Developing Africa Energy Interconnection to Promote the Co-development of Electricity, Mining, Metallurgy, Manufacturing and Trade

Global Energy Interconnection

Development and Cooperation Organization

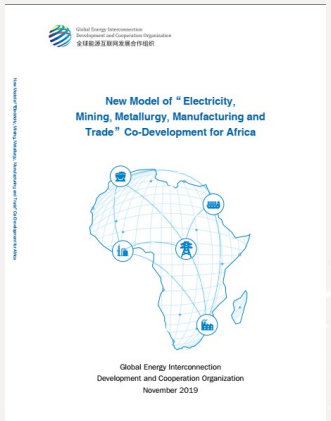
June 2024

1. GEIDCO's Research Works on Africa

GEIDCO is an international organization dedicated to promoting the sustainable development of energy worldwide. Since the establishment in 2016, we have carried out studies focusing on the key issues of Africa's economic & social and energy & power development, such as **African Energy Interconnection**, the **co-development model** of "electricity-mining-metallurgy-industry-trade", the research on **African renewable energy development and investment**, and the **development and delivery of hydropower in the Congo River**, and published a series of research reports in multiple languages.

Currently, we are continuing to optimize and deepen our research, particularly on systematic solutions of building African Energy Interconnection to achieve **carbon neutrality**, accelerate the **development of clean energy**, and improve the **accessibility of electricity**.

2018.09



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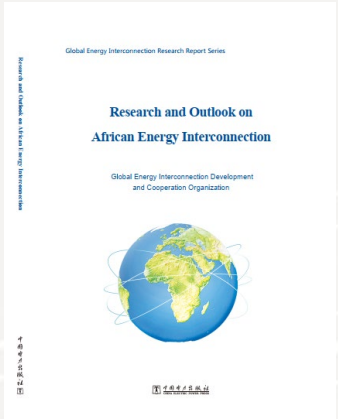

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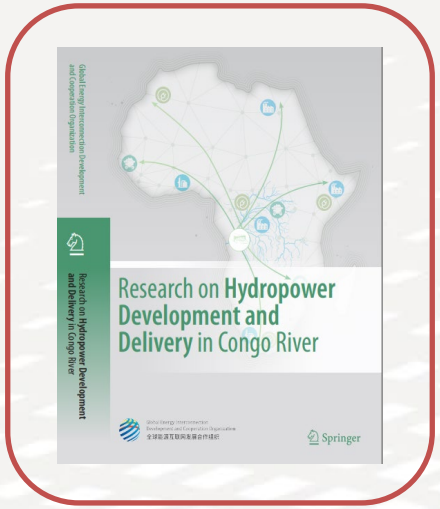

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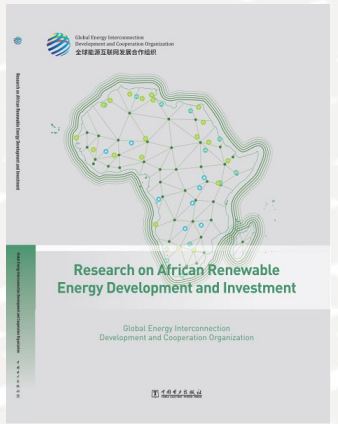


2020.7

More Information on www.geidco.org.cn, https://www.geidcp.com/#/, https://africa-energy-portal.org/

