Team Name: Lalten(#146)

- **Mentor:** Mr. Brent Bennett (United States)
- **Selected Country**: Democratic Republic of Congo
- **Home Country:** India

- **Team Members:**
  Sri Kalyan Tangirala
  Abhinav Pratap Singh
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Democratic Republic of the Congo

The Richest Country in the World?

Google

richest country in the world drc

All | News | Images | Maps | Shopping | More | Settings | Tools

About 38,30,000 results (0.70 seconds)

Democratic Republic of Congo

The Democratic Republic of Congo is widely considered to be the richest country in the world regarding natural resources; its untapped deposits of raw minerals are estimated to be worth in excess of **U.S.** $24 trillion.

globaledge.msu.edu › countries › economy

Democratic Republic of the Congo: Economy >> globalEDGE ...

https://www.google.com/

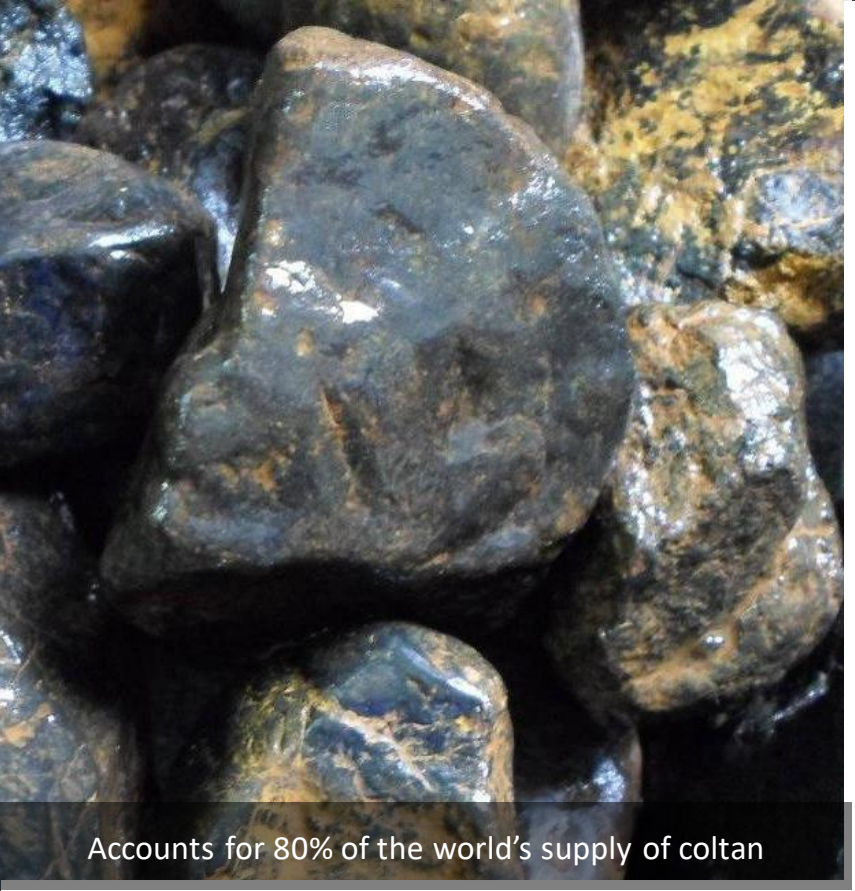
Hydro energy that can power half of the entire African continent.

https://in.reuters.com/article/congo-democratic-dam/after-lost-decades-hopes-rise-for-congo-dam-to-power-africa

Strong equatorial irradiation for unlimited solar energy

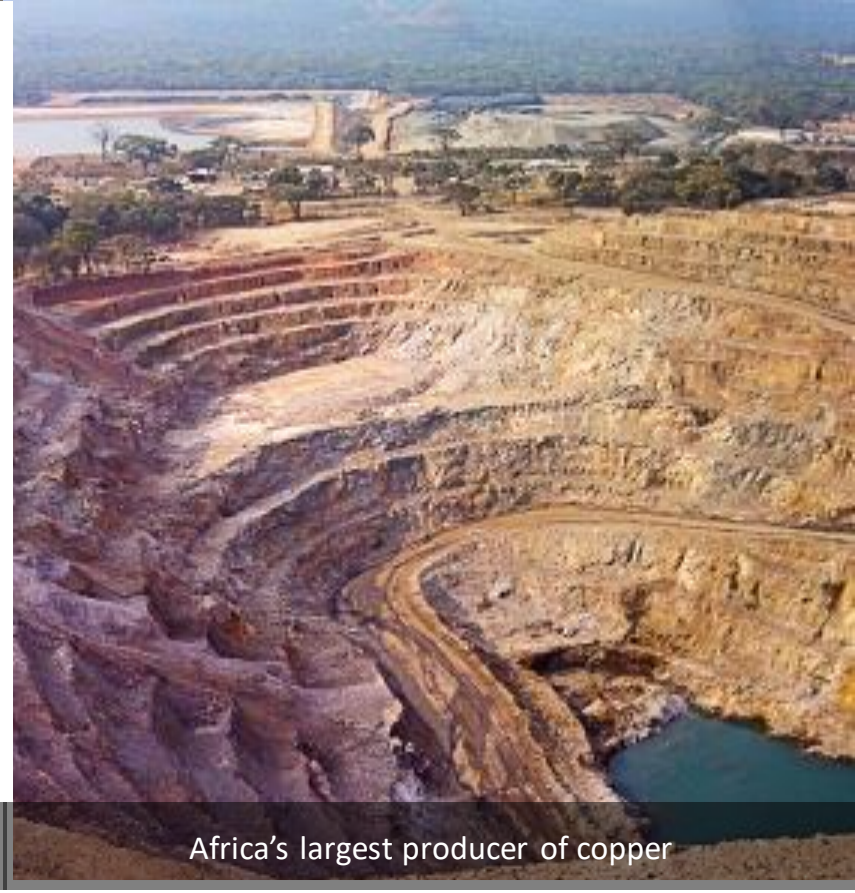
Promising Geothermal Energy

Image Courtesy: https://www.thinkgeoenergy.com



Accounts for 80% of the world's supply of coltan

DRC holds 60% of the world's cobalt reserves



Africa's largest producer of copper

Minerals

https://en.wikipedia.org/wiki/Mining_industry_of_the_Democratic_Republic_of_the_Congo

154 million hectares of forest in the DRC – 2nd largest in World

One of the most diverse forest resources in the world

https://en.wikipedia.org/wiki/Mining_industry_of_the_Democratic_Republic_of_the_Congo

But **what** makes the richest country in the world one of the poorest countries in the world?

Rampant deforestation for charcoal and firewood collection

- The DRC loses around **400,000 hectares of forest cover annually**, leading to a complete destruction of one of the **world's largest carbon sinks.**

https://www.researchgate.net/publication/293762235_The_electricity_supply_industry_in_the_Democratic_Republic_of_the_Congo

Exploitative mining practices, mismanagement and illegal smuggling of the mineral riches of the DRC like cobalt, copper and coltan has severely hurt its economy

https://www.raconteur.net/corporate-social-responsibility/cobalt-mining-human-rights/

More than 97% of DRC's hydropower potential is completely unutilized

Maximum potential: 100,000 MW
Installed Potential: 2472 MW

https://www.hydropower.org/country-profiles/democratic-republic-of-the-congo

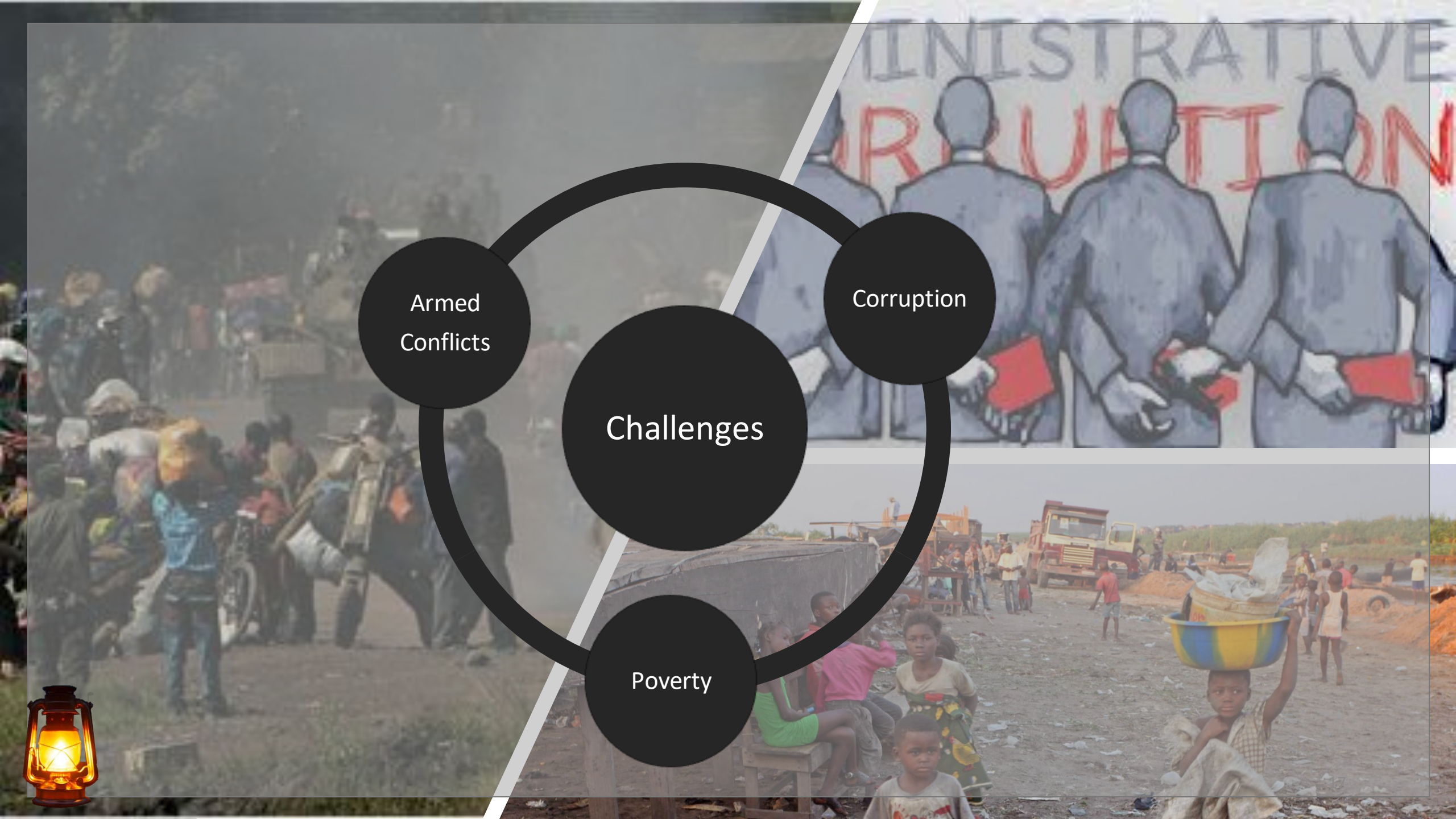
More than 97% of DRC's solar power potential is completely unutilized

