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# Nuclear Energy Plants PROPOSAL

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**PSECC Ltd**

[www.psecc.co.uk](http://www.psecc.co.uk)

Project No. PSECC010



Small nuclear power stations

**Baseload Transitional Clean Energy**

**Net ZERO**

**PREPARED FOR:**

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**Rolls-Royce** [www.rolls-royce-smr.com/](http://www.rolls-royce-smr.com/)

[www.rolls-royce.com/innovation/small-modular-reactors.aspx#/](http://www.rolls-royce.com/innovation/small-modular-reactors.aspx#/)

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## SMALL MODULAR REACTOR

### **Rolls-Royce Small Modular Reactor (SMR) has been established with a clear vision to deliver clean, affordable energy for all.**

Kenya targets to kick off the construction of its first nuclear power plant in 2027 as the country seeks to further diversify its energy generation amid rising demand and push for zero-carbon energy. Our world and Lapsset Corridor need more low-carbon clean power than ever. Rolls-Royce SMR Ltd has been established to develop an affordable Nuclear power plants that generate electricity using a small modular reactor - an intelligent way to meet our future energy needs. To achieve this goal, speed and certainty are critical. Because Rolls-Royce SMR is able to produce a repeatable factory-built power station, that relies on tried and tested nuclear technology, it can be constructed and made operational far more quickly than conventional bespoke nuclear design and build technology.

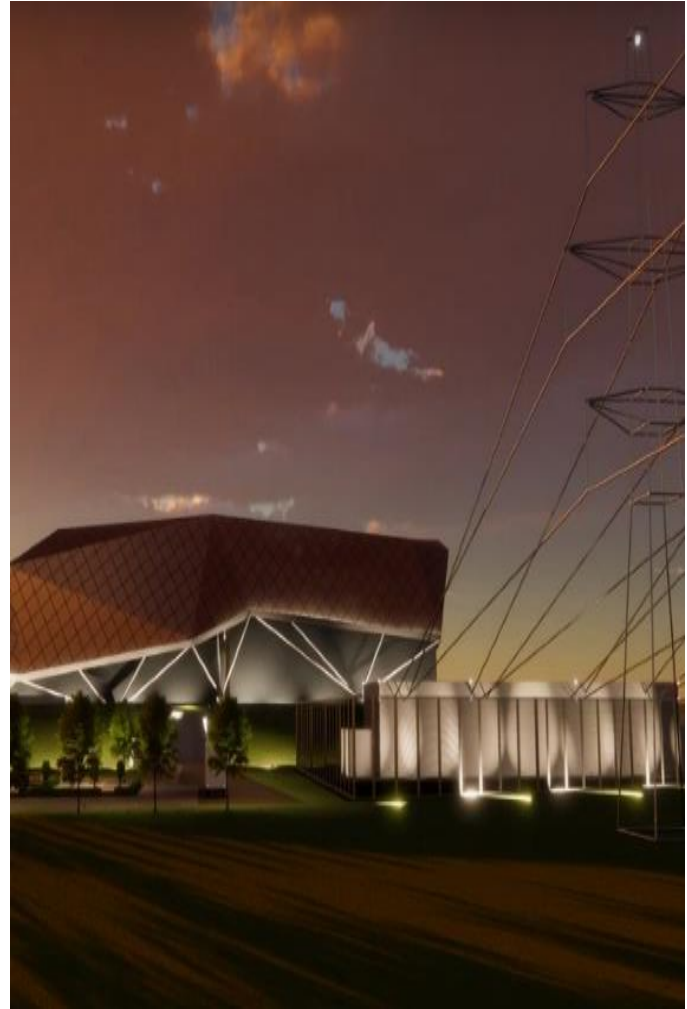
PSECC Ltd & Afri-Fund Capital introduce the Rolls-Royce SMR to Lapsset Corridor – this approach lowers cost, reduces uncertainty and risk for the Government of Kenya and developers and crucially, allows Kenya to address their urgent need for low carbon energy.



## ADVANTAGES

Nuclear energy is the most powerful source of 'always on' clean energy, however, it must be competitive for it to be widely embraced. Rolls-Royce SMR Ltd has designed a factory built nuclear power plant that will offer clean, affordable energy for all.