2. Enormous Potential of Africa's Sustainable Development

Outstanding Human Resource Advantages

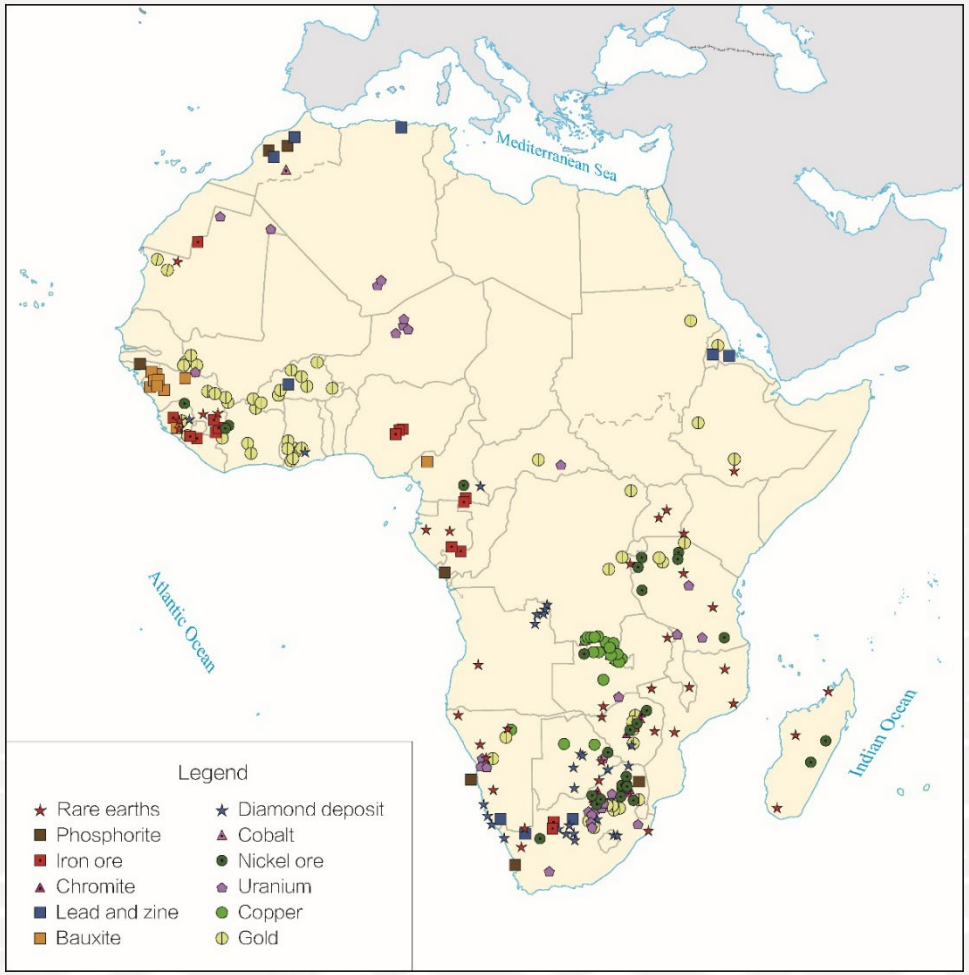
In 2050, the population will reach 2.5 billion, of which the labor force will exceed 1.5 billion. With the rapid development of education and medical care, the quality of the labor force will continue improving.

Increasing Regional Cooperation

The AfCFTA will greatly strengthen the economic ties within the continent, and China-Africa Cooperation will further release Africa's economic development potential.

Abundant Natural Resources

Rich mineral reserves and clean energy resources will facilitate Africa transforming its resource advantages into development advantages.



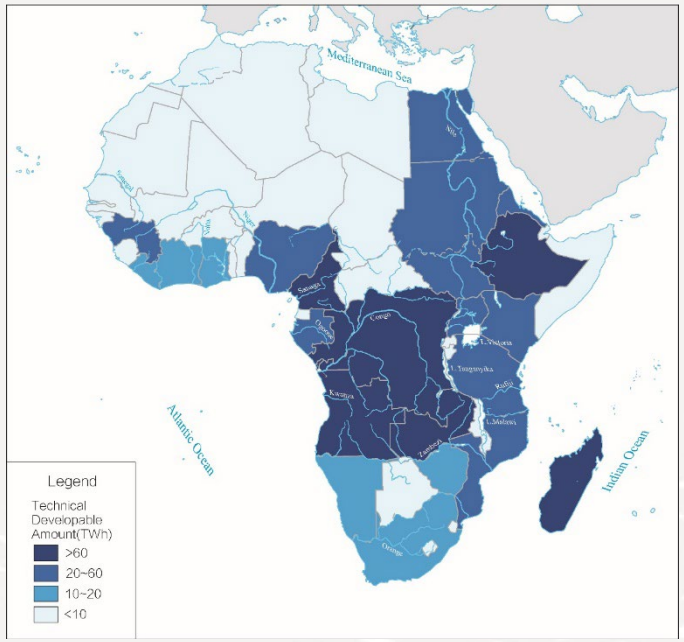
Distribution of African Mineral Resources

Data Source: UN

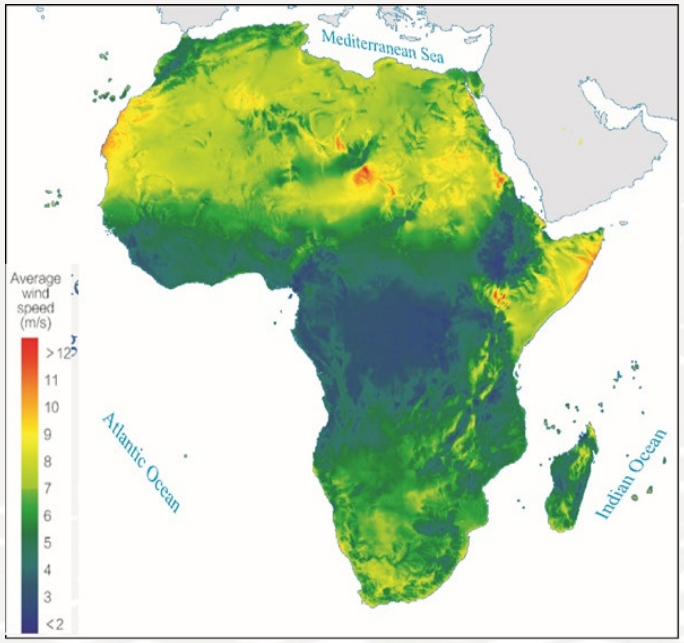
3. Endowment of Africa's Clean Energy Resources