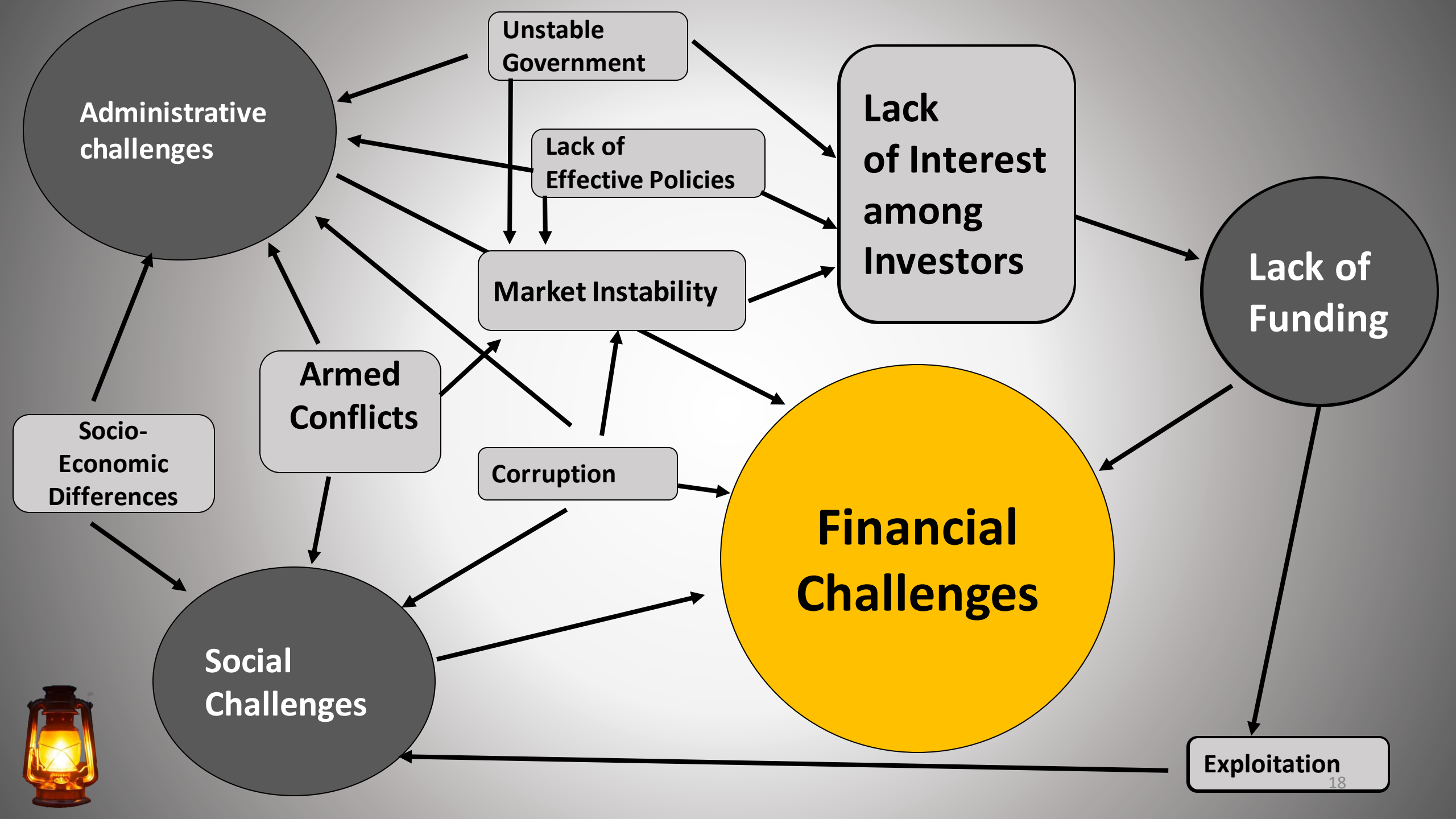
Estimated potential: 85,000 MW
Installed potential: 2500 MW

https://www.internationalrivers.org/wp-content/uploads/sites/

But what makes the richest country in the world one of the poorest countries in the world?

Answer: Lack of Energy Access


Armed Conflicts
Corruption
Challenges
Poverty

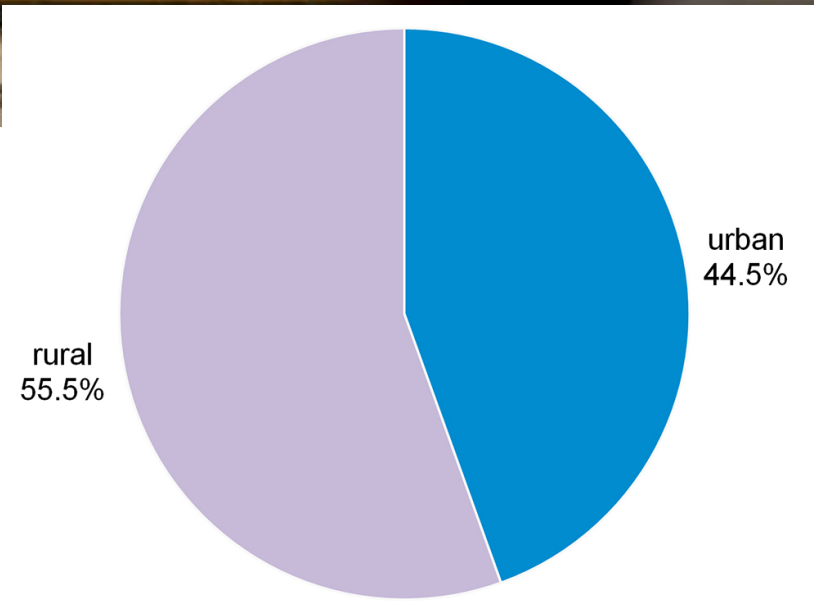

Unstable Government
Administrative challenges
Lack of Effective Policies
Lack of Interest among Investors
Lack of Funding
Market Instability
Armed Conflicts
Socio-Economic Differences
Corruption
Financial Challenges
Social Challenges
Exploitation

Administrative Challenges:

- Ineffective government
- Lack of any solid policy to eradicate energy poverty
- Huge political instability
- Mismanagement of Resources

Social & Cultural Challenges:

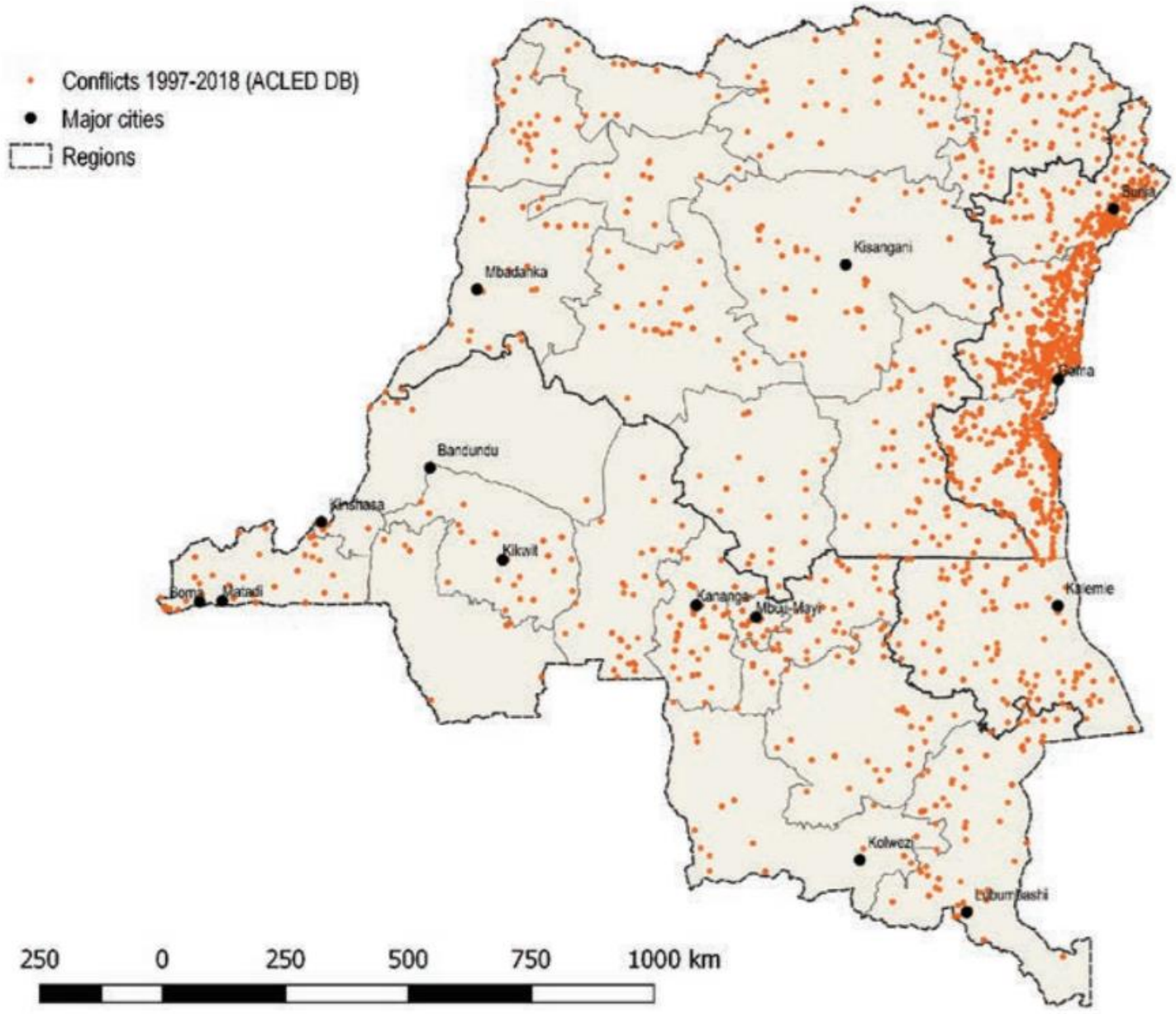
- Ridden with armed conflicts
- One of the biggest levels of internal migration in the world.
- Geopolitics leads to rift between provinces
- High levels of corruption



Congo, Democratic Republic of the urban-rural (2018)

https://www.britannica.com/place/Democratic-Republic-of-the-Congo/Resources-and-power

MAP 10 • Location of conflicts between 1997 and 2018



Source: ACLED, authors https://openknowledge.worldbank.org/handle

Financial Challenges

- Market instability due to Political rifts ,Corruption, and Armed Conflicts
- Why would an investor take interest in investing in DRC's resources?
- Can we incentivize or restructure policies to promote foreign investments?

Image Courtesy: https://www.google.com/imgres?imgurl=enhancing-regional-integration-in-africa-toward-an-african-economic-community

Our Proposed Solution

Based on the four pillars of **affordability, scalability, security and reliability**

The **Core Ideas behind** the framework of our solution:

- Decentralization
- Step by step incrementation
- Inspiration from other Developing Sub-Sahara nations
- Addressed policy direction
- Investments and Collaborative environment.

Energy Solutions: **Improving Energy Access(**2020-2030)

Solar Energy

- Least-Cost Household Distribution in Grid and Off-Grid Areas for Current Population
- Renewable
- Low maintenance cost
- Easily available geographically in DRC
- Useful for powering residences & small-scale establishments.
- **OFF GRID Solution**

Disadvantages:

- Weather-Dependent.
- No baseload power for industrial use.

Image Courtesy: https://www.theneweconomy.com/energy/schneider-electric

Micro-Hydropower Plants:

- DRC has several rapids and river systems from the Congo basin that can be easily tapped.
- Low capital cost
- Low O&M cost
- Mature technology
- High life expectancy
- For powering residential areas & medium-sized businesses.
- Has the capacity to take on more electric load than solar.

Image courtesy: https://www.toshiba-clip.com/en/detail/p=232

Rehabilitating Large Hydropower

- Inga 1 and 2 dams were built in 1972 and 1982. Ideally, they should provide about 1770 MW to the country. But rehabilitation of the two dams is still ongoing and today they only generate 1 000 MW.
- DRC familiar with installation
- Viable for large scale industries.
- Mighty Congo

Disadvantage

- Poor maintenance

Image courtesy: https://constructionreviewonline.com/2019/11/angola-to-buy-5000mw-from-congos-grand-inga-hydropower-plant/

- At least 80% rate of electrification in the DRC
- Per-Capita electricity consumption of about 250 KWh. (Current Per-capita electricity consumption for USA is around 12000 KWh.)
- Affordable and reliable electricity access in the focused regions.
- Establishment of a dedicated Rural Electrification Agency.
- Significant capital generated from the economic growth to invest into more ambitious power projects for achieving energy security.

Targets to be achieved by 2030

Energy Solutions: Establishing **Energy Security**(2030-2040)

Image courtesy: https://www.imb.org/image/night-lights/

Geothermal Energy

- **Inspiration from Kenya National Electrification Policy:**
- Geothermal represents more than 40 per cent of electricity generated making Kenya one of the global leaders in the use of this low-cost renewable energy resource
- Ambitious Project, capital intensive, requires political stability.
- DRC should follow in Kenya's footsteps to utilize Geothermal energy in all possible ways.
- The geothermal resources in the DRC are completely untapped.

Building Hydropower for Africa

- **Investment in the ambitious Grand Inga Dam, the biggest hydropower plant in the world.**
- Funding from African investors who would be the future beneficiary of the project. E.g.: Angola, South Africa, Tanzania etc.
- Highly ambitious Project, capital intensive, requires political stability and will-power.
- Giant leap for establishing DRC's Energy security.
- No Geopolitical conflicts since the Congo river lies entirely in the DRC.
-

Image courtesy: https://www.britannica.com/place/Inga-Falls

- 100% rate of electrification in the DRC.
- Per-Capita Electricity consumption of about 1000 KWh.
- Electric grids and transmission lines constructed in the remote areas of DRC.
- Affordable and reliable electricity access in the majority of the regions.
- Power generation from Geothermal and Nuclear powerplants to establish energy security.
- Grand Inga dam to become a major source of external revenue for the DRC's power sector.

Targets to be achieved by 2040

Sustainability

- Since all the previously suggested energy solutions are renewable, DRC would be in line with UN's sustainability development goals.
- Although DRC has a lot of fossil fuel reserves-
- It has so much renewable energy potential that they can power half of the entire African continent with it.
- Therefore we propose that renewable energy should be the driving factor for improving DRC's energy access.

Solution : Financial Aspects

Investment Plans

Crowd Funding

Generate & Sell your own power.

Empowerment & Consequential benefits from the Mining & Mineral sector.

Crowd Funding (Decentralized Investing)

- An amalgamation of Philanthropy and Profitability.
- Minimized Risks (Divided losses)
- Established platforms like Trine have already raised millions of Euros.
- Several other platforms can be incentivized through lucrative returns.

Reference: https://trine.com/

Generate & Sell your own power.

- For small scale projects like micro hydropower plants and off grid solar.
- Local businesses or associations of local businesses can be allowed to bid on potential projects and then use them to grow their businesses and even extract economic benefit by selling the generated power to nearby customers or other businesses.
- These businesses will be incentivized to maintain the power plants as it would be essential for their growth as well as for reaping profits from selling as much power as they can.

Revitalization of the Mining Sector

- Establishing an Association of the major players involved in the DRC's mining sector. (Like the **OPEC)**
- The Association would be responsible for reducing worker exploitation, illegal smuggling and maintaining an equitable work environment.
- It shall also be responsible for setting regulatory frameworks to ensure profitable and sustainable operation of the mining industry.
- The economic benefit reaped from the revitalization of the mining sector can then be utilized to fuel the energy sector.
- A synergy would be created between the mining and the energy sector in the DRC. Growth in one would complement the other.
- Prioritize the demands of the local population before exporting products outside.