- Proven technology for 60 years of use
- Fast deliver – less build time
- One tenth the size of a conventional plant
- Lower environmental / ecological impacts
- Small footprint
- Less complex construction
- Reduced Risk
- innovative delivery
- Business experts
- Lower running costs
- Climate Change Mitigation
- Transition to Net Zero
- Stable long-term Energy
- Clean, affordable Energy for all
- Low-cost Baseload Electricity
- Scalable
- Can support Green Hydrogen plants



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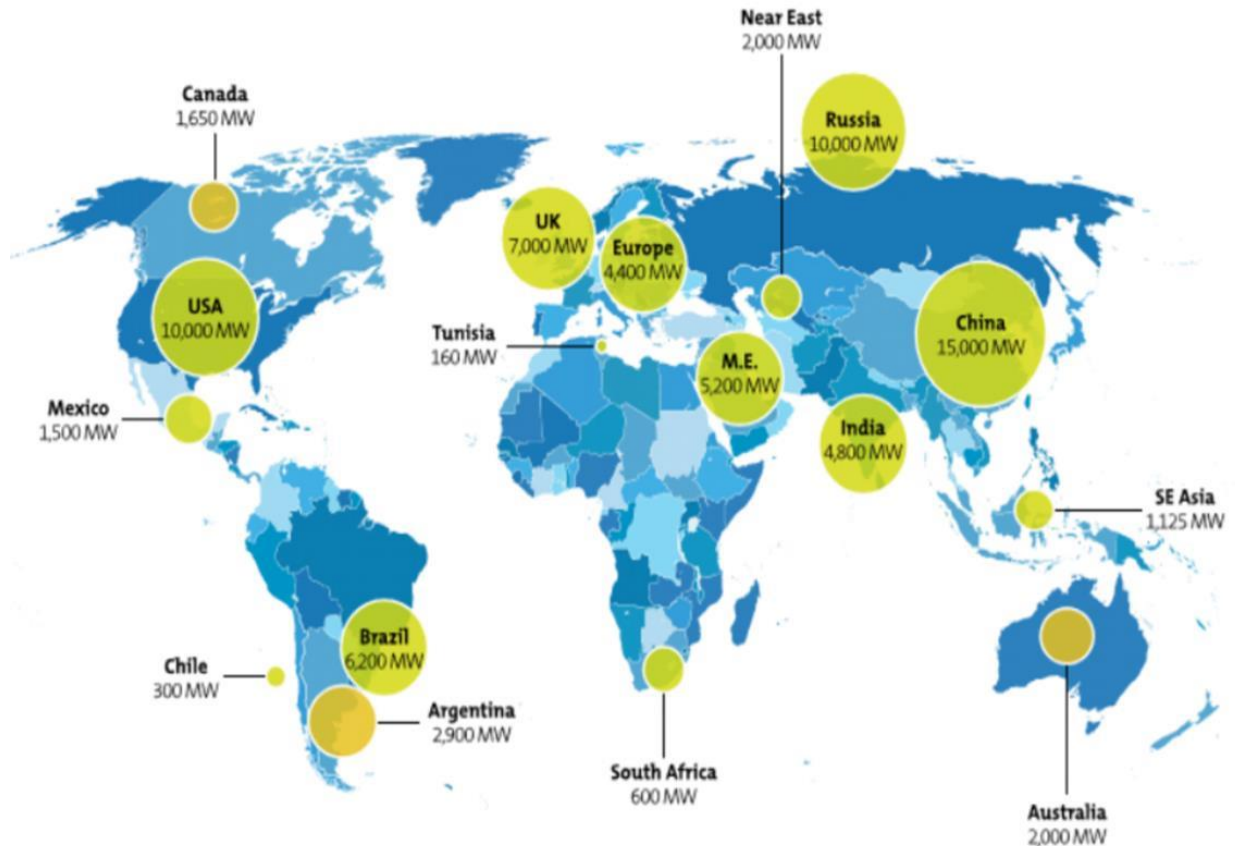
- **PROVEN ESTABLISHED TECHNOLOGY**

### **Small Modular Reactor (SMR)**

- Rolls-Royce SMR uses established nuclear technology and knowhow, to offer a sustainable, low cost, repeatable and scalable product, that can be rolled out in Kenya and Lapsset Corridor and around the world.



