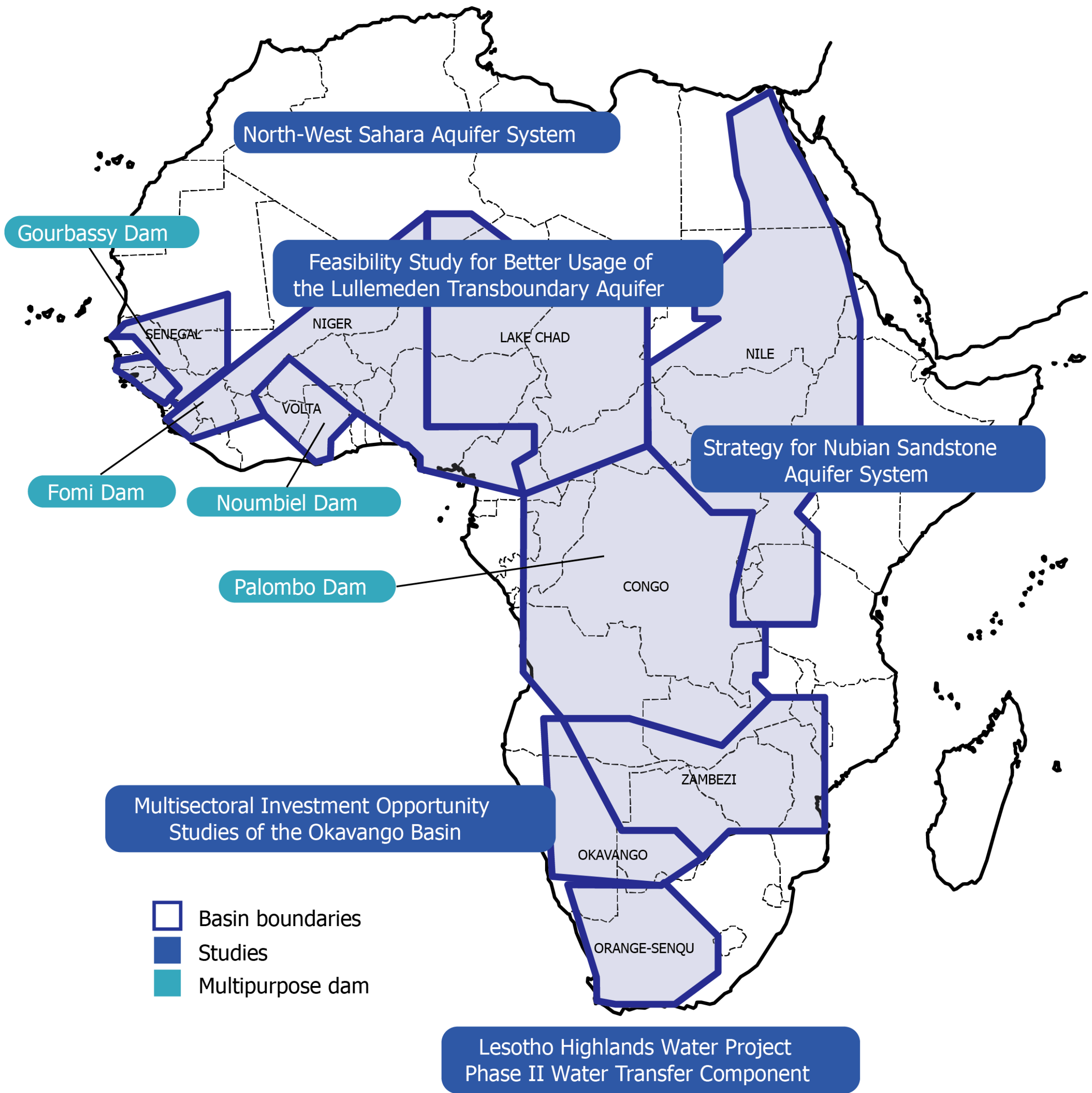
African Power Pools: WAPP, SAPP, EAPP, NAPP, CAPP - Integration of Electricity Markets



