LAPSSET CORRIDOR

Clean Coal Technology PROPOSAL

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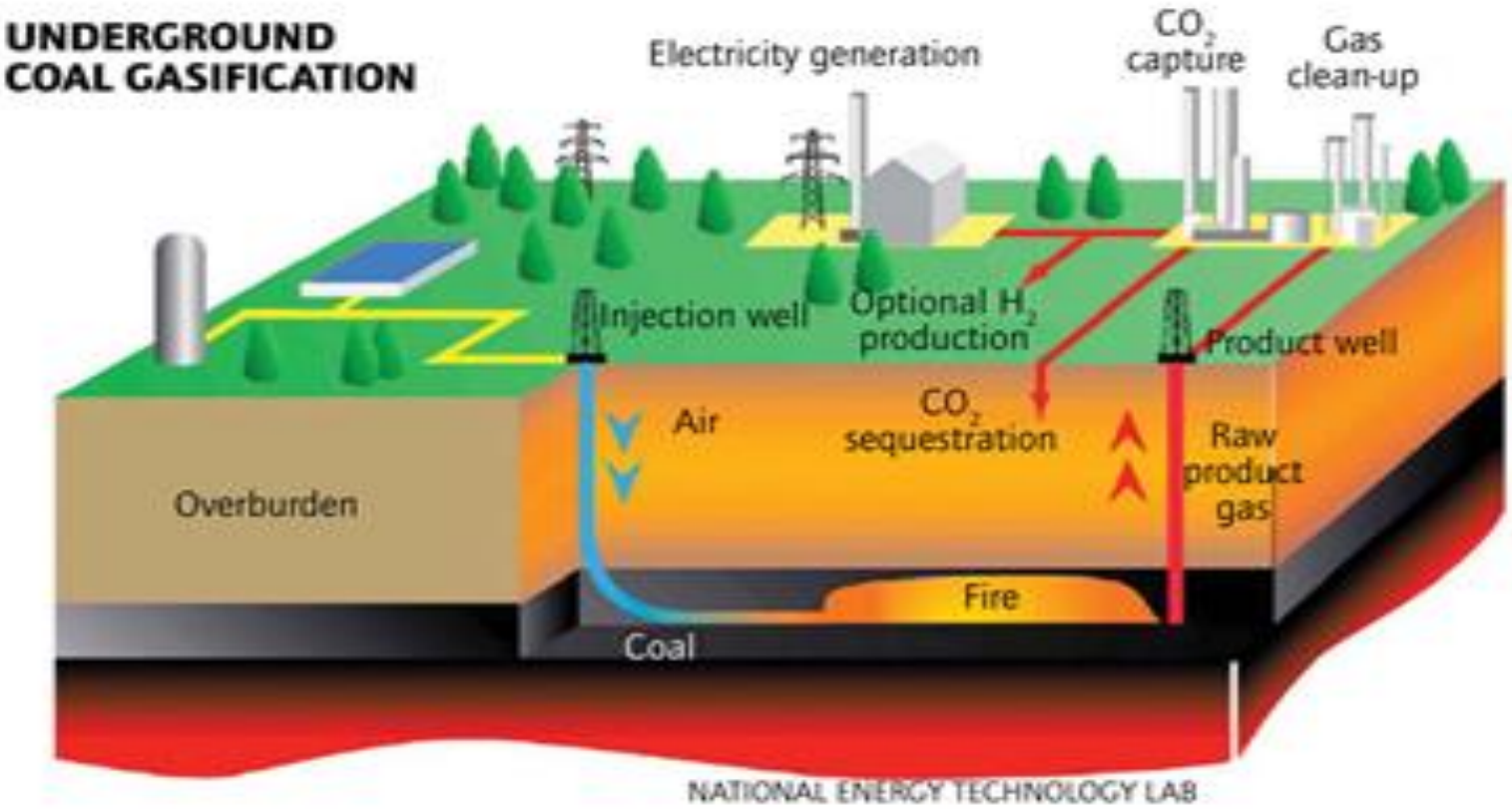


EXECUTIVE SUMMARY

Let us make Kitui Coal plant Clean

It is important to "Transtion" away from Fossil Fuels, however if Kenya still wanted to have coal fired power stations then have Clean Coal technology as part of a transition program. Kenya had plans to set up a 960MW coal-fired power plant in Kitui in the Lapsset Corridor, which will be Kenya's second coal project after the Lamu coal plant. This is, according to the Government treasury's report for public-private partnership (PPP) projects which has flagged the power plant as among the proposed State mega undertakings at the time.