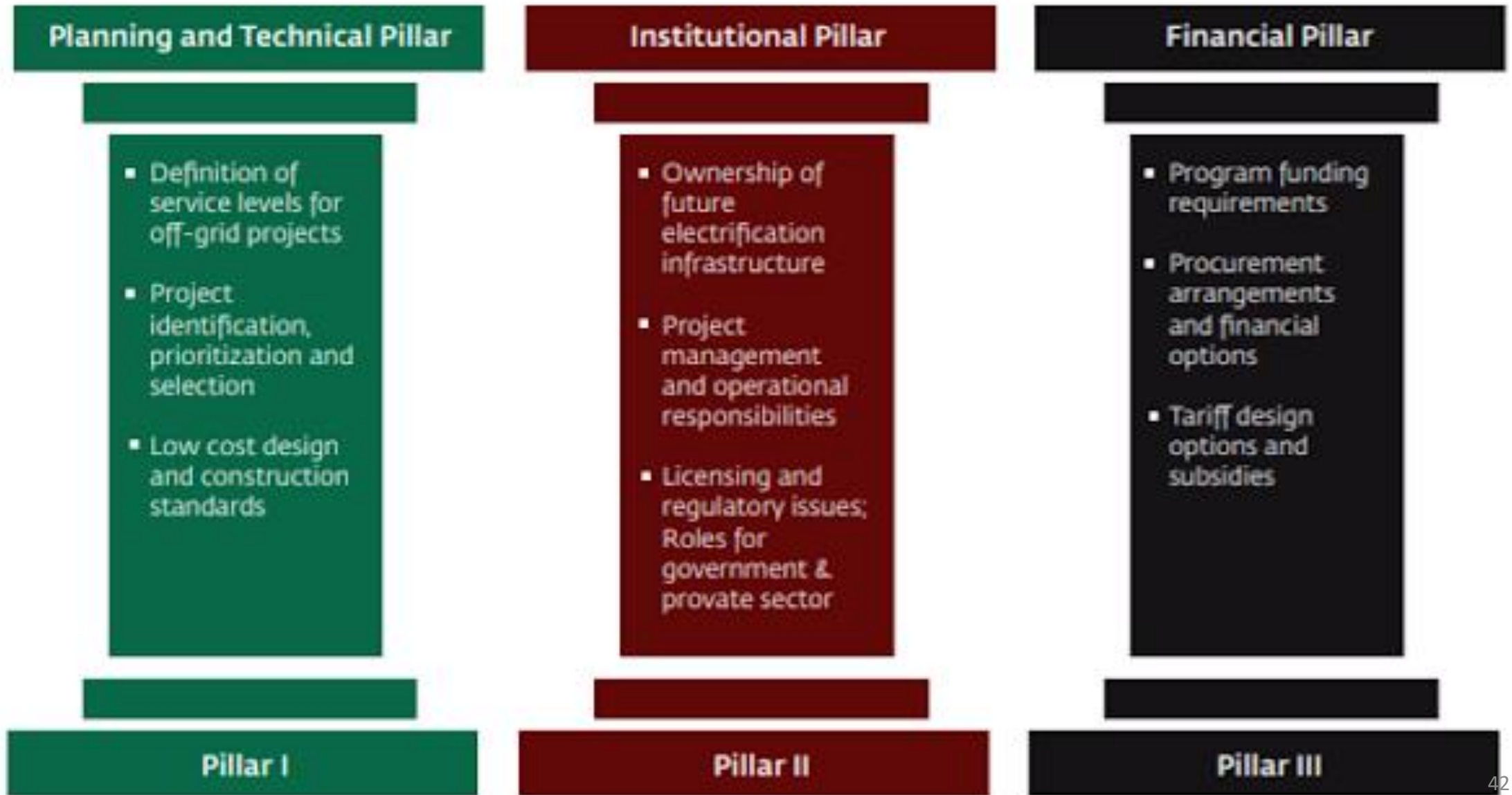
Solution: Implementation

Kenya's Example [2]

- 75% of the Kenya's population has access to electricity. The following are the reasons why they could make it happen:
- Kenya's systematic planning and on point implementation is the reason why more of its citizens are getting affordable energy year after year.
- The following 2 slides show the key strategic elements of the Kenya National Electrification Strategy and how the roles are distributed among various institutions- both government and private in order to make sure that their goals are reached.
- These strategies are not country-specific and can be implemented by DRC to uplift majority of its population from energy poverty.
- The table which specifies roles of various institutions was taken from '**Kenya National Electrification Strategy: Key Highlights 2018**' report and has been edited to make it more relevant to DRC's resources.

http://pubdocs.worldbank.org/en/Kenya-National-Electrification-Strategy-KNES-Key-Highlights-2018.pdf

Figure 4: Pillars and Strategic Elements of the Kenya National Electrification Strategy



http://pubdocs.worldbank.org/en/Kenya-National-Electrification-Strategy-KNES-Key-Highlights-2018.pdf

Our suggested structure for DRC Energy Stakeholders [2]

Level	Institution	Role
Lead Institution	Ministry of Energy	Formulates policies; oversees sector planning, electrification of rural areas, and exploration of indigenous energy resources; promotes renewable energy development; and mobilizes financial resources for the public sector.
National Government	Energy Regulatory Commission	Regulates energy subsectors, protects consumer interests, ensures a reasonable return on investment for developers and utilities, oversees licensing, reviews and approves power purchase agreements, and reviews and approves tariffs.
	Rural Electrification Authority	Implements rural electrification through grid extension and off-grid projects, manages the Rural Electrification Fund, mobilizes funds to support rural electrification, finances project preparation studies for rural electrification, and recommends suitable policies to the government.
	An Electricity Generating Company	Develops and manages all public power generation facilities.
	A Power and Lighting Company	Transmits, distributes, and sells electricity to end users.
	An Electricity Transmission Company	Plans, designs, builds, and maintains electricity transmission lines and associated substations.
	A Hydropower Development Company	Fast-tracks development of Hydropower resources
Private Electricity Suppliers	Independent Power Producers	Provide large scale power(in terms of 100s of MW)
	Private Companies Involved in Off-Grid Solutions.	Provide mini-grids and standalone renewable energy systems like off grid solar power solutions
	Independent Entities	Energy Tribunal Arbitrates disputes between parties in the sector

http://pubdocs.worldbank.org/en/Kenya-National-Electrification-Strategy-KNES-Key-Highlights-2018.pdf

Collaboration of Government and private sector

- Considering the military unrests in various parts of the country, we propose that the Government of DRC should have a vested interest in the private industry.
- This boosts the confidence of the foreign investors to invest in building plants in the DRC.
- The Government can keep the military in check to make sure that the industries are not affected by armed conflicts.
- There has to be a clause in the MoU that whichever industry is established in the DRC- energy, minerals, etc. The first priority is to fulfil the demand of DRC and then export the rest of the oil or minerals.

Solution: Scalability

Approach

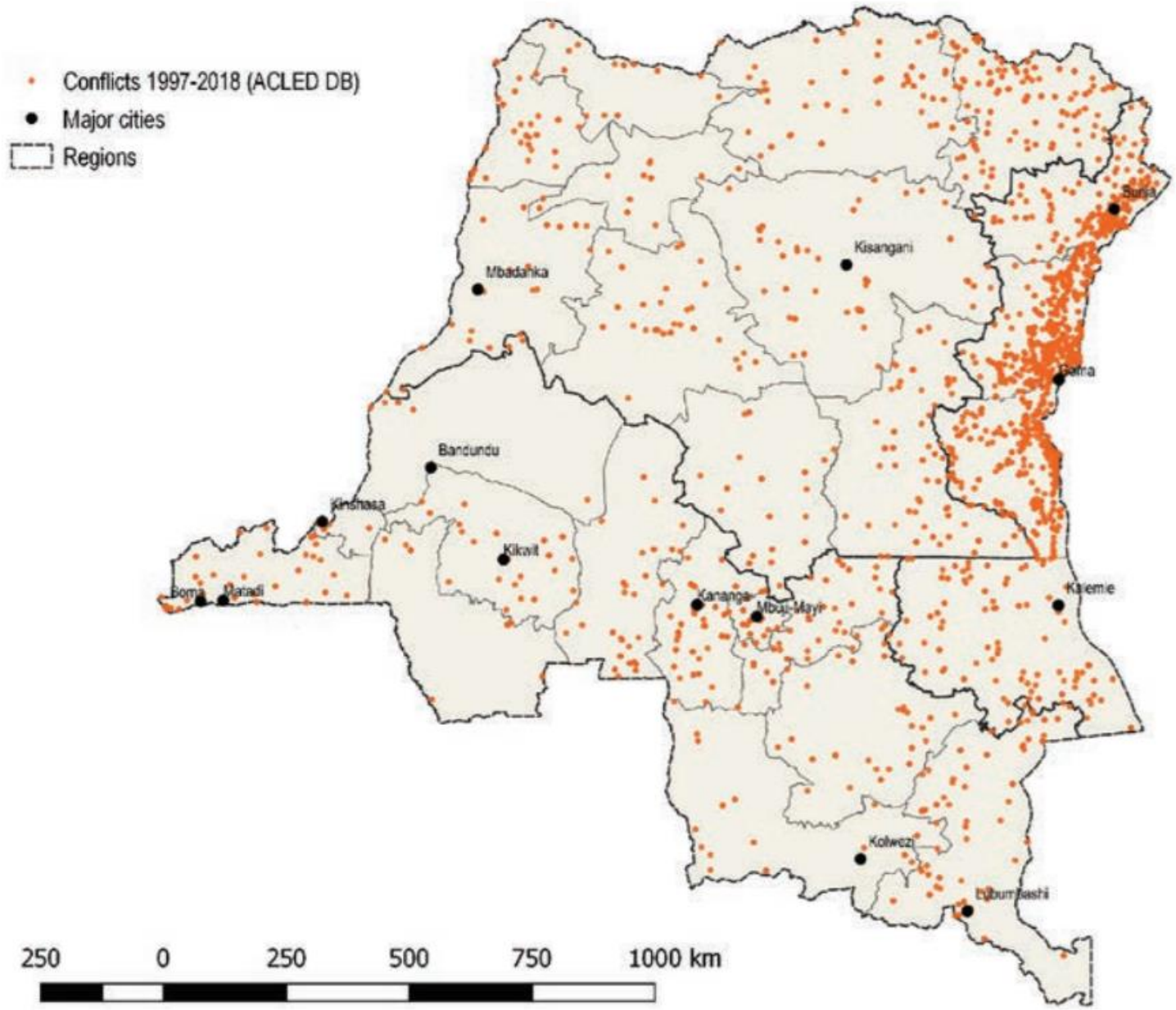
To solve the problem of energy access, we shall divide the DRC into four major parts:

- **Western DRC (includes Kinshasa and surrounding areas)**
- **Southern and South Central DRC (includes the Kasai provinces and Katanga region)**
- **Eastern DRC (Kivu provinces and surrounding regions)**
- **North and North-Western DRC**

