

# AI and Energy Supply Chain in Africa:

Balancing Economic Efficiency with Social Equity

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# Outline

- Motivation
- Key Concept
- African context
- Where AI Fits in Energy Supply Chains
- Economic Efficiency vs Social Equity
- Case Studies – Countries Examples
- Balancing Efficiency and Equity: Key Challenges
- Recommendations
- Opportunities for collaboration

# Motivation

- Africa faces energy deficit, high system losses, grid unreliability
- AI + digital systems are redefining energy markets globally
- Africa seeks growth without worsening inequality

*The question is not whether Africa will adopt AI-driven energy systems, but whether it will do so inclusively?*

# Key Concepts

## Energy Supply Chain



Prediction

Optimization

AI

Automation

Forecasting

### Economic Efficiency



Reduced Cost



Less Wastage



Improved Reliability



### Social Equity



Affordability



Jobs



Inclusion

# The African Context

600 million+ Africans lack reliable electricity



Fossil vs renewable transition ongoing



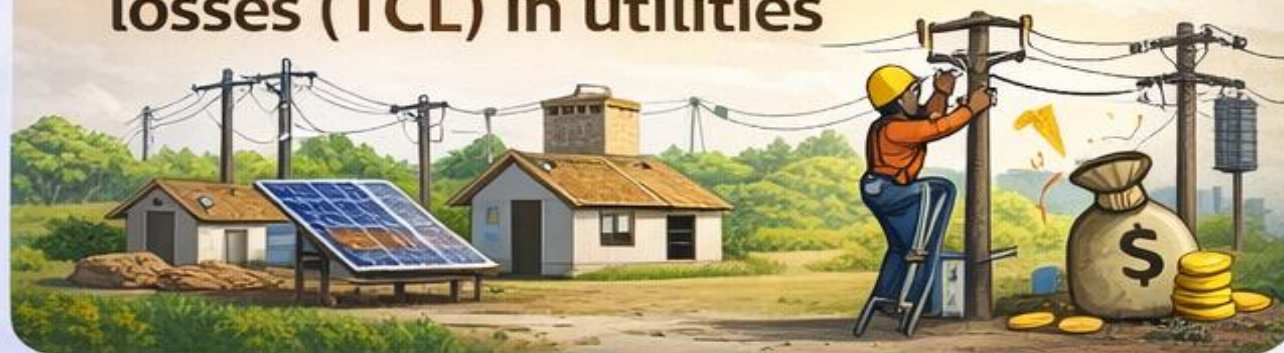
Off-grid and mini-grids expanding in SSA