Rolls-Royce company Market deployment markets - could be of interest to Kenya



The Kenya Government have a fifteen-year Nuclear programme - [www.nuclear.co.ke](http://www.nuclear.co.ke)

The Nuclear Power and Energy Agency, formerly Kenya Nuclear Electricity Board (KNEB), is a State Corporation established under the Energy Act 2019. It is charged with the responsibility of promoting and implementing Kenya's Nuclear Power Programme, carrying out research and development for the energy sector.

Towards attainment of its mandate, the Nuclear Power and Energy Agency shall develop policies and legislation, undertake public education and awareness, identify suitable sites for the construction of Nuclear Power Plants; carry out research, development and innovation on energy technologies as well as capacity building for the energy sector.

Rolls-Royce plans to build small nuclear power plants in Britain that Kenya could utilise over time. Backed by the government and other investors, the industrial giant proposes to build as many as 16 generating plants.

## Solid foundations

Our SMR generates power in the same way as a larger nuclear reactor. Energy is generated by splitting uranium atoms to create steam, turn turbines and produce electricity. The process produces no carbon emissions. One of the key innovations lies in its foundations. A seismic bearing pad resting on a specially engineered platform acts as a giant shock absorber to neutralise movement from any seismic activity.

## Teaming up to bring SMRs to the UK an International markets

We have brought together a cross-sector collaboration of engineering, manufacturing and construction partners working to make our SMR vision a reality.

Our aim is to be part of a joint venture manufacturing and assembling small nuclear power stations for customers such as utility companies. The UK SMR Consortium plan could embed long-term jobs, skills and prosperity in communities across the UK.

Further afield, SMRs could make clean, low carbon nuclear power available to remote communities, small countries and emerging economies across the world.

A Small Modular Reactor (SMR) programme represents a once in a lifetime opportunity for UK nuclear companies to design, manufacture and build next generation reactors to meet the UK's energy needs. The UK Government has the chance to maximise British content, creating and sustaining intellectual property, high-tech, high-skills employment, a reinvigorated UK supply chain and positioning the country as a global leader in innovative nuclear technologies that present tremendous opportunities in international export markets.

Rolls-Royce believes a UK SMR programme has the potential to deliver:



A UK Consortium led by Rolls-Royce to deliver: energy security, jobs, sustainable value, a robust supply chain, exports and low carbon technology.



### **Rolls-Royce believes its SMR design will:**

- Provide 220MW to 440MW of power, depending on the configuration, that's the equivalent of up to 150 onshore wind turbines.
- Supply power to the grid in a timely manner at lower cost to the taxpayer and consumer, generating electricity that is at least as cheap (per MW) as power generated by today's large-scale reactors – potentially even cheaper when SMRs go into volume production.
- Represent the lowest risk by using proven technology and best value by using a high degree of commercial or standardised off-the-shelf components.
- Open up opportunities for UK supply chain companies to enter into volume manufacturing as over 75% of the design (by cost) is modular.
- Appeal to a UK commercial or international utility company or power station operator.
- Be so compact (16 metres high and 4 metres in diameter) it can be transported by truck, train or even barge.
- Sit within a power station that would be roughly five and half times the size of the pitch at Wembley, which is just one-tenth the size of a typical large-scale reactor site (40,000m<sup>2</sup> vs 400,000m<sup>2</sup>).
- Take just 5 years from the start of construction to the generation of the first electricity.
- Be up and running by 2028, maximising the UK's first-mover advantage in the race for exports.
- Minimize operating costs such as refueling and the burden of decommissioning.
- Last for 60 years.

### **A UK SMR will deliver growth for the economy – possible for Kenya**

A Rolls-Royce - led UK SMR solution will deliver an estimated Gross Value Added (GVA) indirect contribution of £71bn to the UK economy, according to our research.