PSECC Ltd & Afri-Fund Capital introduce Carbon Capture Clean Coal Technology and also Underground Coal Gasification (UCG) takes advantage of the same chemical reactions of coal to produce product gases, as those occurring in conventional gasifier reactors. The main difference is that in UCG the underground coal seam itself becomes the reactor, so that the gasification of the coal takes place underground instead of in a manufactured

gasification vessel at the surface. Obviously, this has the one great cost-saving and simplifying advantage of not requiring the coal to be mined in order to be gasified.

UCG eliminates the need for mining, and the dangers to miners and environmental degradation that are associated with it. It also makes deep or difficult to access coal seams into usable energy assets, as only one-sixth to one-eighth of the world's coal reserves are economically mineable. Scientists estimate that with UCG, the U.S. usable coal reserves could increase by 300%, this might be the case also for Kenya.

960MW in size

The power plant could still be situated on eastern side of Mui Basin in Kitui County via an IPP (independent power producer) framework. The Energy ministry, the contracting authority, says the coal project will help diversify Kenya's power mix and drive growth.

Kenya has in recent years discovered coal deposits within the Mui Basin in Kitui, having struck more than 400 million tonnes with further exploration ongoing but mining yet to begin. Electricity will be priced in the same range as geothermal power at US $7.52 per unit, almost a third of what diesel-fired plants charge on average. (PSECC Ltd aim for $0.05 KWh).

COAL USE

What is coal used for in society….

Coal has historically been used for various purposes in society due to its energy content and versatile properties. However, its use has been evolving, and in recent years, there has been a global push towards cleaner and more sustainable energy sources.

Kenya has announced plans for its second coal-fired power plant, following finding coal deposits in Kitui. Feasibility studies are being launched to assess the possibility of developing the power plant in the town east of Nairobi.

AMERICA'S FIRST

CLEAN COAL PLANT

Example - Petra Nova project, not far outside of Houston, captured carbon dioxide from the process of coal combustion for the first time in September, and has now piped 100,000 tons of it from the plant to the West Ranch oil field 80 miles away, where the carbon dioxide is used to force additional oil from the ground. The companies say that the plant can capture over 90 percent of the carbon dioxide released from the equivalent of a 240 megawatt, or million watt, coal unit, which translates into 5,000 tons of carbon dioxide per day or over 1 million tons per year. They're calling it "the world's largest post-combustion carbon capture system."

FUNDING (BEING ARRANGED)

Description	Purpose	Amount
Feasibility Study for Lapsset Plants	Pass EIA and cost criteria to meet $0.05KWh for electricity supply to Lapsset Corridor	$300,000 (dependent uopn exact criteria)
EPC Build costs	Constructiuon of Clean Coal Plant	To be determined
Carbon Dioxide savings	Climate Change Mitigation	14.28 million tons year

EXIT STRATEGY & NEW STRATEGY

The proposed Lamu Coal Power Station had a potential for 1,050 MW (1,410,000 hp) coal-fired thermal power station in Kenya. The proposed plant would be developed on 865 acres of land and feature a 210-meter-tall smokestack, which would become East Africa's tallest structure. It would have been the first ever coal power plant in Kenya.

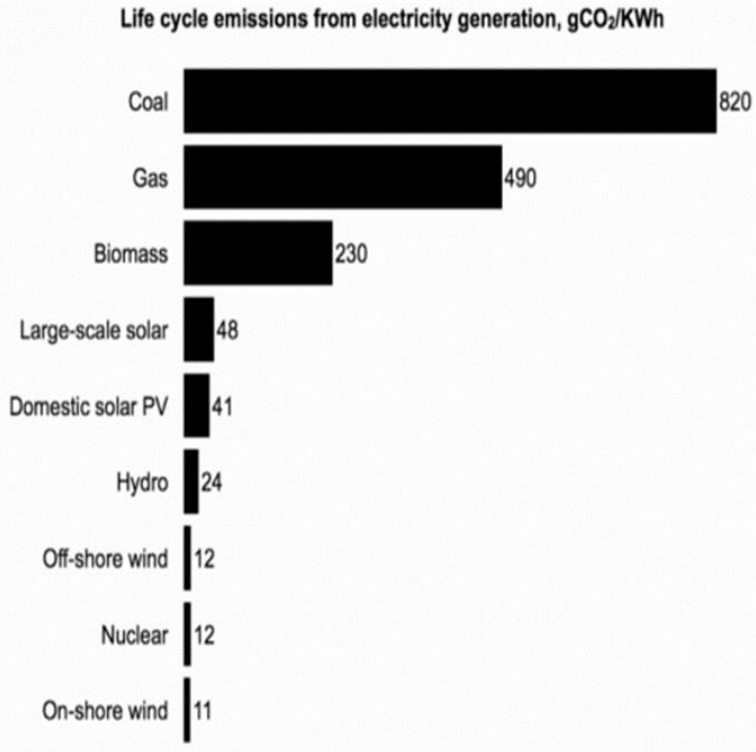
Kenya national government and media have been largely positive about the economic benefits from the coal plant activity. However, community advocates and some local government officials expressed concern over whether the benefits would be well distributed, whether the jobs would really materialize, and the lack of discussion over possible negative effects from the project.