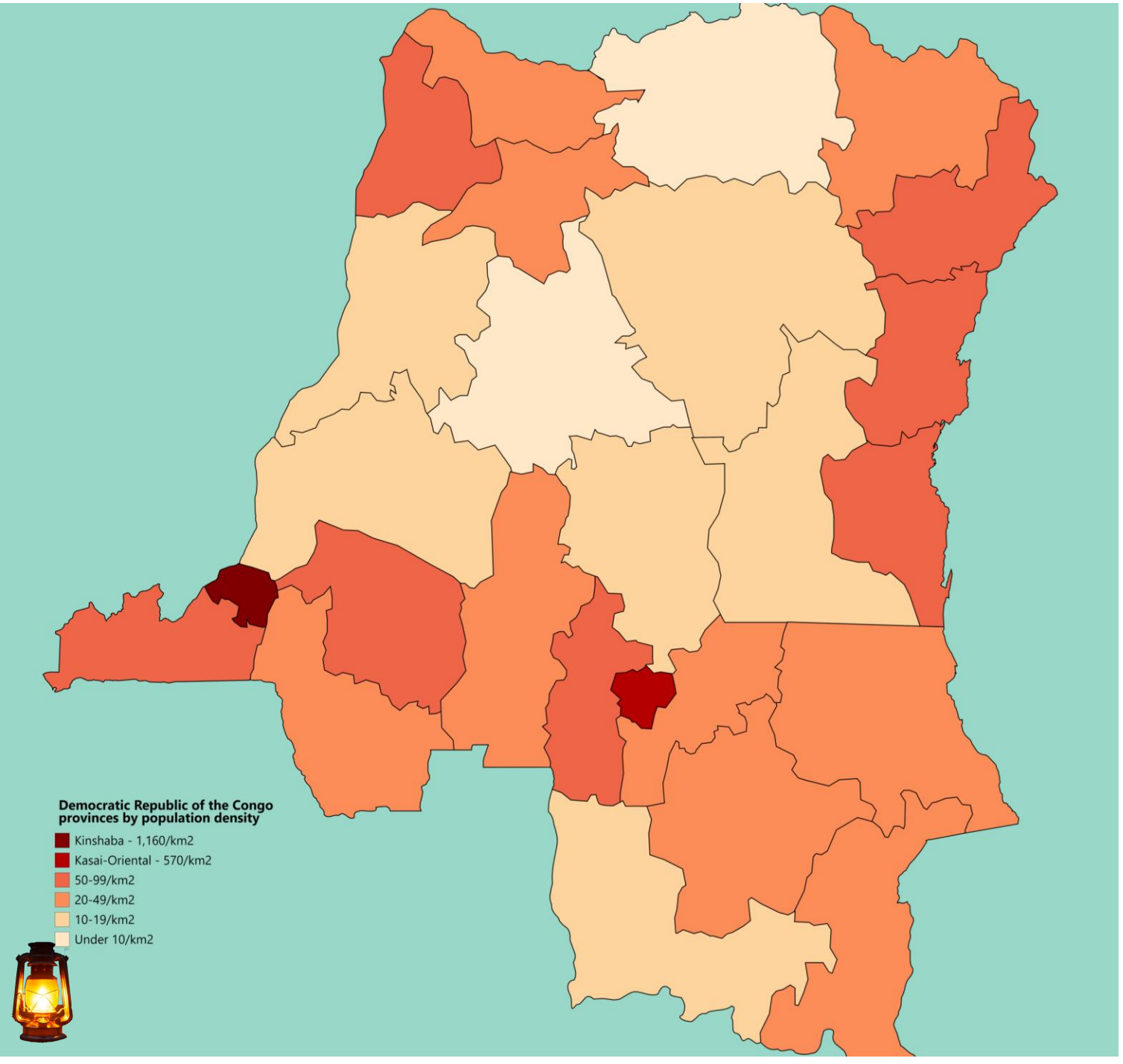
We made these divisions keeping in mind factors like **prevalence of armed conflicts**, **level of development**, **population density** and present condition of **electricity access.**

Which of these regions do we start with?

MAP 10 • Location of conflicts between 1997 and 2018 [6]



Source: ACLED, authors https://openknowledge.worldbank.org/handle



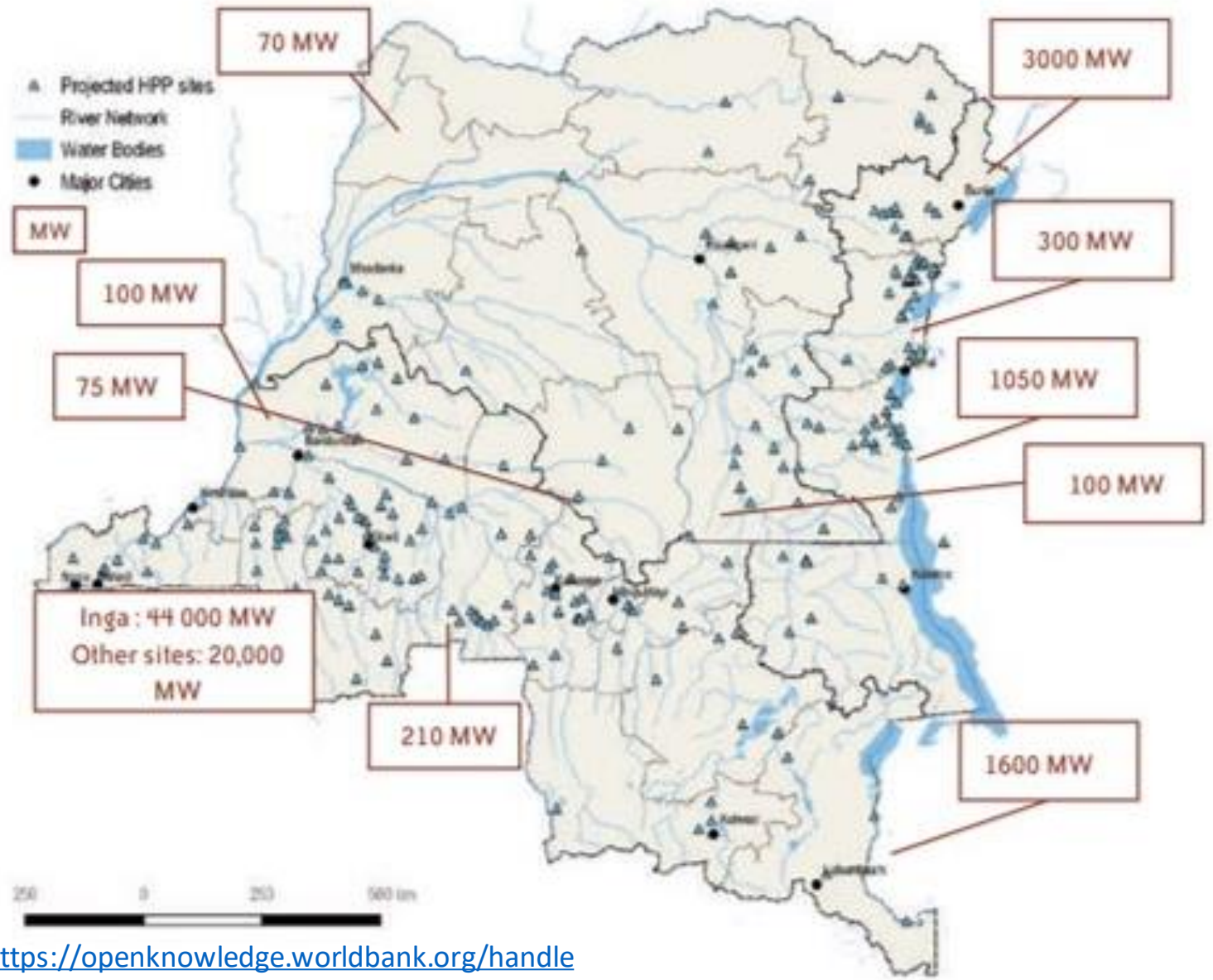
Democratic Republic of the Congo provinces by population density

Kinshaba - 1,160/km2
Kasai-Oriental - 570/km2
50-99/km2
20-49/km2
10-19/km2
Under 10/km2

Population Density Estimates in DRC (2018)[6]

https://openknowledge.worldbank.org/handle

Hydropower resource of DRC [6]