Africa's clean energy resources are rich in total amount and diverse in types. The theoretical reserves of **hydro, wind and solar energy** account for 13%, 18% and 30% of the world's total. It is the continent with the greatest potential for clean energy development in the world.

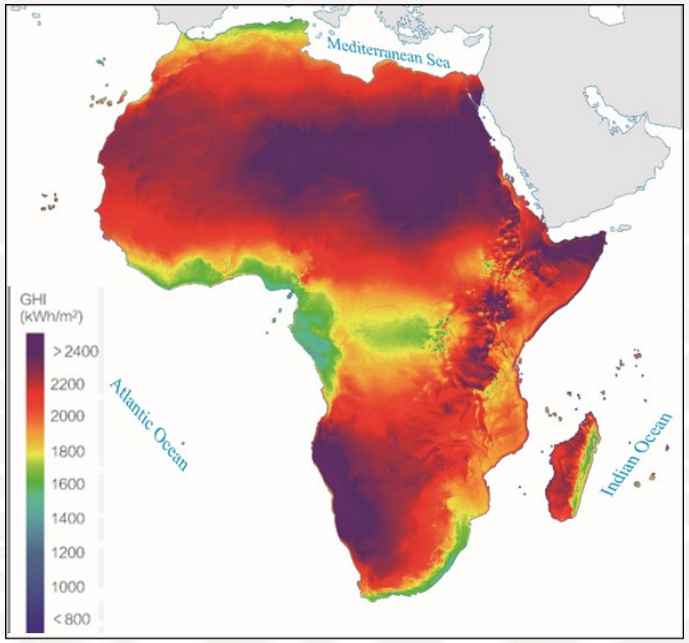
- **Hydro:** Theoretical reserves of ***5.7*** PWh, mainly located in the Congo, Nile, Niger river basin.
- **Wind:** Theoretical reserves of ***366*** PWh, mainly located in the Sahara and northern Mediterranean coast.
- **Solar:** Theoretical reserves of ***64000*** PWh, mainly located in the the Sahara and along the Atlantic coast of southern Africa.



Distribution of hydro energy in Africa



Distribution of average wind speed in Africa



Distribution of GHI in Africa

4. Development Style of Africa's Clean Energy

Combine **centralized** and **distributed** development, make full use of the complementary characteristics of hydro, wind, solar across time and space, to realize large-scale development and efficient utilization.

Centralized Development

The centralized development and wide-range allocation of clean energy can meet the electricity demand in population concentrated areas, reduce electricity costs, supporting the development of industrialization and urbanization.