As of June 2017, recent coverage has centered on the lack of economic viability and need for the proposed Lamu coal plant, citing a range of experts in news and analysis pieces. International accountability organisations also the people of Lamu challenged the environmental and social impact assessment license that Nema granted the project, in willful ignorance of the impacts, the project was halted on 26 June 2019 – Exit Strategy. New Strategy – Make them Clean Coal plants - There are 21 carbon capture projects worldwide on a large scale that are either operating or have been built, but relatively few of these are in the power generation sector — making Petra Nova and Kemper quite novel in context of the United States. In Canada, the Boundary Dam Carbon Capture and Storage Project, also a “post-combustion” capture plant using coal, has been operational since 2014.

The 960MW project for Kenya had been flagged by the nation's Treasury report for public-private partnerships (PPP).

Carbon Dioxide Emissions per energy source

When choosing an energy type to be developed it is now important to take note of the CO_2 emissions per KWh generated. The aim would be to reduce the emission from coal if Clean Coal Technology was used.



The carbon dioxide (CO_2) savings per ton of coal when clean coal technology is used depends on the specific type of clean coal technology employed. Clean coal technologies generally aim to improve the efficiency of coal combustion and reduce emissions of pollutants, including CO_2. Two common clean coal technologies are supercritical and ultra-supercritical steam cycles, and integrated gasification combined cycle (IGCC) another is Underground Coal Gasification UCG). Here are some general considerations:

Supercritical and Ultra-Supercritical Steam Cycles:

These technologies increase the efficiency of coal-fired power plants by operating at higher temperatures and pressures. By improving efficiency, they can reduce the amount of coal needed to generate a unit of electricity and consequently lower CO_2 emissions per unit of electricity produced.

Integrated Gasification Combined Cycle (IGCC):

IGCC involves converting coal into a synthetic gas (syngas) through gasification before combustion. This process can facilitate the capture and storage of CO_2 emissions. Additionally, IGCC plants are designed to be more efficient than traditional coal-fired power plants.

Carbon Capture and Storage (CCS):

Some clean coal technologies involve the capture and storage of CO_2 emissions. This is often referred to as carbon capture and storage (CCS). CCS can significantly reduce the amount of CO_2 released into the atmosphere.

Proposed Energy projects for Lapsset & Kenya

Energy Source	Capacity (MW)	Estimated Emissions Reduction (tCO2/MWh)	Annual Carbon Reduction (tCO2)
Geothermal	5,000	0.01	50,000,000
Solar PV	1,000	0.02	2,000,000
Solar Farms	3,000	0.02	6,000,000
Wind Farms	500	0.02	1,000,000
Waste to Energy Plants	360	0.05	1,800,000
Green Hydrogen Plants	2,200	0.00 (assuming zero emissions)	0
Hydroelectricity Dams	1,296	0.00 (assuming zero emissions)	0
Bioethanol Plants	341	0.05 (assuming emissions similar to waste-to-energy)	1,705,000
Nuclear Plants	940	0.01	9,400,000
Clean Coal Plants	2,040	0.7 (assuming lower emissions for cleaner coal technology)	14,280,000
Total Carbon Reduction			**85,185,000**

If two Clean Coal power plants are to be built on Kenya then the total installed capacity would be 2,040MW saving 14.28 million (tCO_2)

COAL USE

Here are some traditional and contemporary uses of coal in society:

1. **Electricity Generation:**
    - Historically, one of the primary uses of coal has been for electricity generation. Coal-fired power plants combust coal to produce steam, which is then used to generate electricity.
2. **Industrial Processes:**
    - Coal is used in various industrial processes, such as steel production. In a process called coking, coal is heated in the absence of air to produce coke, a crucial component in the iron and steel industry.
3. **Heating:**
    - In some regions, coal has been historically used for heating homes and businesses. However, this practice has declined in many places due to environmental and health concerns associated with coal combustion.
4. **Chemical Production:**
    - Coal can be a feedstock for the production of various chemicals, including coal tar and other compounds used in the chemical industry.
5. **Infrastructure and Construction:**
    - Coal by-products, such as fly ash and bottom ash, have been used in construction materials like concrete. These by-products can provide certain engineering and environmental benefits when used in construction.
6. **Historical Transportation:**
    - In the past, coal was a primary fuel for steam locomotives and ships. However, in modern transportation, there has been a shift away from coal towards cleaner energy sources

Coal can be a feedstock for the production of various chemicals, what are the chemicals:

Coal can serve as a feedstock for the production of various chemicals through processes such as gasification, liquefaction, and pyrolysis. Some of the chemicals that can be derived from coal include:

1. **Coal Tar:**
    - Coal tar is a viscous liquid byproduct obtained during the carbonization of coal. It is a complex mixture of organic compounds and is used in the production of various chemicals, including phenol, creosote, and naphthalene.
2. **Coke:**
    - Coke is a solid carbonaceous material derived from coal through the process of coking. It is used as a fuel and a reducing agent in the production of iron and steel.
3. **Synthetic Fuels:**
    - Coal can be converted into synthetic fuels through processes like coal liquefaction or Fischer-Tropsch synthesis. These synthetic fuels can include synthetic gasoline, diesel, and jet fuel.
4. **Ammonia:**
    - Coal can be used in the production of ammonia through a process called gasification. Ammonia is a key component in the production of fertilizers.
5. **Methanol:**
    - Methanol, also known as wood alcohol, can be produced from coal through gasification. Methanol is used in various industrial processes and as a feedstock for the production of chemicals.

6. **Hydrocarbons:**
    - Coal can be a source of hydrocarbons, which are essential building blocks for the petrochemical industry. Hydrocarbons derived from coal can be used in the production of plastics and other synthetic materials.
7. **Aromatic Chemicals:**
    - Aromatic hydrocarbons derived from coal tar, such as benzene, toluene, and xylene (BTX), are important precursors in the production of various chemicals and polymers.
8. **Phenol:**
    - Phenol is produced from coal tar and is used in the manufacture of resins, plastics, and pharmaceuticals.
9. **Pitch:**
    - Pitch is a byproduct obtained during the distillation of coal tar. It is used in the production of carbon materials, such as electrodes and carbon fibers.

It's worth noting that while coal can be a source of these chemicals, the environmental and sustainability concerns associated with coal usage have led to increased interest in alternative, cleaner feedstocks and processes. Many industries are exploring and investing in technologies that reduce the environmental impact of chemical production.

The Ministry of Energy has developed a Draft Energy White Paper setting out a vision for how Kenya will transform its energy sector by 2040. In the development of the paper, we have mapped the energy journey of Kenya up to present day and done a critical analysis of the current state of the sector to identify key challenges and opportunities.

The draft White Paper put forward four ambitious outcomes as follows: (i) To establish energy as a transformational public good that is inclusive and serves the needs of Kenya's population; (ii) To establish Kenya as a global leader in the drive toward decarbonized economic growth; (iii) Drive Kenya to take a quantum leap to increase installed capacity by 2040 underpinned by renewable energy sources; (iv) Establish Kenya as an investment destination of choice for industries that are seeking to decarbonize. Recognizing the scale of our ambitions, the paper captures critical shifts and related strategic actions to ensure a matching energy system architecture that provides the requisite support.

It's important to note that while coal has played a significant role in the development of societies, there are growing concerns about its environmental impact. The normal combustion of coal releases pollutants, including carbon dioxide (a major contributor to climate change), sulfur dioxide, nitrogen oxides, and particulate matter. As a result, many countries and regions are working towards reducing their dependence on coal and transitioning to cleaner and more sustainable energy sources, such as natural gas, renewable energy (solar, wind, hydro), and nuclear power – coal could still play a role as a Flagship project if Clean Coal Technology is adopted.