A peak benefit of 40,000 UK jobs will be created over the new build phase (2030 – 2050), with jobs split 60:40 between direct employment in the SMR Supply Chain and indirect employment in supporting areas. An UK SMR programme based on 7GWe in the UK and a conservative international export of 9GWe could deliver a total benefit to the UK economy of £188bn for the period 2015 to 2115, according to Rolls-Royce estimates, with the majority (£100bn) in the period 2030 to 2050. This includes a direct benefit of around £117bn, which will be created through the development, manufacture, operation, exports and decommissioning of SMR plants.

In comparison, UK Office for National Statistics (ONS) data from 2014 showed that nuclear energy provided £3.5bn to the UK. Kenya will experience GDP growth as a result of Nuclear Energy.





## Rolls-Royce will help deliver one of UK's largest engineering collaborations

Development of the UK SMR plant promises to be one of the largest national engineering collaborations ever undertaken and Rolls-Royce is ideally placed to champion a British consortium. We are the largest employer of nuclear engineers and scientists in the country and with our decades of experience in producing compact nuclear pressure water reactors (PWRs), we believe we can meet the needs of the SMR opportunity in the civil energy market.

Our nuclear business includes many of the key capabilities needed to undertake an SMR design and build programme. We have 3,000 highly experienced engineers working today on key nuclear island design, manufacturing, procurement and operational support covering the entire lifecycle from inception to life extension and decommissioning, Job creation for Kenya will also result.

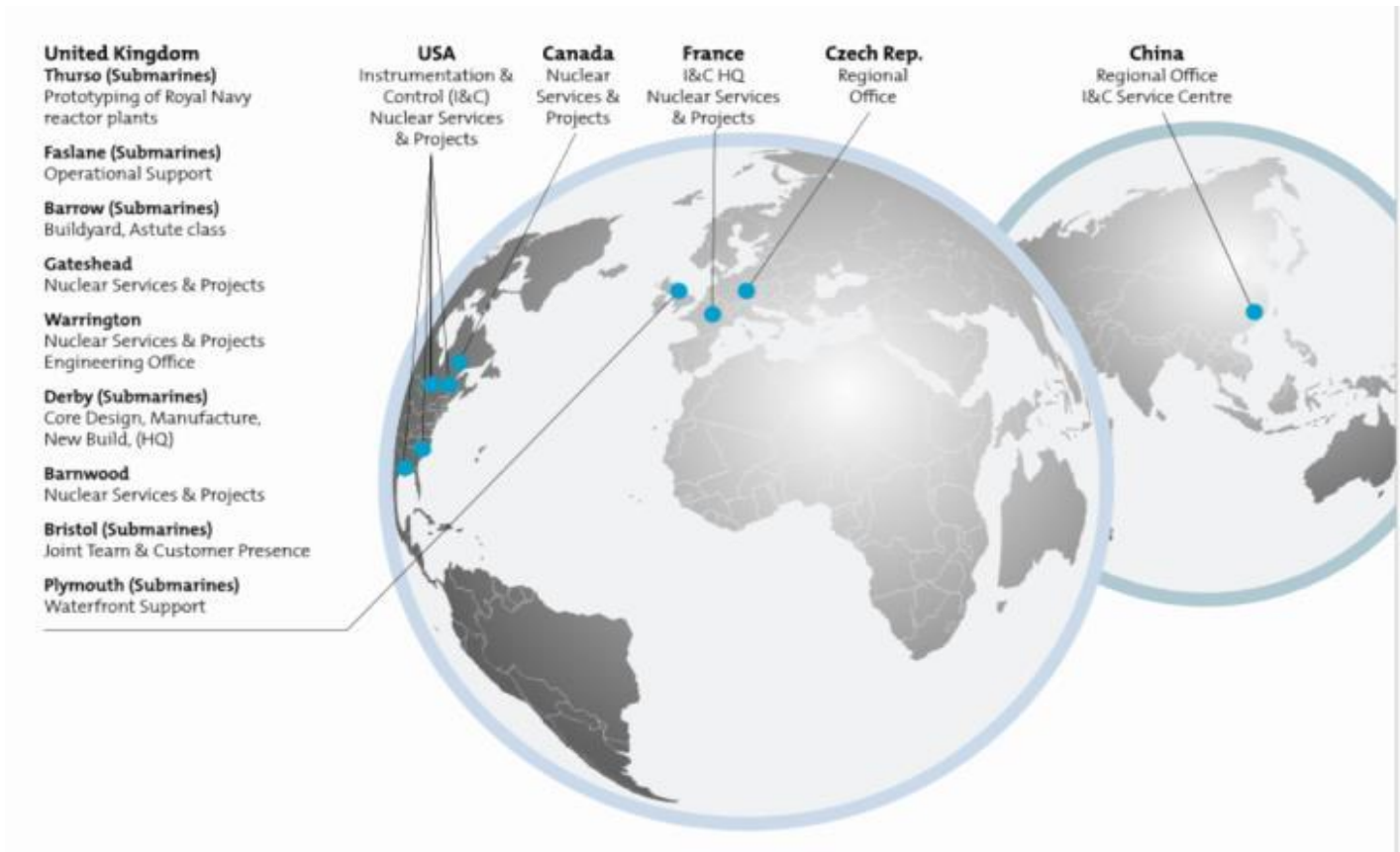
We are the only private Western reactor designer that is also a reactor plant operator, as we have responsibility for the operation of the onshore test reactor in the UK. We operate two further nuclear licensed sites: a nuclear core manufacturing facility for naval reactors and an engineering site, both situated in Derby. This combination of capabilities is matched by only a small number of organisations worldwide. We have been a nuclear reactor plant designer since the inception of the nuclear submarine programme in the UK. in the 1950s. Since then, Rolls-Royce has designed reactors for seven classes of submarine and two separate land-based prototype reactors. We have developed three separate reactor generations and each has seen significant improvements in reactor plant performance, core lifetime and safety.