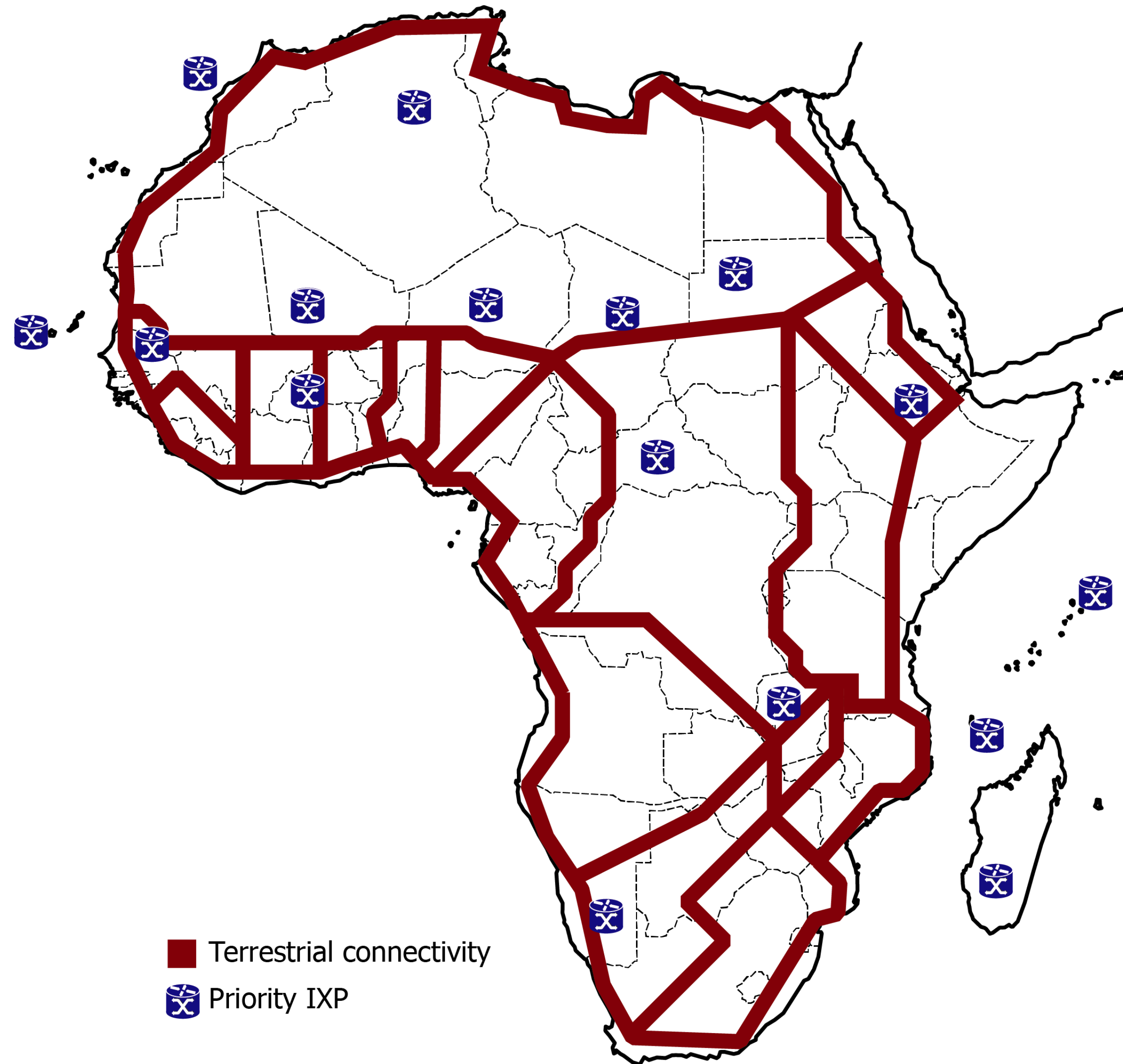
Transportation Impact



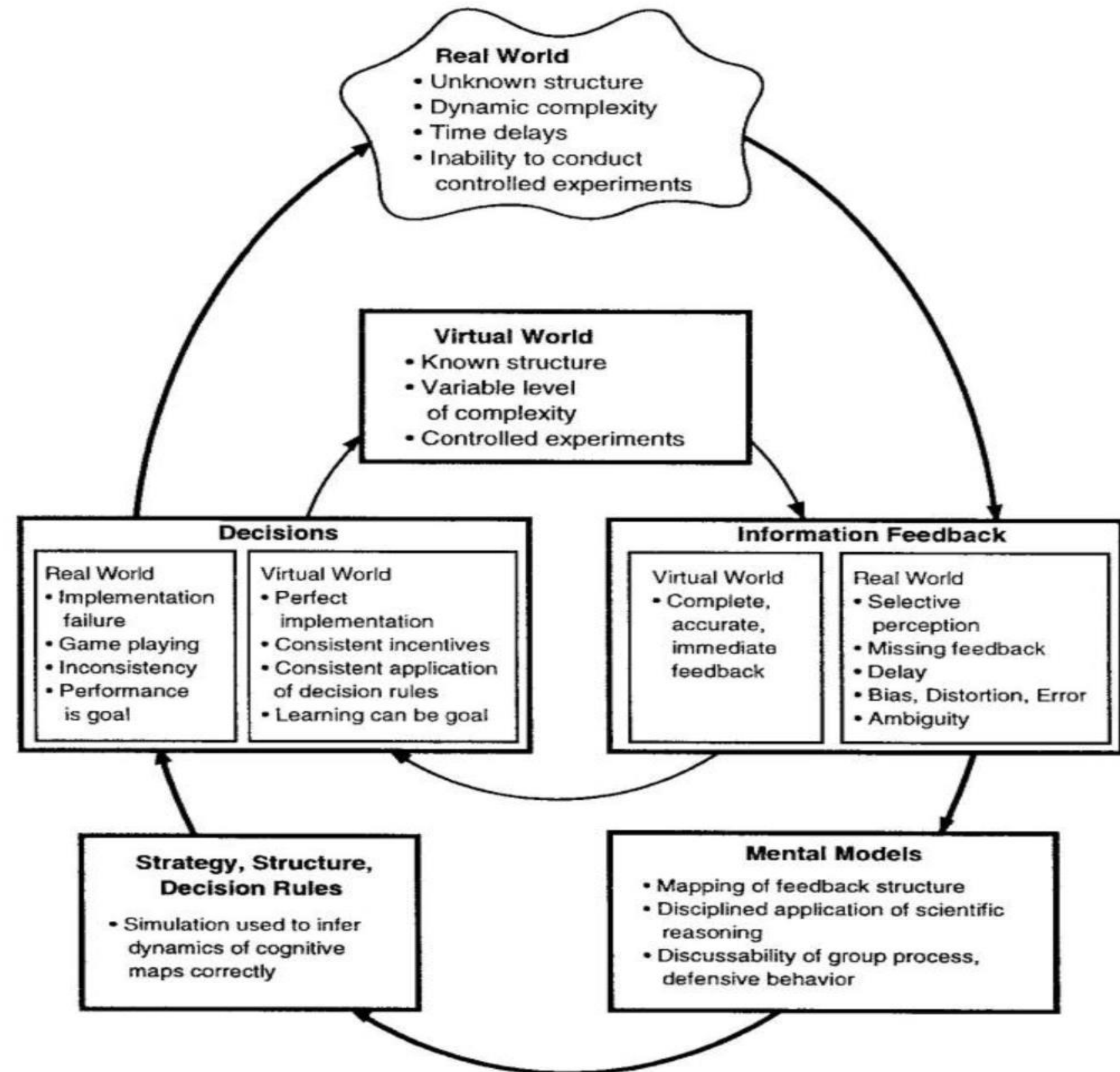
Transboundary Water



Information Communications Technology (ICT) Impact



The Role of System Dynamics



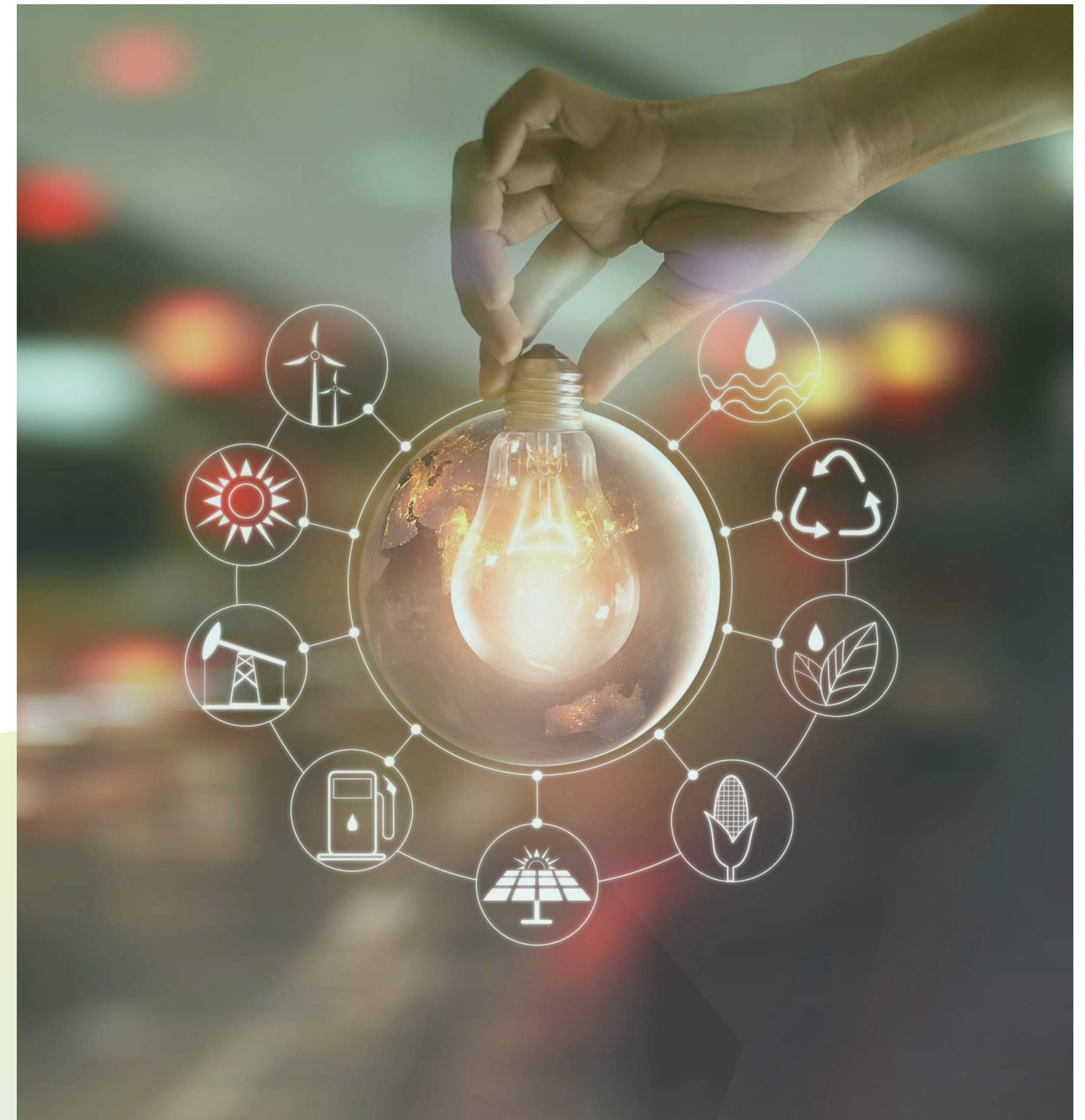
EPRI ELECTRICITY Technology Roadmap

The Electricity Technology Roadmap initiative began in 1997. Although spearheaded by EPRI, over 200 organizations—including energy companies, equipment manufacturers, government agencies and research labs, universities, foundations, engineering and consulting firms, trade associations, financiers, environmental groups, and others— contributed to the framing of this vision.



EPRI ELECTRICITY Technology Roadmap

Power for all, as described in the Roadmap, calls for universal global electrification by 2050, at a minimum level of 1000 kWh per person per year. This would meet basic energy needs, improve most measures of quality of life, and enable universal participation in the global economy. Although U.S. electricity consumption is at more than ten times this level, two-thirds of the world's population remains below this minimum electrification level today.