High technical & commercial losses (TCL) in utilities



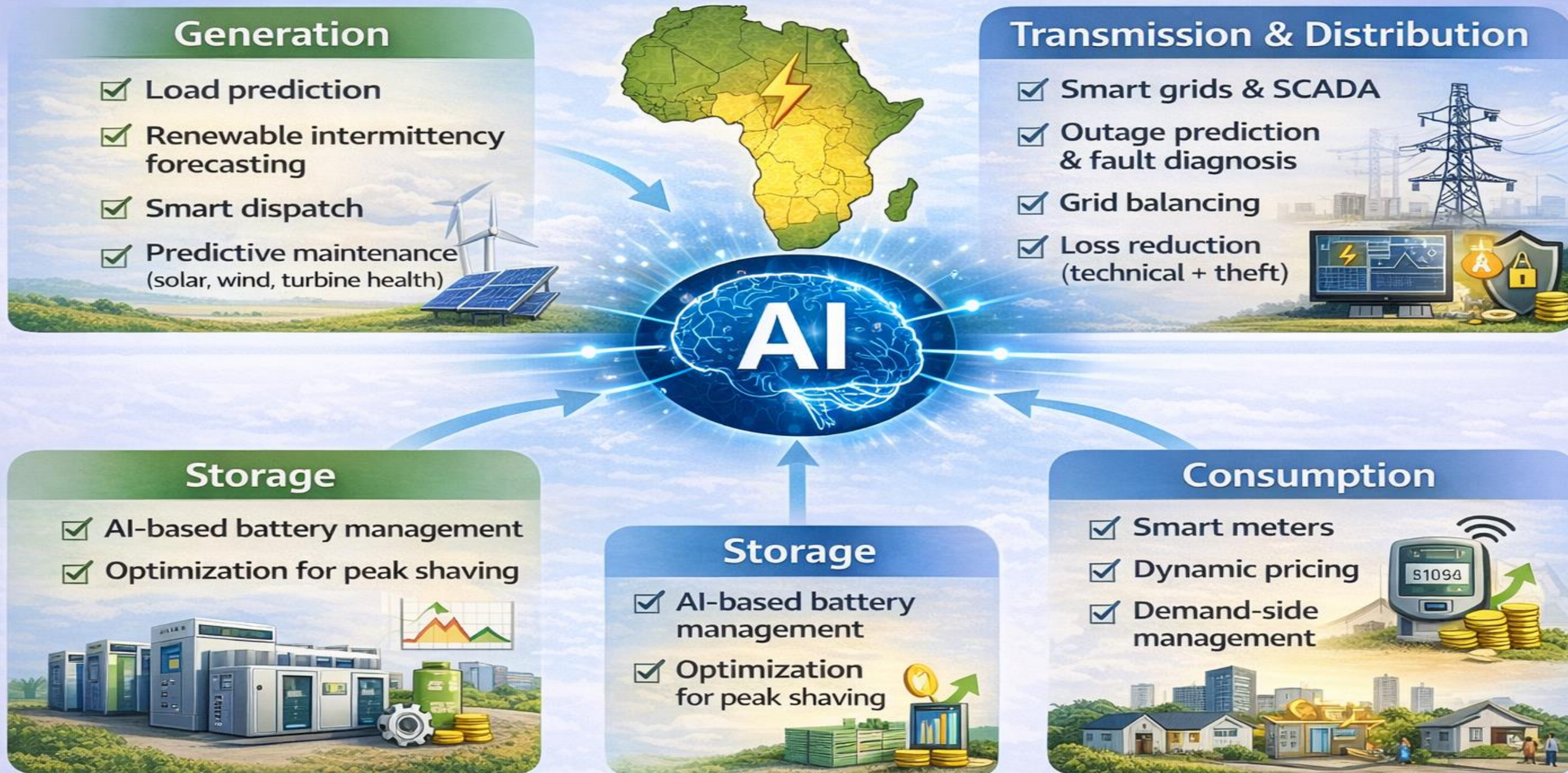
High technical & commercial losses (TCL) in utilities



Growing fintech + mobile penetration (benefits AI adoption)



# Where AI Fits in the Energy Supply Chain



# Economic Efficiency Benefits

## AI enables:

- ✓ lower technical losses
- ✓ reduced downtime
- ✓ optimized asset use
- ✓ lower OPEX for utilities
- ✓ improved tariff setting
- ✓ better electrification planning



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# Social Equity Lens

## Key Questions

Who benefits from AI-driven energy reforms in Africa — and who is left behind?

Affordability → tariff fairness

Accessibility → rural electrification

Job displacement vs job creation

Digital divide

Energy justice (Global South debate)

Algorithmic bias (e.g., credit scoring for PAYGO solar)

Data sovereignty



## DE GERMANY

AI in deployment for:

- Grid congestion forecasting (TenneT)
- AI-optimized industrial energy consumption
- AI for renewable curtailment reduction
- AI for hydrogen electrolysis control

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## GB UNITED KINGDOM

AI already used for:

- Wind farm predictive maintenance (Ørsted & DeepMind)
- Short-term grid balancing & trading
- AI-enhanced demand response

## FR FRANCE

AI operational in:

- Nuclear power predictive maintenance (EDF)
- Smart meters + dynamic tariffs
- AI-optimized electric heating systems

## AE UAE

AI in deployment:

- AI for desalination plant energy efficiency
- AI in solar farms (Dubai Noor)
- Autonomous EV energy district planning

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## SA SAUDI ARABIA

AI operational in:

- Smart grids (NEOM project)
- AI-optimized renewables integration
- Hydrogen production optimization

## **AE UAE**

### **AI in deployment:**

- **AI for desalination plant energy efficiency**
  - **AI in solar farms (Dubai Noor)**
  - **Autonomous EV energy district planning**
- 

