

Just Energy Transitions Africa

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- Towards an energy transition, globally and in Africa
- Elements of a just energy transition
- Enabling the just energy transition

Case studies

Contents - overview

Challenges and opportunities, goals and main elements in the energy transition and needed actions

Challenges

- Low energy access
- Weak energy infrastructure coverage
- High investment cost of electrification and of renewable and new technologies
- Limited purchase power of energy consumers
- High fossil fuel subsidies and electricity tariffs not reflecting real costs
- Weak financial position of energy utilities
- Insufficient public and private funding for energy access and clean energy
- High perceived risk by private investors and financial institutions
- Weak legal-regulatory frameworks
- Lack of interregional connection and integration of energy infrastructure
- Lack of integrated energy resource, supply and demand planning coordinated with other development objectives
- Fragmented way of operation of donors and development partners

Opportunities

- Large natural gas reserves
- Huge renewable energy potential (solar, wind, hydro, geothermal, biofuel)
- Leapfrogging in building new infrastructure
- Fast growing domestic demand for fuels and electricity driven by population growth, urbanization and economic development
- Export opportunities in global transition

Africa 2050 Paris Agræment Sustainable Development Goals

> Energy access Decarbonization Just transition

Energy transition

- Universal access by 2030
- Low-carbon/net-zero emission pathways
- Environmental sustainability and resilience (pollution, land use, water, deforestation)
- Economic diversification and value creation
- Net employment creation

efficiency

Energy

- Just and inclusive distribution of net benefits

Electrification and reliable energy infrastructure

energy

Renewable

New energy technologies

National actions and measures

- Promote access to affordable and reliable energy
- Increase investments in sustainable energy (energy efficiency, renewables, new technologies)
- Modernized and expanded energy infrastructure
- Enabling policies with strong governance and institutions.
- Conducive legal-regulatory frameworks that help promote private investments

Regional and pan-African actions and measures

- Regional coordination and planning
- Integration of electricity and other energy networks

International cooperation and support

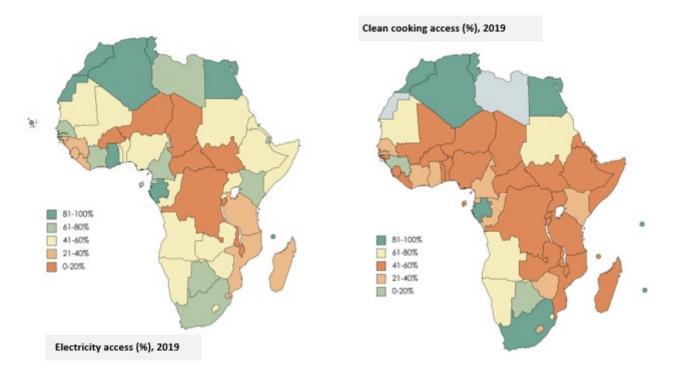
- Increased financial support by donors and financiers for energy access and low-carbon energy transition for investment and technical assistance
- Better cooperation between development partners

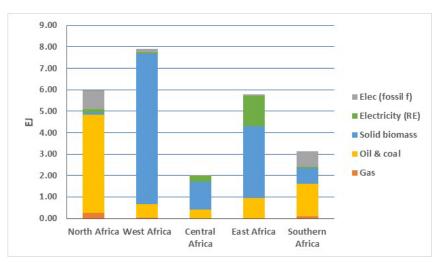
1. Introduction

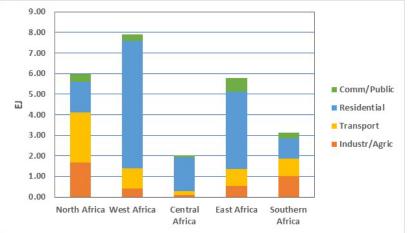
- International context
 - Sustainable development Goals (SDGs)
 - SDG 7 (by 2030): 1) universal energy access for all by 2030, 2) increase substantially the share of renewable energy, 3) double rate of improvement in energy efficiency
 - Other SDGs
 - Climate change and Paris Agreement
 - Maintain average global temperature rise to "well below 2" C above pre-industrial levels
 - Pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels", requiring reaching global carbon net neutrality soon after 2050
 - African Union Agenda 2063
 - By 2063, Africa's energy systems will largely be based on renewable energy resources coupled with a strong and to a considerable extent localized manufacturing sector, highly qualified human resources and integrated energy infrastructure for both centralized and decentralized energy system

2. Energy in Africa

- Energy access
 - About 560 million people w/o access to electricity
 - About 940 million people w/o access to clean cooking fuels
 - Regional differences and between countries