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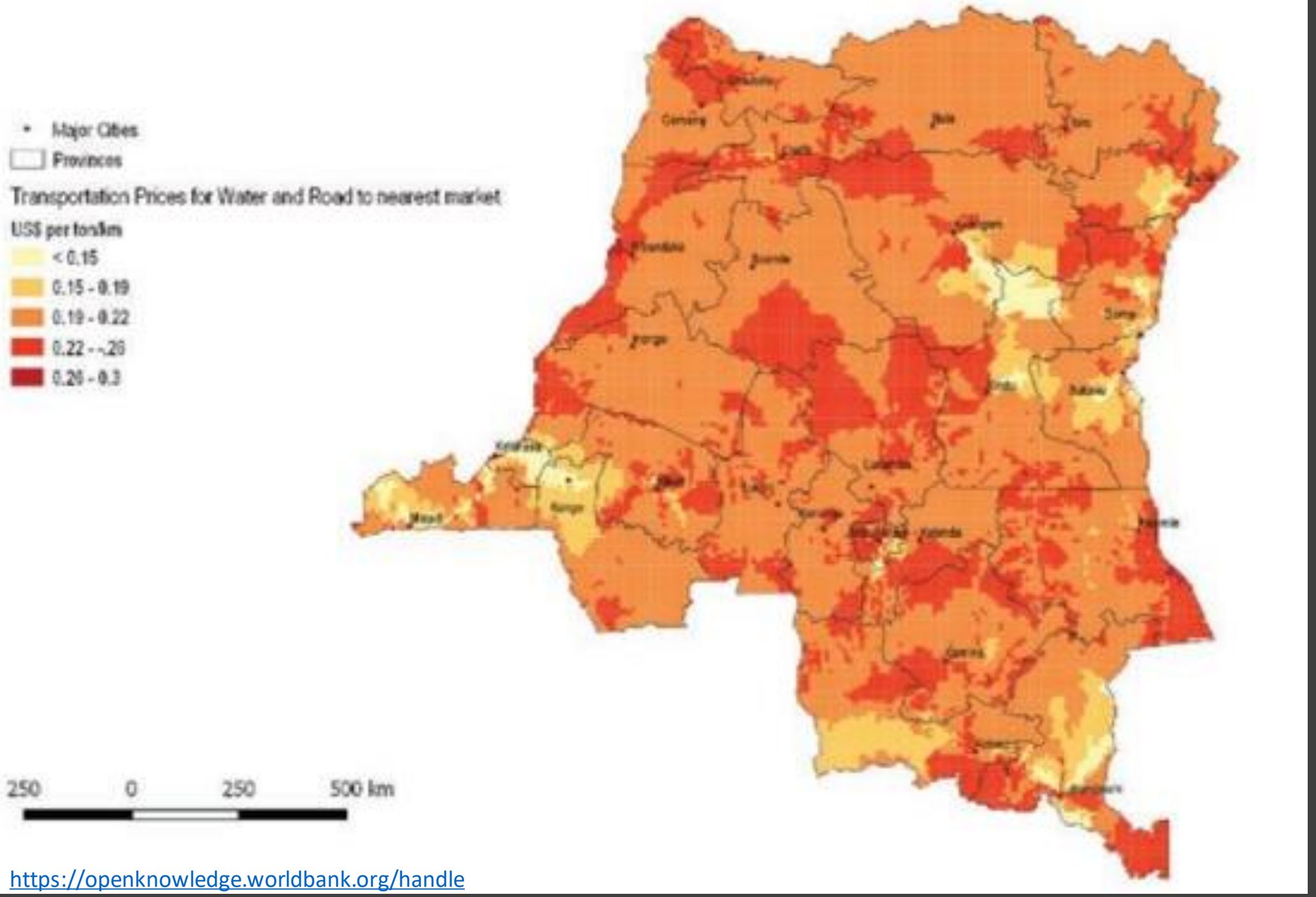
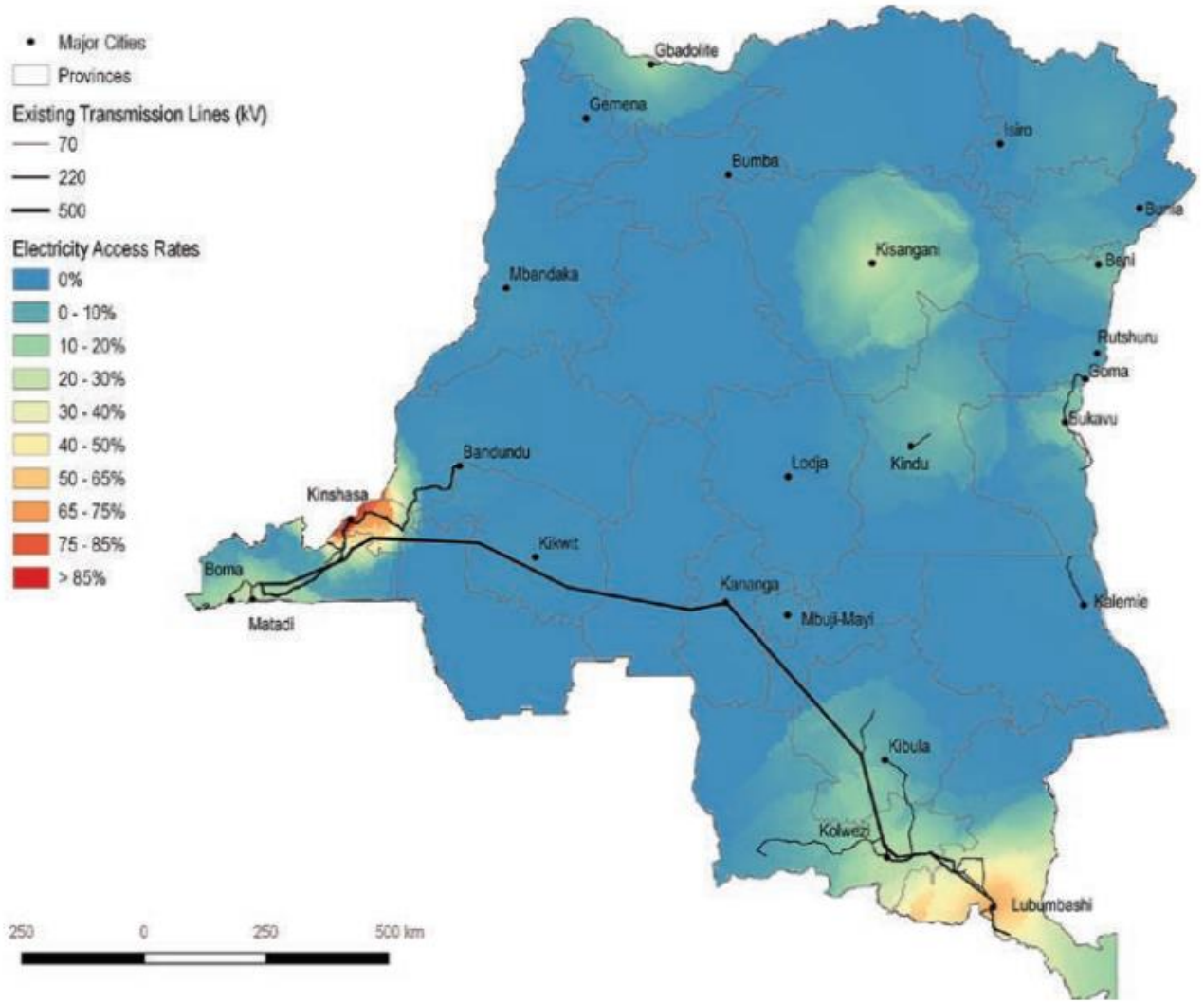


[6]

https://openknowledge.worldbank.org/handle

MAP 6 • Share of people with access to electricity in the DRC [6]



Source: DHS 2013–2014 https://openknowledge.worldbank.org/handle

Which of these regions do we start with?

Answer: Western & Southern DRC

Timeline

- For the first 10 odd years (2020-2030), we propose to focus our attention as well as resources in improving the energy access of the Western & Southern DRC.
- Both the western and southern regions are relatively developed and politically stable. The western region possesses excellent potential in solar and hydropower while the southern region is very rich in mineral resources.
- The development in both the regions will complement each other and the economic benefits obtained can then be invested in the eastern and northern DRC.
- For the next 10 years (2030-2040), the focus should shift on investing in improving energy access in the eastern & northern DRC. The economic growth in the southern and western regions must be utilized to reduce armed conflict in the eastern DRC and put it on a path of equitable development.
- A detailed version of the same is given in the next slide.

Timeline

2020 (Energy Access Improvement)

- Focus on **politically stable regions**. (**Western & Southern DRC**)
- **Decentralize** the means of **power generation**.
- Install **off-grid solar & Micro-hydro power projects.**
- **Revamp** the ailing **hydropower plants** to extract their maximum output.
- **Densify** the existing **transmission grids** to improve energy access and **reliability.**
- Aim to achieve **at least 80% electrification** with a **per-capita electricity consumption** of about **250KWh by 2030.**

2030 (Investing in ambitious projects & extending the economic benefits to Eastern DRC)

- **Revenue** generated from **economic growth** to be invested in **capital intensive energy projects** like **Geothermal** and **Nuclear. (Focused in Eastern DRC)**
- Planning and materialization of the **ambitious Grand Inga dam** to achieve **full hydropower potential**.
- **Expansion of existing power grids** and creation of **new transmission lines** into **remote areas**.

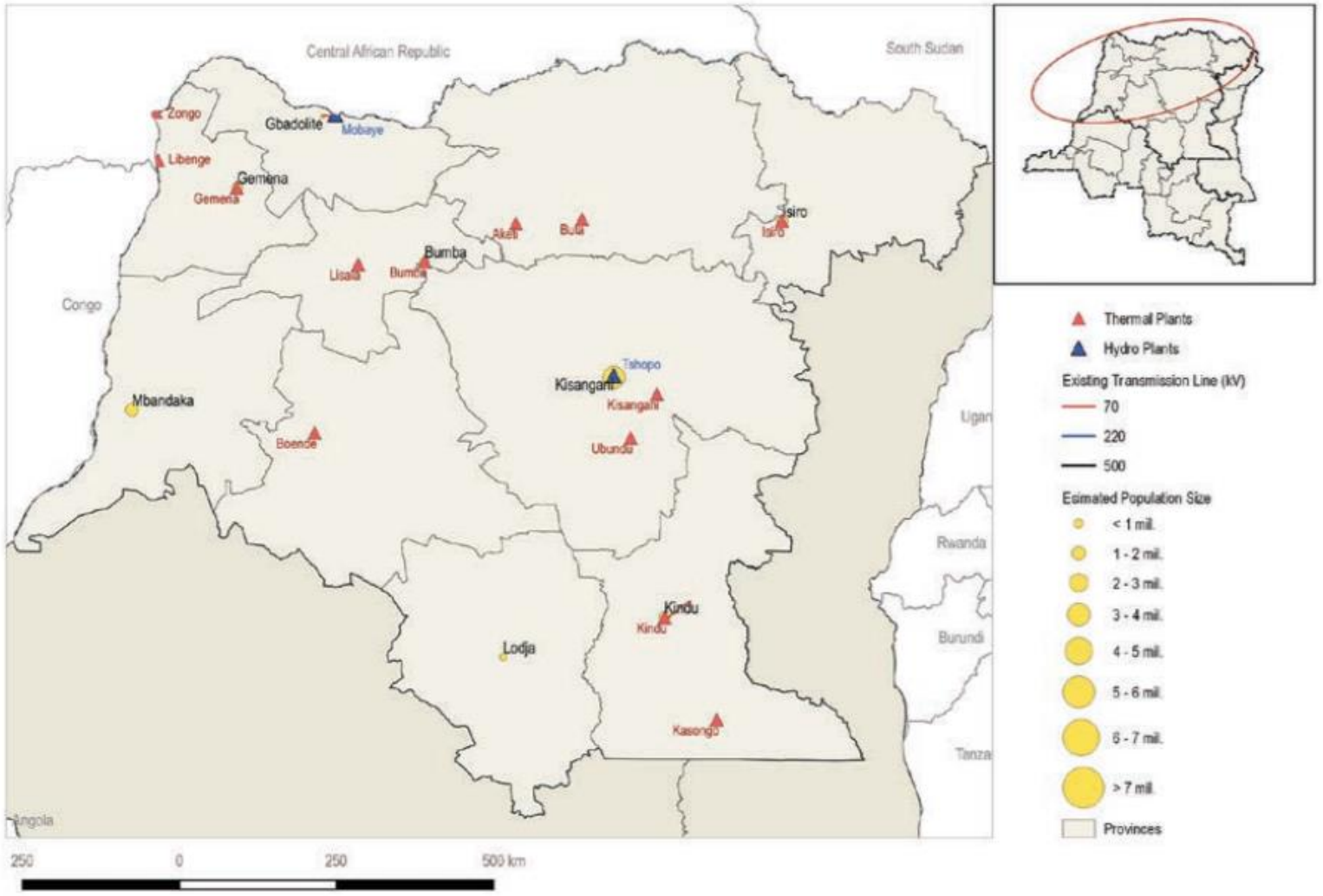
2035 (Establishing Energy Security)