EPRI 2050 Roadmap Vision and Destinations

.01

Strengthening the power delivery infrastructure

.02

Enabling the digital society

.03

Boosting economic productivity and prosperity

.04

Resolving the energy/environment conflict

.05

Managing the global sustainability challenge



EPRI - Summary of the Limiting Challenges

.01 Challenge

Transmission Capacity,
Control, and Stability

.02 Challenge

Infrastructure to Power a
Digital Society

.03 Challenge

Robustness and Security of
Electricity Infrastructure

.04 Challenge

Value of Energy Storage
Technologies



Summaries of the Limiting Challenges

.05 Challenge

Transforming Electricity Markets

.06 Challenge

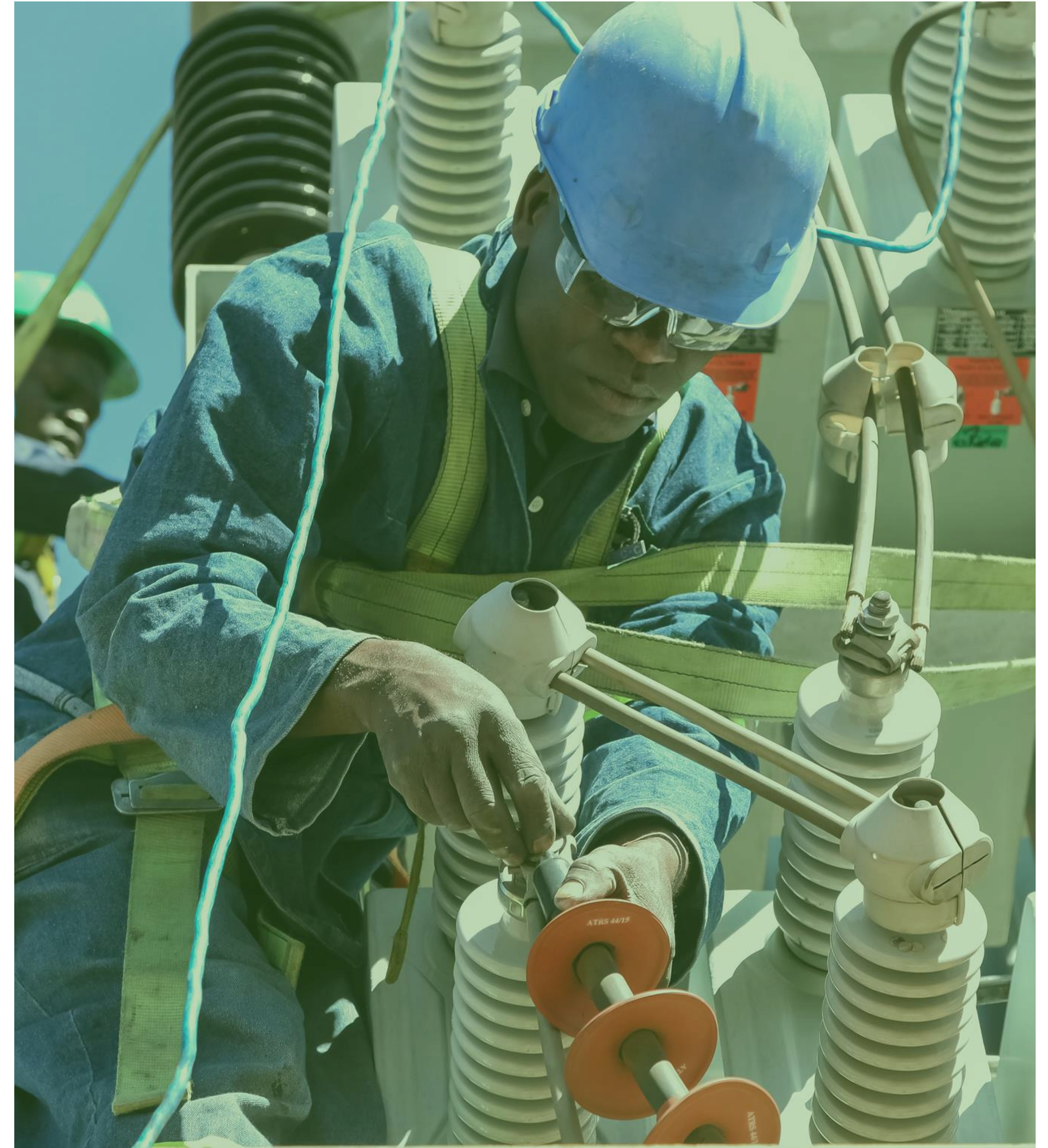
Electricity-Based Transportation Systems