## **SA SAUDI ARABIA**

### **AI operational in:**

- **Smart grids (NEOM project)**
- **AI-optimized renewables integration**
- **Hydrogen production optimization**

## **JP JAPAN**

### **AI in use for:**

- **Smart home energy management (Panasonic, Sony)**
  - **AI in hydrogen energy optimization**
  - **AI for grid frequency regulation**
  - **AI in earthquake-resilient grid response**
- 

## **US UNITED STATES**

### **AI in operation:**

- **Predictive maintenance for wind turbines (GE)**
- **AI-driven microgrids (Schneider Electric, Tesla)**
- **AI-based energy trading platforms**
- **Wildfire-risk prediction for power lines (PG&E)**
- **EV smart charging + V2G management**

# Malaysia



# INDIA



## AI currently used for:

- ✓  Solar irrigation pumps (AI-controlled)
- ✓  AI-driven smart metering rollout
- ✓  AI for grid theft detection
- ✓  Load forecasting for renewables

China is rapidly leading in AI-powered, autonomous vehicles, with **over 60% of new cars sold in 2024** featuring advanced, smart driving capabilities.



2024 new cars with smart driving capabilities

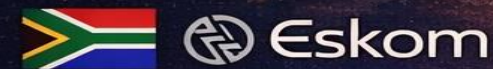
# Pay-As-You-Go (PAYG) Models

Companies like M-KOPA in Kenya use AI-powered predictive analytics to analyze customer data, determine creditworthiness, and create affordable, flexible payment plans for solar home systems.



# SMART METERS & DEMAND MANAGEMENT

AI-driven smart meters optimize energy consumption patterns and improve utility revenue collection.



✓ AI-driven smart meters, such as those used by Eskom in South Africa, optimize energy consumption patterns and improve revenue collection for utilities.

# Balancing Efficiency and Equity: Key Challenges

## Data Scarcity & Quality



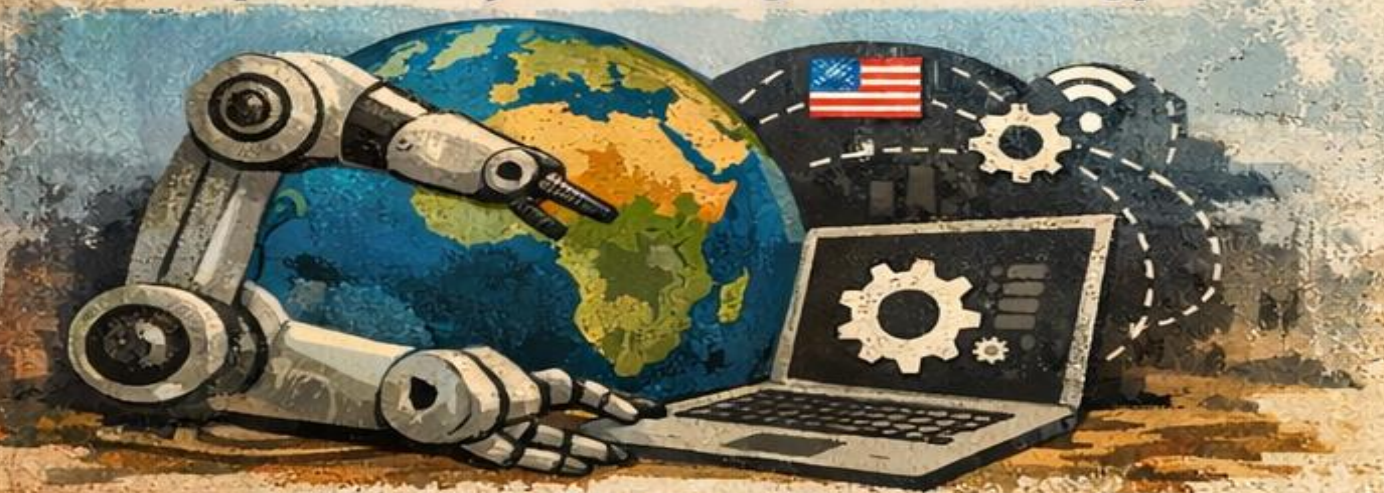
Limited data from local mini-grids  
Risk of biased models

## Infrastructural & Digital Divide



Unreliable power & poor connectivity  
Hindering AI deployment

## Dependency on Foreign Technology



“Digital Colonialism”  
Lack of local context

## Job Displacement vs. Creation



Workforce disruption  
Need for retraining & reskilling

# Recommendation: Pathways to Just Transition

## Local Ownership & Capacity Building



SCHOLARS MENTORSHIP NETWORK  
p r e s e n t s

Investing in local data science expertise through sector focused mentorship programs like **DiaDeRC** to ensure culturally appropriate and sustainable AI solutions.