Energy mix

- Large share of fossil fuels for direct consumption and power generation
- Dominant role of traditional biomass in residential sector

2. Energy in Africa

Low per capita energy consumption

• Global: 1920 koe

Sub-Saharan (w/o South Afr): 870 koe

South Africa: 2696 koe

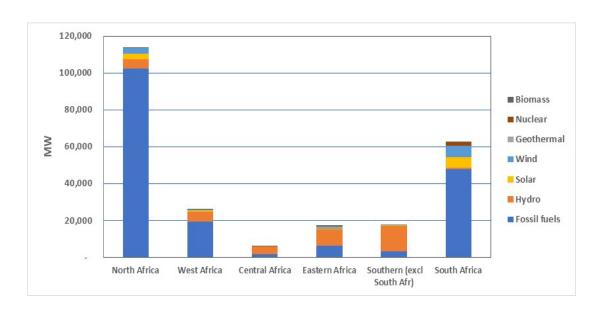
• USA: 6804 koe

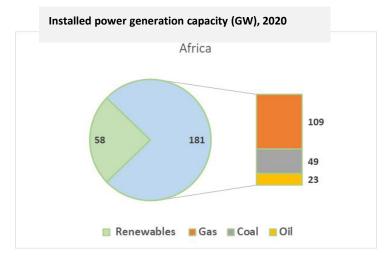
Energy mix

 Share of renewable energy (hydropower) differs per region and per country

- Fossil fuel use and production unevenly distributed
 - Fossil fuel exporters and importers

Crude oil (Mtons)		Oil products (Mton)		Natural gas (billion m³)	Coal (million tons)		
Demand	134	Demand	187	Demand	160	Demand	215
Production	395	Production	111	Production	248	Production	276
- Nigeria	96	- Algeria	39	- Algeria	97	- South Africa	256
- Algeria	66	- Egypt	27	- Nigeria	47	- Mozambique	10
- Libya	53	- South Africa	19	- Egypt	62		
- Egypt	32	- Nigeria	3	- Mozambique/Tanzania	5		
Exports	294	Exports	38	Net exports	88	Exports	75
Imports	33	Imports	114	- LNG exports	51	Imports	14



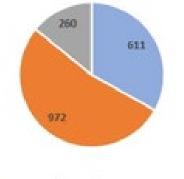


2. Energy in Africa

- Energy situation (around 2020)
 - Issues
 - Relative low investment in energy access and in po
 - To achieve electricity access in Sub-Sah A: about USD 24 billion annually
 - Relative low private investment
 - Efficiency in power T&D
 - Financial situation of power utilities and enabling environment for private investor
 - Lack of integration (power pools) and gas infrastructure
 - Issues and questions:
 - Grid extension vs minigrid and stand-alone electrification options
 - Role of improved stoves/biomass vs LPG
 - Level of penetration of variable solar and wind in power supply
 - Role of natural gas
 - Investments in new technologies

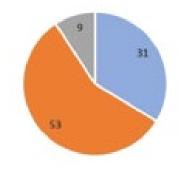
Energy investments

Global, billion, USD (2019)



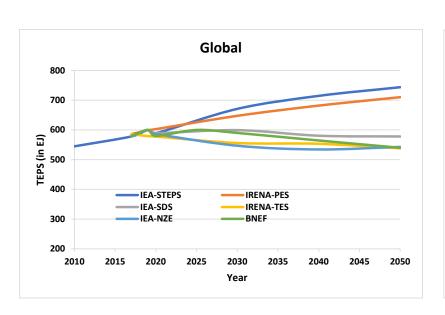
- Renewables; efficiency; storage
- Fossil fuel: supply and power
- Networks

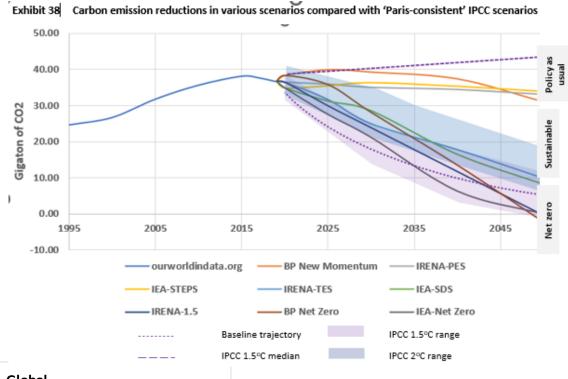
Africa, billion, USD (2019)