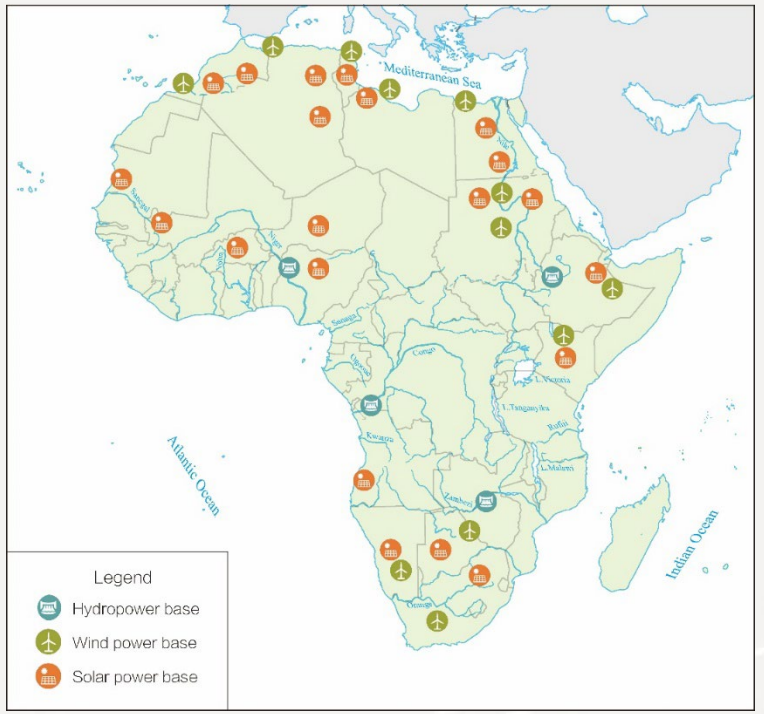


Diagram of large-scale clean energy power generation base in Africa

Distributed Development

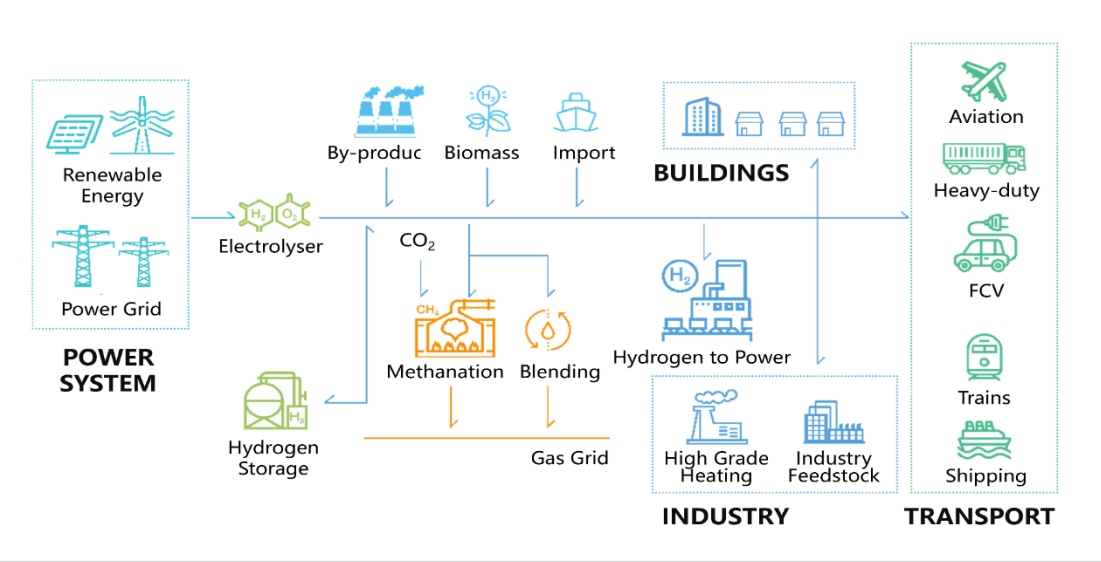
Distributed development of clean energy such as small hydropower, rooftop PV, and biomass cogeneration, according to local conditions can meet residential electricity consumption and rapidly increase electricity access.

China's practice of Agricultural and fishing complementary PV

5. Green Hydrogen in Africa

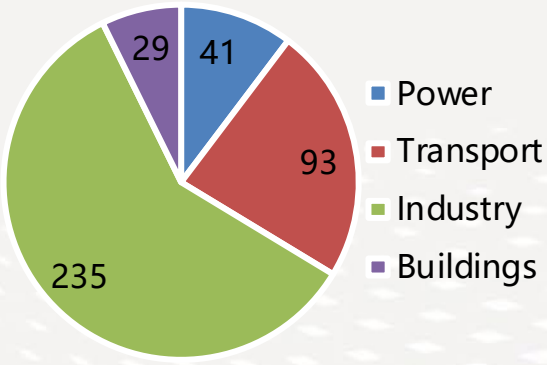
Global Energy Interconnection Development and Cooperation Organization
全球能源互联网发展合作组织

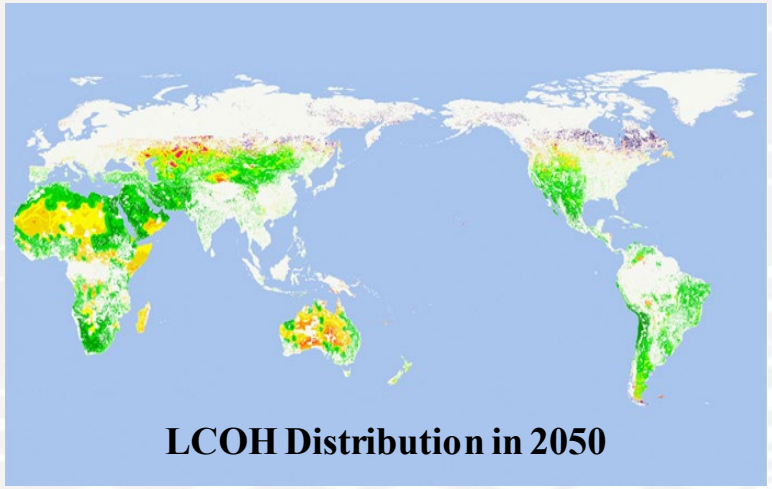
Green hydrogen is the key link between renewable energy and end-users.