- Bring **Geothermal** and **Nuclear power plants** into **fruition**.
- **Grand Inga Dam** to be **completed** and **electricity exported** to other parts of Africa.
- Final stage of **transmission lines constructed** and **each part** of the country **connected to the grid**.
- **Energy security** to be achieved by the DRC.

2040 (Attaining Energy Security)


Thank You!
Team Lalten

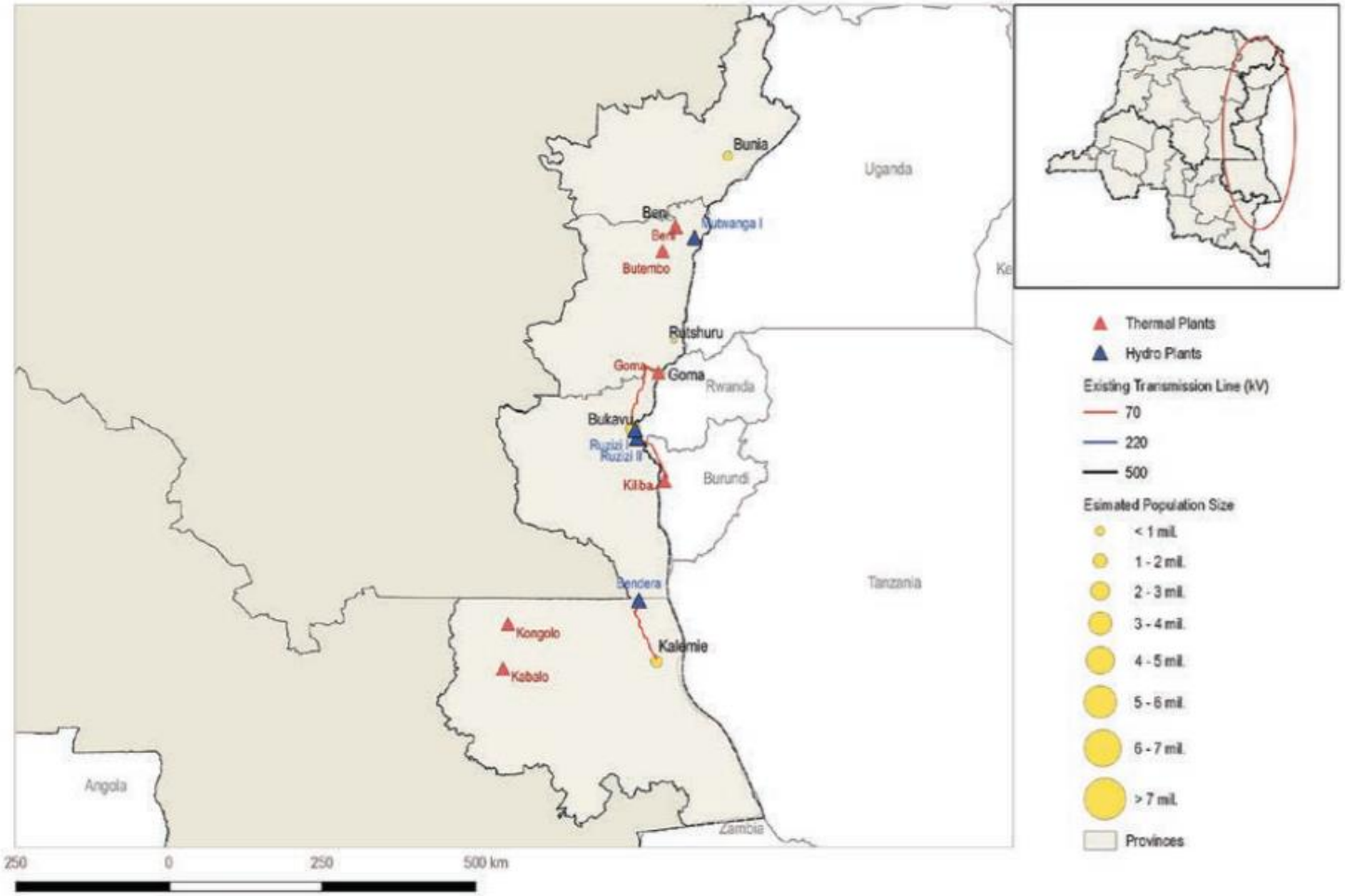
MAP 14 • Existing power system in the North-Central region



Source: WorldPop, Resource Matters, authors

https://openknowledge.worldbank.org/handle

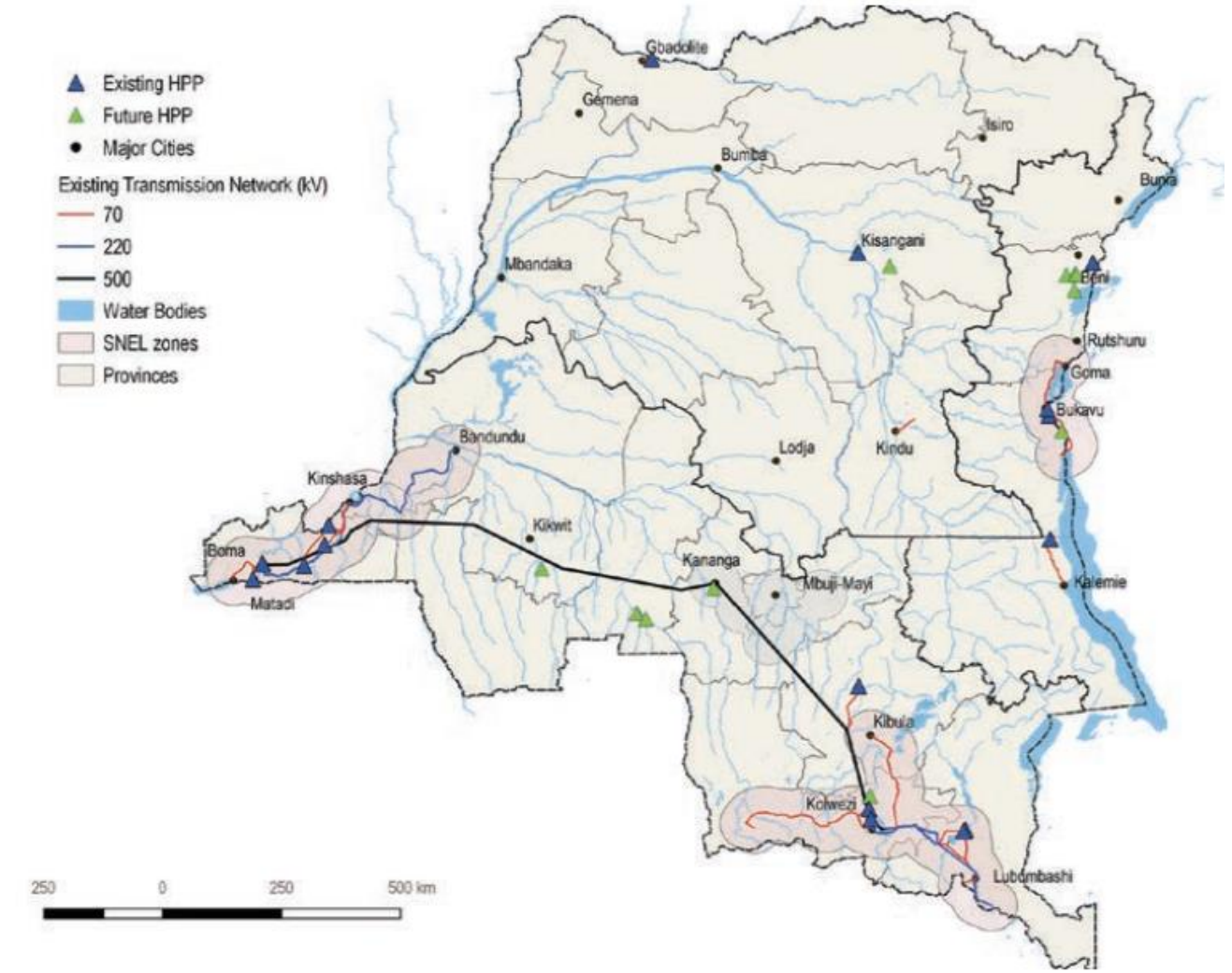
MAP 13 • Existing power system in the Eastern region