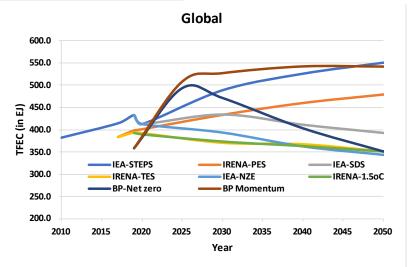


- Renewables; efficiency; storage
- Fossil fuel: supply and power
- Networks

- Scenarios with low-carbon or net zero pathways
 - IEA, IRENA, MultiConsult/AfB, NZFR and other
 - Can be grouped in two or three types
 - Policy-as-usual;
 - Low-carbon/sustainable; Net zero emissions by 2050

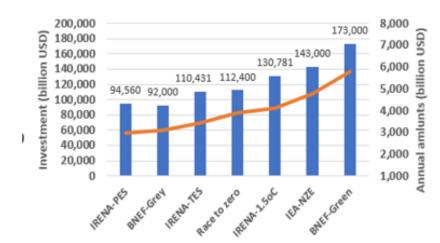


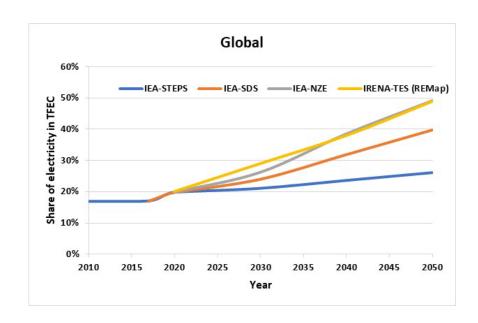


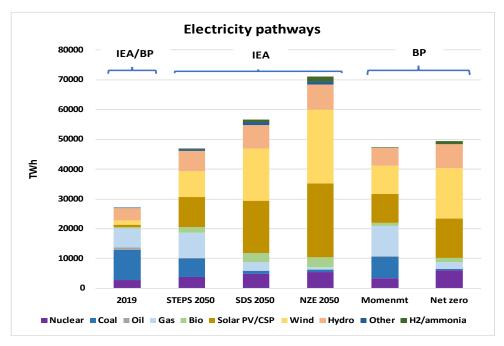


- Global sustainable / net zero
 - Higher end-use efficiency, flattening demand curve
 - Electrification of sectors
 - Higher share of renewables in heat and electricity
 - New energy carriers and technologies
 - Hydrogen and derived fuels
 - Electric vehicles and biofuels for transport
 - The more low carbon the pathway, the more investment will be needed

Exhibit 32 Global total and annual energy investments 2017/20-2050







- Africa sustainable / net-zero
 - Africa has large renewable energy resources
 - Universal access by 2030 in all 'sustainable / net-zero pathways'
 - Energy demand in Africa will grow rapidly, due to
 - Expanded access to modern energy
 - population growth,
 - economic development
 - Electrification of demand
 - universal electricity access,
 - relative higher share of electricity in residential, productive and transport

Estimated potential renewable energy (onshore

Hydro: 1,478 TWh/yr Wind: 978,066 TWh/yr Solar1,499,742 TWh/yr Geothermal: 105 TWh/yr Biomass: 2,374 TWh/yr

Northern Africa (in TWh/yr)

Hydro: 56. Wind: 348,782 . Solar: 499,898.

West Africa (in TWh/yr)

Hydro: 101 TWh/yr Wind: 140,513 Solar: 240,611 Biomass: 64

Western Africa
Northern Africa

Eastern Africa
Southern Africa

Eastern Africa (in TWh/yr) Hydro: 334 .

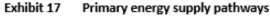
Wind: 242,096 Solar: 308,105 Geothermal: 105 Biomass: 642

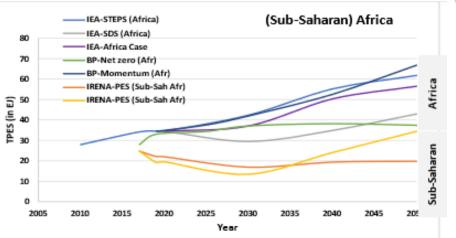
Central Africa (in TWh/yr)

Hydro: 570 TWh/yr Wind: 74,936 Solar: 154,916 Biomass: 1.572

Southern Africa (in TWh/yr)

Hydro: 415 Wind: 171,739 Solar: 246,212 Biomass: 96





- Africa sustainable / net-zero
 - pathways'
 - Electrification of demand and more efficient use of energy
 - Higher share of renewable energy