.07 Challenge

High-Efficiency End Uses of Electricity

.08 Challenge

Advances in Enabling Technologies



Summaries of the Limiting Challenges

.09 Challenge

Strengthened Portfolio of
Generation Options

.11 Challenge

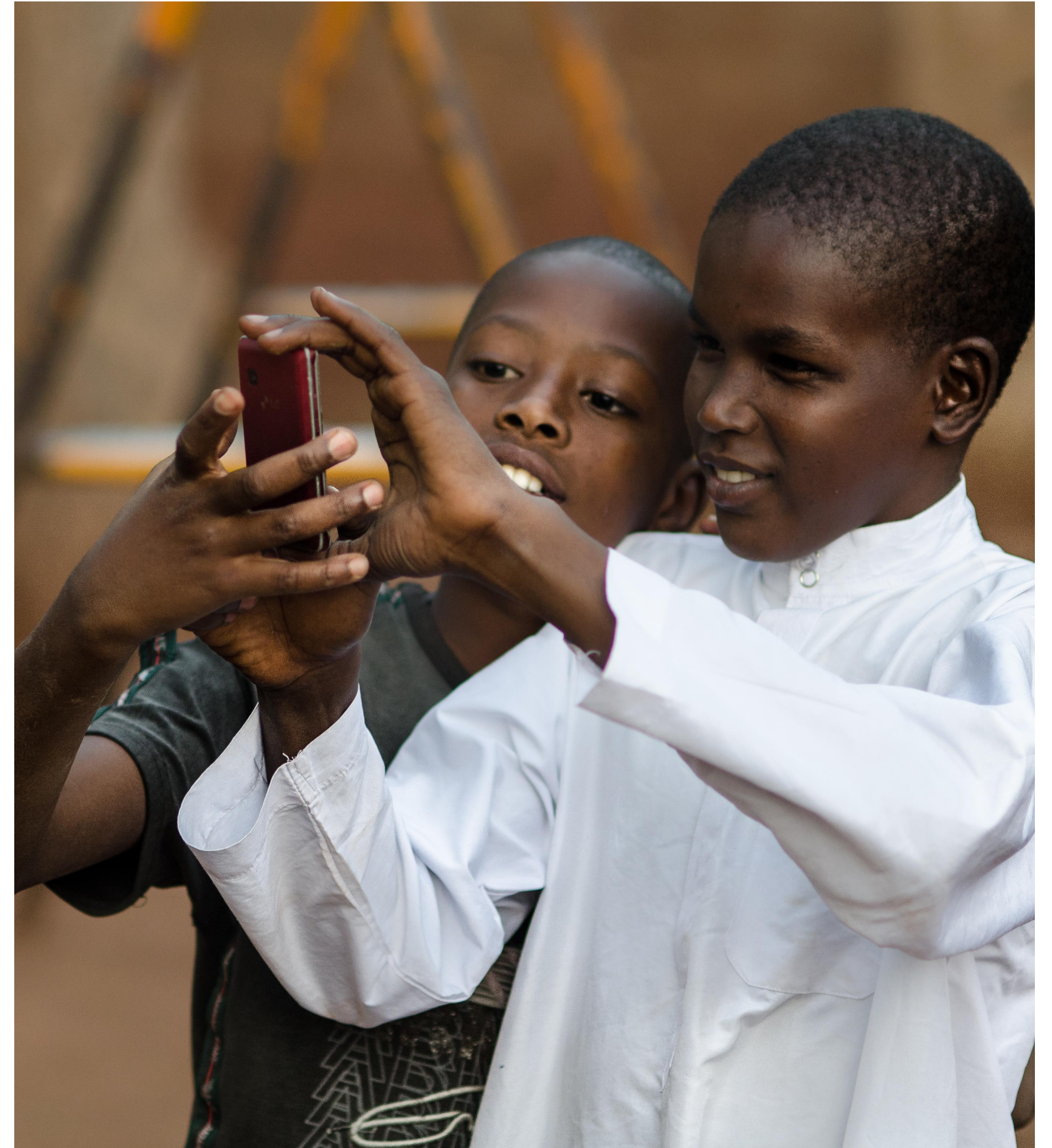
Carbon Capture and Storage
Technologies

.10 Challenge

Universal Global