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In addition Rolls-Royce led the development of the first integral reactor design during the 1980s and early 1990s. This reactor, designated “SIR” (Safe Integral Reactor), was 330 MWe in power, and is arguably the starting point for all subsequent integral reactor designs. Rolls-Royce has been working on the genesis of the SMR development programme for civil nuclear applications since the early 1990s.



### Bringing together Britain’s best brains

A Rolls-Royce - led UK SMR Programme will utilise a broad range of interdisciplinary technical expertise to deliver a commercially viable, sustainable solution to energy security using low-carbon technology. We would also look to utilise support available through regional and local government.

In partnership with UK Government, Rolls-Royce formed the Nuclear Advanced Manufacturing Research Centre (NAMRC) in Sheffield and has continued to support it with funded manufacturing development activity. Rolls-Royce has also established a network of over 25 University Technology Centres (UTC) in the UK and is currently funding a variety of UK University research programmes. We would expect our Consortium to involve a broad range of research organisations including the NAMRC, The Welding Institute (TWI) in Cambridge, the Manufacturing Technology Centre (MTC) in Coventry, The University of Birmingham, The University of Cambridge, The University of Derby, Imperial College London, The University of Manchester, The University of Oxford, The University of Sheffield and The University of Surrey.



## CLIMATE CHANGE MITIGATION

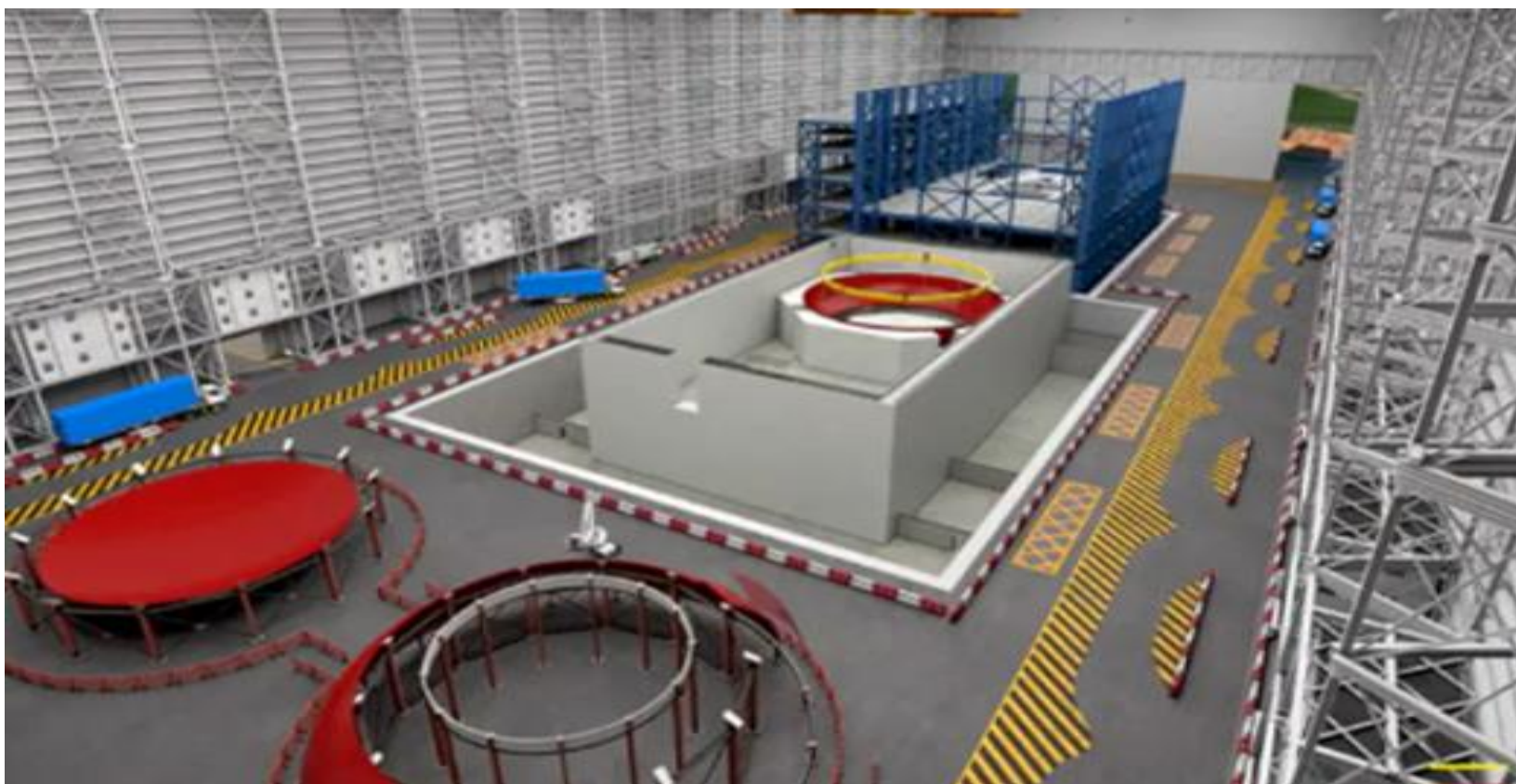
**The Small Modular Reactor (SMR) business is one of the ways that Rolls-Royce is helping to ensure the UK and other Countries continue to develop innovative ways to tackle the global threat of climate change – our plants are ZERO carbon emissions.**

With the Rolls-Royce SMR technology, we have developed a clean energy solution which can deliver cost competitive and scalable net zero power for multiple applications - from grid and industrial electricity production to hydrogen and synthetic fuel manufacturing.

Rolls-Royce brings together global industry leaders in energy generation and engineering, who will harness the potential of this ground-breaking approach to sustainable nuclear power.

### Climate Change Mitigation

Rolls-Royce is a Great British company and has developed the SMR technology as a solution to global energy security.



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## ALIGNMENT WITH LAPSET CORRIDOR STRATEGY

### Kilifi and Kwale our ideal sites for Nuclear Energy Plants

Kilifi and Kwale are counties in Kenya, and they are part of the LAPSET Corridor project - Kilifi County is located on the coast of Kenya, and Kwale County is also situated on the coast, to the south of Kilifi. Kenya targets to kick off the construction of its first nuclear power plant in 2027 as the country seeks to further diversify its energy generation amid rising demand and push for zero-carbon energy.