Exhibit 19 Changes in energy demand per fuel and sector in 2030 in IEA SAS scenario



Exhibit 25 Power sector expansion, Sub-Saharan Africa

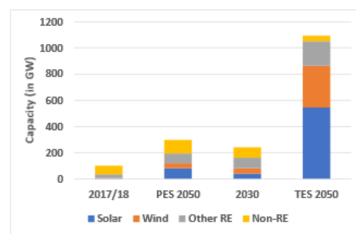
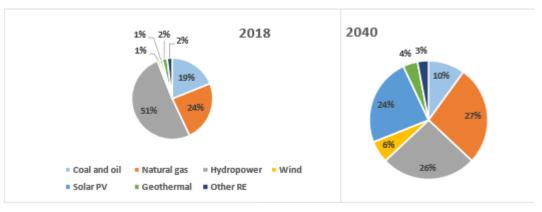
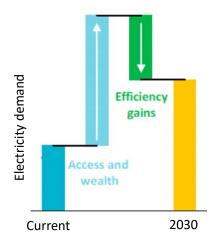


Exhibit 26 Power generation mix, Sub-Saharan Africa (excl. South Africa)



Own elaboration with data from IEA analysis (Africa case, in IEA, 2019)



- Issues and questions:
 - Grid extension vs minigrid and stand-alone electrification options
 - Role of improved stoves/biomass vs LPG
 - Level of penetration of variable solar and wind in energy mix
 - Coal and oil decline, but what will be role of natural gas and infrastructure; stranded assets or investing in the future; for domestic market or export?
 - Investments in new technologies (hydrogen, biofuels, electric vehicle infrastructure)

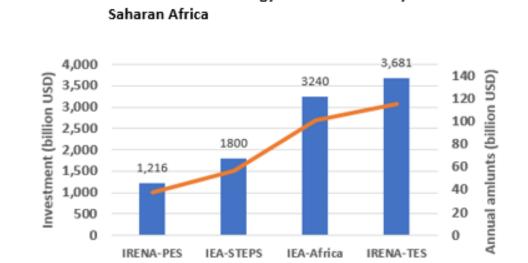
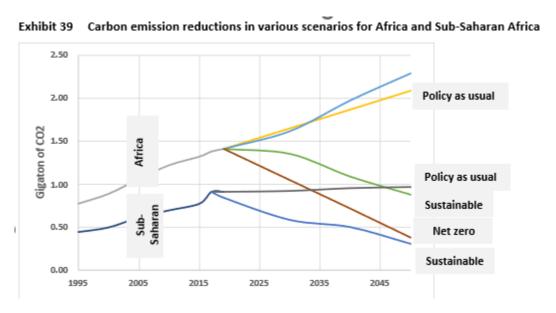
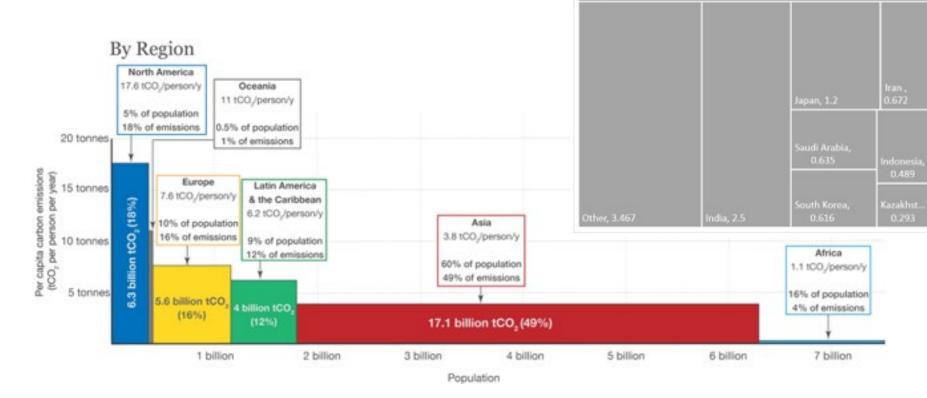


Exhibit 35 Total and annual energy investments 2017/20-2050 in Sub-



Environmental

 Greenhouse gas emissions – historic, current emissions



Cumulative CO2 emissions 1751-2020 from fossil fuels

■ North America ■ Europe ■ Asia ■ Africa ■ Latin America ■ Oceania ■ Int. aviation & shipping