Source: WorldPop, Resource Matters, World Bank, authors

https://openknowledge.worldbank.org/handle

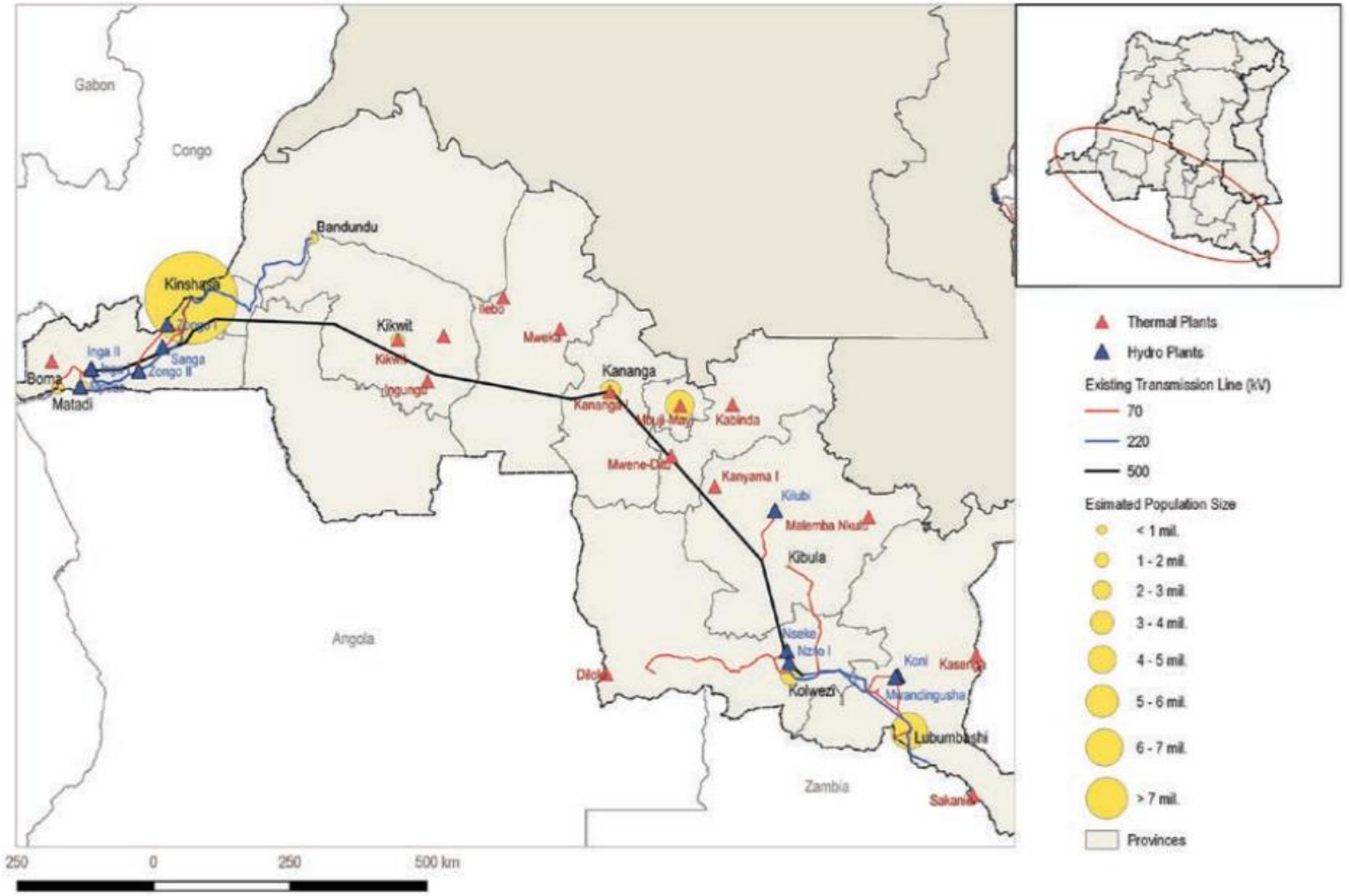
MAP 12 • Targeted areas for grid expansion and densification



Source: SNEL, ESRI, Resource Matters, World Bank, authors

https://openknowledge.worldbank.org/handle

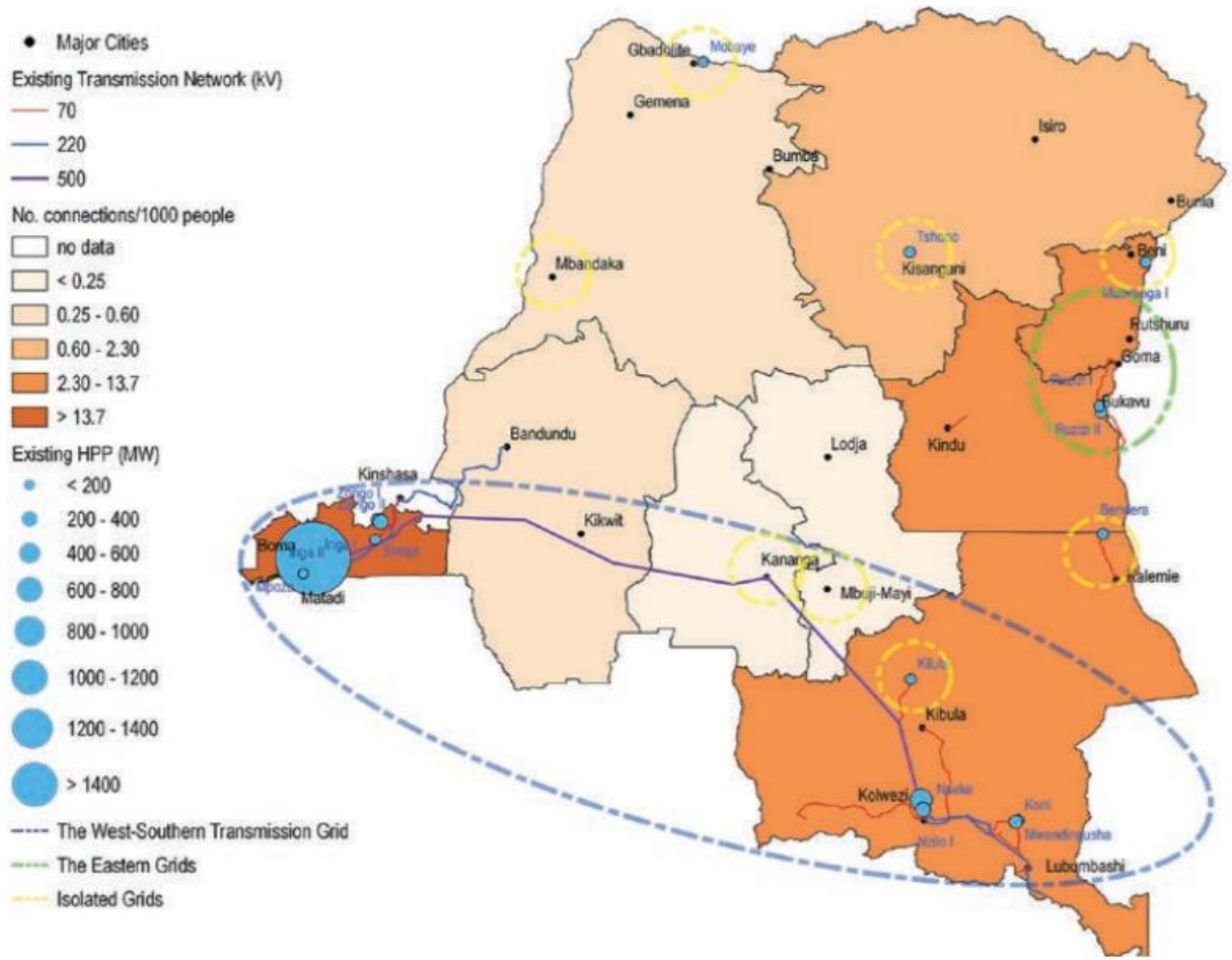
MAP 11 • Existing power system in the South-West region



Source: WorldPop, SNEL, Resource Matters, World Bank

https://openknowledge.worldbank.org/handle

MAP 5 • Current state of the DRC power system development



Source: SNEL, World Bank, authors

https://openknowledge.worldbank.org/handle

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2. http://pubdocs.worldbank.org/en/413001554284496731/Kenya-National-Electrification-Strategy-KNES-Key-Highlights-2018.pdf
3. https://africa-energy-portal.org/sites/default/files/2019-07/DRC%20AEMP%20Presentation.pdf
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6. http://documents1.worldbank.org/curated/en/743721586836810203/pdf/Increasing-Access-to-Electricity-in-the-Democratic-Republic-of-Congo-Opportunities-and-Challenges.pdf
7. https://www.researchgate.net/publication/293762235_The_electricity_supply_industry_in_the_Democratic_Republic_of_the_Congo
8. https://www.britannica.com/place/Democratic-Republic-of-the-Congo/Resources-and-power
9. https://globaledge.msu.edu/countries/democratic-republic-of-the-congo/economy
10. https://trine.com/
11. https://www.ambardcusa.org/invest-in-the-drc/industries/hydrocarbon/
12. https://www.stimson.org/wp-content/files/file-attachments/Renewable%20Energy%20and%20UN%20Peacekeeping%20DRC.pdf
13. https://usea.org/sites/default/files/event-/Democratic%20Republic%20of%20Congo%20Power%20Sector.pdf