《The Development and outlook of Green Hydrogen》

Hydrogen Demand Forecast In 2050（Mton）



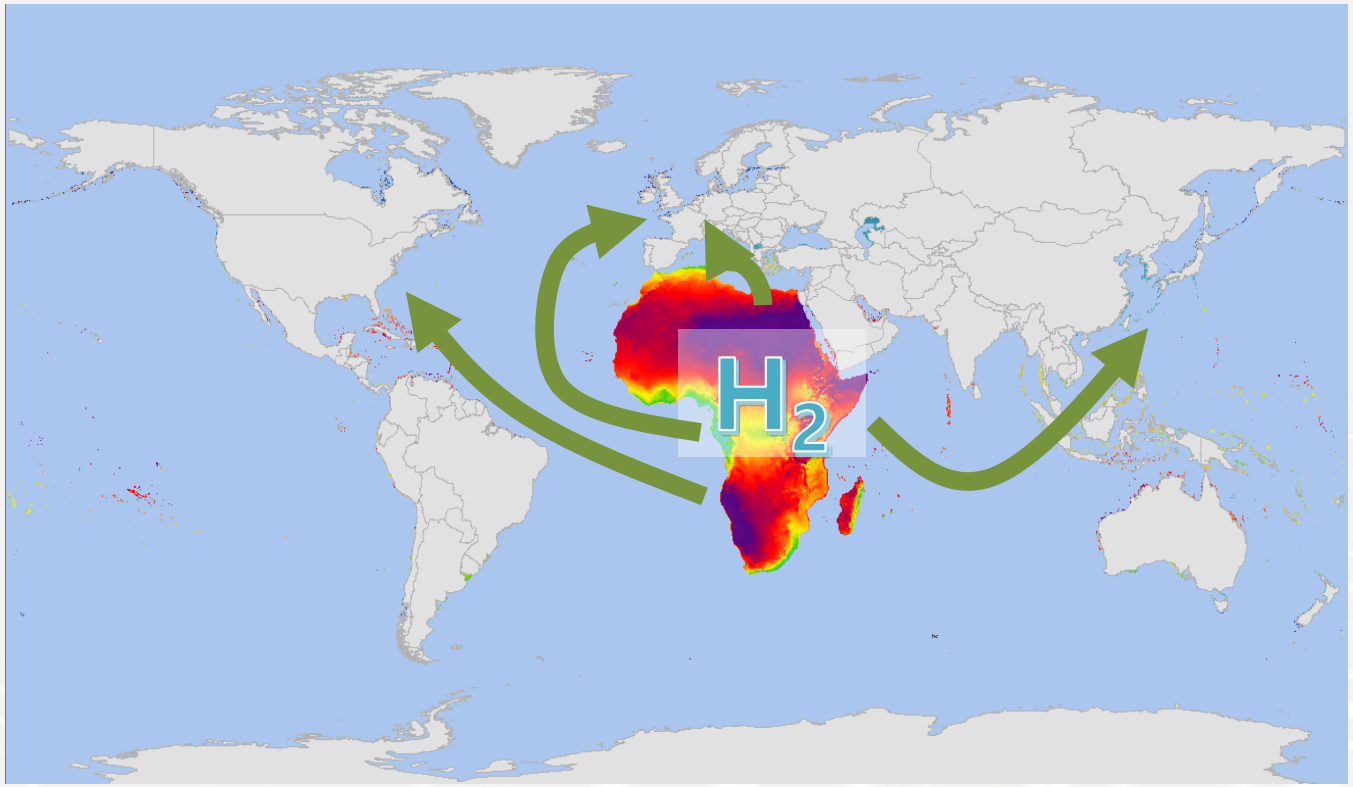


LCOH Distribution in 2050

5. Green Hydrogen in Africa

Opportunities for green hydrogen development in Africa.

- Promoting renewable energy development and global energy transformation
- Creating new industrial chains and increasing employment opportunities



		2025	2030
Hydrogen by **Inga hydro**	Hydro Power LCOE（cent/kWh）	3.2	2.6
	Electrolytic efficiency	70%	75%
	Electrolysis CAPEX（$/kW）	500	400
	Shipping Cost ($/kg)	2	2
	C. I. F European Main Ports ($/kg)	**4.2**	**3.8**
Hydrogen by Europe Offshore Wind	LCOH ($/kg)	5.3	4.1

Economic analysis of hydrogen production by Inga hydropower

6. African Energy Interconnection

Coordinate the development of power generation and grids, to build the African Energy Interconnection (AEI) with characteristics of safe, efficient, flexible and intelligent.