Other, 1.047

USA, 5.3

North Africa,

0.514

South

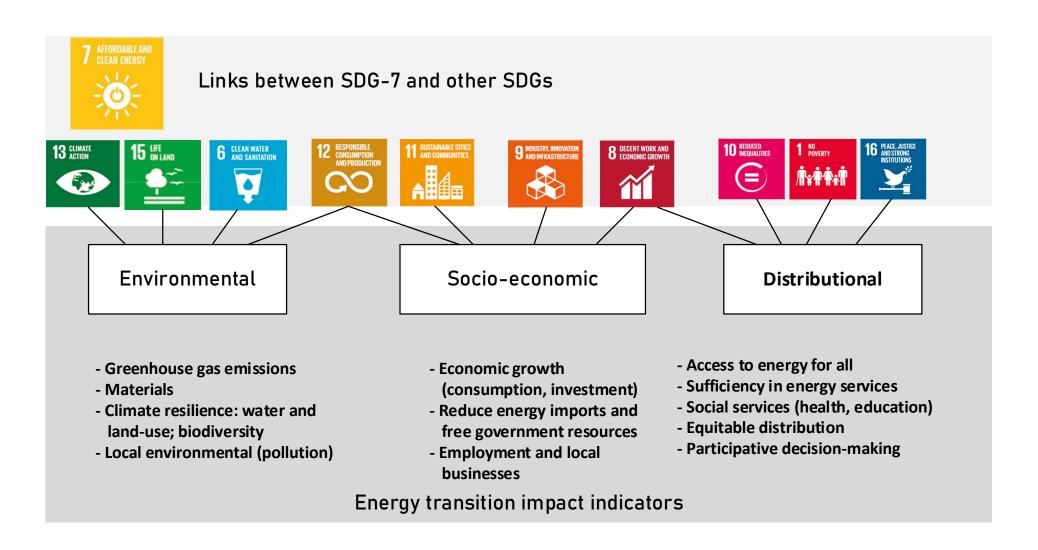
Africa,

0.456

Canada, 0.573

International, 1.15

Exhibit 13



- Environmental / economic
 - Minerals and exports
 - Important in the energy transition will be copper, cobalt, nickel, lithium and rare earth elements (REEs, particularly neodymium and dysprosium). Worldwide, a small number of countries dominate the production of clean energy metals.
 - There is a danger that the dependency on oil and gas is replaced by a dependency on critical materials that are even more prone to be used as a geopolitical weapon
 - Local impacts of mining (environmental, labour conditions)
 - Who will be winners and losers?
 - Higher GDP per capita is not necessarily associated with higher equality with higher human development

Exhibit 42 Natural resources exports as % share in government revenue in selected countries

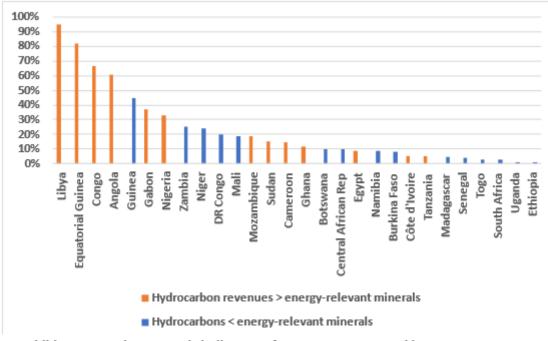
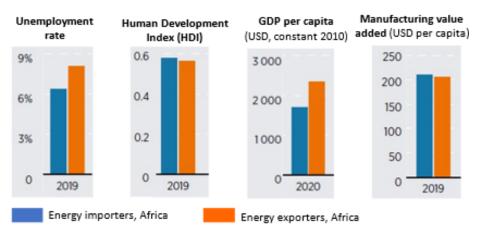


Exhibit 46 Socio-economic indicators of energy exporters and importers



Distributional

- Universal access to electricity and clean cooking methods
 - But also: sufficiency and quality of service (users climbing up the energy ladder)
- Participation level in decision-making
 - Stakeholder engagement, involvement communities, civil society
 - More inclusive governance structures
- Equitable distribution of costs and benefits
 - Real cost of energy generation and service versus energy subsidies. Especially in power sector, state-owned power utilities are in financial troubling situation
 - Subsidies in Africa in the order of USD 40 million a year
 - For comparison: power sector investment in Africa are about USD 35 billion annually. Investment needed annually in addition to achieve universal access by 2030 is about USD 24 billion annually
 - Rather than subsidise consumption (subvention too of the rich that consume most), help poor get connected to the system (grid connections; LPG infrastructure) with time-bound initial investment support
 - Subsidies make bad policy but good politics; once in place are difficult to withdraw. Any reforms to phase out subsidies for fossil fuels should therefore include measures to mitigate the likely negative impacts on the poorest