Kenya plans to utilize nuclear power for electricity generation by 2034 in order to meet its decarbonisation targets, improve stability and reliability of supply as well as lowering the cost. Energy Principal Secretary Alex Wachira says nuclear energy would provide a suitable baseload alongside geothermal to help spur Kenya's economic development – PSECC Ltd recommend Rolls-Royce to Kenya for consideration.

Energy Ps Alex Wachira addressing the delegates for Nuclear power infrastructure development training. “Nuclear energy is an indispensable tool for achieving the global sustainable development agenda. It has stood as a beacon of promise in this regard, offering clean, reliable, and continuous energy generation,” said PS Wachira.

Delegates drawn from seventeen countries will be in Mombasa for two weeks for the Interregional Training Course on Nuclear Power Infrastructure Development. The delegates are drawn from Algeria, Egypt, Senegal, Uganda, Zambia, Nigeria, Ghana, Ethiopia, Bangladesh, Sri Lanka, Indonesia, Mongolia, Thailand, Turkey, Jordan Poland and Kenya.

Acting CEO of the Nuclear Power and Energy Agency (NuPEA) Justus Wabuyabo told the Business Daily the agency has advanced plans to float international tenders for the construction of the in either Kilifi or Kwale counties.

The revelation follows approval by the International Atomic Energy Agency (IAEA) in 2021 for Kenya to go ahead with setting up the infrastructure for the plants.



“We will do the bidding stage, as anytime between 2026 and 2027 and start construction in 2027. Construction ranges six to ten years so we are looking at 2034-35 to commission the first plant,” Mr Wabuyabo said.

“We are now focusing on Kilifi and Kwale as our ideal sites. They have met most of the criteria but before we determine the final site we have to do a detailed scientific study as provided for by IAEA like seismic tests,” he added.

The plant is expected to have a capacity of 1,000 Megawatts (MW), which if successfully delivered will be key to helping boost the electricity supply to the economy and help reduce reliance on dirty thermal plants.



## TENTATIVE TIMELINE

Following is the tentative timeline of the Nuclear programme, divided into 3 phases:

Phases	Name	Description	Time Frame
Phase 1:	Implementation / Feasibility	Strategic pathway	2027
Phase 2:	Small Modular Reactor	470MW	2028
Phase 3:	Small Modular Reactor	470MW	2031

## COST

The details of the indicative cost are provided below (dependent upon exact criteria):

Title	Cost (USD)	MWh per year
Phase 1. Implementation / Feasibility Study / EIA etc (approximately)	\$300,000	
Phase 2. Small Modular Reactor	\$2.90 Billion	Approximately 4 million MWh
Phase 3. Small Modular Reactor	\$2.66 Billion	Approximately 4 million MWh

Items	Cost
PSECC Ltd coordination	
Coordinator	To Be Determined
Project Manager	To Be Determined



## REVENUE

PSECC Ltd calculations (to be confirmed by Rolls-Royce once plant is operational and O&M considered) – indicative.

Items	Revenue (USD)
Yearly Energy Generation from 470MW plant producing 4 million MWh – electricity sold at \$0.05 KWh	\$200 Million
Government 35% share of revenue per year	\$70 Million
Total revenue generation over 60 years	\$12 Billion
Total Government revenue share over 60 years	\$4.2 Billion

## CARBON DIOXIDE SAVINGS

Nuclear Energy plant	Savings in Carbon Dioxide per year
1	4.7 Million (tCO <sub>2</sub> )
2	4.7 Million (tCO <sub>2</sub> )

### Proposed Energy projects for Lapsset & Kenya

Energy Source	Capacity (MW)	Estimated Emissions Reduction (tCO <sub>2</sub> /MWh)	Annual Carbon Reduction (tCO <sub>2</sub> )
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
<b>Total Carbon Reduction</b>			<b>85,185,000</b>



## ASSURANCES

- Baseload Electricity supply to Lapsset Corridor – 4 Million MWh per year
- Proven track record
- Low-Cost electricity supply, We have 3,000 highly experienced engineers
- Revenue Generation for the Government of Kenya
- Carbon Dioxide savings of 4.7 million (tCO<sub>2</sub>) per year to help Net ZERO

## CONTACT US

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