- **Building Interconnected Grids across the African Continent.** African power flow pattern will be "Central exporting power to North and Southern Africa within the continent, and realizing mutual complementation with Asia and Europe". Inter-regional and inter-continental interconnection will be built among the synchronous power grids of power pools.
- **Strengthen T&D Grids in African Countries.** While building a strong transmission grids, accelerate the construction and upgrading of distribution grids, and improve reliability, intelligence and economy. Develop micro grids based on distributed sources and energy storage in remote areas.
- **Huge Comprehensive Benefits.** By 2050, the total investment of AEI, including power sources and grids, will reach 3.2 trillion USD, contributing about 2.1 percent of Africa‘s economic growth annually.

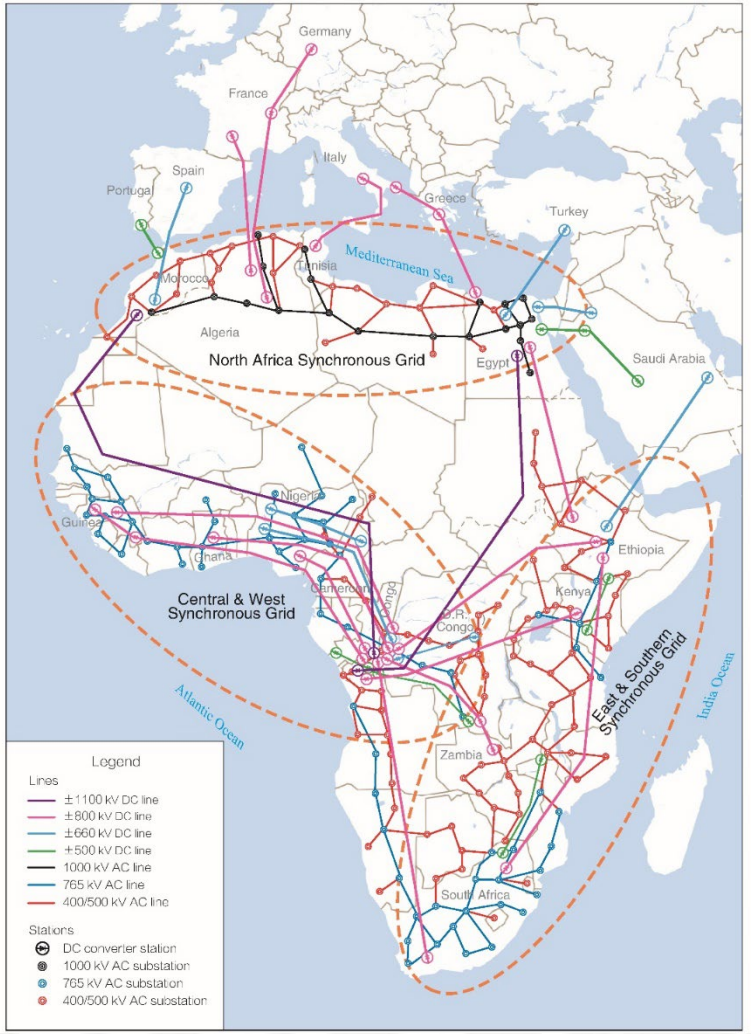
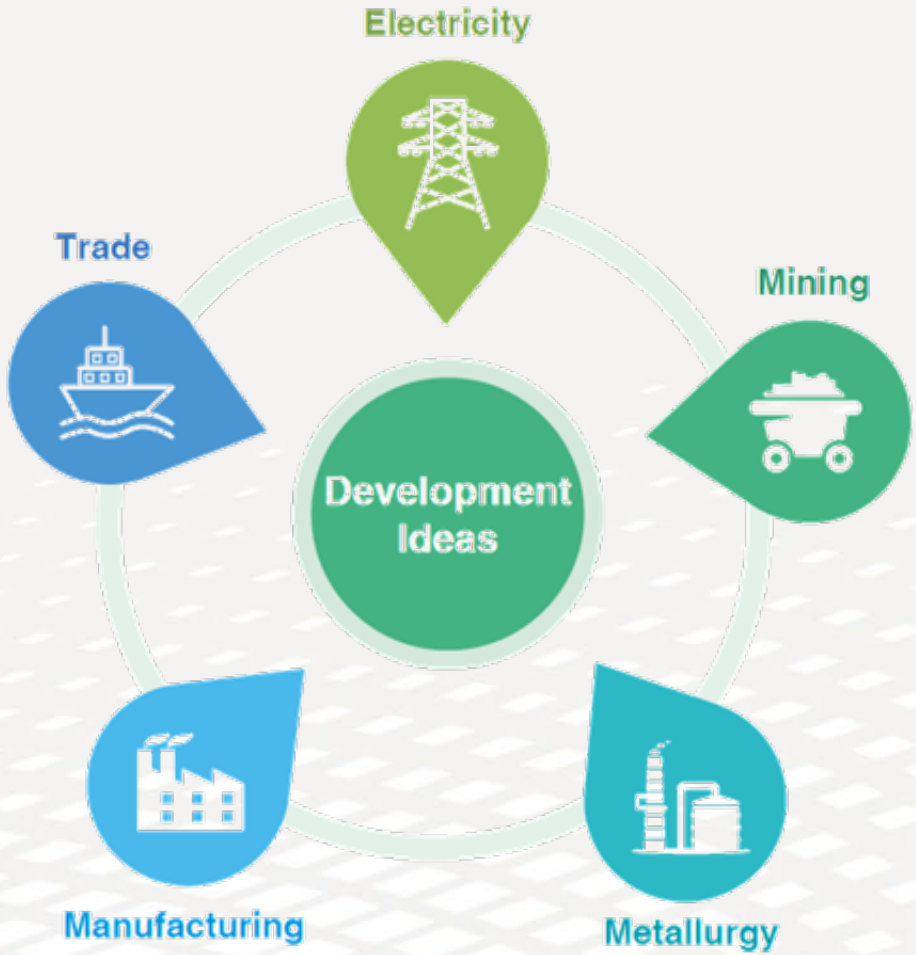