Socio-economic

- Economic growth
 - Expected net economic growth and employment creation
 - Differences between countries (mineral exporters gain; oil exporters loose)
 - Differences between sectors (e.g., some manufacturing and retail will gain; as will services, transport, utilities will benefit form transition; coal and oil gas and supporting services will loose)
- Employment and businesses
 - Job losses in coal sector and oil as well informal charcoal (biomass) sector
 - Substantial public investment in transitionrelated technologies and education can help create substantial new employment, while greater social spending, can counteract negative income impacts

Exhibit 43 Socio-economic outlook in IRENA energy scenarios 2019-2050 for Africa

	2019	2030		2050		
		PES	1.5°C	PES	1.5°C	
Population (thousand)	1.065	1,3	352	1,947		
GDP (in 2019 USD trillion)	2.56	3.9	4.1	9.7	10.4	
GDP difference PES-1.5°C		5.	9%	7.19	%	
Overall net employment (million)	280	548	569	722	747	
Employment difference PES-1.5°C		3.8%		3.6%		
Energy sector jobs (million)	4.5	14.3	20	17.5	23	
- Renewables	0.36	0.9	4.3	2.3	8.1	

Environmental / economic

- Water, energy and land use
 - Impacts of large hydropower
 - Biomass for energy (discussion on dedicated crops vs residues for biofuel production)
- Air pollution
 - Transition to cleaner fuels implies less local pollutants
 - Transport, indoor biomass burning

Barriers or gap

Enabling lines of action

of action

Lack of transparent and accountable decision-making and capable institutions

High fossil fuel and tariff subsidies ('not-smart')

Build string national policy and regulatory frameworks

Social dialogue and stakeholder participation

High perceived risks for private investors

and financiers

Intra- and

interregional

coordination

Weak position of

SOEs/utilities

Insufficient integrated

energy enabling with

targets

Weak

regulation

Objectives

Low-carbon or net-zero transition

Universal access to reliable, sufficient and affordable energy

Low pollution and sustainable use of water, land, minerals, natural resources

Net economic growth and employment

Equitable distribution of costs and benefits between countries, regions and groups within countries

Make available a reliable and affordable energy infrastructure

Mobilization of public and private financing

International support and cooperation

High initial investment cost of renewable and new technologies

Insufficient regional

integration and

cooperation

Weak grids and

limited regional

integration

High investment

cost of energy

access

Lack of sufficient

Insufficient policy coordination with environmental, social and other economic/sectoral policies

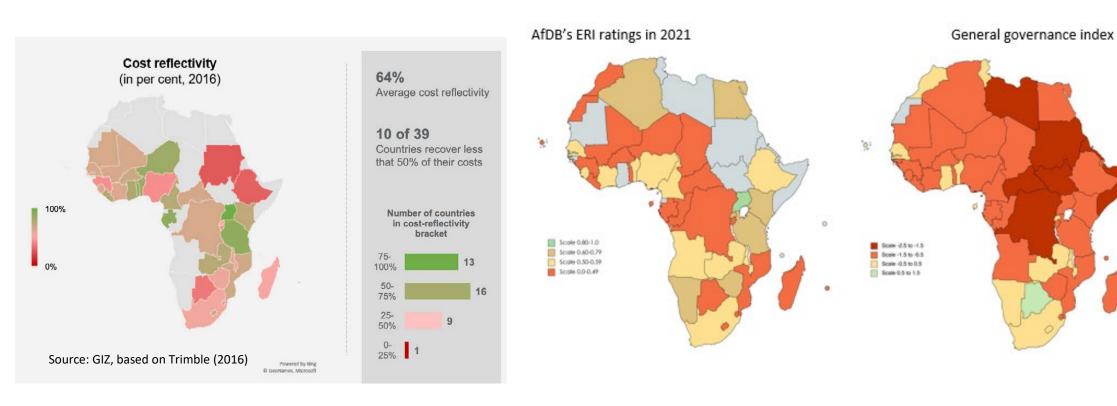
public funding

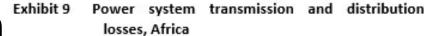
Lack of sufficient private investment and financing