## Collaborative Governance



Strengthening partnerships between governments, private sector, and local communities.

## Regulatory Frameworks



Developing clear, equitable AI regulations on data privacy, security, and ethical use.

## Focus on Localized Data



Using local data to reflect specific energy use and infrastructure limitations.

 **DiaDeRC**

## Course on Applied Science

**CADS 2.0**

- A Toolkit for Discovery
- Sector Focused Peer Communities
- Mentorship Rooted in Practice
- Your Data, Your Challenge, Your Context
- A Capstone that drives impact.

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# opportunities for Collaboration

  
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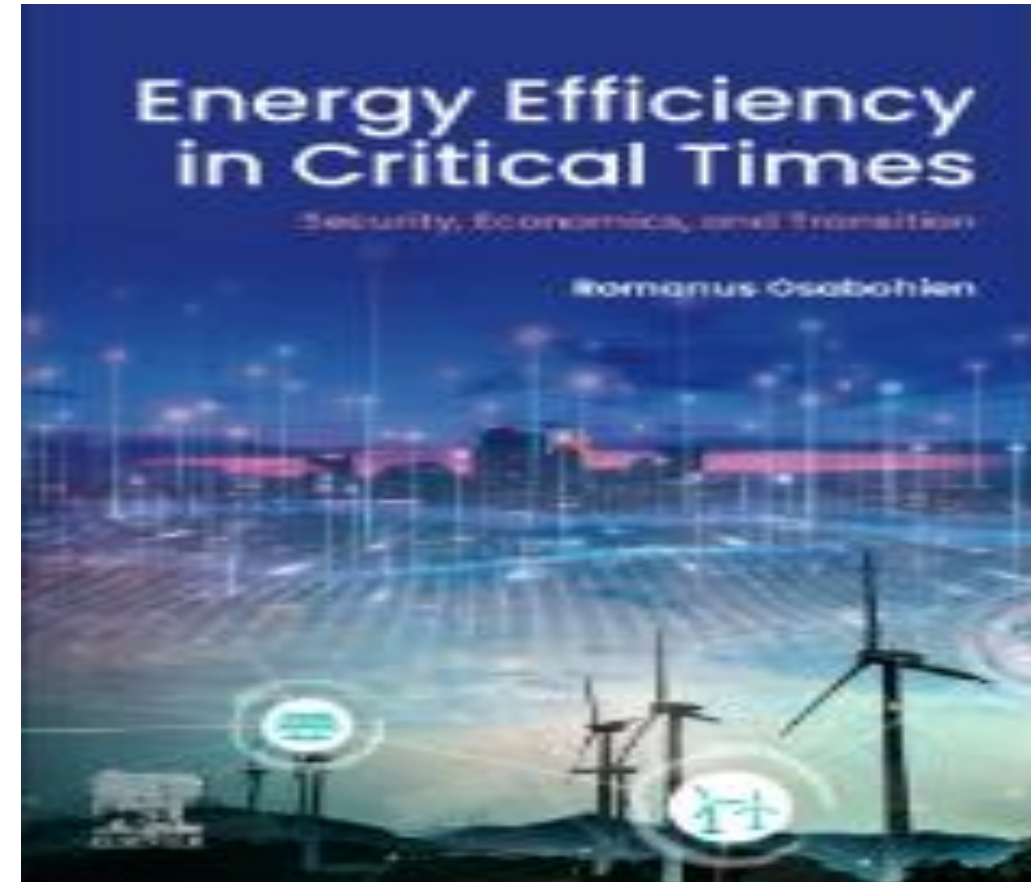
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## Energy Efficiency in Critical Times

Security, Economics, and Transition

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# THANK YOU



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