Illustration of African power grid interconnection

7. Electricity, Mining, Metallurgy, Manufacturing and Trade Co-Development

The establishment of AEI will drive innovation in business models and development paths. **The "Electricity, Mining, Metallurgy, Manufacturing and Trade" Co-Development** is an effective way and important carrier for the implementation of AEI.

"Electricity, Mining, Metallurgy, Manufacturing and Trade" Co-Development Model: Leveraging Africa's rich, high-quality clean energy and mineral resources, the model proposes accelerated development of large clean energy bases, advocates grid interconnection at the cross-border, cross-regional and intercontinental level, promotes large-scale exploitation and allocation of clean energy resources, along with their efficient consumption, and forges an industrial chain featuring coordinated development of electricity, mining, metallurgy, manufacturing and trade. Via adoption of this model, Africa will foster a virtuous cycle of "investment-development production-export-reinvestment", boosting high-quality economic growth, securing increased economic benefit, and thus embarking on the path of sustainable development.



7. Electricity, Mining, Metallurgy, Manufacturing and Trade Co-Development

The co-development of electricity, mining, metallurgy, manufacturing and trade will effectively tackle such difficulties as the lack of electricity in industrial development, the lack of markets in power development, the lack of credit in project financing and the lack of guarantee of investment returns. In the meantime, it will comprehensively boost the appeal of African countries' infrastructure projects to international capital and multinational corporations, radically change the paths of energy and economic development, and advance coordinated sustainable economic, social and environmental development.

Electricity — With electricity as its core, the model seeks to develop clean power and grid interconnection.

Mining — The model proposes leveraging resource advantages to promote the large-scale exploitation and use of mineral resources.

Metallurgy — The value of mineral resources would be enhanced to build comparative advantage in modern metallurgy.

Manufacturing — The model would speed up the construction of modern industrial parks, and forge pillar industries and advantaged industry.

Trade — The model seeks synergistic development of trade and industry, shifting from trade in raw materials towards trade in manufactured goods, expanding international trade and promoting Africa's economic prosperity.

7. Electricity, Mining, Metallurgy, Manufacturing and Trade Co-Development

At the continental level, five regional economic zones will be formed, namely, **Gulf of Guinea Economic Belt, Eastern Economic Circle, Congo River Economic Circle, Southern Economic Circle and the Mediterranean Sea Economic Belt.**

Create a common rise of Africa.