Electrification

.12 Challenge

Ecological Asset
Management



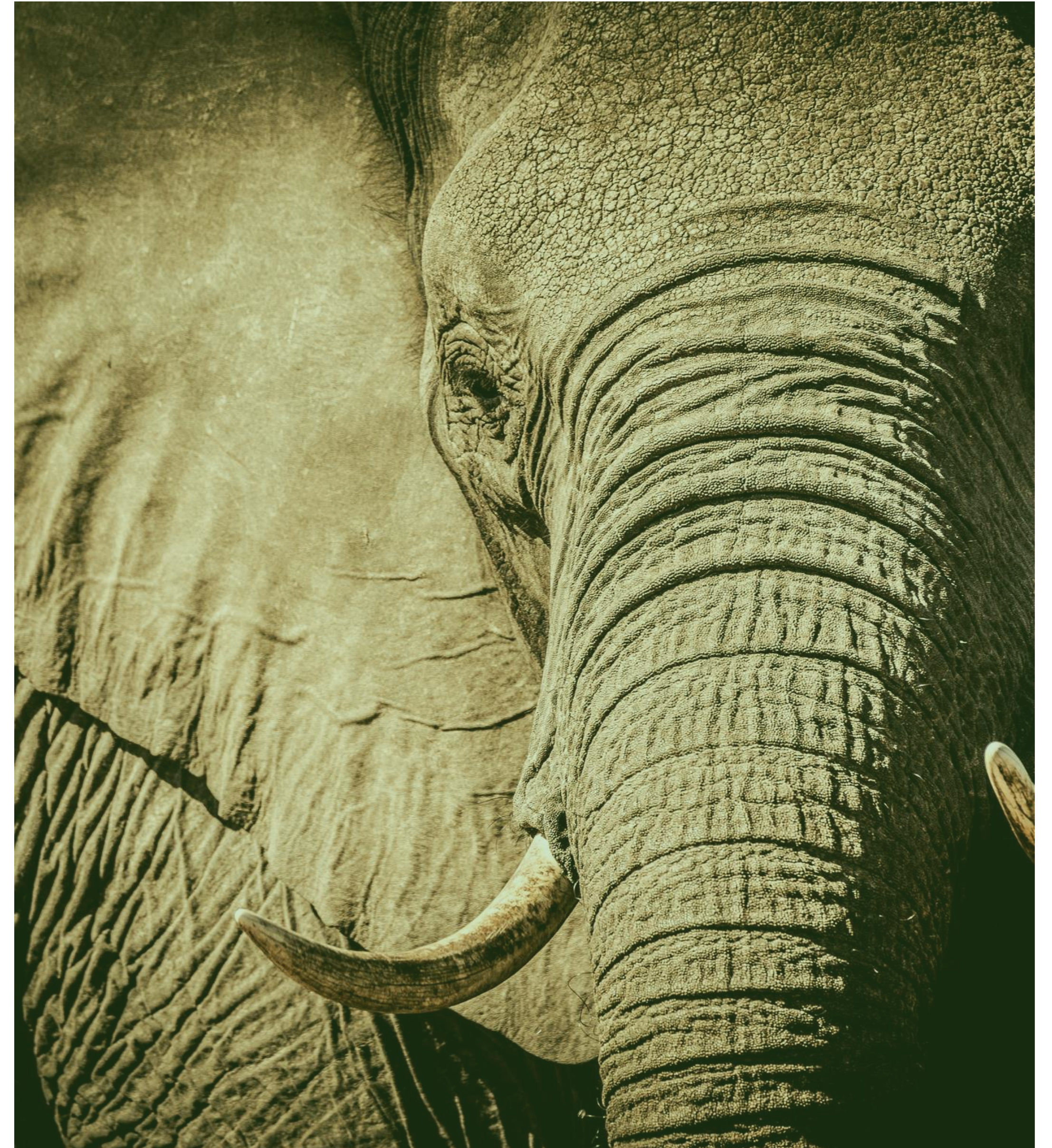
Summaries of the Limiting Challenges

.13 Challenge

Improving Water Availability
and Quality

.14 Challenge

Environmental Science



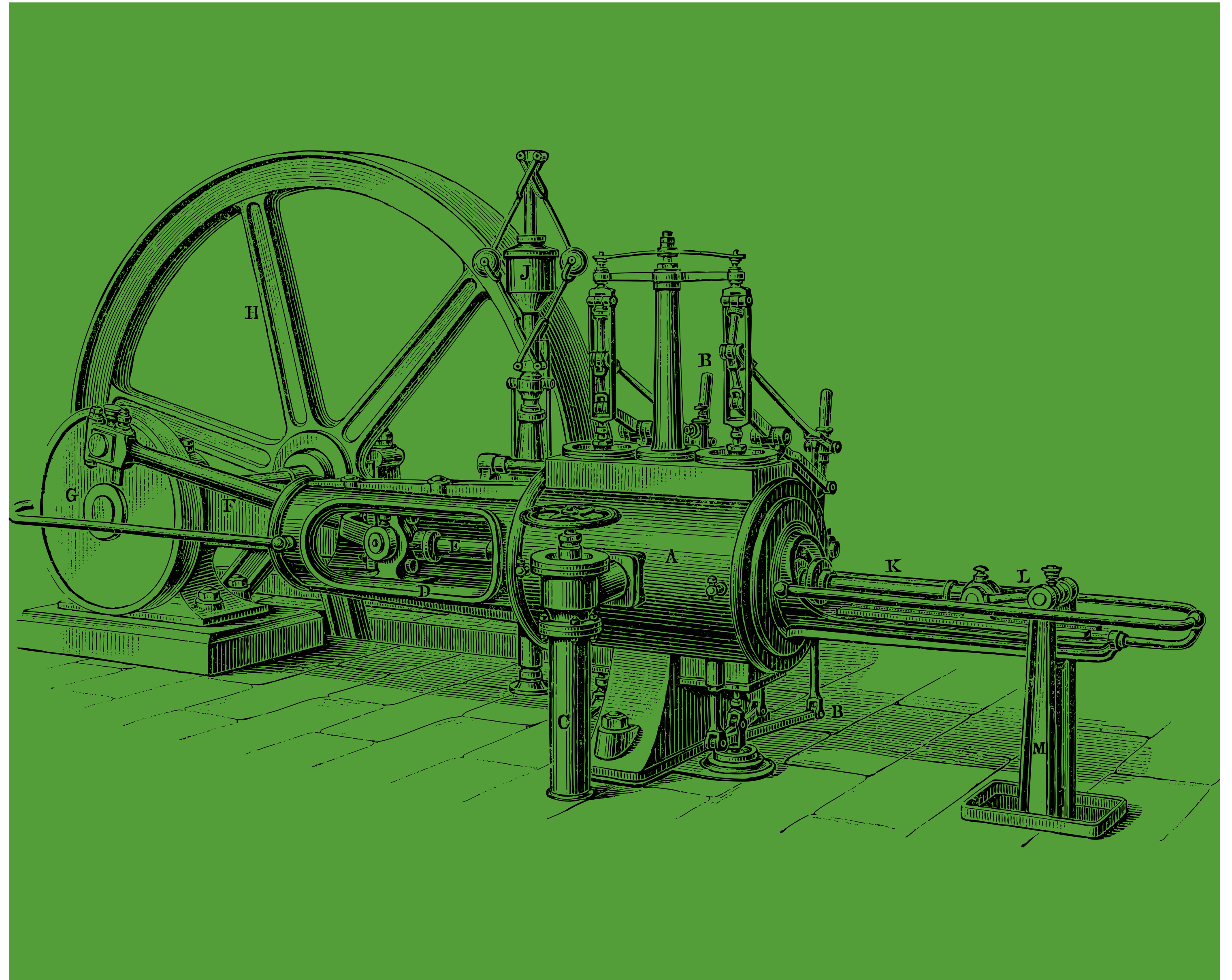
The Strategic Role of IEEE Smart Village