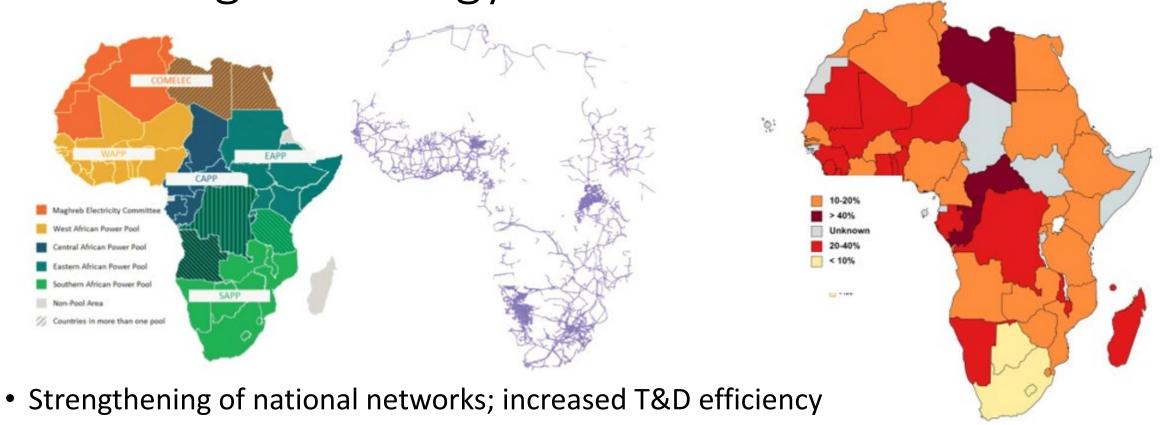
- Strong policy frameworks with targets and sound regulations
 - Targets for energy access, renewable energy, energy efficiency; greening the sector (phasing out coal, reduce oil dependence)
 - Integrated energy resources, supply and demand planning
 - Integrated on-grid and off-grid electrification planning; mini-grid and grid connection policy
 - Integration with other development policies (rural development, urban development, agriculture, mining, transport, etc.) and social policies (employment, income)
- Regulatory-legal-institutional framework
 - Financial sound management of energy sector; cost-reflective prices and tariffs
 - If subsidies are needed, these should be smart (e.g.; infrastructure rather than consumption; time-bound;)
 - Institutional setup (independent institutions and regulating agencies)

Enabling policies							Deployment policies							
Renewable		Energy eff.		Access		Grid		Regulations				Incentives		
NDC - RE target	National energy policy - RE target	NDC - EE target	National energy policy - EE target	Offgrid or RE electrification target	Clean cooking target	Cost-reflective power tariffs	Off-grid or RE network connection policy	Biofuel mandate	RE quota/mandates/ obligations	RE net-metering policies	RE feed-in tariff	RE auctions or tenders	Tax incentives	Financial support, subsidies, rebates

- Regulatory-legal-institutional framework
 - Financial sound management of energy sector; cost-reflective prices and tariffs
 - If subsidies are needed, these should be smart (e.g.; infrastructure rather than consumption; time-bound;)
 - Institutional setup (independent institutions and regulating agencies)

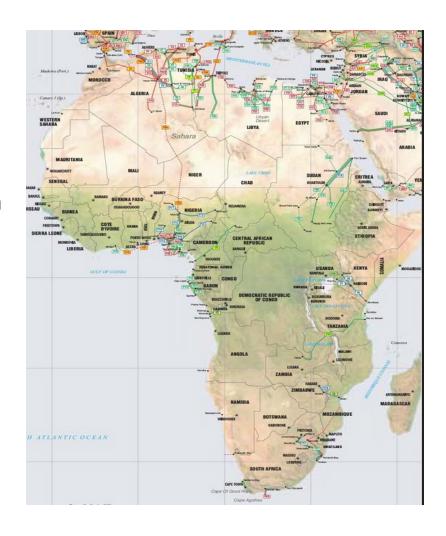


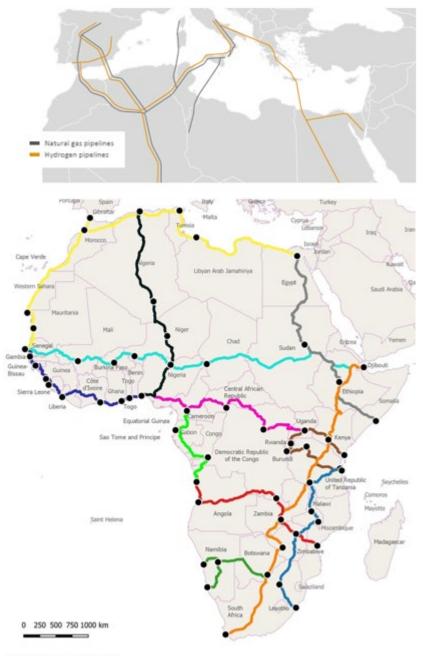




- Increase access by grid expansion and decentralized options (minigrids and stand-alone solutions)
- Pan-African and regional cooperation and cooperation
 - Grid integration and power pools with
 - Regional planning and cooperate to find adequate mix of variable renewables (solar, wind) with base load (hydropower, biomass, natural gas)