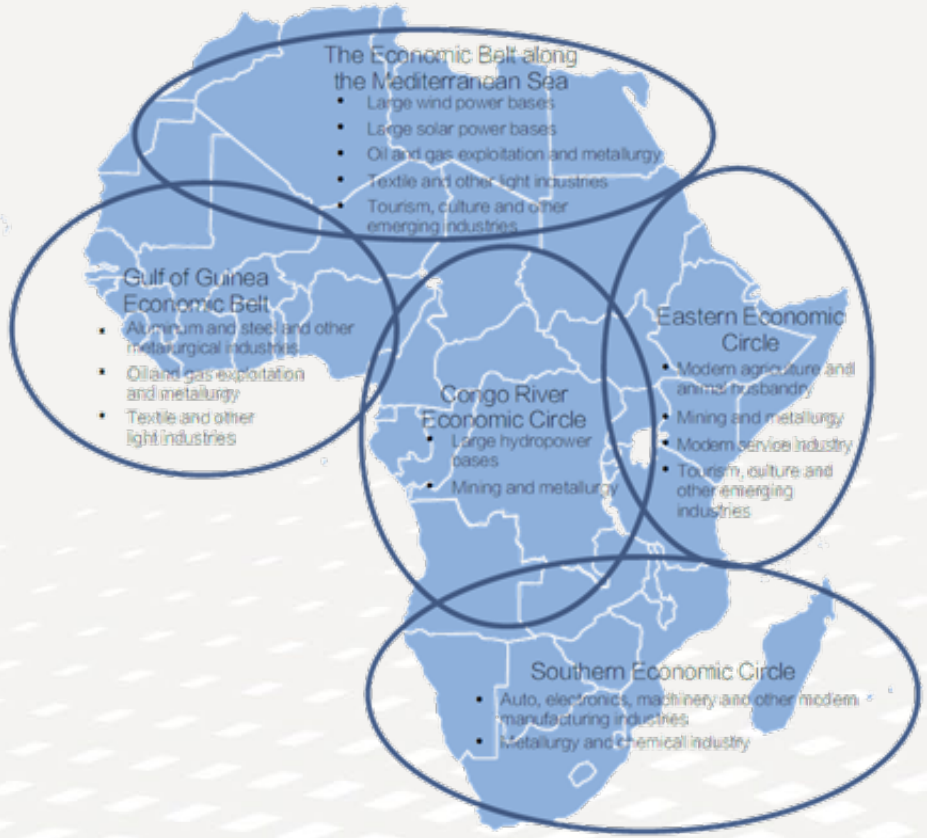
Forming a fast, convenient and safe trade channels among African countries and regions, providing more opportunities for industry cultivation, market expansion and economic development.

Prioritizing metallurgical industry and manufacturing.

In each economic circle, a group of modern industrial central cities will be formed to cultivate globally competitive raw material bases, metallurgical industries, and processing and manufacturing clusters.

Building industrial parks.

Relying on leading enterprises and major projects with high relevance and strong driving function, the model will focus on creating a number of mining and metallurgy processing demonstration industrial parks, form advantageous industrial clusters and innovative development pilot zones, and attract investment demonstration zones.



Paths for Co-development of Electricity, Mining, Metallurgy, Manufacturing and Trade in Africa

7. Electricity, Mining, Metallurgy, Manufacturing and Trade Co-Development

The co-development of electricity, mining, metallurgy, manufacturing and trade would advance the improvement and upgrading of industry, drive economic growth, promote social progress, improve the ecological environment, enhance political mutual trust and generate a wide range of enormous benefits.

Annual output of mineral processing industries

will reach about

480 billion USD

1 Driving economic growth

The co-development model will promote the development of new energy, electricity, mining, refining and machining industries, and forge a new engine for Africa economic growth. By 2050, the total annual output value of electrolytic aluminum, steel, other metallurgy and processing industries would exceed 480 billion USD , total annual export value exceeding USD 100 billion.

Promote employment

by accumulatively

100 million jobs by 2050

2 Creating new jobs

Adoption of the model would boost the development of clean energy, power generation, grid construction, new materials, minerals and metallurgy, equipment manufacturing and information technology, creating more than 100 million jobs in total by 2050.

Accessibility of electricity

will reach

100% in 2050

3 Achieving full electricity coverage

By 2035, the power access rate in Africa would be raised to above 90%, with everyone gaining access to electricity by 2050.

8. Ethiopia-Kenya ±500 kV HVDC Interconnection Project

The roughly 1000 km long HVDC transmission system, known as the Ethiopia-Kenya ±500 kV HVDC Interconnection Project, transmits environmentally friendly hydroelectricity (2000 MW) from Ethiopia to Kenya. Furthermore the HVDC link will improve the exchange of energy between the two countries and optimize the use of distributed energy resources in this region.

- **Project Owner:** Ethiopian Electric Power Corporation (EEPCO) and Kenya Electricity Transmission Co. Ltd. (KETRACO).
- **Commissioning Date:** November 2022.
- **Feasibility Study / Project Management / Supervision:** Tractebel - eNGie.
- **Finance:** World Bank and African Development Bank Group, USD 450 million.
- **Converter Station:** Siemens Energy.
- **EPC:** China Electric Power Equipment and Technology (CET) in Ethiopia, KEC International Limited (KEC) in Kenya.

Converter Station

Lineman on a bundle conductor of the line during construction in Ethiopia

HVDC Corridor

Accelerating the construction of the African Energy Interconnection will effectively guarantee clean, reliable and cheap energy supply for Africa, promote electrification, industrialization, cleanliness and integration. Realizing co-development of "Electricity-Mining-Metallurgy-Manufacturing-Trade" will transform Africa's resource advantages into economic advantages, fundamentally change the way of energy and economic development, and help Africa achieve sustainable development.

Thank you.