Creating African and International Energy Peace Corps



The Strategic Role of Micro-Grids and Connectivity

MICROGRIDS- 21ST
CENTURY STEAM ENGINES



Smart Village and the Micro Grid Future

.01

Develop New Architectures, Control Strategies, and Energy Management Schemes

- Seamless Integration of Renewable Energies and New Loads
- Reduce the Impact on PCC
- Improve System Reliability

.03

Develop Enabling Technologies for Residential Demand Response

.02

Power Quality Monitoring, Control and Improvement

.04

Cyber Security Enhancement



Recommendation

Explore the development of the Knowledge Engine for data capture among African Policy Makers and the International R&D Community towards a simultaneous creation of energizing and creating 21st century data driven economies.

For further reading and source references

[Africa: The African Union and New Partnership for Africa's Development \(NEPAD\) - The Power Footprint](#)

[Intelligent Machines:
AI is Reinventing the way we Invent](#)

[African Power Pool Interconnections Development:
A Foundation for Bridging the Digital Divide](#)

[EPRI Releases Electricity Technology Roadmap](#)

[Africa launches an ambitious program for
infrastructure development](#)

For further reading and source references

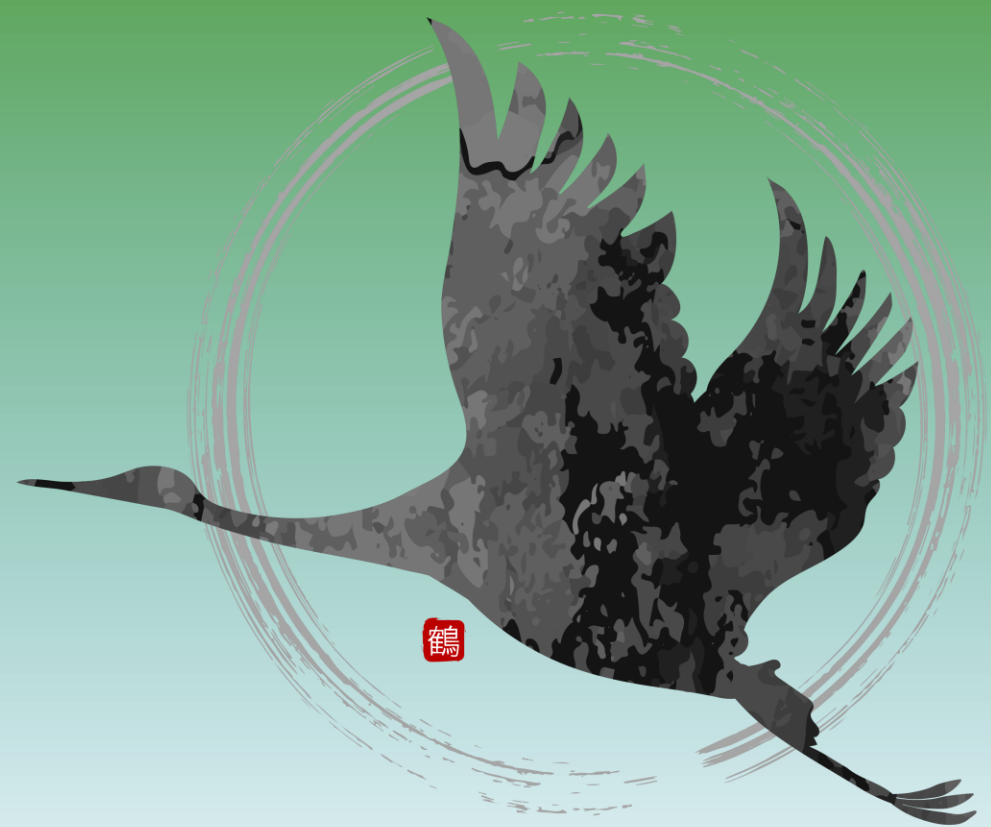


<https://www.semanticscholar.org/paper/African-power-pool-interconnections-development%3A-a-Blyden/b7527a8f1cb23524c7757ae39d452ec67e67ccf9>

<https://www.semanticscholar.org/paper/Exploring-A-Systems-Dynamics-Approach-To-and-in-the-Blyden/dc39770e29df22afbade583f6e425b1a0a162394>

<https://www.semanticscholar.org/paper/The-integration-of-plant-expert-systems-and-the-of-Blyden/50ac5ab2cffe32e0a6f7f2c859b2932b54752749>

Questions?



Thank You