- Natural gas infrastructure
 - Gas networks not welldeveloped
 - Stranded asset in net-zero carbon world or investment?
 - Domestic or export?
- Future:
 - Conversion of networks for H₂ operation





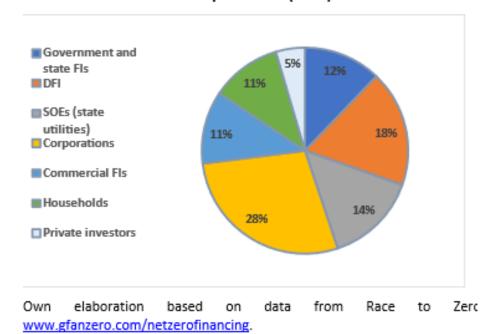
African hydrogen routes

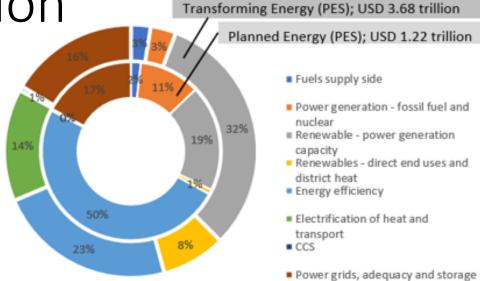
Exhibit 36 Energy investments in IRENA scenarios per technology and measure (2018-2050), Sub-Saharan Africa

5. Enabling the energy transition

Mobilisation of public and private financing

Exhibit 58 Financing of the energy sector investments in energy sector in Africa per source (2030)





Political and regulatory risks
Currency and financial market risk
Counterpart, contract enforcement risk
Power off-taker and grid risk
Returns uncertainity (production volume, resource risk,

liquidity risk, demand and price uncertainity)

Natural disaster risk Technology risks POLICY MEASURES AND INCENTIVES
Policy roadmaps with implementation target
Regulations and standards
Fiscal incentives
Transparent public procurement
Public-private partnerships
Capacity building

RISK MITGATION AND BLENDED FINANCE Government guarantees Currency risk hedging Export credit guarantees Partial risk/credit guarantees

Liquidity guarantees
Specialized insurance schemes
Aggregation and project bundling
Contract standardization
Blended finance

- International cooperation
 - Reducing fragmentation, increasing coherence and leveraging synergies between existing initiatives
 - Need for a new coordinated approach
- Time for an African Grean Deal Plan?



Source: AfDB, IRENA



- Learning from history:
 - Roosevelt's New Deal
 - Marshall Plan
 - EU Green Deal

Methodology and expected results

- Expand and enhance the research relating to sustainable energy transitions in Africa
 - by extensive literature review,
 - validating the empirical research (comparing results, data, arguments pro and con),
 - and examining illustrative country case studies
- Organize the data and regional profiles relating to the sources and use of energy demand and supply in Africa, including graphs with historical trends and future scenarios
 - Compare and summarise scenario work or organisations such as IRENA, IEA, AfDB, companies (BP, other), NGOs (Net-zero)
- Assess realistic alternatives for African countries that
 - highlight the continent's comparative advantage in attaining sustainable pathways for transition, in accordance with the 2030 SDGs and the AU's Agenda 2063.
 - Highlight investment needs and sustainable financing challenges as well as the role of public and private stakeholders, development partner
- For discussion: role of UNDP in just energy transition in general and in Africa

Case studies (In focus)

GAS IN AFRICA AND MOZAMBIQUE
 MINERALS, ENERGY AND POVERTY IN DR CONGO
 JOBS, COAL AND THE JUST ENERGY TRANSITION IN SOUTH AFRICA
 RURAL ELECTRIFICATION IN ZAMBIA AND NIGERIA
 AMBITIOUS GOALS: CABO VERDE BECOMING 100% RENEWABLE ENERGY
 RENEWABLE ENERGY IPP PROCUREMENT PROGRAM, SOUTH AFRICA
 USE OF LPG FOR COOKING IN NIGERIA AND GHANA
 SUBSIDY REFORM IN MOROCCO AND EGYPT
 POWER SECTOR REFORM AND PUBLIC-PRIVATE PARTNERSHIPS IN UGANDA